Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Communications Marketplace Report	)	GN Docket No. 20-60

2020 COMMUNICATIONS MARKETPLACE REPORT

Adopted: December 31, 2020 **Released: December 31, 2020**

By the Commission: Commissioner Carr approving in part, concurring in part and issuing a statement; Commissioner Rosenworcel concurring and issuing a statement; Commissioner Starks approving in part, dissenting in part and issuing a statement.

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I. INTRODUCTION

1. Every two years, the Commission is required to publish a *Communications Marketplace Report* that, among other things, assesses generally the state of competition across the broader communications marketplace, including competition to deliver voice, video, audio, and data services among providers of telecommunications, providers of commercial mobile service, multichannel video programming distributors, broadcast stations, providers of satellite communications, Internet service providers, and other providers of communications services.[1] The Commission must consider all forms of competition, including "the effect of intermodal competition, facilities-based competition, and competition from new and emergent communications services."[2] The Commission also must assess whether laws, regulations, regulatory practices—whether federal, state, local, Tribal, or foreign—or marketplace practices pose a barrier to competitive entry into the communications marketplace or to the competitive expansion of existing providers of communications service.[3]

[1] 47 U.S.C. §§ 163(a), (b)(1); *see also* Section 401 of the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (RAY BAUM'S Act of 2018), Pub. L. No. 115-141, 132 Stat. 1087 (codified at 47 U.S.C. § 163) (RAY BAUM'S Act of 2018).

[2] 47 U.S.C. § 163(d)(1).

[3] 47 U.S.C. § 163(b)(3). In assessing the state of competition under subsection (b)(1) and regulatory barriers under subsection (b)(3) of the Act, the Commission must also "consider market entry barriers for entrepreneurs and other small businesses in the communications marketplace in accordance with the national policy under section 257(b)." (continued….)

2. In December 2018, the Commission adopted the first *Communications Marketplace Report*, providing a comprehensive evaluation of the state of the communications marketplace (as of year-end 2017).[4] In February 2020, the Commission updated certain figures, maps and tables contained in the *2018 Communications Marketplace Report*, to reflect the most recent data available as of year-end 2018.[5] On February 27, 2020, the Commission adopted a Public Notice seeking input on the state of the communications marketplace to inform its assessment of competition in the communications marketplace in its second *Communications Marketplace Report* (*2020 Communications Marketplace Report*) to Congress.[6]

3. With this second *2020 Communications Marketplace Report*, the Commission fulfills the requirement set forth in RAY BAUM'S Act of 2018 to provide a comprehensive evaluation of the state of competition in the communications marketplace in the United States. As required, this *Report* assesses the state of all forms of competition in the communications marketplace; the state of deployment of communications capabilities; barriers to competitive entry, including market entry barriers for entrepreneurs and other small businesses. Further, this *Report* describes the actions taken by the Commission in the previous two years to address challenges and opportunities in the communications marketplace. It also discusses the actions taken by the Commission to help Americans in the face of the unprecedented COVID-19 pandemic. Finally, this *Report* discusses the Commission's agenda for continuing to address the challenges and opportunities in front of us over the next two years.

II. ASSESSMENT OF THE STATE OF COMPETITION

4. RAY BAUM'S Act of 2018 requires the Commission to assess the state of competition in the communications marketplace. We first assess the state of competition separately within several specific components of the broader communications marketplace, including the mobile wireless marketplace, the fixed broadband marketplace, the voice services marketplace, the video marketplace including cable industry prices, and the audio marketplace.

5. In assessing the state of competition, we report on several economic indicators. These include indirect measures of competition—such as the number of providers along with barometers of market concentration—that are recognized as being associated with the level of competition. We also report, among other things, prices and product offerings. This entails looking at the major factors that affect prices, including inputs such as spectrum, infrastructure, or video content, as well as the quality of the service being offered to consumers and quality enhancing investment. The *Report* further recognizes that some markets are interrelated, and so assesses competition between some of these markets, such as between fixed and mobile broadband and between multichannel video programming distributors (MVPDs), online video distributors (OVDs), and broadcast television stations.

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47 U.S.C. § 163(d)(3). The Commission must include the International Broadband Data Report required by section 103(b)(1) of the Broadband Data Improvement Act as part of the Communications Marketplace Report. *See* RAY BAUM'S Act of 2018 § 402(c), 132 Stat. at 1089; 47 U.S.C. § 163; 47 U.S.C. § 1303(b)(1).

[4] *Communications Marketplace Report et al.*, GN Docket No. 18-231 et al., Report, 33 FCC Rcd 12558 (2018) (*2018 Communications Marketplace Report*).

[5] *FCC Releases Certain Data Updated as of December 31, 2018 for the Communications Marketplace Report*, GN Docket No. 18-231, Public Notice, 35 FCC Rcd 1479 (OEA 2020) (*CMR Updated Data Public Notice*); FCC, *2018 Communications Marketplace Report – Updates*, https://www.fcc.gov/communications-marketplace-report-updates (last visited Oct. 27, 2020).

[6] *See generally Office of Economics and Analytics Seeks Comment On The State Of Competition In The Communications Marketplace*, GN Docket No. 20-60, Public Notice, 35 FCC Rcd 1577 (OEA 2020) (*2020 Public Notice*). The comment period was scheduled to end on April 13, 2020, and the reply comment period was scheduled to end on May 13, 2020. These deadlines were extended on April 10, 2020, due to the COVID-19 pandemic, and community and business efforts to respond to this public safety crisis. The revised comment date was April 27, 2020, and the revised reply comment date was May 28, 2020. Appx. A of this *Report* provides a list of all parties who filed in this proceeding.

A. The Mobile Wireless Marketplace

6. We assess competition among mobile wireless service providers and discuss the resulting pricing, quality, and other related outcomes. In addition to the three facilities-based nationwide mobile wireless service providers, the mobile wireless marketplace consists of numerous regional and local facilities-based providers, mobile virtual network operators (MVNOs) who purchase mobile wireless services wholesale, cable providers that rely on a hybrid wholesale/hotspot arrangement to offer service, and mobile satellite providers who currently primarily focus on niche services like tracking services for aircraft and ships and operations in remote locations. Additionally, as a condition following the merger of T-Mobile and Sprint, DISH has committed to building its own independent fifth-generation (5G) mobile network. Mobile wireless services are an important and increasingly prevalent part of Americans' daily lives, and competition in the provision of mobile wireless services drives innovation and investment to the ultimate benefit of the American people and economy. In this section, we present and review available 2019 data for all mobile wireless services, including voice, messaging, and broadband, and we also present certain information as of mid-2020.

7. Mobile wireless service connections have grown by 2 to 5% per year since year-end 2017, while data usage has continued to grow substantially faster, rising to 9.2 GB per subscriber per month at year-end 2019, an increase of approximately 39% from year-end 2018. Growing consumption is made possible by the increasing availability of unlimited data plans from both postpaid and prepaid mobile wireless brands as well as the increased speeds offered by nationwide service providers. For instance, nationwide Long Term Evolution (LTE) download speeds increased from 16 Mbps in the second half of 2017 to 26.2 Mbps in the second half of 2019, an increase of approximately 64%.

8. The wireless industry is currently undertaking the implementation and construction of 5G mobile wireless networks that are expected to deliver even faster download speeds, reduced latency, and better security to users than 4G LTE networks. This has entailed increased deployment of small cells and Distributed Antenna Systems (DAS) to fill local coverage gaps, densify networks, and increase local capacity. At the same time, the Commission has made available significant amounts of mid-band spectrum as well as nearly 12 gigahertz of licensed and unlicensed millimeter wave (mmW) spectrum to meet service needs. In addition to the quality improvements that this investment and access to spectrum allow, CTIA data indicate that industry prices declined, with ARPU decreasing from roughly $39 in 2017 to approximately $37 in 2019, an indicator of strong competition in the mobile wireless marketplace.

1. Overview of the Mobile Wireless Marketplace

a. Service Providers

9. *Facilities-Based Service Providers.* Following the completed merger of T-Mobile and Sprint on April 1, 2020,[7] there are three facilities-based mobile wireless service providers in the United States that this *Report* terms "nationwide service providers": AT&T, T-Mobile, and Verizon Wireless. Although none of these three nationwide service providers has a network that is truly ubiquitous, the three service providers each have networks that they report cover a substantial majority of the country—at least 98% of the U.S. population and at least 84% of U.S. road miles—with their 4G LTE networks.[8]

[7] The Commission approved the transaction between T-Mobile and Sprint, subject to certain conditions, on October 16, 2019. *See generally Applications of T-Mobile US, Inc., and Sprint Corporation For Consent to Transfer Control of Licenses and Authorizations; Applications of American H Block Wireless L.L.C, DBSD Corporation, Gamma Acquisition L.L.C., and Manifest Wireless L.L.C. for Extension of Time*, WT Docket No. 18-197, Memorandum Opinion and Order, Declaratory Ruling, and Order of Proposed Modification, 34 FCC Rcd 10578 (2019) (*T-Mobile-Sprint Order*). In this *Report*, we present and review data for year-end 2019, and as such, T-Mobile and Sprint data are, for the most part, reported separately. *See also* Press Release, T-Mobile, T-Mobile Completes Merger with Sprint to Create the New T-Mobile (Apr. 1, 2020), https://www.t-mobile.com/news/un-carrier/t-mobile-sprint-one-company.

[8] *See infra* section II.A.6.

Collectively, these three service providers account for over 400 million connections.[9] U.S. Cellular, currently the fourth largest facilities-based service provider in the United States, is best characterized as a multi-regional service provider, and has developed wireless networks and customer service operations in portions of 20 states.[10] As of December 31, 2019, U.S. Cellular accounted for approximately five million connections.[11] Two other larger regional service providers include C Spire, which provides service to nearly one million subscribers in the Southeastern United States,[12] and Claro, which provides service to approximately 920,000 subscribers in Puerto Rico.[13] There are also dozens of other facilities-based mobile wireless service providers throughout the United States, many of which provide service in a single, often rural, geographic area.[14] These non-nationwide facilities-based service providers increase choices for consumers and help make facilities-based service more widely available in rural areas.[15]

10. *T-Mobile-Sprint Transaction*. In April 2018, T-Mobile and Sprint announced their intent to merge. T-Mobile and Sprint claimed that the merger would represent a total implied enterprise value of approximately $146 billion and would rapidly allow them to create a nationwide 5G network with a combined company that would have lower costs and better quality than the standalone competitors.[16] In its initial filing to the Commission, T-Mobile emphasized that the proposed merger would spur 5G network deployment nationally, improve rural coverage, and permit the combined companies to compete with wired broadband providers through a new in-home fixed broadband service offering.[17]

11. This transaction involved the transfer of multiple spectrum licenses and authorizations, and was subject to Commission review to determine whether the transaction would serve the public interest, convenience, and necessity.[18] Accordingly, we assessed the extent to which this merger of two firms that compete in many of the same geographic and product markets might lessen some elements of competition, and whether any potential harms would be counterbalanced by the potential benefits of the transaction. In response to Commission staff's concerns about certain aspects of the proposed transaction, in May 2019, T-Mobile made several commitments to the Commission—including a pledge to divest Sprint's Boost Mobile business and various 5G deployment commitments.[19] On October 16, 2019, the

[9] *See infra* Fig. II.A.1.

[10] United States Cellular Corp., 2019 SEC Form 10-K at 1 (filed Feb. 25, 2020). U.S. Cellular is a majority-owned (82%) subsidiary of Telephone and Data Systems, Inc. *Id*.

[11] *See id.*

[12] C Spire, About C Spire, *C Spire Celebrates 30 Years of Customer Inspiration This Month* (Feb. 13, 2018), https://www.cspire.com/company_info/about/news_detail.jsp?entryId=29600003.

[13] América Móvil, América Móvil's Second Quarter of 2020 Financial and Operating Report at 23 (July 14, 2020), https://www.americamovil.com/investors/reports-and-filings/quarterly-results/default.aspx.

[14] Examples of regional facilities-based service providers include Appalachian Wireless, Carolina West Wireless, Cellcom, Choice Wireless, GCI, Nex-Tech Wireless, and Sagebrush Cellular. *Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 17-126, Twentieth Report, 32 FCC Rcd 8968, 8975, para. 14 & n.50 (2017) (*Twentieth Wireless Competition Report*).

[15] *Policies Regarding Mobile Spectrum Holdings Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd 6133, 6207, paras. 179-80 (2014) (*Mobile Spectrum Holdings Report and Order*).

[16] Press Release, T-Mobile, T-Mobile and Sprint to Combine, Accelerating 5G Innovation & Increasing Competition (Apr. 29, 2018), https://www.t-mobile.com/news/press/5gforall.

[17] *See generally* Applications of T-Mobile USA, Inc., and Sprint Corporation for Consent To Transfer Control of Licenses and Authorizations, ULS File No. 0008224209 (Lead Application) (filed June 18, 2018, amended July 5, 2018), Exh. 1—Description of the Transaction, Public Interest Statement, and Related Demonstrations at 2.

[18] 47 U.S.C. §§ 214(a), 310(d).

[19] *See T-Mobile-Sprint Order*, 34 FCC Rcd at 10801-28, Appx. G.

Commission adopted the *T-Mobile-Sprint Order*, which required, "as a condition of our approval, that the Applicants fulfill a series of commitments to address the potential for lost price competition, such as the divestiture of Boost Mobile."[20]

12. *Mobile Virtual Network Operators.* MVNOs do not own any network facilities, but instead they purchase mobile wireless services wholesale from facilities-based service providers and resell these services to consumers.[21] In 2019, TracFone, an América Móvil subsidiary,[22] was the largest MVNO, with approximately 21 million subscribers.[23] In 2015, Google launched "Project Fi," an MVNO in partnership with T-Mobile and Sprint whereby Google Fi subscribers switched between Wi-Fi networks and these two service providers' 4G LTE networks.[24]

13. Cable providers have also begun entering the mobile wireless market through MVNO arrangements. These products rely on combining the mobile networks of facilities-based partners with hotspot or small-cell networks that send traffic through the cable provider's infrastructure.[25] In 2016,

[20] *T-Mobile-Sprint Order*, 34 FCC Rcd at 10582, para. 11.

[21] *Twentieth Wireless Competition Report*, 32 FCC Rcd at 8976, para. 15. The Commission is not able to provide an exact figure of the number of MVNOs that currently offer services. This is partly because, as resellers of service offered by facilities-based service providers, MVNOs are not licensees and typically do not file section 214 applications. Furthermore, as the Commission has found in prior competition reports, "[c]omprehensive data on MVNO subscribers are generally not reported by either MVNOs or facilities-based providers that host MVNOs. Estimates of the number of MVNOs operating in the United States vary considerably. Many MVNOs are privately-held companies that do not publicly report financial or subscriber data." *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Sixteenth Report, 28 FCC Rcd 3700, 3739, para. 32 (2013) (*Sixteenth Wireless Competition Report*).

[22] Verizon announced that it has entered into an agreement with América Móvil to acquire TracFone Wireless, Inc., the leading pre-paid and value mobile provider in the United States. The consideration for the transaction will include $3.125 billion in cash and $3.125 billion in Verizon common stock, subject to customary adjustments, at closing. The agreement also includes up to an additional $650 million in future cash consideration related to the achievement of certain performance measures and other commercial arrangements. Verizon expects the transaction to close in the second half of 2021. *See* Verizon Wireless, *Verizon to acquire TracFone Wireless* (Sept. 14, 2020), https://www.verizon.com/about/news/verizon-to-acquire-tracfone.

[23] TracFone, *TracFone Home*, http://www.tracfone.com/ (last visited Oct. 27, 2020); BestMVNO, *For the First Time Straight Talk Has More Subscribers Than All Other Tracfone Brands Combined* (Feb. 24, 2020), https://bestmvno.com/straight-talk/for-the-first-time-straight-talk-has-more-subscribers-than-all-other-tracfone-brands-combined/.

[24] FierceWireless, *Google Unveils "Project Fi" MVNO with Sprint and T-Mobile as Partners* (Apr. 22, 2015), http://www.fiercewireless.com/story/google-unveils-project-fi-mvno-sprint-and-t-mobile-partners/2015-04-22. In June 2016, Google added U.S. Cellular as a partner. FierceWireless, *Google's Project Fi to Add U.S. Cellular to Partner Network* (June 8, 2016), http://www.fiercewireless.com/story/googles-project-fi-add-us-cellular-partner-network/2016-06-08. Similar Wi-Fi service is also provided by two other MVNOs: FreedomPop, *FreedomPop Home*, https://www.freedompop.com/ (last visited Oct. 27, 2020) and Republic Wireless, *Republic Wireless FAQ*, https://republicwireless.com/faqs (last visited Oct. 27, 2020).

[25] Chris Mills and Fiona Armstrong, Tutela, *Special Report: State of MVNOs* at 18 (Oct. 2019) ("The most immediate solution for wireless traffic offload are the networks of public or semi-public hotspots operated by the cable companies. Comcast . . . claims to operate a network of 18 million 'xfinitywifi'hotspots nationwide"); *see also id.* at 21. ("Altice Mobile is also well positioned to exploit future technology improvements and spectrum deployments to embrace the 'hybrid MVNO' model. Altice operates the core network, device SIMs, and in some cases has infrastructure agreements in place with Sprint for small cells."), https://www.tutela.com/hubfs/Assets/USA%20State%20of%20MVNOs%20Report%20-%20October%202019.pdf.

both Comcast[26] and Charter,[27] the nation's two largest cable providers, activated MVNO options they held with Verizon Wireless. Comcast launched its Xfinity Mobile wireless service in the spring of 2017, which has since grown to more than 2 million subscribers by year-end 2019.[28] Charter began offering its service in the summer of 2018 and has grown to approximately 1.1 million customers by year-end 2019.[29] Altice,[30] another cable provider, launched an MVNO service on Sprint's network in September 2019, and it had 69,000 subscribers by the end of 2019.[31]

14. *DISH*. As a condition of the T-Mobile-Sprint transaction,[32] DISH entered into an agreement with T-Mobile to provide mobile wireless service.[33] On July 1, 2020, DISH acquired the Boost Mobile brand and its approximately 9 million customers from T-Mobile,[34] as a result of the required divestiture by the Commission and Department of Justice in approving the T-Mobile-Sprint merger.[35] Initially this offering will be an MVNO,[36] which would make it the second largest in the nation behind TracFone. The MVNO agreement between T-Mobile and DISH allows DISH to use T-Mobile's wireless network to provide service to its customers, offers DISH the option to construct and use its own network, and requires T-Mobile to interconnect with DISH's network.[37] Unlike traditional MVNOs, however, DISH has committed to building its own independent 5G network,[38] using its AWS-4, Lower

[26] FierceWireless, *Comcast to Launch Wireless Service in 2017 with Verizon MVNO, 15M Wi-Fi Hotpots* (Sept. 20, 2016), http://www.fiercewireless.com/wireless/comcast-to-launch-wireless-service-2017-verizon-mvno-15m-wi-fi-hotspots.

[27] FierceCable, *Rutledge: Charter Has Asked Verizon to Activate MVNO Agreement* (Sept. 21, 2016), http://www.fiercecable.com/cable/rutledge-charter-has-asked-verizon-to-activate-mvno-agreement.

[28] FierceWireless, *Comcast Adds 261,000 Wireless Subscribers in Q4, Its Largest Gain Yet* (Jan. 23, 2020), https://www.fiercewireless.com/wireless/comcast-adds-261-000-wireless-subscribers-q4-its-largest-gain-yet.

[29] FierceWireless, *Charter's Mobile Service Crosses 1M Subscriber Mark* (Feb. 3, 2020), https://www.fiercewireless.com/operators/charter-s-mobile-service-crosses-1-million-subscriber-mark.

[30] Altice describes itself as an "infrastructure-based Mobile Virtual Network Operator," as it operates its own core network infrastructure to provide wireline broadband, though it does not have its own radio access network for its mobile offering. The distinction in Altice's ability to leverage its own facilities has allowed it to obtain numbers directly under waiver. *See Numbering Policies for Modern Communications; Number Resource Optimization*, WC Docket No. 13-97; CC Docket No. 99-200, Order, 33 FCC Rcd 12501 (WCB 2018).

[31] FierceWireless, *Altice Mobile Raises Prices by $10 for New Customers* (Feb. 13, 2020), https://www.fiercewireless.com/operators/altice-mobile-raises-price-by-10-for-new-customers.

[32] *T-Mobile-Sprint Order*, 34 FCC Rcd at 10591-3, paras. 34-36; *see also United States et al. v. Deutsche Telekom AG, T-Mobile US, Inc. Softbank Group Corp. and Sprint Corp.*, Competitive Impact Statement, No. 1:19-cv-02232, at 8 & n.2 (D.D.C.) (filed July 30, 2019).

[33] *See* Letter from Charles Mathias and Catherine Matraves, FCC, to Kathleen O'Brien Ham, Counsel to T-Mobile, DA 20-421, 35 FCC Rcd 3556 (filed Apr. 16, 2020) (Mathias and Matraves Letter).

[34] DISH, *DISH Enters Retail Wireless Market with Close of Boost Mobile, Advances Build of the Nation's First Standalone 5G Network* (July 1, 2020), http://about.dish.com/2020-07-01-DISH-enters-retail-wireless-market-with-close-of-Boost-Mobile-advances-build-of-the-nations-first-standalone-5G-network.

[35] *T-Mobile-Sprint Order*, 34 FCC Rcd at 10591-92, 10661, paras. 33-34, 189; *see also* DISH, *DISH to Become National Facilities-based Wireless Carrier* (July 26, 2019), http://about.dish.com/2019-07-26-DISH-to-Become-National-Facilities-based-Wireless-Carrier.

[36] *T-Mobile-Sprint Order*, 34 FCC Rcd at 10591-92, paras. 33-34.

[37] *Id.* at 10592-3, para. 34; *see also* Mathias and Matraves Letter at 1-2.

[38] *T-Mobile-Sprint Order*, 34 FCC Rcd at 10594, 10740, paras. 37, 369; *see also* DISH, *DISH Enters Retail Wireless Market with Close of Boost Mobile, Advances Build of the Nation's First Standalone 5G Network* (July 1, 2020), http://about.dish.com/2020-07-01-DISH-enters-retail-wireless-market-with-close-of-Boost-Mobile-advances-build-of-the-nations-first-standalone-5G-network.

700 MHz, and H Block spectrum licenses.[39] As DISH expands its network, it will operate as a hybrid of a facilities-based operator and an MVNO, and ultimately the Commission expects it to become a standalone facilities-based operator.[40]

15. In its second 2020 quarterly earnings call, DISH stated it intends to cover 20% of the U.S. population by mid-2022 and deploy over 15,000 cell sites by mid-2023, with an eventual nationwide network of 50,000 cell sites with a $10 billion investment cost.[41] DISH spent more than $900 million for 5,492 licenses for 5G-capable mid-band spectrum in Auction 105, the second largest amount of any winning bidder.[42] Further, we note that DISH has already made arrangements with suppliers, including Fujitsu for radios, VMWare for cloud networking, and Altiostar and Mavenir for software.[43]

16. *Mobile Satellite Providers*. In the United States, and globally, satellites provide telecommunications infrastructure for communications, including voice, video, audio, and data services.[44] Mobile satellite service (MSS)[45] generally involves transmitting and receiving communications signals from mobile earth stations located on land, on sea, or on airplanes.[46] MSS operates in a 70 megahertz range of spectrum allocated in the L-band, in a 40 megahertz range in the 2 GHz MSS band, in a 33 megahertz range in the Big LEO band, and in a 4 megahertz range in the Little LEO band.[47] Voice and

[39] *See T-Mobile-Sprint Order*, 34 FCC Rcd at 10829-41, Appx. H.

[40] *See id.* at 10594, 10741-45, 10829-41, paras. 37, 372-38, Appx. H.

[41] CitiResearch, *DISH Network Corp (DISH), Wireless Outlook Needs to Pivot Beyond Tech to the TAM*, at 1 and 3 (Aug. 9, 2020); J.P. Morgan, *DISH Network, Strong Video Trends as Focus Shifts to Wireless Execution; Boost Likely Loses Subs from Here*, at 1 (Aug. 7, 2020).

[42] *Auction of Priority Access Licenses in the 3550-3650 MHz Band; Winning Bidders Announced for Auction 105*, AU Docket No. 19-244, Public Notice, DA 20-1009, Exh. A, at 1, https://auctionfiling.fcc.gov/form175/search175/index.htm, (OEA, WTB Sept. 2, 2020) (*3.5 GHz Public Notice*).

[43] DISH, *DISH Selects Mavenir to Deliver Cloud-Native OpenRAN Software for Nation's First Virtual 5G Wireless Broadband Network* (Apr. 23 , 2020), http://about.dish.com/2020-04-23-DISH-Selects-Mavenir-to-Deliver-Cloud-Native-OpenRAN-Software-for-Nations-First-Virtual-5G-Wireless-Broadband-Network; DISH, *DISH advances O-RAN network, Selects Fujitsu for 5G radio units and Altiostar for virtualized RAN software solution* (June. 30, 2020), https://about.dish.com/2020-06-30-DISH-advances-O-RAN-network-Selects-Fujitsu-for-5G-radio-units-and-Altiostar-for-virtualized-RAN-software-solution; VMWare, *DISH Selects VMware to Help Build the Most Advanced, Automated, End-to-End 5G Network in the U.S.*, https://www.vmware.com/company/news/releases/vmw-newsfeed.DISH-Selects-VMware-to-Help-Build-the-Most-Advanced-Automated-End-to-End-5G-Network-in-the-U.S.459a7317-5c39-48ec-a2c1-fef8509d4075.html (last visited Oct. 27, 2020).

[44] Satellites function as relay stations in space that receive signals from an earth station and then re-transmit the signal to a distant point located often thousands of miles from the point of signal origination. An earth station is a station located either on the Earth's surface or within the major portion of the Earth's atmosphere and intended for communication: (1) With one or more space stations; or (2) With one or more stations of the same kind by means of one or more reflecting satellites or other objects in space. 47 CFR § 25.103. The Commission's definition is identical to the definition established by the International Telecommunication Union (ITU). ITU, Radio Regulations—Articles (ed. 2016), at 13 (Article 1, 1.63), http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/1.43.48.en.101.pdf (*ITU Radio Regulations*) (last visited Oct. 27, 2020).

[45] MSS generally refers to services provided to mobile earth stations using MSS frequency bands. The newer ESIMs, discussed below, refer to services provided to mobile earth stations using the FSS frequency bands.

[46] 47 CFR § 25.103.

[47] There are MSS allocations in the 1525-1559 MHz (space-to-Earth) band and the 1626.5-1660.5 MHz (Earth-to-space) band of the L-band, and in the 2000-2020 MHz and 2180-2200 MHz bands of the 2 GHz band. Other frequency bands with MSS allocations have been given specific labels in the Commission rules: the Big LEO bands (1610-1626.5 MHz and 2483.5-2500 MHz) and the Little LEO bands (137-138 MHz, 400.15-401 MHz, and 148-150.5 MHz). 47 CFR § 25.103. Due to encumbrances, not all of the allocated spectrum is available for use by MSS providers.

data services are conducted in the L-band, Big LEO band, and 2 GHz bands, while the Little LEO band is limited to non-voice services.[48] Examples of MSS applications include voice, low-speed data, and tracking services for aircraft and ships, as well as handsets operating in remote locations on land.

17. Currently, five satellite operators provide MSS in the United States: Inmarsat, Ligado (formerly known as LightSquared),[49] Iridium, Globalstar, and ORBCOMM.[50] Due to technological differences, MSS services vary significantly in characteristics, such as cost, geographic availability, required customer equipment, data bandwidth and allowances, two-way capabilities, latency, network reliability, and ease of use.[51] Inmarsat, the largest MSS operator, provides extensive voice, video, and data communications services to mobile earth stations using GSO satellites, five of which have been granted access to the U.S. market.[52] In 2019, MSS generated approximately $700 million in U.S. revenues.[53]

18. Over the last ten years, the Commission also has allowed the operation of Earth Stations in Motion (ESIMs) within the spectrum bands allocated to fixed satellite services (FSS).[54] Earth Stations on Vessels, Vehicle-Mounted Earth Stations, and Earth Stations Aboard Aircraft—collectively designated as ESIMs[55]—are mobile in nature, but nevertheless operate in FSS spectrum because at any point in time, their emissions have the same characteristics as those of a fixed earth station transmitting from the same location. Given that ESIMs have access to a significant amount of FSS spectrum and they use directional

[48] *See, e.g.*, *Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks; Amendments to Rules for the Ancillary Terrestrial Component of Mobile Satellite Service Systems*, IB Docket No. 13-213, RM-11685, Report and Order, 31 FCC Rcd 13801, 13802 & n.2 (2016) (noting distinction between Big LEO systems, which operate with voice and higher data-rate capabilities, and Little LEO systems, which do not provide voice service and generally operate with lower data-rate capabilities).

[49] *Ligado Amendment to License Modification Applications IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and SAT-MOD-20151231-00091 et al.*, IB Docket No. 11-109, Order and Authorization, 35 FCC Rcd 3772 (2020).

[50] *See* Inmarsat, *Our Satellites*, https://www.inmarsat.com/about-us/our-technology/our-satellites/ (last visited Oct. 27, 2020); Ligado, *Covering a Continent with the Ligado SkyTerra 1 Satellite*, https://ligado.com/wp-content/uploads/SkyTerra1_InfoSheet_0819.pdf (last visited Oct. 27, 2020); Iridium, *Iridium Global Network*, https://www.iridium.com/network/globalnetwork/ (last visited Oct. 27, 2020); Globalstar, *Our Technology*, https://www.globalstar.com/en-us/corporate/about/our-technology (last visited Oct. 27, 2020); ORBCOMM, *Satellite IoT and M2M Networks*, https://www.orbcomm.com/en/networks/satellite (last visited Oct. 27, 2020).

[51] Inmarsat Plc, 2018 Annual Report and Financial Statements at 1, https://www.inmarsat.com/wp-content/uploads/2019/12/Inmarsat-Group-Limited-Annual-Report-2018.pdf (last visited Oct. 27, 2020); Iridium Communications, Inc., 2019 SEC Form 10-K at 2-5 (filed Feb. 25, 2020); Globalstar, 2019 SEC Form 10-K at 3-9 (filed Feb. 28, 2020).

[52] FCC, *Space Station Approval List*, https://www.fcc.gov/approved-space-station-list. (last visited Oct. 27, 2020).

[53] Mobile satellite 2019 revenues totaled $0.7 billion in both 2018 and 2019, approximately 1% of total U.S. satellite services revenue. SIA Comments at 5, SIA *Ex Parte*. For total mobile satellite revenues from 2013 through 2017, *see 2018 Communications Marketplace Report*, 33 FCC Rcd at 12673, Fig. F-1.

[54] *See generally Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands*, IB Docket No. 02-10, Report and Order, 20 FCC Rcd 674 (2005); *see also Amendment of Parts 2 and 25 of the Commission's Rules to Allocate Spectrum and Adopt Service Rules and Procedures to Govern the Use of Vehicle-Mounted Earth Stations in Certain Frequency Bands Allocated to the Fixed-Satellite Service*, IB Docket No. 07-101, Report and Order, 24 FCC Rcd 10414 (2009).

[55] *O3b Limited*; *Request for Modification of U.S. Market Access for O3b Limited's Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service and in the Mobile-Satellite Service*, Order and Declaratory Ruling, 33 FCC Rcd 5508, 5516, para. 21 & n.59 (2018) (*O3b Modification Order*).

antennas that enhance throughput,[56] ESIMs are able to transmit and receive very high data-rate broadband communications while in motion.[57] Licensees increasingly use ESIMs to deliver broadband to ships, vehicles, trains, and aircraft using the same frequency bands, hardware, satellites, transponder beams, and gateways used to serve earth stations at fixed locations.[58]

19. FSS operators provide broadband services to aircraft and maritime vessels, which include government organizations, commercial entities, and individual clients.[59] For example, Intelsat and Telesat offer broadband services for maritime vessels (including maritime enterprise VSAT services[60] and broadband connectivity for cruise ships), as well as broadband connectivity for in-flight entertainment and Wi-Fi services for the aeronautical industry.[61] SES and ViaSat provide broadband service on commercial airlines and cruise ships.[62] Hughes/Echostar also provides broadband service on commercial airlines.[63]

[56] The use of directional antennas required for FSS spectrum use means that FSS spectrum can be re-used repeatedly, for each satellite spot beam, unlike MSS services which traditionally use non-directional antennas, preventing the reuse of spectrum. *O3b Modification Order*, 33 FCC Rcd at 5516, para. 21 & n.59.

[57] *O3b Modification Order*, 33 FCC Rcd at 5516, para. 21 & n.59. ESIMs enable the provision of very high data rate broadband communications, navigational, situational awareness, and other services to mobile platforms that often cannot be served using other communications technologies. *See Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, IB Docket No. 17-95, Report and Order and Further Notice of Proposed Rulemaking, 33 FCC Rcd 9327, 9328-29, para. 3 (2018) (*ESIMs Order*). The Commission continues to distinguish ESIMs, which operate in FSS spectrum, from mobile earth stations, which operate in MSS spectrum. *ESIMs Order* 33 FCC Rcd at 9328-30, paras. 3-4, 10 (defining ESIMs to collectively designate the three types of FSS earth stations that the Commission authorizes to transmit while in motion: Earth Stations on Vessels (ESVs), Vehicle-Mounted Earth Stations (VMESs), and Earth Stations Aboard Aircraft (ESAAs)); 47 CFR § 25.103 (*Mobile Earth Station*) (defining mobile earth station as "[a]n earth station in the Mobile-Satellite Service intended to be used while in motion or during halts at unspecified points.").

[58] *ESIMs Order*, 33 FCC Rcd at 9328, para. 2.

[59] "Satellites are playing an increasingly profitable role in the aviation industry. A $1B market today, the London School of Economics projects that airline broadband will encompass a $30B market by 2035. Connected aircraft could also save airlines $15B annually in operating costs, according to the same study." SIA Comments at 8-9. *See also* Grous, Alexander, *Sky High Economics.* Department of Media and Communications, London School of Economics and Political Science (2017), http://eprints.lse.ac.uk/87438/1/Grous_Sky%20High_Author.pdf.

[60] Vessels can connect to the global communications network with VSAT technology, which provides crew and passengers with high-speed Internet access and phone service. iDirect, *ViaSatellite, The Coming Wave of Maritime VSAT Growth*, https://www.satellitetoday.com//long-form-stories/maritime-vsat/ (last visited Oct. 27, 2020).

[61] *See* Intelsat, 2019 SEC Form 10-K, at 11 (filed Feb. 20, 2020) (Intelsat 2019 SEC Form 10-K); Telesat Canada, 2019 SEC Form 20-F at 34 (filed Feb. 27, 2020) (Telesat Canada 2019 SEC Form 20-F). For example, Telesat has a long-term contract with Panasonic Avionics Corporation (Panasonic) to provide satellite capacity to support Panasonic's in-flight entertainment and communications systems. *See* Telesat, *Panasonic Signs Long Term Contract For Multiple Transponders on Telesat Satellites to Expand Aeronautical Broadband Service Over Latin America* (Nov. 14, 2012), www.telesat.com/news-events/panasonic-signs-long-term-contract-multiple-transponders-telesat-satellites-expand. Likewise, Intelsat leases transponder capacity to GoGo for aviation. Intelsat, *Gogo Adds Intelsat 29e Services to Provide Broadband Connectivity for Aircraft Crossing the North Atlantic* (Nov. 17, 2016), http://www.intelsat.com/news/press-release/gogo-adds-intelsat-29e-services-to-provide-broadband-connectivity-for-aircraft-crossing-the-north-atlantic/.

[62] SES plans to launch SES-17 in 2021 to provide aviation service over the Americas and Atlantic. SES, 2019 Annual Report at 36, 41, https://www.ses.com/sites/default/files/2020-04/SES_Annual_Report_2019_HighRes_1.pdf (SES 2019 Annual Report) (last visited Oct. 27, 2020); ViaSat, 2019 SEC Form 10-K at 3-4 (filed May 28, 2020) (ViaSat 2019 SEC Form 10-K).

[63] Hughes, *Thales and SES Select Hughes for Next-Generation Aviation Connectivity Network to Provide Increased Capacity, Coverage and Redundancy over the Americas* (Mar. 8, 2017), https://www.hughes.com/resources/press-

(continued….)

b. Connections/Subscribers and Connections Market Share

20. To estimate the number of mobile wireless subscribers/connections, this *Report* uses Numbering Resource Utilization/Forecast (NRUF) data,[64] which track how many phone numbers have been assigned to mobile wireless devices,[65] and CTIA data.[66] As shown in Figure II.A.1 below,[67] NRUF estimates of mobile wireless connections at year-end 2018 were approximately 422 million, an increase of around 3% from year-end 2017, and at year-end 2019 were approximately 430 million, an increase of around 2% from year-end 2018. CTIA estimates of mobile wireless connections at year-end 2018 were approximately 422 million, an increase of around 5% from year-end 2017, and at year-end 2019 were approximately 442 million, an increase of approximately 5% from year-end 2018.

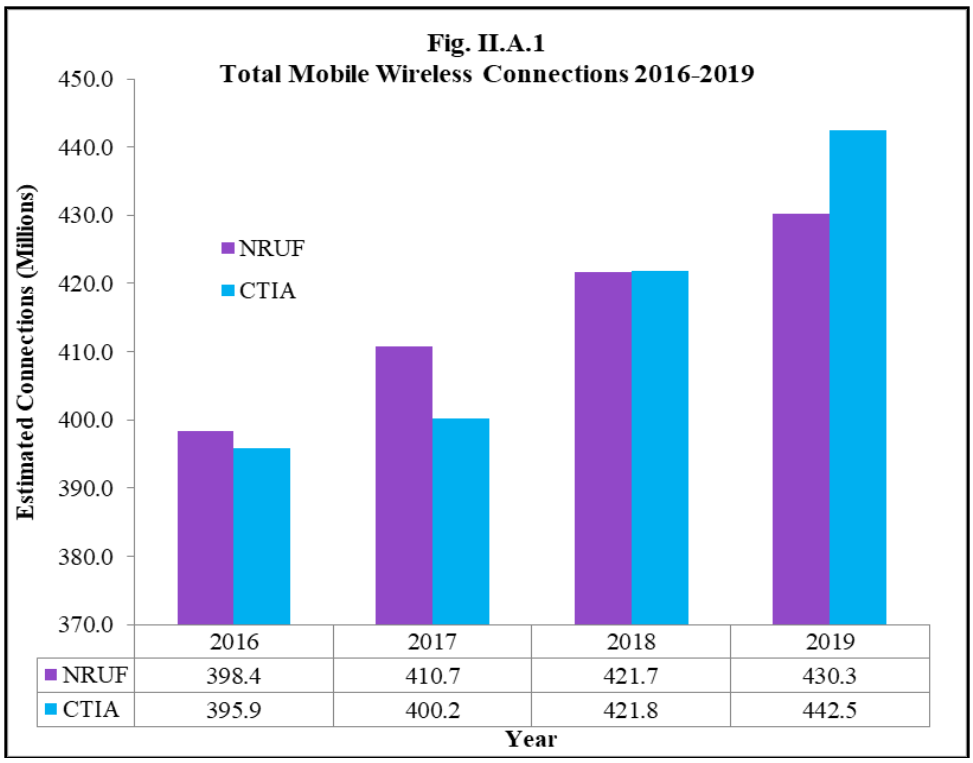
releases/thales-and-ses-select-hughes-next-generation-aviation-connectivity-network; Hughes, *Aeronautical Broadband Solutions*, https://www.hughes.com/what-we-do/by-industry/aeronautical-broadband-solutions (last visited Oct. 27, 2020).

[64] NRUF data indicate the number of assigned phone numbers that a wireless service provider has in a particular rate center (there are approximately 18,000 rate centers in the country). Rate centers are geographic areas used by local exchange carriers for a variety of reasons, including the determination of toll rates. Harry Newton, Newton's Telecom Dictionary: 19th Expanded & Updated Edition at 660 (July 2003). All mobile wireless service providers must report to the Commission the quantity of their phone numbers that have been assigned to end users, thereby permitting the Commission to calculate the total number of mobile wireless subscribers. For purposes of geographical analysis, the rate center data can be associated with a geographic point, and all of those points that fall within a county boundary can be aggregated together and associated with much larger geographic areas based on counties. We note that the aggregation to larger geographic areas reduces the level of inaccuracy inherent in combining non-coterminous areas, such as rate center areas and counties.

[65] While NRUF provides a measure of the number of mobile wireless connections or connected devices that have assigned telephone numbers, the data have limitations, like providing only the quantity of mobile wireless connections that have a telephone number, rather than the number of consumers subscribed to mobile broadband or voice service. *Twentieth Wireless Competition Report*, 32 FCC Rcd at 8977-78, n.65. If a mobile broadband or voice subscriber uses a device that does not have a telephone number assigned to it (e.g., a tablet), then that subscriber will not be recorded. *See Modernizing the FCC Form 477 Data Program*, WC Docket No. 11-10, Further Notice of Proposed Rulemaking, 32 FCC Rcd 6329, 6337, para. 26 & n.38 (2017) (*2017 Data Collection Improvement FNPRM*). These data also do not reflect when consumers move to a different state and retain the same telephone number. *See Establishing the Digital Opportunity Data Collection et al.*, WC Docket No. 19-195, Report and Order and Second Further Notice of Proposed Rulemaking, 34 FCC Rcd 7505, 7530-31, para. 60 (2019) (*Digital Opportunity Data Collection Order and Second Further Notice*).

[66] Different sources refer to their data as connections or subscribers, and when discussing the different data, we will use the terminology most currently used by the source and, where possible, provide a definition of this term. For example, CTIA explains its use of the terms "subscribers" and "connections" as follows: "Traditionally, the term 'subscribers' was used as a term of art, reflecting the number of revenue-generating units, equally describable as 'wireless connections'—the equivalent of wired telephone 'lines.' The terms 'subscriber' does not indicate a unique individual person. Indeed, the growing number and variety of non-traditional devices and machine-to-machine applications mean that the term 'subscribers' is increasingly less descriptive of a growing share of the universe of active units." CTIA, CTIA's Wireless Industry Indices Report, Year-End 2019 Results at 16 (CTIA Year-End 2019 Wireless Industry Indices Report).

[67] For details of total mobile wireless connections over time, *see* Appx. B.1 of this *Report*.



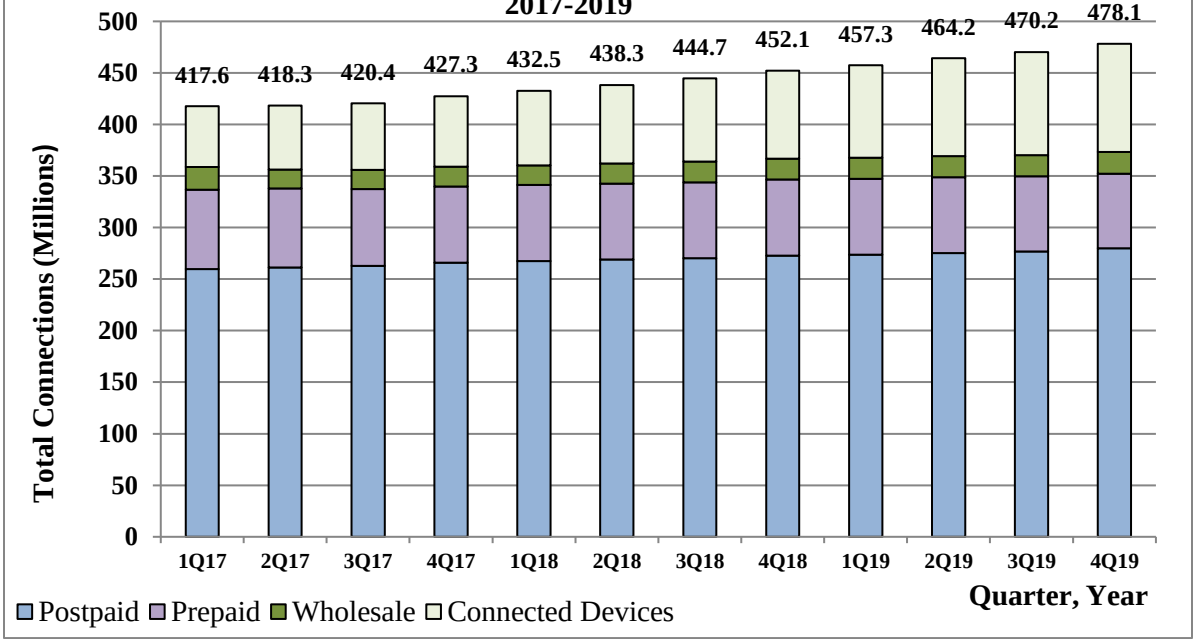
	2016	2017	2018	2019
NRUF	398.4	410.7	421.7	430.3
CTIA	395.9	400.2	421.8	442.5

Source: NRUF, CTIA Year-End 2019 Wireless Industry Indices Report.

21. Figure II.A.2 presents data on total connections by service segment, based on UBS Investment Research data. It shows that, in 2019, the postpaid segment accounted for approximately 59% of all connections, while the prepaid segment accounted for approximately 15% of all connections. Most notably, Internet connected devices surpassed prepaid connections in the middle of 2018 and is now the second-largest segment by volume, accounting for approximately 22% of all wireless connections.[68]

[68] These wireless connections are "composed almost entirely of data-capable devices, with web-capable devices, smartphones, tablets/laptops and wireless broadband modems composing the vast majority of all wireless-connected devices." In addition, the number of data-only devices—such as connected cars, IoT devices and wearables—increased to approximately 175 million in 2019. CTIA Year-End 2019 Wireless Industry Indices Report at 6.

Fig. II.A.2
Quarterly Total Mobile Wireless Connections by Service Segment
2017-2019



Source: UBS Investment Research. UBS Data 2017-2019. Published with permission from UBS.

22. Figure II.A.3 presents data on total mobile wireless connections for the largest publicly traded service providers operating in the United States, including an estimate of their respective market shares as of year-end 2019.[69] As of the end of 2019, the market shares for Verizon Wireless and AT&T were each greater than the next three largest providers, T-Mobile, Sprint, and U.S. Cellular, combined.

Fig II.A.3
Estimated Total Connections for Publicly Traded Facilities–Based Mobile Wireless Service Providers (in thousands): 2016–2019

Service Providers	EOY 2016	EOY 2017	EOY 2018	EOY 2019	EOY 2019 (% Connection Market Share)
Verizon	145,859	151,978	155,798	169,602	35.4
AT&T	134,875	146,847	157,095	163,388	34.1
T-Mobile	71,455	74,040	79,651	86,046	18.0
Sprint	59,515	54,683	54,495	54,165	11.3
U.S. Cellular	5,079	5,063	5,041	4,948	1.0
Top 5 Service	**416,783**	**432,611**	**452,080**	**479,149**	

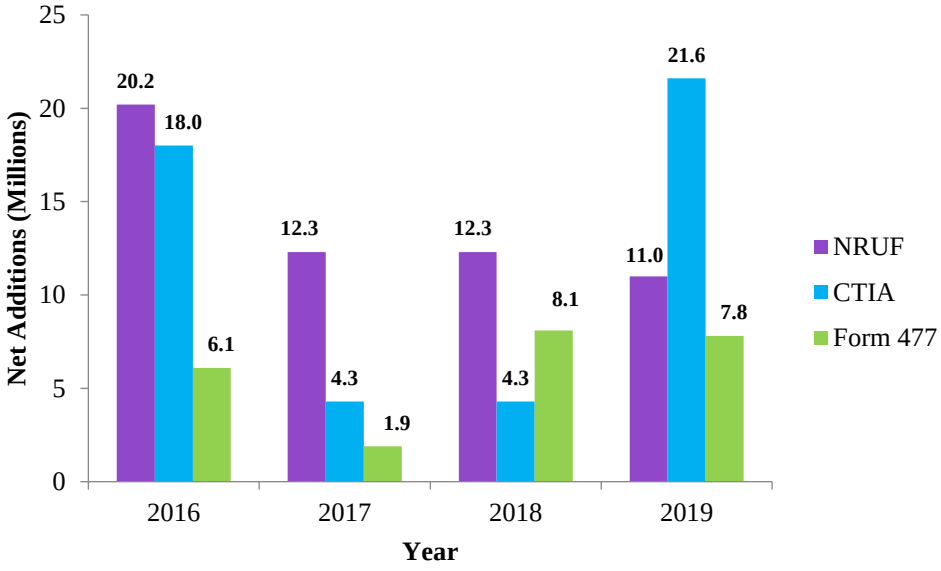
Source: UBS Investment Research. UBS Data 2016-2019. Published with permission from UBS. Total estimated connections figure includes data only for the service providers reported in this table.

23. Estimates of the number of net additions in 2018 and 2019 vary, likely due to differences in the way in which connections are measured. As shown in Figure II.A.4, for 2018, there were approximately 12.3 million net additions based on NRUF data, compared with 4.3 million based on CTIA data. Mobile voice subscriber data as reported by service providers on FCC Form 477 show that for

[69] The size of a company, typically measured by service revenues or subscribers, relative to the total size of the industry determines its market share. *See, e.g.*, The MIT Dictionary of Modern Economics at 268 (4th ed. 1992).

2018, net subscriber additions totaled approximately 8.1 million. In 2019, NRUF showed 11.0 million additions, CTIA showed 21.6 million additions, and preliminary figures from FCC Form 477 showed 7.8 million additions.[70]

Fig. II.A.4
Total Mobile Wireless Connections Annual Net Additions (2016-2019)

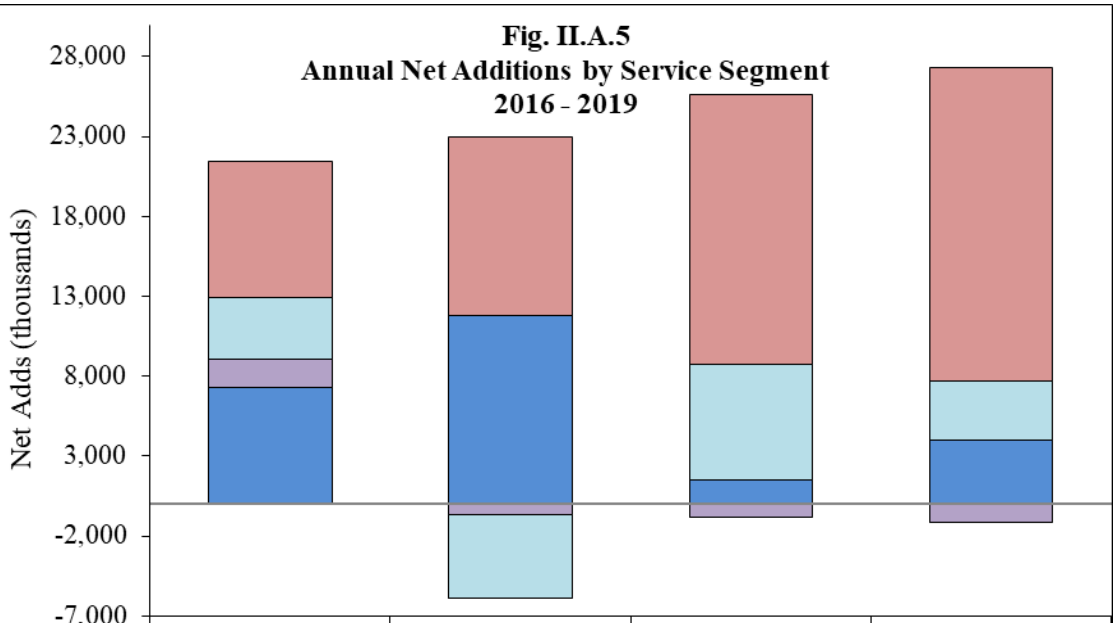


Source: NRUF, CTIA Year-End 2019 Wireless Industry Indices Report, FCC Form 477.

24. Figure II.A.5 below shows that in both 2018 and 2019, a substantial majority of wireless additions were connected devices, accounting for approximately 69% and 75% of all wireless additions in those two years, respectively. Additionally, wholesale additions surpassed postpaid additions in 2018, perhaps in part due to the entry of cable providers into the wireless market. Lastly, prepaid connections declined in each of the last three years. Figure II.A.6 shows net subscriber additions by the four nationwide service providers from 2016 through 2019.

[70] Based on FCC Form 477 data, the preliminary total number of mobile voice telephone subscriptions at year-end 2019 was 356 million, as compared to 348 million at year-end 2018. We again note that the year-end FCC Form 477 data are preliminary only, are subject to corrections as appropriate by the service provider, and the final data will be published in due course by the agency. *See, e.g.*, FCC, Wireline Competition Bureau, *Voice Telephone Services: Status as of December 31, 2018* (Mar. 6, 2020), https://www.fcc.gov/voice-telephone-services-report. These data do not include non-voice devices.

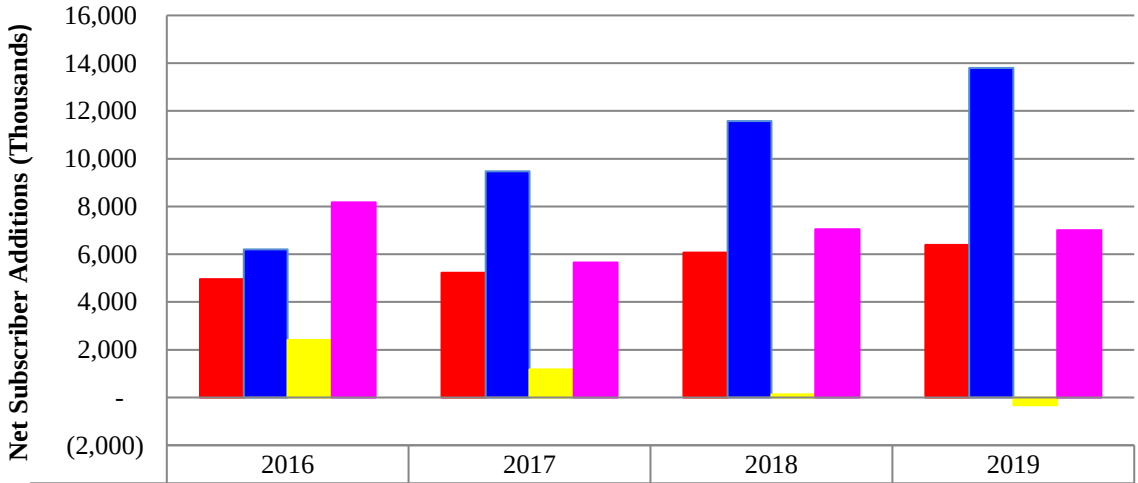
Fig. II.A.5
Annual Net Additions by Service Segment
2016 - 2019



	2016	2017	2018	2019
Total	21,476	17,039	24,763	26,168
Connected	8,578	11,150	16,841	19,554
Wholesale	3,838	-5,215	7,265	3,769
Prepaid	1,750	-685	-841	-1,121
Postpaid	7,310	11,789	1,498	3,966

Source: UBS Investment Research. UBS Data 2016-2019. Published with permission of UBS.

Fig. II.A.6
Annual Net Additions by Service Provider: 2016-2019



	2016	2017	2018	2019
Verizon	4,955	5,222	6,069	6,392
AT&T	6,196	9,474	11,581	13,804
Sprint	2,411	1,173	129	(330)
T-Mobile	8,173	5,658	7,044	7,011

Source: UBS Investment Research. UBS Data 2016-2019. Published with permission of UBS.

25. *Market Concentration.* High market concentration levels in any market may raise some concern that a market is not competitive, although it is not necessarily the case.[71] To measure mobile wireless market concentration, the Commission employs the Herfindahl-Hirschman Index (HHI), widely used in competition analysis.[72] The HHI is calculated by summing the squared market shares of all firms in the given market. In this *Report*, we calculate HHIs based on the NRUF data by Economic Area (EA) to maintain continuity with past reports and to ensure that we do not compromise the confidential information found in the NRUF data. As of year-end 2017, the weighted average HHI (weighted by population across the 172 EAs in the United States) for mobile wireless services was 3,106.[73] As of year-end 2019, taking into account the transaction between T-Mobile and Sprint, the weighted average HHI for mobile wireless services by EA was 3,622.[74]

c. Churn

26. Churn measures the percentage of connections that are disconnected from mobile wireless service during a given time period.[75] A service provider's churn rate depends on many factors, such as the distribution of its customers between postpaid and prepaid service plans, customer satisfaction with their service provider, and switching costs.[76] High levels of industry churn can indicate that consumers are not only willing but are also able to easily switch between service providers. For 2019, CTIA reported an annual industry-wide churn rate of 19.5%, and a monthly rate of 1.6%.[77] Figure II.A.7 shows the industry weighted churn rates, according to UBS, for the nationwide providers by quarter. At the end of 2019, stronger wireless competition among the top four providers and new competition from cable MVNOs resulted in a slight increase in churn rates.[78]

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[71] It is well understood that we can observe intense competition even with a small number of firms in the market. *See, e.g.*, Ernest Gellhorn, Antitrust Law and Economics 117 (4th ed. 1994) (stating "[m]arket shares are not synonymous with market power; they should mark the beginning for careful analysis, not the end of it."); Michael Whinston, *Antitrust Policy toward Horizontal Mergers*, Handbook of Industrial Organization, Vol. 3, (eds. Mark Armstrong and Robert Porter 2007); John Sutton, Sunk Costs and Market Structure (1991); Joseph Farrell and Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, 10(1) The B.E. Journal of Theoretical Economics 1 (2010); Gregory J. Werden and Luke M. Froeb, *Unilateral Competitive Effects of Horizontal Mergers*, Handbook of Antitrust Economics (ed. Paolo Buccirossi 2008).

[72] To the extent that this section uses the term "markets," we do not intend it to be interpreted as synonymous with the antitrust concept of the "relevant market," which the Commission defines in the context of secondary market transactions review. *See, e.g.*, *T-Mobile-Sprint Order*, 34 FCC Rcd at 10601, para. 55.

[73] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12582-83, para. 30.

[74] Antitrust authorities in the United States generally classify markets into three types: Unconcentrated (HHI < 1500), Moderately Concentrated (1500 < HHI < 2500), and Highly Concentrated (HHI > 2500). U.S. Department of Justice and the Federal Trade Commission, Horizontal Merger Guidelines (Aug. 19, 2010), http://www.justice.gov/atr/public/guidelines/hmg-2010.pdf.

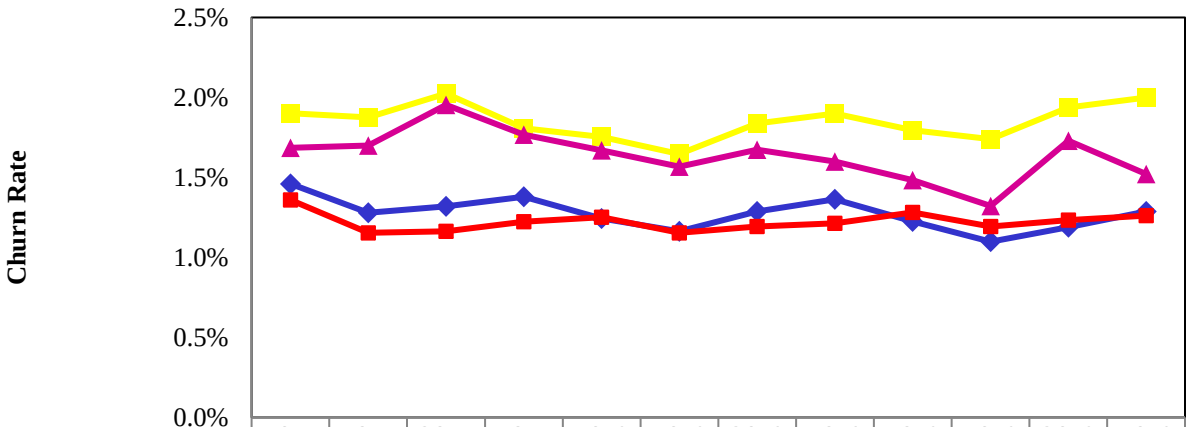
[75] CTIA defines churn as "a measure of the number of subscribers disconnecting from service during the period." CTIA Year-End 2019 Wireless Industry Indices Report at 35. Churn is calculated by dividing the aggregate number of wireless connections that canceled service during a time period by the total number of wireless connections at the beginning of that time period. For an annual calculation, if a service provider has an average monthly churn rate of 2%, the service provider would lose 24% of its subscribers over the course of a year. Service providers publish their monthly churn rate information as part of their quarterly filings with the SEC.

[76] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12567, para. 11.

[77] CTIA Year-End 2019 Wireless Industry Indices Report at 37. For prepaid services, CTIA reported an annual industry-wide churn rate of 47.2% and a monthly churn rate of 4.45%. *Id*. at Appx. C, 14.

[78] Instinet, LLC, Equity Research, Churn Return: 2020 to Interrupt Years of Progress at 3 (2020); Bevin Fletcher, *Sprint sheds subscribers as churn climbs* (Jan. 27, 2020), https://www.fiercewireless.com/financial/sprint-sheds-subscribers-as-churn-climbs.

Fig. II.A.7
Quarterly Churn Rate for Nationwide Mobile Wireless Providers
1st Quarter 2017- 4th Quarter 2019



	1Q17	2Q17	3Q17	4Q17	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19
AT&T	1.5%	1.3%	1.3%	1.4%	1.2%	1.2%	1.3%	1.4%	1.2%	1.1%	1.2%	1.3%
Verizon Wireless	1.4%	1.2%	1.2%	1.2%	1.3%	1.2%	1.2%	1.2%	1.3%	1.2%	1.2%	1.3%
Sprint	1.9%	1.9%	2.0%	1.8%	1.8%	1.6%	1.8%	1.9%	1.8%	1.7%	1.9%	2.0%
T-Mobile	1.7%	1.7%	2.0%	1.8%	1.7%	1.6%	1.7%	1.6%	1.5%	1.3%	1.7%	1.5%

Source: UBS Investment Research. UBS Data 2017-2020. Published with permission of UBS.

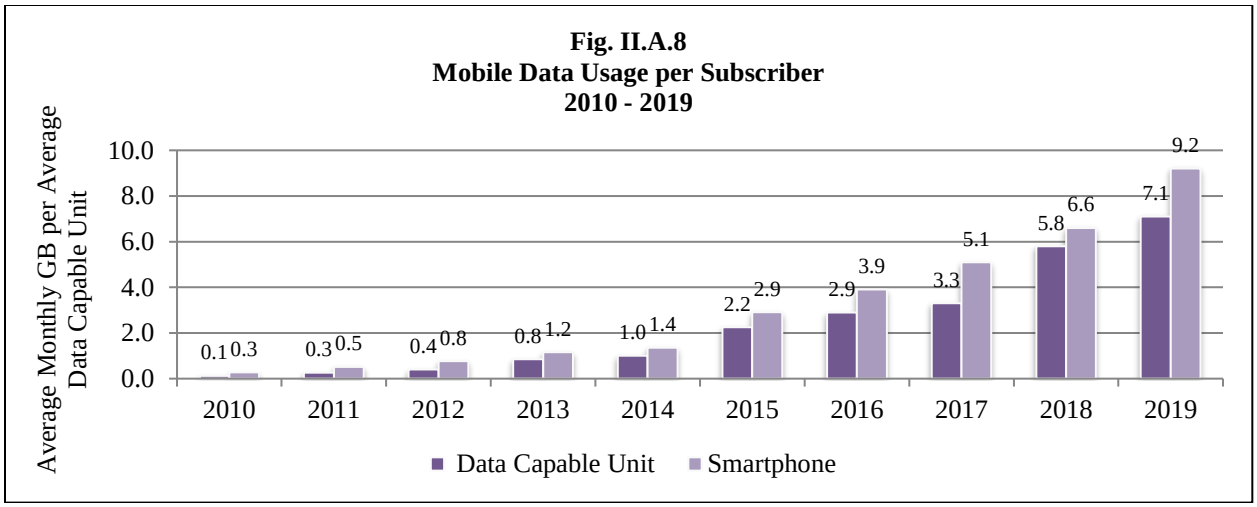
d. Data Usage

27. As shown in Figure II.A.8, monthly data usage per smartphone subscriber rose to an average of 9.2 GB per subscriber per month, an increase of approximately 39% from year-end 2018 to year-end 2019.[79] Figure II.A.9 further shows that total network annual data usage increased by approximately 30% from 2018 to 2019, with a commensurate increase in total annual minutes of voice use (MOUs) of approximately 29%,[80] while total messaging traffic experienced a much smaller increase of approximately 3%.[81]

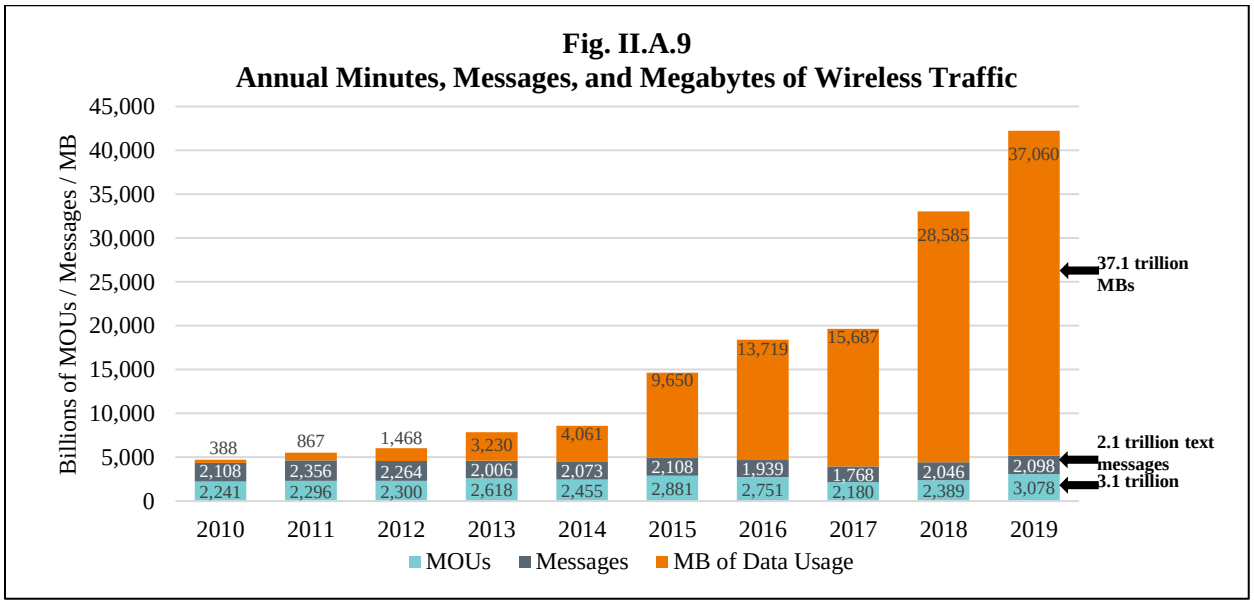
[79] CTIA Year-End 2019 Wireless Industry Indices Report at 15.

[80] *Id.* at 13.

[81] *Id.* This provider-reported messaging traffic does not include traffic from over-the-top messaging applications and services, which would only appear in the total data traffic figures, thereby contributing to the total MB of data traffic. *See id.*



Source: CTIA Year-End Wireless Industry Indices Report at 15, Chart 4.



Source: CTIA Year-End Wireless Industry Indices Report at 13, Chart 2.

28. This growth in data usage is primarily driven by increasing data demanded per device. According to a 2019 Pew survey, smartphone and tablet ownership were 81% and 52%, respectively, largely unchanged from the 77% and 53% ownership figures reported in 2018.[82] Pew reported that 17% of American adults are "smartphone-only" Internet users—they own a smartphone, but do not have traditional fixed home broadband service—a 3-point decrease from a year earlier.[83] Comparatively, the U.S. Census Bureau's American Community Survey (ACS) found that, as of 2019, approximately 10% of total U.S. households subscribed to a cellular data plan with no other type of Internet subscription.[84]

[82] Pew Research Center, *Mobile Fact Sheet* (June 12, 2019), http://www.pewinternet.org/fact-sheet/mobile/ (Pew Mobile Fact Sheet).

[83] *See* Pew Mobile Fact Sheet.

[84] U.S. Census Bureau, 2019 American Community Survey 1-Year Estimates, *Types of Computers and Internet Subscriptions*, https://data.census.gov/cedsci/table?q=S2801%3A%20TYPES%20OF%20COMPUTERS%20AND%20INTERNET%20SUBSCRIPTIONS&tid=ACSST1Y2019.S2801&hidePreview=true (last visited Oct. 27, 2020). We note that (continued….)

Many consumers also choose to depend on some combination of fixed and mobile broadband access, while discontinuing their landline telephone services. In fact, according to preliminary data from the Centers for Disease Control and Prevention, as of June 2019, the percentage of U.S. adults living in households that were identified as having wireless-only telephone service (no landline telephone service) was approximately 59%.[85]

2. Mobile Wireless Spectrum and Service Providers' Spectrum Holdings

29. Spectrum is a critical input in the provision of mobile wireless services.[86] It can affect whether, when, and where existing service providers and potential entrants will be able to expand capacity or deploy networks.[87] Incumbent service providers may need additional spectrum to increase their coverage or capacity, while new entrants need access to spectrum to enter a geographic area at all. Spectrum bands vary in breadth and in their propagation characteristics, and these variations have implications for how spectrum is deployed.[88] The effective supply of spectrum capacity available for mobile wireless service depends on several aspects of spectrum policy, including allocation and licensing policies, as well as interference and technical rules.[89] Increasing the total supply of spectrum bandwidth that the Commission allocates and licenses to mobile wireless service providers can increase network capacity and reduce the degree of frequency reuse required to achieve a given level of capacity.[90] The efforts of the Commission to allocate more mid-band and mmW spectrum to meet consumer demand for mobile broadband services and to fuel innovation and investment in the mobile wireless market are detailed in sections V and VI below.

30. Subject to Commission approval, licensees may transfer licenses, in whole or in part (through partitioning and/or disaggregation), on the secondary market.[91] In reviewing proposed transfers

Pew surveys U.S. adults while ACS relies on sampling households, which is a likely source of divergence for these respective statistics.

[85] CDC, NCHS, Stephen J. Blumberg and Julian V. Luke, *Wireless Substitution: Early Release of Estimates from the National Health Interview Survey*, January-June 2019, National Center for Health Statistics (May 2020), https://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless202005-508.pdf. For a more detailed discussion of competition between fixed and mobile, *see infra* section II.B.3.

[86] Non-spectrum inputs in the provision of mobile wireless services include cellular base stations and towers to carry transmissions and backhaul, which routes voice and data traffic from base stations to mobile switching centers. Backhaul may be provided via wireless spectrum, copper, or fiber, though we note copper may lack sufficient capacity for current data demands.

[87] *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6134, para. 2.

[88] Spectrum below 1 GHz (low-band spectrum) has certain propagation advantages for network deployment over long distances, and for penetrating buildings and urban canyons, while spectrum above 1 GHz (mid- or high-band spectrum) allows for the better transmission of large amounts of information. *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6135, para. 3. In this sense, low-band spectrum may be thought of as "coverage" spectrum, and higher band spectrum may be thought of as "capacity" spectrum. Service providers deploy their spectrum bands differently depending on the nature of the service, geography, density, or other factors in their network build-out. *See 2018 Communications Marketplace Report*, 33 FCC Rcd at 12584, para.31 & n.99; *Twentieth Wireless Competition Report*, 32 FCC Rcd at 8992, para. 36 & n.112.

[89] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12584-85, para. 31.

[90] *See* Theodore Rappaport, Wireless Communications: Principles and Practice at 58 (2d ed. 2002).

[91] As part of its secondary market policies, the Commission also permits mobile wireless licensees to lease all or a portion of their spectrum usage rights for any length of time within the license term and over any geographic area encompassed by the license.

of control of spectrum, the Commission uses an initial spectrum screen[92] to help identify, for case-by-case review, local markets where changes in spectrum holdings resulting from the transaction may be of particular concern.[93] In addition, the Commission determined that increased aggregation of below-1-GHz spectrum would be treated as an "enhanced factor" under its case-by-case review of license transfers if post-transaction the acquiring entity would hold approximately one-third or more of the currently suitable and available spectrum below 1 GHz.[94]

31. In the past decade, in the context of its review of secondary market transactions, as well as in rulemakings, the Commission periodically has determined that additional spectrum was suitable and available for mobile wireless use, and therefore subject to inclusion in the spectrum screen.[95] The current suitable and available spectrum included in the spectrum screen, with an associated spectrum trigger of 250 megahertz, is shown in Figure II.A.10.

[92] The Commission includes spectrum that it finds suitable and available for the provision of mobile wireless services in the spectrum screen. *See, e.g., T-Mobile-Sprint Order*, 34 FCC Rcd at 10607-08, paras. 70-72; *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6169, para. 71.

[93] *See, e.g., T-Mobile-Sprint Order*, 34 FCC Rcd at 10607-08, paras. 70-72; *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6221-22, para. 225. In the case of transfer of business units, the Commission's initial Herfindahl-Hirschman Index (HHI) screen identifies, for further case-by-case market analysis, those markets in which, post-transaction: (1) the HHI would be greater than 2800 and the change in HHI would be 100 or greater; or (2) the change in HHI would be 250 or greater, regardless of the level of the HHI. *See, e.g., T-Mobile-Sprint Order*, 34 FCC Rcd at 10614-15, para. 87 & n.277; *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6140-41, para. 13 & n.34.

[94] *See, e.g., T-Mobile-Sprint Order*, 34 FCC Rcd at 10614-15, para. 87; *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6240, paras. 282-88.

[95] *See Incentive Auction Closing and Channel Reassignment*, Public Notice, 32 FCC Rcd 2786 (WTB 2017); *Applications of SprintCom, Inc., Shenandoah Personal Communications, LLC, and NTELOS Holdings Corp. for Consent To Assign Licenses and Spectrum Lease Authorizations and To Transfer Control of Spectrum Lease Authorizations and an International Section 214 Authorization*, Memorandum Opinion and Order, 31 FCC Rcd 3631, 3637-38, paras. 15-16 (WTB, IB 2016) (*Sprint-Shentel-NTELOS* Order); *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6172-90, paras. 82-134; *Applications of AT&T Mobility Spectrum LLC, New Cingular Wireless PCS, LLC, Comcast Corporation, Horizon Wi-Com, LLC, NextWave Wireless, Inc., and San Diego Gas & Electric Company for Consent To Assign and Transfer Licenses*, Memorandum Opinion and Order, 27 FCC Rcd 16459, 16470-71, para. 31 (2012); *Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band*, Report and Order, 25 FCC Rcd 11710, 11711, para. 1 (2010); *Applications of Sprint Nextel Corporation and Clearwire Corporation for Consent To Transfer Control of Licenses, Leases, and Authorizations*, Memorandum Opinion and Order, 23 FCC Rcd 17570, 17598-99, paras. 70, 72 (2008); *Applications of AT&T Inc. and Dobson Communications Corporation for Consent To Transfer Control of Licenses and Authorizations*, Memorandum Opinion and Order, 22 FCC Rcd 20295, 20307-08, para. 17 (2007).

Fig. II.A.10
Spectrum Included in the Spectrum Screen[96]

Spectrum Band	***Megahertz (Amount)***
600 MHz	70
700 MHz	70
Cellular	50
SMR	14
Broadband PCS	130
AWS-1	90
AWS-3	65
AWS-4	40
H Block	10
WCS	20
BRS	67.5
EBS	116.5
Total Amount of Spectrum	***743.0***

32. With respect to high-band spectrum, the Commission has made available nearly 12 gigahertz of licensed and unlicensed mmW spectrum through its *Spectrum Frontiers* proceedings. The 64-71 GHz band is available for unlicensed use, and an additional 4950 megahertz is available for licensed use, as shown in Figure II.A.11 below.[97] The Commission adopted a separate threshold for mmW spectrum holdings, with an associated trigger of 1850 megahertz, as an initial analytical tool to aid in identifying certain markets for further review in proposed secondary market transactions.[98] Figure II.A.12 shows average megahertz holdings by licensee in the mmW spectrum bands.

[96] We previously discounted the available 112.5 megahertz of EBS spectrum such that 89 megahertz was included in the screen for review of proposed secondary market transactions. *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6177-79, 6184-6187, paras. 100-102, 118-25. Following the adoption of the *2.5 GHz Report and Order*, which became effective on April 27, 2020, the amount of EBS spectrum now included in the spectrum screen is 116.5 megahertz. *Transforming the 2.5 GHz Band*, WT Docket No. 18-120, Report and Order, 34 FCC Rcd 5446, 5481, 5482-83, para. 96 & n.279, paras. 99-100.

[97] *See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, 33 FCC Rcd 5576 (2018) (*Spectrum Frontiers Third Report and Order*); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, 32 FCC Rcd 10988, 10990, para. 2 (2017) (*Spectrum Frontiers Second Report and Order*); *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, et. al*., Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016) (*Spectrum Frontiers Report and Order*).

[98] *See, e.g.*, *T-Mobile-Sprint Order*, 34 FCC Rcd at 10614-15, para. 87; *Application of Verizon Communications Inc. and Straight Path Communications, Inc. for Consent To Transfer Control of Local Multipoint Distribution Service, 39 GHz, Common Carrier Point-to-Point Microwave, and 3650-3700 MHz Service Licenses*, Memorandum Opinion and Order, 33 FCC Rcd 188, 194-95, paras. 18-19 (WTB 2018); *Spectrum Frontiers Second Report and Order*, 32 FCC Rcd at 11009-11, paras. 70, 74 & n.189; *Spectrum Frontiers Report and Order*, 31 FCC Rcd at 8082, para. 185.

Fig. II.A.11
Spectrum Included in the mmW Spectrum Threshold

Spectrum Band	*Megahertz (Amount)*
24 GHz	700
28 GHz	850
Upper 37 GHz	1000
39 GHz	1400
47 GHz	1000
Total Amount of Spectrum	***4950***

Fig. II.A.12
Population-Weighted Average Megahertz Holdings by Licensee, by mmW Frequency Band

	24 GHz	28 GHz	Upper 37 GHz	39 GHz	47 GHz
Spectrum Counted	700	850	1,000	1,400	1,000
AT&T	255	-	4	782	-
DISH	17	28	10	0.4	609
T-Mobile	334	126	-	321	380
US Cellular	27	24	4	27	-
Verizon Wireless	6	610	974	126	-
Other	58	60	6	136	8

33. *Service Providers' Spectrum Holdings.* Figures II.A.13 and II.A.14 below present spectrum holdings by service provider. As of July 2020, the three nationwide service providers, AT&T, T-Mobile, and Verizon Wireless together held approximately 78% of all the spectrum included in the spectrum screen, measured on a MHz-POPs basis. Figure II.A.15 shows the population-weighted average megahertz spectrum holdings of licensees by frequency band.[99]

[99] We consider population-weighted spectrum holdings in order to account for customer density in different geographic areas. A spectrum license in Los Angeles or New York City, for example, covers more customers than a spectrum license over the same amount of land area in White Sands, New Mexico.

Fig. II.A.13
Percentage Spectrum Holdings, Measured on a MHz-POPs Basis by Licensee, by Frequency Band

	600 MHz	700 MHz	Cell.	SMR	PCS	H Block	AWS-1	AWS-3	AWS-4	WCS	BRS	EBS
Spectrum	**70 meg.**	**70 meg.**	**50 meg.**	**14 meg.**	**130 meg.**	**10 meg.**	**90 meg.**	**65 meg.**	**40 meg.**	**20 meg.**	**67.5 meg.**	**116.5 meg.**[100]
AT&T	0.0%	42.3%	44.6%	0.0%	29.4%	0.0%	16.5%	33.5%	0.0%	100.0%	0.0%	0.0%
T-Mobile	45.3%	14.9%	0.1%	96.5%	51.0%	0.0%	41.2%	5.5%	0.0%	0.0%	93.1%	79.2%
VZW	0.0%	31.0%	47.7%	0.0%	16.9%	0.0%	40.1%	19.4%	0.0%	0.0%	0.0%	0.0%
USCC	2.6%	3.5%	3.9%	0.0%	1.1%	0.0%	0.8%	1.9%	0.0%	0.0%	0.0%	0.0%
DISH	26.2%	6.6%	0.0%	0.0%	0.0%	100.0%	0.0%	34.8%	100.0%	0.0%	0.0%	0.0%
Other	25.8%	1.7%	3.7%	3.5%	1.6%	0.0%	1.4%	5.0%	0.0%	0.0%	6.9%	20.8%

Staff estimates as of July 2020. Numbers may not sum to 100% due to rounding. Abbreviations for spectrum bands: Cell. (Cellular), SMR (Specialized Mobile Radio Service), PCS (Personal Communications Service), BRS (Broadband Radio Service), and EBS (Educational Broadband Service).

Fig. II.A.14
Population-Weighted Average Megahertz Holdings by Licensee, by Frequency Band[101]

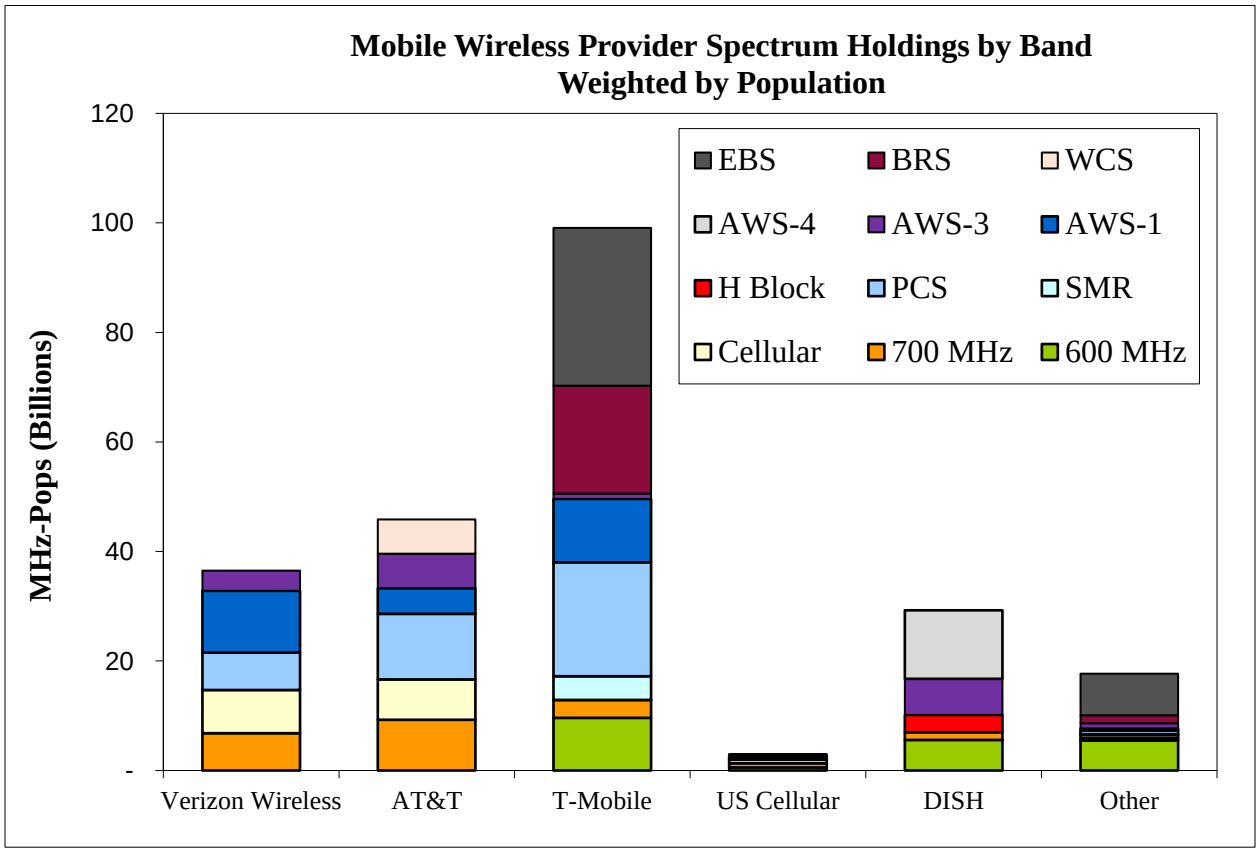
	600 MHz	700 MHz	Cell.	SMR	PCS	H Block	AWS-1	AWS-3	AWS-4	WCS	BRS	EBS
Spectrum Counted	**70 meg.**	**70 meg.**	**50 meg.**	**14 meg.**	**130 meg.**	**10 meg.**	**90 meg.**	**65 meg.**	**40 meg.**	**20 meg.**	**67.5 meg**	**116.5 meg.**
AT&T	0.0	29.7	23.6	0.0	38.3	0.0	14.9	20.3	0.0	20.0	0.0	0.0
T-Mobile	30.8	10.4	0.0	13.8	66.5	0.0	37.0	3.3	0.0	0.0	62.9	92.2
VZW	0.0	21.7	25.2	0.0	22.0	0.0	36.1	11.8	0.0	0.0	0.0	0.0
USCC	1.8	2.4	2.1	0.0	1.4	0.0	0.7	1.2	0.0	0.0	0.0	0.0
DISH	17.8	4.6	0.0	0.0	0.0	10.0	0.0	21.1	40.0	0.0	0.0	0.0
Other	17.5	1.2	2.0	0.5	2.1	0.0	1.3	3.1	0.0	0.0	4.6	24.3

Staff estimates as of July 2020.

[100] In the *2018 Communications Marketplace Report*, we erroneously calculated Sprint's EBS holdings; *see 2018 Communications Marketplace Report*, 33 FCC Rcd at 12587, Fig. A-24. The correct percentage as of Aug. 2018 was 75.7%.

[101] The population-weighted average megahertz for each provider is calculated by multiplying that provider's spectrum in a county by the county's population (MHz-POPs), summing for all counties, and then dividing by the 2010 total U.S. population.

Fig. II.A.15
Spectrum Holdings by Band Weighted by Population



Staff estimates as of July 2020.

3. Wireless Infrastructure

34. Wireless infrastructure facilities constitute another major input in the provision of mobile wireless services.[102] In addition to towers and other tall structures─such as lattice towers, guyed towers, monopoles, rooftops, water towers, and steeples─wireless infrastructure also includes DAS and small cells.[103] In order to expand or to improve coverage in existing service areas, and to accommodate newer technologies, mobile service providers have deployed additional cell sites. According to CTIA, as shown in Figure II.A.16, cell sites in commercial use increased from 308,334 in 2016, to 323,448 in 2017, to 349,344 in 2018, and to 395,562 in 2019.[104]

[102] Another component is the backhaul connections that link a mobile wireless service provider's cell sites to the mobile switching centers that provide connections to the provider's core network, the PSTN, or the Internet, carrying wireless voice and data traffic for routing and onward transmission. Backhaul facilities are generally provided by incumbent local exchange carriers (ILECs), competitive local exchange carriers (CLECs), competitive fiber and microwave wholesalers, cable providers, tower companies, and independent backhaul operators. *Twentieth Wireless Competition Report*, 32 FCC Rcd 8968, 8997-98, para. 42 & n.135; *Sixteenth Wireless Competition Report*, 28 FCC Rcd 3700, 3912, para. 336; *see also* American Tower 2019 Annual Report, Part I at 1 ("We also hold … fiber…that we lease primarily to communications service providers and third-party tower operators."); Crown Castle 2018 Corporate Sustainability Report, at 4 ("75,000+ route miles of dense, high-capacity fiber").

[103] *See Twentieth Wireless Competition Report*, 32 FCC Rcd at 8997, para 42 & n.133, n.134 (provides a full description of DAS and small cells).

[104] CTIA Year-End 2019 Wireless Industry Indices Report, Chart 19, at 53. The reported cell sites include small cells and distributed antenna systems which may be located on rooftops, monopoles, and other pre-existing

(continued….)

Figure II.A.16
Year-End Cell Site Counts by Service Provider, 2016–2019

Cell Sites	2016	2017	2018	2019
AT&T	67,000	70,300	74,500	81,800
Sprint	50,000	50,000	50,000	50,000
T-Mobile	59,417	61,457	64,285	66,319
Verizon Wireless	58,300	61,800	64,000	66,500
U.S. Cellular[105]	6,415	6,460	6,531	6,578
Total by Top Wireless Service Providers	**241,132**	**250,017**	**259,316**	**271,197**
CTIA Reported Total Cell Sites	**308,334**	**323,448**	**349,344**	**395,562**

Source: Cell site counts for individual service providers are from UBS Data: 2016-2019. The total industry-wide cell count is from CTIA Year-End 2019 Wireless Industry Indices Report.

35. Mobile service providers have increased deployment of small cells and DAS sites to fill local coverage gaps, to densify networks and increase local capacity, and to build their 5G networks.[106] The telecommunications industry is deploying small cells in cities across the country, often through attaching small-scale antennas/radios near the top of light or small utility poles.[107] These small cells are

structures as well as on lattice towers. Because multiple cell sites can be co-located at the same "tower" site, the reported cell sites should not be equated with "towers." In addition, the reported cell sites may include repeaters and other cell-extending devices. CTIA Year-End 2019 Wireless Industry Indices Report at 53.

[105] U.S. Cellular 2019 cell site count is from U.S. Cellular 2019 SEC Form 10-K at 2; 2018 cell site count is from U.S. Cellular 2018 SEC Form 10-K at 2 (filed Feb. 22, 2019); 2017 cell site count is from U.S. Cellular 2017 SEC Form 10-K at 2 (filed Feb. 26, 2018); 2016 cell site count is from U.S. Cellular 2016 SEC Form 10-K at 2 (filed Feb. 24, 2017).

[106] *Twentieth Wireless Competition Report*, 32 FCC Rcd at 8998, para. 43; *see also* T-Mobile 2019 Annual Report at 7 ("66,000 macro cell sites and 25,000 small cell/distributed antenna system sites"); AT&T Inc., 2019 Annual Report at 29 (filed Feb. 20, 2020), https://investors.att.com/~/media/Files/A/ATT-IR/financial-reports/annual-reports/2019/complete-2019-annual-report.pdf (AT&T 2019 Annual Report) ("The industry-wide deployment of 5G technology, …, will involve significant deployment of "small cell" equipment."); Mike Dano, *Charter Is Preparing to Build a Wireless Network, LIGHT READING* (Sept. 13, 2019), https://www.lightreading.com/mobile/4g-lte/charter-is-preparing-to-build-a-wireless-network/d/d-id/754100 ("Altice USA has already deployed more than 20,000 LTE small cells in parts of Long Island and elsewhere that sit atop its wired cable network"); Monica Alleven, *Verizon pledges 5x more small cells in 2020* (Feb. 14, 2020), https://www.fiercewireless.com/tech/verizon-pledges-5x-more-small-cells-2020#:~:text=Verizon%20is%20building%20on%20its,small%20cells%20to%20do%20it; Thompson Reuters, EDITED TRANSCRIPT Crown Castle Q1 2020 Earnings Call (Apr. 30, 2020), at 3 ("with approximately 45,000 small cells on air, and expect to deploy approximately 10,000 this year"), https://investor.crowncastle.com/static-files/ce31f824-7ca7-413f-911b-23fc5cb88bfa; CTIA Comments at 46 ("The vast majority of 25,000 additional cell sites in 2018 were new small cell").

[107] *See, e.g.*, City of Sacramento, *5G SMALL CELL DEPLOYMENT IN SACRAMENTO,* https://www.cityofsacramento.org/Smart-City/5G ("install 5G small cell towers on more than 300 utilities poles") (last visited Oct. 27, 2020); City of Palo Alto, *Project Description – AT&T Small Cell Wireless Project* (June 12, 2019), at 1, https://cityofpaloalto.org/civicax/filebank/blobdload.aspx?t=73333.24&BlobID=72243; City of Dallas, *Deployment Update of Small Cell Network Nodes* (May 10, 2019), at 8, https://dallascityhall.com/government/Council%20Meeting%20Documents/msis_3_deployment-update-of-small-cell-network-nodes_combined_051319.pdf; Jonathan Andrews, *Chicago and Minneapolis turn on 5G as San Diego lays groundwork* (Apr. 11, 2019), https://cities-today.com/chicago-and-minneapolis-turn-on-5g-as-san-diego-lays-groundwork/; Linda Hardesty, *NYC allows 5G equipment on streetlamps* (Feb. 4, 2020), https://www.fiercewireless.com/5g/nyc-allows-5g-equipment-streetlamps; Crown Castle, Small Cell 101, https://www.crowncastle.com/communities/small-cell-information ("Small cells are … usually attached to existing infrastructure in the public right of way like utility poles or streetlights") (last visited Oct. 27, 2020).

connected primarily to fiber backbones.[108] CTIA estimates that 80% of future wireless infrastructure deployments will be in the form of small cells.[109] Rather than building their own DAS deployments, some service providers share neutral host systems owned by third-party operators.[110] Today, there are more than 130 tower and DAS operators in the United States,[111] and a majority of towers are now owned or operated by independent tower companies rather than by mobile wireless service providers.[112] In most cases, tower operators and property owners lease antenna, rooftop, and other site space to multiple wireless service providers.[113]

36. The three largest publicly traded neutral host providers are American Tower, Crown Castle, and SBA Communications. As of July 2020, according to one estimate, these three infrastructure providers owned or operated approximately 97,554 towers (not including DAS and small cells).[114] At the end of December 2019, Crown Castle and SBA had an average of 2.1 and 1.8 tenants per tower site,

[108] *See, e.g.*, Fiber Optic Association, *Reference Guide*, https://www.thefoa.org/tech/ref/appln/SmallCells.html ("Small cells are designed to operate on fiber backbones") (last visited Oct. 27, 2020); *see also* Crown Castle, Small Cell 101, https://www.crowncastle.com/communities/small-cell-information ("Small cells are always connected by fiber optic cable") (last visited Oct. 27, 2020); RVA, *Status Of U.S. Small Cell Wireless/ 5G&Smart City Applications From The Community Perspective* at 8 (March 2018), https://nextcenturycities.org/wp-content/uploads/5Gresearch.pdf ("Small cell deployment is clearly correlated with… fiber deployment").

[109] CTIA, *The Wireless Industry* Data (Topic=Small Cell), https://www.ctia.org/the-wireless-industry/infographics-library?topic=60 (last visited Oct. 27, 2020). *See also* Scott Bergmann, *A Year of Accelerated Wireless Infrastructure Investment* (March 22, 2019), https://www.ctia.org/news/a-year-of-accelerated-wireless-infrastructure-investment (last visited Oct. 27, 2020).

[110] American Tower Corporation 2019 Annual Report at 3 ("small cells and other network architectures that may support our tenants' networks"); *see also* Crown Castle 2018 Corporate Sustainability Report at 32 ("providing our customers with space on or access to our towers (including other structures, such as rooftops), small cell networks, and fiber"); SBA 2019 Annual Report, Item I, at 1 ("We generally have constructed or acquired towers that accommodate multiple tenants").

[111] *See* Wireless Estimator, *Top 100 Tower Companies in the U.S.*, http://wirelessestimator.com/top-100-us-tower-companies-list/ (last visited Oct. 27, 2020).

[112] Major nationwide wireless service providers have sold their towers to neutral third-party tower companies. *See* Press Release, Crown Castle, Crown Castle Announces $4.85 Billion AT&T Tower Transaction (Oct. 20, 2013), https://investor.crowncastle.com/news-releases/news-release-details/crown-castle-announces-485-billion-att-tower-transaction; Jarad Matula, *American Tower buys Verizon towers for $5B* (Feb. 5, 2015), https://www.rcrwireless.com/20150205/cell-tower-news/cell-tower-news-american-tower-buys-verizon-towers-5b-tag8; Press Release, Crown Castle, Crown Castle and T-Mobile USA Announce $2.4 Billion Tower Transaction, (Sept. 28, 2012), https://investor.crowncastle.com/news-releases/news-release-details/crown-castle-and-t-mobile-usa-announce-24-billion-tower; Fierce Wireless, *Sprint sells off towers to pay down debt* (July 24, 2008), https://www.fiercewireless.com/wireless/sprint-sells-off-towers-to-pay-down-debt.

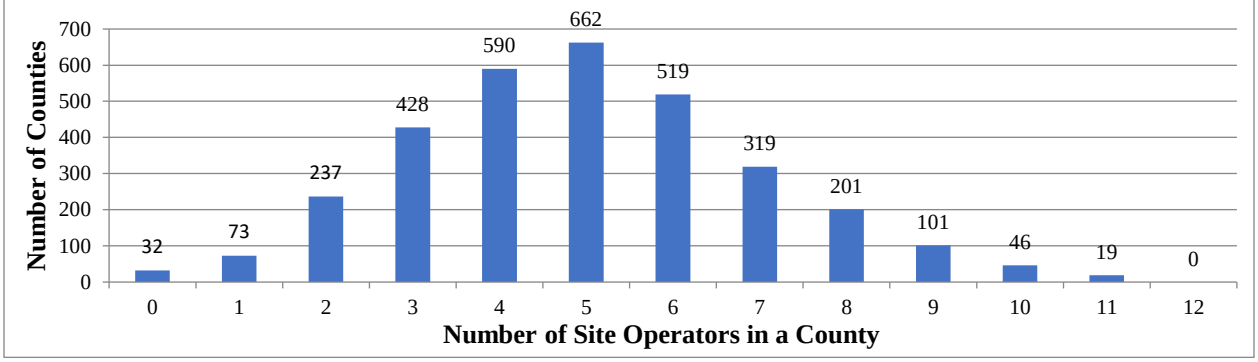
[113] *See, e.g.*, American Tower 2019 Annual Report, Part I at 1 ("Our primary business is the leasing of space on communications sites to wireless service providers…"); *see also* Crown Castle 2018 Corporate Sustainability Report, at 5 ("Shared Infrastructure Model"); Verizon Wireless 2019 Annual Report, at 51 ("We lease network equipment including towers, distributed antenna systems, small cells, …"); T-Mobile 2019 Annual Report, Part I, Item 2, at 27 ("As of December 31, 2019, we primarily leased approximately 66,000 macro towers and 25,000 distributed antenna system and small cell sites").

[114] *See* Wireless Estimator, *Top 100 Tower Companies in the U.S.* (Crown Castle at 40,567, American Tower at 40,586, and SBA at 16,401, not including rooftop sites, DAS and small cells), http://www.wirelessestimator.com/t_content.cfm?pagename=US-Cell-Tower-Companies-Complete-List (last visited Oct. 27, 2020); *see also* American Tower 2019 Annual Report, Part I, at 1 (40,974 sites in the United States as of Dec. 31, 2019); Crown Castle, Company Overview (August 2020), at 4 (over 40,000 towers), https://investor.crowncastle.com/static-files/e2d9530c-7a09-4247-8e63-449ea2bc3926; SBA 2019 Annual Report, Item I, at 3 (16,401 sites as of Dec. 31, 2019).

respectively.[115] The three tower companies also have significant capacity available for additional antennas or tenants.[116] Figure II.A.17 shows that, as of May 2020, there were three or more tower or cell site operators in 2,885 (around 89%) counties nationwide, and four or more tower operators in 2,457 (around 76%) counties nationwide based on information from 32 tower or cell site operators in the United States.[117]

Fig. II.A.17

Number of Counties with a Certain Number of Site Operators, May 2020



Source: 32 tower companies' data on standalone towers, rooftops, DAS, and small cells (May 2020).

4. Pricing Levels and Trends

37. Mobile service providers continue to offer nationwide pricing plans throughout their service areas, with little variation in monthly recurring charges between rural and non-rural markets.[118] The majority of mobile wireless subscribers in the United States are "postpaid" subscribers, billed each

[115] Crown Castle Earnings Materials Q4 2019, *Supplemental Information Package and Non-GAAP Reconciliations*, Fourth Quarter (Dec. 31, 2019), at 8 (average of 2.1 tenants per tower), https://investor.crowncastle.com/static-files/8e62e78b-eacc-4aed-8d36-e13f2d475b8a; SBA 2019 Annual Report, Item 1, at 1 (average of 1.8 tenants per tower).

[116] American Tower 2019 Annual Report, Part I, at 4 ("We believe that the majority of our towers have capacity for additional tenants and that substantially all of our towers that are currently at or near full structural capacity can be upgraded or augmented to meet future tenant demand with relatively modest capital investment."); SBA 2019 Annual Report, Item 1, at 1 ("most of our towers have significant capacity available for additional antennas"); Crown Castle Earnings Materials Q1 2020, *Supplemental Information Package and Non-GAAP Reconciliations*, First Quarter (Mar. 31, 2020), at 3, https://investor.crowncastle.com/static-files/8e62e78b-eacc-4aed-8d36-e13f2d475b8a ("We seek to increase our site rental revenues by adding more tenants on our shared communications Infrastructure").

[117] Tower site information was downloaded from 32 tower providers' websites between February and May 2020 (except the Crown Castle data that are from April 2018 since the general public can no longer download Crown Castle's tower list from its website). *See* Wireless Estimator, *Top 100 Tower Companies in the U.S.*, http://www.wirelessestimator.com/t_content.cfm?pagename=US-Cell-Tower-Companies-Complete-List (last visited Oct. 27, 2020)

[118] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12570, para. 14; *Sixteenth Wireless Competition Report*, 28 FCC Rcd at 3797, para. 137. The pricing analysis included in this section shows that mobile service providers offer nationwide pricing plans available throughout their service area, with no pricing disparity between rural and urban markets, rendering unnecessary a separate standalone rate survey authorized in the 2011 Order that modernized the universal service program for awarding support to mobile service providers in high-cost areas. *See Connect America Fund*, Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663, 17694, 17708-09, paras. 85, 113, 114 (2011).

month after service has been provided, while fewer are "prepaid" subscribers paying for services in advance of receiving them.[119]

a. Postpaid Service

38. In 2019, service providers continued the trend of offering unlimited data plans,[120] with major providers adding tiers to their unlimited data plans.[121] Providers also continued not to count certain types of data towards deprioritization and data limits (T-Mobile's "Binge On" program, for example).[122] Competition is intensifying as companies expand their service offerings to compete in an ever more connected world. As CTIA states, "Wireless consumers are benefitting in the form of lower prices, device promotions, unlimited data services, bundled service offerings, additional incentives, free add-ons, and more."[123]

39. T-Mobile, for example, introduced two new unlimited plans in June 2019, Magenta and Magenta Plus.[124] Magenta and Magenta Plus are upgraded versions of T-Mobile ONE and T-Mobile One Plus.[125] In contrast to T-Mobile ONE, the Magenta plan adds 3 GB of high-speed smartphone hotspot–or tethering–per line and unlimited 3G tethering thereafter. Magenta Plus keeps all the value in T-Mobile ONE Plus including a Netflix Standard subscription for families. As with the T-Mobile ONE plan, customers would continue to get unlimited talk, text, and 4G LTE smartphone data, free data and texting in 210+ countries and destinations, an hour of Gogo inflight Wi-Fi and unlimited texting on domestic flights, and more. Subsequently, in August 2019, Verizon Wireless introduced a new lineup of unlimited

[119] The prepaid and postpaid versions of a given pricing plan or promotion still differ somewhat, largely because prepaid subscribers may lack the credit background or income necessary to qualify for postpaid service. To prevent credit losses and mitigate the credit risk associated with the prepaid segment, service providers require advance payment for both prepaid service and handsets. *2018 Communications Marketplace Report*, 33 FCC Rcd at 12570, para. 14.

[120] While a majority of unlimited plans are offered to postpaid subscribers, some providers now also offer unlimited plans to their prepaid subscribers.

[121] Postpaid subscribers who use up their plan's data allowance in a given month generally experience data deprioritization only during network congestion. *See, e.g.*, T-Mobile, *Magenta*, https://www.t-mobile.com/cell-phone-plans/magenta (last visited Oct. 27, 2020); Verizon Wireless, *Get More Unlimited FAQs*, https://www.verizonwireless.com/support/get-more-unlimited-faqs/ (last visited Oct. 27, 2020); Verizon Wireless, *Get More Unlimited – Data plan FAQs*, https://www.verizonwireless.com/support/above-unlimited-faqs/ (last visited Oct. 27, 2020). AT&T, on their Mobile Share Plus plans, offers zero overages, as well as "Rollover Data," which allows its postpaid subscribers to roll over their unused data at no additional cost. AT&T, *Save More with Unlimited Your Way*^{SM}, https://www.att.com/shop/wireless/data-plans.html (last visited Oct. 27, 2020); AT&T, *Rollover Data FAQs*, https://att-bundles.com/faq/wireless/does-att-offer-rollover-data/ (last visited Oct. 27, 2020).

[122] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12570, para. 15. On all T-Mobile plans, during congestion, a small fraction of customers using more than 50 GB a month may notice reduced speeds until the next bill cycle due to prioritization. *See* T-Mobile, *Unlimited video streaming with Binge On*, https://www.t-mobile.com/offers/binge-on-streaming-video (last visited Oct. 27, 2020).

[123] CTIA Comments at 30.

[124] T-Mobile, *Love Your Discount, Not Your Carrier? T-Mobile Will Match or Beat that Discount on Magenta* (May 23, 2019), https://www.t-mobile.com/news/press/uncarrier-launches-discount-match. T-Mobile, *Plans*, https://www.t-mobile.com/cell-phone-plans (last visited Oct. 27, 2020).

[125] T-Mobile ONE offered unlimited 4G LTE smartphone data; unlimited talk and text; industry-first Un-carrier benefits; unlimited smartphone mobile hotspot data (tethering) at 2G speeds; and 200 MB domestic roaming off-network. T-Mobile, *T-Mobile ONE Fact Sheet*, https://www.t-mobile.com/news/press/t-mobile-fact-sheet (last visited Oct. 27, 2020). In addition to everything the T-Mobile ONE plan offers, T-Mobile One Plus customers received unlimited HD streaming in the United States; 20 GB of 4G LTE mobile hotspot data with unlimited 3G data; twice the data speeds abroad; unlimited in-flight Wi-Fi on Gogo-enabled flights to, from, or within the United States; voicemail to text; and name ID (identify calls from unknown numbers). *See* T-Mobile, *T-Mobile One Plus*, https://www.t-mobile.com/support/plans-features/t-mobile-one-plus (last visited Oct. 27, 2020).

plans starting at $35 per line for four lines, which include: Start Unlimited, Do More Unlimited, Play More Unlimited, Get More Unlimited, and Just Kids (introduced in April 2019). Verizon Wireless's largest plan, Get More Unlimited, includes 75 GB of 4G LTE data, along with 720p HD video streaming for $90 (1 line) per month.[126]

40. In November 2019, AT&T launched three new unlimited plans: AT&T Unlimited Starter for $35 per line for four lines, AT&T Unlimited Extra for $40 per line for four lines, and AT&T Unlimited Elite for $50 per line for four lines.[127] The largest plan, AT&T Unlimited Elite, includes 30 GB of mobile hotspot data per line, HD streaming, and HBO.[128] U.S. Cellular offered a new unlimited plan that removes previous caps on 4G LTE data, starting at $55 per month for one line in August 2019.[129] In November 2019, U.S. Cellular further introduced new unlimited plans, including Basic, Everyday, and Even Better Unlimited Plans, starting at $30 per line for four lines allowing customers to choose and customize their plans.[130]

b. Prepaid Service

41. The three nationwide service providers also offer prepaid service under their own prepaid brands, in addition to selling mobile wireless service wholesale to MVNOs. Verizon Wireless has the smallest share of prepaid subscribers among the nationwide service providers, with only one prepaid brand, Verizon Wireless Prepaid.[131] To varying degrees, the other two nationwide service providers pursue a multi-brand prepaid strategy.[132] TracFone, the largest MVNO, also has multiple prepaid brands, including Net10 Wireless, Straight Talk, Clearway, Walmart Family Mobile, SIMPLE Mobile, Telcel, SafeLink, Page Plus, and GoSmart Mobile, which target different market and demographic segments such as premium, Hispanic, or low-income subscribers.[133]

42. In addition, T-Mobile entered into an Asset Purchase Agreement with Sprint and DISH, whereby DISH would acquire Sprint's prepaid wireless business, operated under the Boost Mobile and Sprint prepaid brands (excluding the Assurance brand Lifeline customers and the prepaid wireless

[126] Access to Verizon's 5G Ultra-Wideband network is $10 per month with any of the unlimited plans, and for a limited time was included in the Get More Unlimited, Do More Unlimited and Play More Unlimited plans. Verizon Wireless, *Verizon customers get more plans to fit everyone in the family with more ways to save* (Aug. 2, 2019), https://www.verizon.com/about/news/verizon-customers-get-more-plans.

[127] AT&T, *AT&T to Offer Its Best Unlimited Wireless Plans at an Incredible Value* (Oct. 30, 2019), https://about.att.com/story/2019/new_unlimited_plans.html.

[128] AT&T Unlimited Starter offers unlimited data, talk, and text in the United States, as well as in Mexico and Canada; AT&T Unlimited Extra gives all the benefits of Starter, plus 15GB of mobile hotspot data per line.

[129] Fierce Wireless, *US Cellular drops data cap with new $55/month unlimited plan* (Aug. 9, 2019), https://www.fiercewireless.com/operators/us-cellular-drops-data-cap-new-55-month-unlimited-plan.

[130] U.S. Cellular's new Everyday Unlimited Plan comes with bonus features such as HD video streaming, roaming in Mexico and Canada, 15 GB of hotspot access, 25 GB of priority data and one free movie night per month/line through the company's new entertainment partner, Redbox, for $40 per line/month for four lines. U.S. Cellular, *U.S. Cellular Offers Customers Choice and Customization with New Unlimited Plans Starting at $30 per Month* (Nov. 4, 2019), https://www.uscellular.com/get-to-know-us/our-company/press-room/2019/USCellular-Offers-Customers-Choice-and-Customization-with-New-Unlimited-Plans-Starting-at-30-per-Month.

[131] As noted above, Verizon Wireless announced that it has entered into an agreement to acquire TracFone from América Móvil. Verizon Wireless, *Verizon to acquire TracFone Wireless* (Sept. 14, 2020), https://www.verizon.com/about/news/verizon-to-acquire-tracfone.

[132] AT&T prepaid brands include AT&T Prepaid and Cricket; T-Mobile prepaid brands include Metro by T-Mobile (formerly MetroPCS).

[133] TracFone Wireless Inc., *Brands*, http://www.tracfonewirelessinc.com/en/brands/ (last visited Oct. 27, 2020).

customers of Shenandoah Telecommunications Company and Swiftel Communications, Inc.).[134] On July 1, 2020, DISH announced that it had completed its $1.4 billion acquisition of Boost Mobile. With this purchase, DISH officially entered the retail wireless market, serving more than nine million customers. The company continues to promote the Boost Mobile brand.[135]

43. Furthermore, as postpaid offerings have shifted away from term contracts and equipment subsidies, facilities-based service providers have adopted pricing plans and promotions for their high-end prepaid monthly service offerings that are similar to their postpaid offerings. For example, in October 2018, T-Mobile's Metro by T-Mobile introduced new all-unlimited plans. For one line at $60 per month, customers get: Unlimited 4G LTE data (reduced after 35 GB, 480p streaming only), a 15 GB 4G LTE mobile hotspot, Google One's 100 GB tier of cloud storage, and Amazon Prime.[136] AT&T's Cricket offered new customers, as a limited time offering, their Unlimited BYOD Plan for $40 a month in November 2019.[137] In July 2020, DISH's Boost Mobile offered its customers a $35 10 GB plan that includes unlimited talk and text.[138] Generally, prepaid subscribers who reach the limit of their high-speed data allowance in a given month may continue to use their handsets for data service on an unlimited basis, but at reduced speeds.[139] For example, Cricket reduces data download speeds to a maximum of 128 kbps after the customer's high-speed data allowance is used.[140]

c. Price Indicators for Mobile Wireless Services

44. As can be seen from the discussion above, it is difficult to directly compare prices between providers or over time, because providers offer a variety of plans, frequently under multipart pricing and bundling schemes. Plans also vary in non-price terms and features, such as the consequences of reaching usage limits.[141] Figure II.A.18 presents monthly postpaid prices for the three nationwide service providers' basic, mid-level, and premium unlimited plans, including now-common discounts for automatic payments.[142] Basic unlimited plans offer little more than unlimited talk, text, and data, and

[134] T-Mobile, 2019 SEC Form 10-K at 75 (filed Feb. 6, 2020) (T-Mobile 2019 SEC Form 10-K) https://www.sec.gov/Archives/edgar/data/0001283699/000128369920000026/tmus-20191231.htm.

[135] DISH, *DISH enters retail wireless market with close of Boost Mobile, advances build of the nation's first standalone 5G network* (July 1, 2020), http://about.dish.com/2020-07-01-DISH-enters-retail-wireless-market-with-close-of-Boost-Mobile-advances-build-of-the-nations-first-standalone-5G-network.

[136] Fierce Wireless, *T-Mobile rebrands MetroPCS prepaid service as 'Metro by T-Mobile'* (Sept. 24, 2018), https://www.fiercewireless.com/wireless/t-mobile-rebrands-metropcs-prepaid-service-as-metro-by-t-mobile.

[137] Cricket, *Calling All New Customers: Bring Your Device to Cricket this Holiday for "Unlimited" Wireless Savings* (Nov. 20, 2019), https://www.cricketwireless.com/newsroom/news-release/40-Dollar-BYOD.html. This promotional price ran from November 22, 2019 through January 30, 2020.

[138] DISH, *DISH enters retail wireless market with close of Boost Mobile, advances build of the nation's first standalone 5G network* (July 1, 2020), http://about.dish.com/2020-07-01-DISH-enters-retail-wireless-market-with-close-of-Boost-Mobile-advances-build-of-the-nations-first-standalone-5G-network.

[139] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12572, para. 17.

[140] Cricket Wireless, *Mobile Broadband Information* (July 24, 2020), https://www.cricketwireless.com/legal-info/mobile-broadband-information.html.

[141] It is therefore difficult to identify sources of information that track mobile wireless service prices in a comprehensive and consistent manner. In addition, data on subscribership is not available at the plan level. Thus, a comparison of average prices would require assumptions regarding the number of customers who subscribe to each plan that each company offers, which would not likely be accurate due to a lack of data. *See, e.g., 2018 Communications Marketplace Report*, 33 FCC Rcd at 12572, para. 18; *Twentieth Wireless Competition Report*, 32 FCC Rcd at 9006, para. 57.

[142] In addition, T-Mobile incorporates taxes and fees into its advertised prices for its Magenta and Magenta Plus plans. As these fees vary by locality, we are unable to fully account for the differences in pricing in Fig. II.A.18 in this *Report*.

speeds that are deprioritized during network congestion. Mid-level plans typically offer increased data before deprioritization, some high-speed mobile hotspot data, discounted or free subscription to an online video service (e.g., Netflix or Disney+), and improved video streaming quality. Premium plans typically offer increased mobile hotspot data limits, video quality, and other varying features across the providers. Figure II.A.19 shows the current monthly prices for major prepaid service providers. Unlimited service is also the primary offering of prepaid plans, although postpaid users frequently are given priority over prepaid users on a given network during times of peak congestion.[143] Further, postpaid and prepaid users may also experience deprioritized speeds during periods of peak network congestion after they have exceeded certain monthly data thresholds, depending on their plan type. The limits are shown in Figures II.A.20 and II.A.21.

Fig. II.A.18
Monthly Postpaid Unlimited Prices for Top 3 Service Providers

	Plan Type					
	Basic		Mid-Level		Premium	
Provider	1 Line	4 Lines	1 Line	4 Lines	1 Line	4 Lines
AT&T	$65	$140	$75	$160	$85	$200
T-Mobile	$60	$120	$70	$160	$85	$200
Verizon Wireless	$70	$140	$80	$180	$90	$220

Fig. II.A.19
Monthly Prepaid Unlimited Prices for Top 4 Service Providers

	Plan Type			
	Basic		Premium	
Provider	**1 Line**	**4 Lines**	**1 Line**	**4 Lines**
Boost Mobile	$50	$140	$60	$180
Cricket	$50	$100	$55	$130
Metro	$50	$140	$60	$150
Straight Talk	$55	N/A	N/A	N/A

Note: The prices for unlimited data plans in Figures II.A.18 and II.A.19 were taken from service providers' websites on July 31, 2020. Prices include any per line charges indicated by the service provider, but exclude fees and taxes. Prices do not include any additional charges such as for equipment installment plans, insurance, international use, or mobile hotspots. If a service provider includes any such feature as part of its unlimited data plan without extra charge, the above price would include this feature. Further, the above prices do not include any one-time charges paid, such as activation fees and termination fees, nor promotions that are advertised as short-term. Prices and the specifics of the plans are subject to change.

Fig. II.A.20
Data Deprioritization Limits for Top 3 Postpaid Service Providers

[143] For example, MetroPCS in its Terms and Conditions indicates that "[t]o differentiate the services we sell, at times and at locations where there are competing customer demands for network resources, we give the data traffic of customers who choose T-Mobile-branded services precedence over the data traffic of customers who choose non-T-Mobile-branded services such as Metro by T-Mobile." *See* Metro by T-Mobile, *Metro by T-Mobile Terms and Conditions of Service*, https://www.metropcs.com/terms-conditions/terms-conditions-service.html (last visited Oct. 27, 2020). *See also* Cricket, *Mobile Broadband Information* (July 24, 2020), https://www.cricketwireless.com/legal-info/mobile-broadband-information.html ("Congestion Management may affect certain customers on the Cricket Core Plan or the Cricket More Plan that provides unlimited data access. On these unlimited plans, customers may experience reduced data speeds and increased latency during periods of network congestion as compared to other customers using the same cell site.").

	Plan Type		
Provider	**Basic**	**Mid-Level**	**Premium**
AT&T	Congestion	50 GB	100 GB
T-Mobile	Congestion	50 GB	50 GB
Verizon Wireless	Congestion	25-50 GB	75 GB

Fig. II.A.21
Data Deprioritization Limits for Top 4 Prepaid Service Providers

	Plan Type	
Provider	**Basic**	**Premium**
Boost Mobile	35 GB	35 GB
Cricket	Congestion	Congestion
Metro	35 GB	35 GB
Straight Talk	60 GB	N/A

Note: The deprioritization limits in Figures II.A.20 and II.A.21 were taken from service providers' websites on July 31, 2020. "Congestion" indicates that users are deprioritized when there is congestion on the network, regardless of the amount of data a customer has consumed in a given month.

45. *Consumer Price Index.* The CPI is a measure of the average change over time in the prices consumers pay for a fixed market basket of goods and services. As documented in previous *Reports*, the Wireless Telephone Services CPI[144] shows that mobile wireless prices have declined significantly since the mid-1990s.[145] According to the CPI data, the price (in constant dollars) of mobile wireless services has continued to decline: From 2018 to 2019, the annual Wireless Telephone Services CPI decreased by approximately 3% while the broader Telephone Services CPI fell by 1%, and the overall CPI increased by approximately 2%.[146] Further, from 2017 through 2019, the annual Wireless Telephone Services CPI decreased by approximately 5%, the Telephone Services CPI decreased by approximately 3%, and the overall CPI increased by approximately 4%.

46. *Average Revenue Per Unit.* Various measures of Average Revenue per Unit (ARPU) are frequently used as a proxy for price, particularly in industries with multiple pricing plans and complicated rate structures, such as mobile wireless services.[147] As shown in Figure II.A.22 below, which is based on CTIA data, from 2017 to 2019 industry ARPU fell from $38.66 to $36.86, a decline of approximately

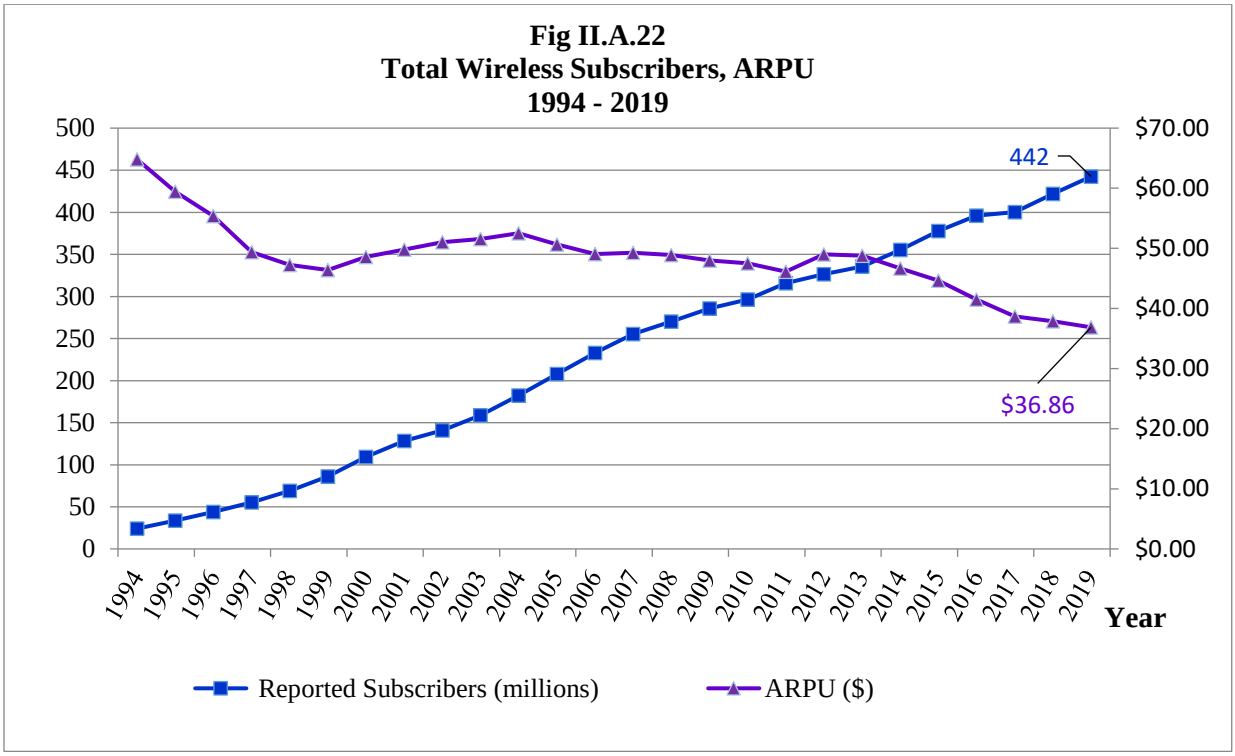
[144] All CPI figures were taken from Bureau of Labor Statistics (BLS) databases (U.S. Bureau of Labor Statistics, *Home Page*, http://www.bls.gov (last visited Oct. 27, 2020). The index used in this analysis, the CPI for All Urban Consumers (CPI-U), represents about 93% of the total U.S. population. U.S. Bureau of Labor Statistics, *Consumer Price Index: Frequently Asked Questions*, https://www.bls.gov/cpi/questions-and-answers.htm (last visited Oct. 27, 2020). The CPI category "Telephone Services" has two components: Wireless telephone services and landline telephone services. Additional information can be found at U.S. Bureau of Labor Statistics, *Consumer Price Index: How the Consumer Price Index Measures Price Change for Telephone Services*, https://www.bls.gov/cpi/factsheets/telephone-services.htm (last visited Oct. 27, 2020).

[145] *See, e.g., 2018 Communications Marketplace Report*, 33 FCC Rcd at 12574, para. 19.

[146] For changes in the CPI over time, *see* Appx. B-2 of this *Report*.

[147] *See Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless, Including Commercial Mobile Services*, Seventeenth Report, 29 FCC Rcd 15311, 15328, para. 35 & n.52 (WTB 2014) (*Seventeenth Wireless Competition Report*); Patrick McCloughan and Sean Lyons, *Accounting for ARPU: New evidence from international panel data*, Telecommunications Policy 30, 521-32 (2006); Eun-A Park and Krishna Jayakar, *Competition between Standards and the Prices of Mobile Telecommunication Services: Analysis of Panel Data*, TPRC 2015 (Aug. 15, 2015).

5%.[148] Recent changes by service providers, such as the removal of overage charges, the move toward unlimited data plans, multiple line pricing, and Equipment Installment Plans (EIPs) have all contributed to the reported decline in ARPU.[149]



Source: CTIA Year-End 2019 Wireless Industry Indices Report.

47. *Average Revenue Per Unit by Service Provider.* Based on UBS estimates, as seen in Figure II.A.23, from the fourth quarter of 2017 to the fourth quarter of 2019, subscriber-based ARPU declined for all service providers. Specifically, AT&T's ARPU declined by approximately 19%; Sprint's ARPU declined by approximately 1%; and T-Mobile and Verizon Wireless's ARPU both declined by approximately 5%. Industry ARPU declined by approximately 10% over this time period.

[148] CTIA reported an industry average measure of ARPU which is calculated "based on total reported wireless service revenues for the period, divided by the average reported subscriber units during the survey period." CTIA Year-End 2019 Wireless Industry Indices Report at 8.

[149] Fig. II.A.22 presents more than 20 years of subscribers/connections and ARPU. For additional details on ARPUs from 1993 to 2019, *see* Appx. B-3 of this *Report*.

Fig. II.A.23
ARPU Estimates of National Facilities-Based Mobile Wireless Service Providers
4th Quarter 2016–4th Quarter 2019

Nationwide Providers	4Q16	4Q17	4Q18	4Q19
AT&T	$36.58	$34.13	$29.57	$27.71
Sprint	$32.03	$32.49	$33.31	$32.04
T-Mobile	$33.80	$35.62	$34.27	$33.73
Verizon Wireless	$37.52	$35.27	$33.98	$33.52
Industry ARPU	**$35.93**	**$34.73**	**$32.51**	**$31.38**

Source: UBS Investment Research. UBS Data 2016-2019. Published with permission of UBS.

48. *Revenue Share by Service Provider.* As shown in Figure II.A.24, AT&T and Verizon Wireless faced declining service revenues from 2016 through 2018, however their revenues increased in 2019. Sprint's service revenues fell in each reporting period. Finally, T-Mobile had significant revenue growth each year from 2016 through 2019.

Fig. II.A.24
Service Revenues and Shares Among Nationwide Wireless Service Providers ($ millions)
2016–2019

Service Providers	2016		2017		2018		2019	
	Revenue	Revenue Share	Revenue	Revenue Share	Revenue	Revenue Share	Revenue	Revenue Share
AT&T	59,153	33.3%	57,023	33.0%	54,294	31.7%	55,331	31.6%
Sprint	24,200	13.6%	22,736	13.1%	21,980	12.8%	20,971	12.0%
T-Mobile	27,844	15.7%	30,160	17.4%	31,992	18.7%	33,994	19.4%
Verizon Wireless	66,580	37.5%	63,121	36.5%	63,020	36.8%	64,979	37.1%

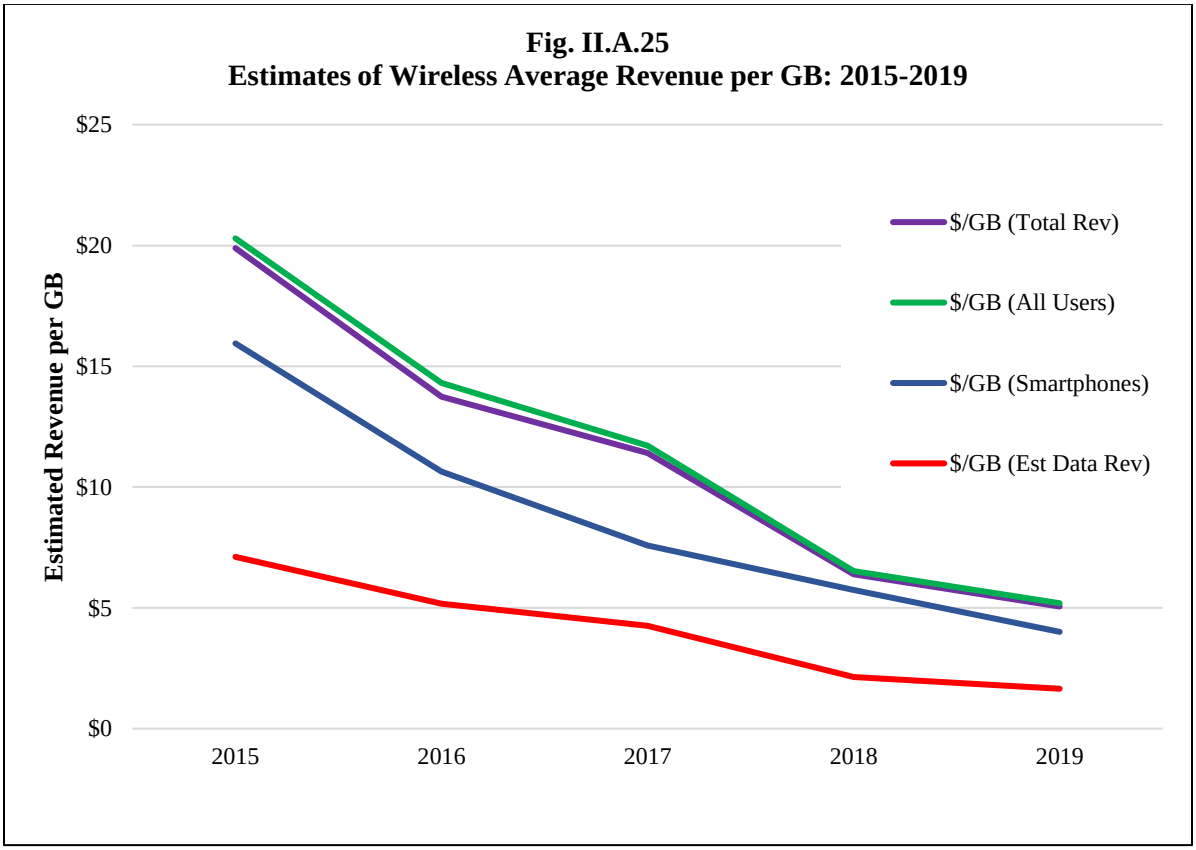
Source: UBS Investment Research. UBS Data 2016-2019. Published with permission of UBS.

49. *Estimated Average Revenue per GB.* Given the variation in data plans, including shared plans, the lack of information on how much data users consume across these different plans, and the fact that revenues specific to data consumption are no longer reported by service providers, we lack the necessary information to measure precisely the price per GB of mobile broadband data. By making certain assumptions,[150] however, we can provide various industry-wide estimates of the average revenues

[150] To derive $/GB (Total Rev), we divide the Total Service Revenues by the Total Wireless Data Traffic, assuming that 100% of service revenues are attributable to data. CTIA Year-End 2019 Wireless Industry Indices at 39, 62. To derive $/GB (All Users) and $/GB (Smartphones) we divide ARPU by the monthly average GB data usage, and we calculate this metric both with all users and with smartphone users only. Again, this assumes that 100% of revenues are attributable to data and that average revenue is the same for both smartphone users and non-smartphone users. CTIA Year-End 2019 Wireless Industry at 44, 63. Finally, for $/GB (Est. Data Rev), we estimate the percentage of total revenues that are attributable to data by dividing Internet Access Service Revenues by Total Revenues for NAICS 5172, U.S. Census Bureau, 2018 Annual Service Survey, Table 4: Estimated Sources of Revenue for Employer Firms: 2013 through 2018, https://www.census.gov/data/tables/2018/econ/services/sas-naics.html (last visited Oct. 27, 2020). The 2019 data percentage was estimated based on the average growth rate across 2015 to 2018. We then applied these percentages to the CTIA data (Total Service Revenues/Total Wireless Data Traffic). CTIA Year-End 2019 Wireless Industry Indices at 39, 62. This does not take into account the fraction of revenues (continued….)

per GB. Figure II.A.25 below shows four different estimates of the average revenue per GB, based on data from CTIA and the U.S. Census Bureau. All four estimates indicate that average revenue per GB has been declining. Specifically, as of year-end 2019, these estimates show a decrease of approximately 20% to 30% compared to 2018, and a decrease of approximately 62% to 68% compared to 2016.

Fig. II.A.25
Estimates of Wireless Average Revenue per GB: 2015-2019



Source: CTIA Year-End 2019 Wireless Industry Indices Report; U.S. Census Bureau, 2018 Annual Service Survey.

5. Non-Price Competition

a. Investment

50. Over the past 10 years, according to CTIA data,[151] mobile wireless service providers have invested over $286 billion in their networks, with service providers reporting $29.1 billion in incremental investment in 2019.[152] As a result of the continued investment in their networks, consumers have benefitted greatly from the resulting increase in higher data speeds, expanded network coverage, and increased network densification.[153] Based on the most current data from UBS Investment Research, in

that are made up of messaging. Note that prior *Reports* reported a $/MB figure. However, we will now report a price per GB, as the price per MB is below one cent.

[151] According to CTIA, the capital investment reported "excludes the cost of licenses used to deliver wireless service, whether acquired at private or public auctions, or via other acquisition processes. Likewise, investment by third-party tower erectors, and non-carrier owners or managers of networks, is not tracked by nor reflected in CTIA's survey. CTIA's survey collects only historical (past data) and not projected or planned investment." CTIA Year-End 2019 Wireless Industry Indices Report at 47.

[152] *Id*.

[153] We note that capital expenditure (CapEx) in system/network assets may be cyclical or "lumpy" because technological change in the mobile wireless service industry is commercially implemented in successive generations of technologies. Consequently, CapEx may vary between periods, and fluctuations in measures of CapEx are (continued….)

2019, wireless service providers made total capital investments of $30.7 billion, of which the nationwide providers accounted for $29.8 billion.[154]

51. Figure II.A.26 shows capital investment by providers. In 2016-2017, AT&T, T-Mobile, and Verizon Wireless each had CapEx of approximately 16.3% to 17.4% of service revenue.[155] CapEx by Sprint, on the other hand, has varied considerably over the years, from approximately 17% of service revenue in 2015, to 7.5% in 2016, and to 11% in 2017. In the last few years, all four nationwide providers have invested a higher percentage of their revenues into their respective networks in preparation for 5G. Overall, over the past three years, the CapEx for the nationwide providers averaged approximately 17% of service revenues.[156] As the mobile wireless industry prepares for a full rollout of 5G services, equipment vendor, Ericsson, for example, reported that worldwide, it currently has over 100 commercial agreements for the deployment of 5G, and that in the United States, all of the nationwide providers have selected it as an equipment vendor.[157] S&P Global Market Intelligence recently reported that it estimates that capital investment by U.S. mobile providers could "grow at 5% for 2020, boosted by small cells, 5G deployments and to a lesser extent, a new wireless entrant,"[158] namely DISH.

consistent with the cyclical nature of technological adoption in the mobile wireless service industry. *Twentieth Wireless Competition Report*, 32 FCC Rcd at 9014, para. 68.

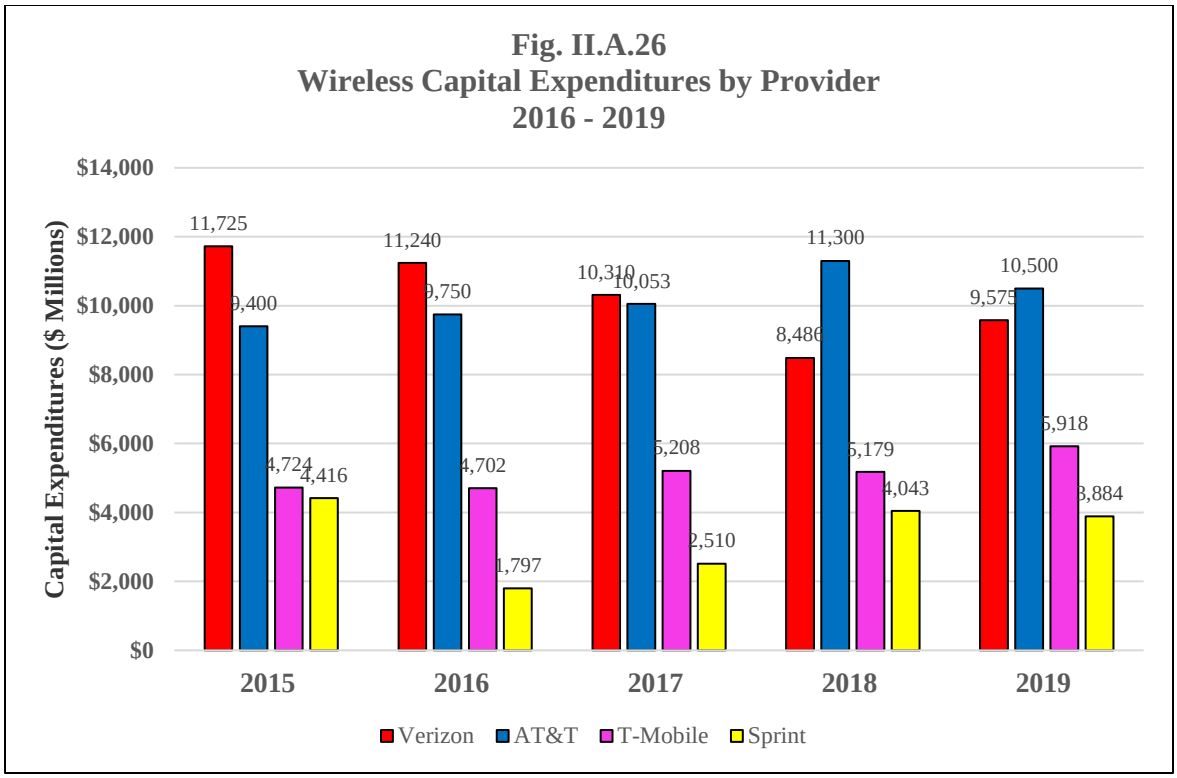
[154] UBS and CTIA numbers may differ as they use different methodologies for accounting for CapEx. CTIA's data are based on their voluntary survey of all wireless providers (with a very high response rate). UBS uses quarterly and annual filings from publicly traded service providers along with their wireless model to calculate industry investment.

[155] UBS Investment Research. UBS Data, 2016-2019.

[156] *Id*.

[157] Ericsson 5G, *Discover the Power of 5G*, https://www.ericsson.com/5g/5g-networks/5g-contracts (last visited Oct. 27, 2020).

[158] S&P Global Market Intelligence: Wireless Investor: Capex rising with 5G (last accessed Aug. 3, 2020).



Source: UBS Investment Research. UBS Data 2016-2019. Published with permission of UBS.

b. Innovation and Technological Change

52. Focusing first on 4G LTE, we note that 4G LTE networks transformed the wireless industry: Increases in download speeds and network capacities allowed consumers to use their mobile devices in new ways, such as streaming video in high definition, accessing ride sharing platforms, and live-mapping driving routes.[159] CTIA reports that from the initial deployment of 4G LTE networks in 2010 through the end of 2019, the average 4G download speed has increased by a factor of 31, from 1.3 megabits per second to 41 megabits per second.[160] Mobile data consumption also increased dramatically: In 2019, Americans used more than 37 million gigabytes of data, a 96-fold increase from 2010.[161] In a series of surveys, Pew found that 81% of Americans owned a smartphone in 2019 compared to just 35% in 2011.[162] Between January 1, 2020 and June 30, 2020, users worldwide installed an estimated 71.5 billion apps from the Apple App Store and the Google Play Store.[163] CTIA reports that the number of American jobs that depend on the wireless industry has grown significantly from 3.7 million in 2011 to 20.4 million in 2019.[164]

[159] Letter from Kara Graves, Assistant Vice President, Regulatory Affairs, CTIA, to Marlene Dortch, Secretary, FCC, OEA Docket No. 20-60, WTB Docket No. 19-348, Attach., The 4G Decade: Quantifying the Benefits at 10 (filed Aug. 6, 2020) (CTIA 4G Decade Report).

[160] CTIA 4G Decade Report at 10.

[161] *Id*. at 11.

[162] *See* Pew Mobile Fact Sheet.

[163] Sarah Perez, *Global App Revenue Jumps to $50B in the First Half of 2020, in part Due to COVID-19 Impacts*, Tech Crunch, (June 30, 2020), https://techcrunch.com/2020/06/30/global-app-revenue-jumps-to-50b-in-the-first-half-of-2020-in-part-due-to-covid-19-impacts/.

[164] CTIA 4G Decade Report at 6.

53. The wireless industry is currently implementing the new 5G technology standard.[165] Industry participants expect 5G networks to deliver faster download speeds and reduced latency to users than previous technologies, while also expanding network capacity.[166] Further, the new reliability and security standards of 5G[167] could support a large number of connected devices.[168] In addition to the low- and mid-band spectrum used by previous cellular technologies such as 4G LTE, 5G may also be deployed on high-frequency spectrum bands (mmW spectrum).[169] Bands with higher frequencies can transmit more information but have less favorable propagation characteristics, especially in indoor settings.[170] 5G, however, makes high-frequency bands practical for wireless use through advances in antenna design and the use of small cells that reduce transmission distances.[171]

54. 5G's expected performance gains could improve both how consumers use their mobile devices on a day-to-day basis and the productivity in a wide range of industries.[172] For example, 5G networks could allow users to access content more quickly, stream video at higher qualities, and use fully immersive virtual reality and augmented reality technologies.[173] As 5G networks continue to expand, their ability to support high-definition video chat has the potential to enhance mobile telemedicine visits in a greater number of areas, allowing patients to seek care more quickly and conveniently.[174] As the Free State Foundation (FSF) explains,[175] the additional capacity of 5G may also allow service providers to provide fixed wireless broadband access,[176] which may be particularly useful in rural areas with limited wireline infrastructure, but high wireless penetration.[177] In urban areas, 5G networks using mmW spectrum would create the potential for gigabit data rates, low latency, and increased capacity, which would improve network performance in heavily trafficked areas.[178] Further, improved antenna beam

[165] For purposes of 5G mapping, the Commission has adopted the 5G-NR technology standards developed by the 3rd Generation Partnership Project (3GPP). *Digital Opportunity Data Collection Order and Second Further Notice*, 34 FCC Rcd at 7524, para.44; *Establishing the Digital Opportunity Data Collection et al.*, WC Docket No. 19-195, 11-10, Report and Order and Third Further Notice of Proposed Rulemaking, 35 FCC Rcd 7460, 7476-7483, paras. 38-51 (2020) (*Digital Opportunity Data Collection Second Order and Third Further Notice)*.

[166] *See* WEF—World Economic Forum, The Impact of 5G: Creating New Value Across Industries and Society, at 7, (Jan. 2020), http://www3.weforum.org/docs/WEF_The_Impact_of_5G_Report.pdf (WEF 5G Impact Report).

[167] *See* 3rd Generation Partnership Project, 3GPP TR 21.915 V15.0.0 (2019-09) Technical Report, (Sept. 2019), https://www.3gpp.org/ftp//Specs/archive/21_series/21.915/21915-f00.zip.

[168] *See* IHS Markit, The 5G Economy: How 5G Will Contribute to the Global Economy, at 11-14, (Nov. 2019), https://www.qualcomm.com/media/documents/files/ihs-5g-economic-impact-study-2019.pdf (IHS 5G Economic Impact Study).

[169] IHS 5G Economic Impact Study at 15.

[170] *See generally e.g.*, *Spectrum Frontiers Report and Order*.

[171] CTIA Comments at 59.

[172] *See* IHS 5G Economic Impact Study at 14-19.

[173] *See* AMTA—The Australian Mobile Telecommunications Association, 5G & EMF Explained 5G & EMF, at 4 (March 2018), https://amta.org.au/wp-content/uploads/2019/05/5GEMF_Explained_May2018_Final-1.pdf (AMTA 5G Explained).

[174] *See* AT&T, *5 Ways 5G Will Transform Healthcare*, https://www.business.att.com/learn/updates/how-5g-will-transform-the-healthcare-industry.html (last visited Oct. 27, 2020).

[175] FSF Comments at 13.

[176] WEF 5G Impact Report at 7.

[177] IHS 5G Economic Impact Study at 28.

[178] *Id*. at 15.

steering creates more reliable connections when users are moving at high speeds, thus improving the consumer experience when traveling by car or public transit.[179]

55. Other use cases could benefit primarily from 5G's potential to expand applications of the Internet of Things (IoT). 5G networks can support a greater number of connected devices operating in concert, which should allow both businesses and individuals to implement more intricate IoT systems.[180] GSMA estimates that the number of connected devices will increase from 9.1 billion in 2018 to 25.2 billion in 2025, and that 3.1 billion of those devices will use cellular technologies.[181] Precision agriculture, which involves the use of IoT in farm management, is expected to be important in the years to come.[182] With access to 5G networks, farmers will be better positioned to manage crops using specialized connected devices, such as autonomous vehicles for field tasks,[183] and sensors that monitor moisture levels and the chemical composition of soil.[184] Remote monitoring is also expected to be applied in industrial settings, where IoT connected devices can be used to optimize production, predict maintenance, and monitor safety risks that otherwise could not be detected.[185] Additionally, the low latency of 5G connections potentially allows firms to automate precise and time-sensitive processes.[186]

56. Smart home devices are also expected to increasingly leverage 5G cellular networks, with the goal of improving device reliability and alleviating difficulties in device setup.[187] In telehealth, the expansion of IoT medical devices could allow healthcare providers to monitor more patients remotely and to improve health outcomes.[188] GSMA's 2019 5G report suggests that cities could see significant benefits from 5G deployment.[189] For example, GSMA suggests that cities may be able to better manage traffic through IoT connected traffic lights and road cameras.[190] 5G is also expected to play an important role in autonomous vehicles. In the short term, 5G networks may be used to create more effective driver assistance features, while in the long run 5G networks have the capability to offload the large amounts of data needed to make vehicles fully autonomous.[191]

[179] AMTA 5G Explained at 5.

[180] *See* GSMA, Internet of Things in the 5G Era: Opportunities and Benefits for Enterprises and Consumers, at 3 (Nov. 2019), https://www.gsma.com/iot/wp-content/uploads/2019/11/201911-GSMA-IoT-Report-IoT-in-the-5G-Era.pdf (GSMA IoT Report).

[181] *See* GSMA, The GSMA Guide to the Internet of Things, at 2 (Sept. 2018), https://www.gsma.com/iot/wp-content/uploads/2018/09/4048-GSMA-IOT-Guide2018-WEB.pdf.

[182] *See, e.g.*, *Establishing a 5G Fund for Rural America*, GN Docket No. 20-32, Notice of Proposed Rulemaking and Order, 35 FCC Rcd 3994, 3996, para. 5 (2020) (*5G Fund NPRM and Order*).

[183] CTIA Comments at 36.

[184] IHS 5G Economic Impact Study at 19.

[185] *Id*. at 31.

[186] WEF 5G Impact Report at 7.

[187] IHS 5G Economic Impact Study at 30-31.

[188] AT&T Business Editorial Team, *5 ways 5G will transform healthcare*, https://www.business.att.com/learn/updates/how-5g-will-transform-the-healthcare-industry.html (last visited Oct. 27, 2020).

[189] GSMA IoT Report at 4.

[190] *Id*. at 8.

[191] IHS 5G Economic Impact Study at 31.

57. In contrast to prior generations of technologies, the costly process of transitioning spectrum from 4G use to 5G use may be largely avoided through Dynamic Spectrum Sharing (DSS).[192] DSS allows service providers to allocate spectrum resources between 4G and 5G in real time.[193] In effect, 4G and 5G users would be able to coexist within the same spectrum band, alleviating the need to completely clear bands during transition.[194]

c. Mobile Wireless Devices, Services, and Advertising

58. In addition to competing on device promotions, price, and network quality, mobile wireless providers compete using differentiated plans and bundled services. Wireless providers frequently offer a variety of plans and services to appeal to subsets of consumers.[195] As noted in section II.A.4,[196] plans may differ in features such as video streaming services, streaming quality, data limits, and thresholds that trigger speed limits.[197] Wireless providers also compete by offering mobile hotspots with differing available speeds and data limits, cloud storage differentiated by storage allowances, and international service capabilities.[198]

59. Mobile wireless service providers frequently offer special promotions for customers porting their numbers from competitors or adding new lines to their account.[199] For example, in December 2019, AT&T, T-Mobile, U.S. Cellular, and Verizon Wireless all offered different promotions involving the Samsung Galaxy S10E.[200] AT&T offered a free Galaxy S10E with the purchase of a standard S10 or S10 Plus using the company's annual trade-in plan. Similarly, Verizon Wireless offered a free S10E with purchase of an S10 or S10 Plus, with the requirements that the consumer must start at least one new line of service and also pay off the balance if they leave Verizon Wireless within 24 months of receiving the promotion. T-Mobile offered the $750 S10E for $360 to customers adding a new line, paid over 36 monthly installments. Finally, U.S. Cellular offered 50% off the price of the S10E to be paid over 30 months to new or current customers with the "Total Plan with Unlimited Plus Data."[201]

60. Individuals use devices such as smartphones, tablets, and laptops to access wireless services. For example, a Deloitte survey reported that smartphone penetration had grown from 82% in

[192] In February 2020, Ericsson's Head of Networks stated that they expected 80% of their commercial 5G partners to use DSS within the 12 months. Fierce Wireless, *Ericsson Defends Dynamic Spectrum Sharing* (Feb. 27, 2020), https://www.fiercewireless.com/tech/ericsson-defends-dynamic-spectrum-sharing.

[193] *See* Qualcomm, *Key breakthroughs to drive a fast and smooth transition to 5G standalone* (Aug. 19, 2019), https://www.qualcomm.com/news/onq/2019/08/19/key-breakthroughs-drive-fast-and-smooth-transition-5g-standalone.

[194] *See* Qualcomm, *Key breakthroughs to drive a fast and smooth transition to 5G standalone* (Aug. 19, 2019), https://www.qualcomm.com/news/onq/2019/08/19/key-breakthroughs-drive-fast-and-smooth-transition-5g-standalone.

[195] CTIA Comments at 30.

[196] *See infra* section II.A.4 for additional details on service providers' plans and services.

[197] CTIA Comments at 30-31.

[198] Jason Cipriani, *Compared: 5G data plans from Verizon, AT&T, Sprint, and T-Mobile*, ZDNet (Oct. 22, 2020), https://www.zdnet.com/article/compared-5g-data-plans-from-verizon-at-t-sprint-and-t-mobile/.

[199] *See infra* section II.A.4; *see also, e.g.*, AT&T, *Switch and Save*, https://www.att.com/wireless/switch-and-save/ (last visited Oct. 27, 2020).

[200] Jeffery Van Camp, *How to Pick the Right Galaxy S10, and Where to Order It*, Wired (Dec. 3, 2019), https://www.wired.com/story/samsung-galaxy-s10-deals/.

[201] *See* Jeffery Van Camp, *How to Pick the Right Galaxy S10, and Where to Order It*, Wired (Dec. 3, 2019), https://www.wired.com/story/samsung-galaxy-s10-deals/.

2017 to 85% in 2018.[202] Statista, on the other hand, reported smartphone penetration rates of 80% in 2018, and 82% in 2019.[203] To access 5G-capable networks, many smartphone users will need to upgrade their devices.[204] Handset manufacturers including Samsung, Motorola, and LG are releasing 5G capable devices in 2020,[205] and Apple has just announced the release of its 5G iPhone 12.[206] The Consumer Technology Association (CTA) predicts that around 20 million 5G-capable phones will ship in 2020, contributing $15 billion in revenue and representing 19% of total smart phone revenue.[207]

61. Mobile wireless providers also compete for customers through extensive advertising and marketing campaigns.[208] Service providers' marketing campaigns often focus on aspects such as network quality,[209] 5G capabilities,[210] price differences,[211] differentiating services,[212] and device promotions.[213] In 2019, AT&T spent $6.1 billion on advertising,[214] Sprint spent $1.1 billion,[215] T-Mobile spent $1.6 billion,[216] and Verizon Wireless spent $3.1 billion.[217] During the period covered by this report, service

[202] Deloitte, *2018 Global Mobile Consumer Survey: U.S. Edition* at 2 (2018), https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-global-mobile-consumer-survey-exec-summary-2018.pdf.

[203] Statista, *Smartphone User Penetration as Share of Population in the United States from 2018 to 2024* (Apr. 21, 2020), https://www.statista.com/statistics/201184/percentage-of-mobile-phone-users-who-use-a-smartphone-in-the-us/.

[204] Phillip Prado, *Should You Upgrade Now or Wait for One of 2020's 5G Phones* (Dec. 15, 2019), https://www.androidauthority.com/5g-smartphones-2020-1063813/.

[205] *See, e.g.*, Press Release, Samsung, Capture Your World in a Whole New Way: Samsung Galaxy S20 5G Series Available Today (Mar. 6, 2020), https://news.samsung.com/us/samsung-galaxy-s20-5g-series-available-today-capture-your-world; Larry Dignan, *Motorola Enters Flagship Smartphone Fray, Launches Moto Edge, Edge Plus at $999*, ZDNET (Apr. 22, 2020), https://www.zdnet.com/article/motorola-enters-flagship-smartphone-fray-launches-moto-edge-edge-plus-at-999/; AT&T News, *AT&T Expands 5G Device Lineup with the LG V60 ThinQ 5G Coming Soon*, AT&T (Feb. 26, 2020), https://about.att.com/story/2020/lg_v60_thinq_5g.html.

[206] Press Release, Apple, Apple announces iPhone 12 and iPhone 12 mini: A new era for iPhone with 5G (Oct. 13, 2020), https://www.apple.com/newsroom/2020/10/apple-announces-iphone-12-and-iphone-12-mini-a-new-era-for-iphone-with-5g/.

[207] This prediction was "[p]rior to the current crisis" of COVID-19 and actual shipments are likely to be lower. CTA Comments at 6-7.

[208] CTIA Comments at 32-33.

[209] ispot.tv, *Verizon TV Commercial, 'Ned: $650 When You Switch,'* https://www.ispot.tv/ad/IxQq/verizon-ned-650-when-you-switch (last visited Oct. 27, 2020).

[210] ispot.tv, *T-Mobile TV Commercial, 'A New Moment in Wireless Has Begun,'* https://www.ispot.tv/ad/nqlA/t-mobile-a-new-moment-in-wireless-has-begun (last visited Oct. 27, 2020).

[211] ispot.tv, *T-Mobile Essentials TV Commercial, 'Families Save Big: 50 Percent,'* https://www.ispot.tv/ad/nR50/t-mobile-families-save-big-50-percent (last visited Oct. 27, 2020).

[212] ispot.tv, *Verizon TV Commercial, 'Disney+ on Us,'* https://www.ispot.tv/ad/ZAFd/verizon-disney-on-us (last visited Oct. 27, 2020).

[213] ispot.tv, *AT&T Unlimited TV Commercial, 'Innovations: Jeans: Samsung Galaxy S10e'*, https://www.ispot.tv/ad/IJY8/at-and-t-unlimited-innovations-jeans-samsung-galaxy-s10e (last visited Oct. 27, 2020).

[214] AT&T Inc., SEC Form 10-K at n.22 (filed Feb. 20, 2020) (AT&T 2019 SEC Form 10-K).

[215] Sprint, SEC Form 10-K at F-18 (filed May 29, 2020)

[216] T-Mobile 2019 SEC Form 10-K at 70.

[217] Verizon Communications Inc., SEC Form 10-K at n.15 (filed Feb. 21, 2020) (Verizon 2019 SEC Form 10-K).

providers have increasingly focused on 5G in their advertisements.[218] CTIA reports that, in 2019, AT&T spent roughly $90 million on advertisements with 5G in the title, while Verizon Wireless spent roughly $86 million.[219]

d. Speed of Service

62. Network speed is a key characteristic of mobile wireless performance, and the Commission has recognized the importance of accurate and timely data on wireless upload and download speeds.[220] Mobile broadband speeds experienced by consumers can vary greatly with a number of factors, including the service provider's received signal quality, cell traffic loading and network capacity in different locations, as well as the capabilities of consumers' devices.[221] Because these and other factors cause variations in mobile network performance, various methodologies have been employed to measure mobile network speeds. The two most prevalent methodologies rely on crowdsourced data and structured sample data. Crowdsourced data are user-generated data produced by consumers who voluntarily download speed test applications on their mobile devices. Structured sample data, by contrast, are generated from tests that control for the location and time of the tests as well as for the devices used in the test.[222] This *Report* presents speed data using the Ookla Net Index data (crowdsourced), OpenSignal data (crowdsourced), and RootMetrics (structured sample).[223]

63. Figures II.A.27 and II.A.28 present the nationwide mean and median 4G LTE download and upload speeds by service provider based on Ookla data for the second half of 2018 through the second half of 2019.[224] Figure II.A.29 presents the increase over time for mean and median 4G LTE

[218] Alexandra Bruell, *Wireless Carriers Revamp Ad Strategies for 5G*, The Wall Street Journal (Feb, 26, 2019), https://www.wsj.com/articles/wireless-carriers-revamp-ad-strategies-for-5g-11551236521.

[219] CTIA Comments at 33.

[220] *See generally Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 19-285, 2020 Broadband Deployment Report, 35 FCC Rcd 8986 (2020) (*2020 Broadband Deployment Report*). In addition, in section III.A, we assess the extent to which Americans are covered by mobile 4G LTE (based on FCC Form 477 data at minimum advertised speeds of 5 Mbps/1 Mbps, and Ookla data at a median speed of 10 Mbps/3 Mbps or higher).

[221] As we have pointed out, crowdsourced data have certain limitations. For example, bias is often introduced into speed test data because tests are performed only at specific times and places, potentially providing a less accurate snapshot of mobile broadband performance. Further, we noted that the methods by which different speed test apps collect data can vary and may not use techniques that control for certain variables. *Digital Opportunity Data Collection Second Order and Third Further Notice*, 35 FCC Rcd at 7487-7488, para. 65. For additional discussion of the various factors, *see Twentieth Wireless Competition Report*, 32 FCC Rcd at 9033, para. 87; *Sixteenth Wireless Competition Report*, 28 FCC Rcd at 3895, para. 293.

[222] For a detailed discussion of crowdsourcing and structured sample data, *see Twentieth Wireless Competition Report*, 32 FCC Rcd at 9033-34, para. 88. Many apps that collect crowdsourced data collect data via background or automated tests, as well as through user-initiated tests.

[223] While speed metrics based on the FCC Speed Test (available for both Android phones and the iPhone) were reported in the *Seventeenth Wireless Competition Report* through the *Nineteenth Wireless Competition Report*, we stopped reporting these metrics in the *Twentieth Wireless Competition Report* and do not report them in this *Report* due to certain anomalies found in the underlying data. We may include data from the FCC Speed Test in future *Reports*, as the anomalies are aged out of the dataset. An in-depth discussion of the Measuring Broadband America Program's FCC Speed Test is available in the *Seventeenth Wireless Competition Report. Seventeenth Report*, 29 FCC Rcd at 15467, Appx. VI., paras. 7-9; *see also* FCC, *Measuring Mobile Broadband Performance*, https://www.fcc.gov/general/measuring-mobile-broadband-performance (last visited Oct. 27, 2020).

[224] Ookla gathers crowdsourced mobile speed data through the use of its Speedtest mobile app. Speedtest, *Speedtest Apps for Mobile Data*, http://www.speedtest.net/mobile/ (last visited Oct. 27, 2020). An in-depth discussion of the Ookla speedtest is available in the *Seventeenth Report. Seventeenth Report*, 29 FCC Rcd at 15465-66, Appx. VI., paras. 1-6. The upload and download speeds were calculated by Ookla and provided to the Commission for use in this *Report*. In addition, we present 5G download and upload speed data in Appx. B-4 of this *Report*.

download speeds for all providers, from the first half of 2014 through the second half of 2019.[225] Based on Ookla data, Figure II.A.29 indicates that the median 4G LTE download speed increased from 11.0 Mbps to 26.2 Mbps, an increase of approximately 138%, over this time period.

Fig. II.A.27
Ookla Speedtest—Estimated 4G LTE Download Speeds by Service Provider, Nationwide

Service Provider	2H2018			1H2019			2H2019		
	Mean Download Speed (Mbps)	Median Download Speed (Mbps)	Number of Tests ('000s)	Mean Download Speed (Mbps)	Median Download Speed (Mbps)	Number of Tests ('000s)	Mean Download Speed (Mbps)	Median Download Speed (Mbps)	Number of Tests ('000s)
AT&T	29.03	20.79	2,642	37.08	28.33	3,167	41.18	30.43	3,188
Sprint	26.30	16.73	1,794	32.44	21.72	1,594	36.74	23.71	1,441
T-Mobile	32.29	23.88	3,052	34.29	25.28	2,688	34.92	25.45	3,180
Verizon Wireless	30.69	22.97	3,886	32.36	24.47	3,419	33.28	24.53	3,708

Source: Ookla SPEEDTEST intelligence data, © 2020 Ookla, LLC. All rights reserved. Published with permission of Ookla.

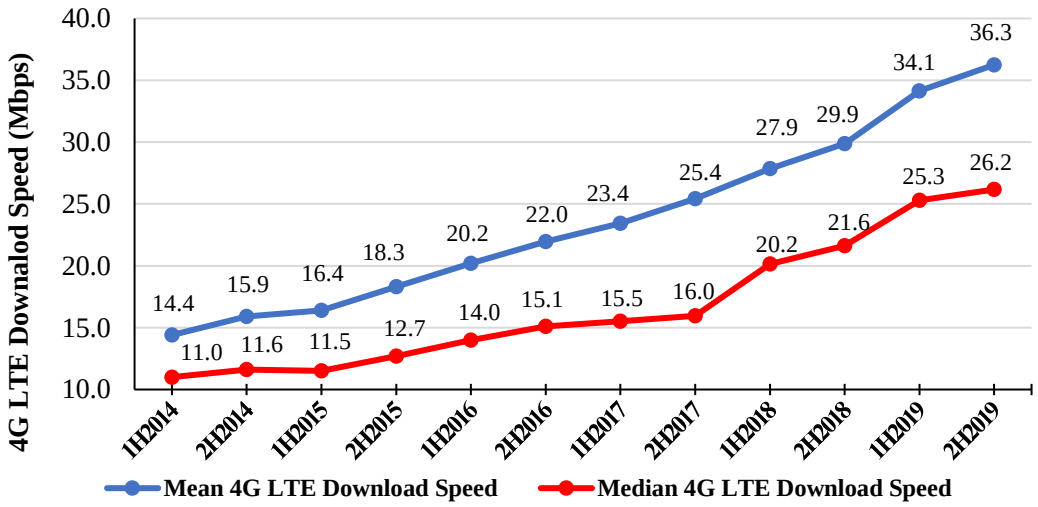
[225] Note that in recent years, Ookla has updated its data cleaning and aggregation rules. In Fig. II.A.29, the legacy rules are reflected in the speeds through the first half of 2016, and updated cleaning rules are reflected in the speeds in the second half of 2016 and beyond.

Fig. II.A.28
Ookla Speedtest - Estimated 4G LTE Upload Speeds by Service Provider, Nationwide

Service Provider	2H2018			1H2019			2H2019		
	Mean Upload Speed (Mbps)	Median Upload Speed (Mbps)	Number of Tests ('000s)	Mean Upload Speed (Mbps)	Median Upload Speed (Mbps)	Number of Tests ('000s)	Mean Upload Speed (Mbps)	Median Upload Speed (Mbps)	Number of Tests ('000s)
AT&T	7.88	5.34	2,642	9.18	6.90	3,167	9.89	7.93	3,188
Sprint	3.28	2.48	1,794	3.61	2.70	1,594	4.18	3.15	1,441
T-Mobile	11.75	9.54	3,052	12.98	10.40	2,688	14.23	11.61	3,180
Verizon Wireless	9.90	6.99	3,886	10.48	7.52	3,419	10.94	7.81	3,708

Source: Ookla SPEEDTEST intelligence data, © 2020 Ookla, LLC. All rights reserved. Published with permission of Ookla.

Fig. II.A.29
Ookla Speed Test: Total 4G LTE Download Speeds, Nationwide



Source: Ookla SPEEDTEST intelligence data, © 2020 Ookla, LLC. All rights reserved. Published with permission of Ookla.

64. Nationwide average 4G LTE download and upload speeds for the second half of 2018 through the second half of 2019 from OpenSignal are presented in Figures II.A.30 and II.A.31 below.[226]

Fig. II.A.30
OpenSignal—Estimated 4G LTE Download Speeds, Nationwide

Service Provider	2H2018	1H2019	2H2019

[226] OpenSignal gathers crowdsourced mobile speed data through the use of its mobile app as well as through partner apps. The partners it works with are strategically selected to cover a wide range of users, demographics, and devices. Opensignal, *Methodology Overview: How Opensignal Measures Mobile Network Experience*, https://www.opensignal.com/sites/opensignal-com/files/opensignal_methodology_overview_june_2020.pdf (last visited Oct. 27, 2020).

	Average Download Speed (Mbps)	Average Download Speed (Mbps)	Average Download Speed (Mbps)
AT&T	19.5	24.6	29.1
Sprint	15.5	21.1	25.9
T-Mobile	21.9	24.3	26.3
Verizon Wireless	22.0	23.8	25.9

OpenSignal, © 2020 OpenSignal.

Fig. II.A.31
OpenSignal –Estimated 4G LTE Upload Speeds, Nationwide

Service Provider	2H2018	1H2019	2H2019
	Average Upload Speed (Mbps)	Average Upload Speed (Mbps)	Average Upload Speed (Mbps)
AT&T	5.1	5.4	6.4
Sprint	2.6	2.6	3.0
T-Mobile	7.0	7.5	8.8
Verizon Wireless	7.4	7.2	8.2

Source: OpenSignal, © 2020 OpenSignal.

65. RootMetrics mobile wireless indices within the United States for the second half of 2018 through the second half of 2019 are presented in Figure II.A.32.[227]

Fig. II.A.32
RootMetrics National Speed Index Data, 2nd Half 2018--2st Half 2019

Service Provider	2nd Half 2018			1st Half 2019			2nd Half 2019		
	Speed Index	Data Index	Text Index	Speed Index	Data Index	Text Index	Speed Index	Data Index	Text Index
AT&T	89.2	93.8	96.5	89.9	94.4	96.5	90.2	94.7	96.8
Sprint	81.3	86.0	95.1	83.4	88.8	95.0	83.9	88.9	95.5
T-Mobile	88.7	91.9	92.1	89.0	92.2	91.7	89.0	92.1	92.0
Verizon Wireless	90.4	95.0	96.8	91.2	95.5	96.3	90.7	95.1	96.5

Source: RootMetrics Data, © 2020 RootMetrics. All rights reserved. Published with permission of RootMetrics.

6. Network Coverage

66. This section first provides a description of the FCC Form 477 data that are used in this *Report* for both analyzing mobile and fixed coverage. We then describe how the Commission has already

[227] RootMetrics, *Methodology*, http://rootmetrics.com/en-US/methodology (last visited Oct. 27, 2020). RootMetrics performs drive tests and stationary tests in specific locations, using leading Android-based smartphones for each network. RootScores are scaled from 0 to 100. An in-depth discussion of the RootMetrics dataset is available in the *Seventeenth Report*, 29 FCC Rcd at 15467-68, Appx. VI, paras 10-11.

reformed─and is further proposing to reform─the FCC Form 477 data collection. Finally, we evaluate mobile coverage as of year-end 2019. Fixed coverage is assessed in section III.A.

a. FCC Form 477

67. The FCC Form 477 data are currently the most comprehensive data available to evaluate broadband deployment.[228] The FCC Form 477 deployment data are also available to the public, which increases the transparency of our analysis and permits the public to independently assess our broadband service deployment data.[229] The Commission has collected FCC Form 477 deployment data since 2014, and, thus, these data have provided a consistent yardstick against which to measure year-over-year broadband deployment.[230]

68. We measure mobile network coverage based on a set of maps that contain information on deployment at a detailed geographic level.[231] In conducting this analysis, we use the actual-area methodology, which analyzes FCC Form 477 mobile broadband data on a sub-census-block level and calculates the percentage of each census block covered by each service provider by technology. Unlike the centroid methodology,[232] in which a particular entire census block is either considered to be covered

[228] *See* 2020 *Broadband Deployment Report*, 35 FCC Rcd at 8997-98, para. 24; *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 18-238, 2019 Broadband Deployment Report, 34 FCC Rcd 3857, 3868, para. 25 (2019) (*2019 Broadband Deployment Report)*; *2018 Communications Marketplace Report* 34 FCC Rcd at 12651, para. 184.

[229] FCC, *Form 477 Resources*, https://www.fcc.gov/economics-analytics/industry-analysis-division/form-477-resources (last visited Oct. 27, 2020). All FCC Form 477 data used in this *Report* have been certified as accurate by the filers. We note that the *Report*'s analysis may understate or overstate consumers' options for services to the extent that broadband providers fail to report data or misreport data. *See* FCC, *Explanation of Broadband Deployment Data*, https://www.fcc.gov/general/explanation-broadband-deployment-data (last visited Oct. 27, 2020) (describing quality and consistency checks performed on providers' submitted data and explaining any adjustments made to the FCC Form 477 data as filed).

[230] *See* AACG Reply Comments at 3 (asserting that FCC Form 477 data provide a consistent set of measures to allow parties to see the evolution of broadband across time and geography).

[231] Currently, FCC Form 477 collects broadband deployment data from facilities-based providers of fixed and mobile broadband service. *See* 47 CFR § 1.7001(b). The FCC Form 477 reporting requirements exclude providers of terrestrial wireless "hot spot" services, like local-area Wi-Fi or Wi-Fi within public places, but include facilities-based network providers that provide resale of mobile services. Facilities-based providers of mobile service submit polygons in a shapefile format representing geographic coverage nationwide (including U.S. territories) for each transmission technology (e.g., 5G-NR, 4G LTE, CDMA-based, GSM-based), indicating the geographic areas in which users should expect to receive the minimum upload and download speeds advertised by the service provider for the deployed technologies. FCC Form 477, *Local Telephone Competition and Broadband Reporting Instructions* (May 21, 2020), https://transition.fcc.gov/form477/477inst.pdf.

The scope and nature of the FCC Form 477 data on mobile services coverage is an improvement over earlier data sources in certain key respects, such as the uniformity of data reporting. *See Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act*, 2016 Broadband Progress Report, 31 FCC Rcd 699, 708-09, para. 22 (2016) ("[D]ata from the Form 477 . . . help us better analyze mobile broadband deployment than in years past.").

[232] The centroid methodology considers a census block covered if the geometric center point, or centroid, is covered. The methodology estimates coverage of population, land, and road miles by aggregating the totals for "covered" census blocks. *Twentieth Wireless Competition Report*, 32 FCC Rcd at 9016-17, para. 71. In practice, actual-area and centroid methodologies yield similar results at the national level. *Twentieth Wireless Competition Report*, 32 FCC Rcd at 9017-18, para. 72. In this *Report*, we provide mobile wireless coverage maps in Appx. B-5, and we report our results based on the centroid analysis in Appx. B-6. We include the continental United States, Hawaii, Alaska, and Puerto Rico, and exclude all water-only blocks in our analysis.

or not, the actual-area methodology estimates the area of the census block that is covered.[233] However, because we currently do not know the distribution of the population at the sub-census-block level, we must approximate the population covered by each technology. To do this, we assume, for purposes of this *Report*, that the population of a census block is uniformly distributed such that the fraction of the population covered in a block is proportional to the fraction of the actual area covered. We then sum the estimated covered population across blocks to estimate the total covered population within the United States. Likewise, we assume that the fraction of the road miles covered in a block is proportional to the fraction of the actual area covered.[234]

69. We measure fixed deployment data at the census block level. FCC Form 477 filers report a list of census blocks in which they provide access to broadband.[235] For purposes of the analysis of access to advanced telecommunications capability in this *Report*, a census block is classified as served if the FCC Form 477 data indicate that service is available in the census block, even if not to every location.[236] Therefore, it is not necessarily the case that every household, housing unit, or person will have coverage from a given service provider in a census block that this analysis indicates is served.[237] Thus, as the Commission has previously explained, this analysis could overstate the coverage experienced by some consumers, especially in large or irregularly-shaped census blocks.[238] While some commenters

[233] This sub-census-block analysis can determine the unique combination of service providers serving a particular percentage of the area in a census block with a certain technology. As this analysis was done at each technology level, the set of unique combinations that it produces are valid for each individual technology, but not across multiple technologies. Essentially, we can distinguish the unique percentages covered by various service providers at the sub-census-block level using a particular technology (e.g., 4G LTE), but we currently cannot determine how this interplays with other technologies (e.g., with 2G or 3G technologies).

[234] In order to fully take advantage of the increase in precision offered by the actual-area coverage methodology, spatially accurate representations of population and road miles would be necessary. We do not have access to such information for the current *Report*, however.

[235] *See Modernizing the FCC Form 477 Data Program*, WC Docket No. 11-10, Report and Order, 28 FCC Rcd 9887, 9902, para. 32 (2013).

[236] The Commission's instructions for completing FCC Form 477 state: "For purposes of this form, fixed broadband connections are available in a census block if the provider does, or could, within a service interval that is typical for that type of connection—that is, without an extraordinary commitment of resources—provision two-way data transmission to and from the Internet with advertised speeds exceeding 200 kbps in at least one direction to end-user premises in the census block." FCC, FCC Form 477 Local Telephone Competition and Broadband Report Instructions, at 17 (Dec. 5, 2016), https://us-fcc.box.com/v/Form477InstThruJune19 (2018 FCC Form 477 Instructions); FCC, FCC Form 477 Local Telephone Competition and Broadband Report Instructions at 18 (May 21, 2020), https://transition.fcc.gov/form477/477inst.pdf (2019 FCC Form 477 Instructions) (current version).

[237] A household consists of all the people who occupy a housing unit. A house, an apartment or other group of rooms, or a single room, is regarded as a housing unit when it is occupied or intended for occupancy as separate living quarters; that is, when the occupants do not live with any other persons in the structure and there is direct access from the outside or through a common hall. U.S. Census Bureau, *Subject Definitions*, https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#household (last visited Oct. 27, 2020). Commission staff developed population estimates for 2011-19 by updating the 2010 census block population estimates. These estimates are based upon annual U.S. Census mid-year county (or county-equivalent) level population and housing unit estimates for the fifty states, the District of Columbia, and Puerto Rico. These data are used in conjunction with U.S. Census Bureau TIGER data to indicate new roads, that is, new housing development, to distribute population amongst the census blocks comprising each county (or county-equivalent). FCC, *Staff Block Estimates*, https://www.fcc.gov/reports-research/data/staff-block-estimates (last visited Oct. 27, 2020).

[238] *See, e.g.*, *2020 Broadband Deployment Report*, 35 FCC Rcd at 8998, para. 26; *2019 Broadband Deployment Report*, 34 FCC Rcd at 3869, para. 25 & n.92.

criticize as overly inclusive the use of census-block reporting for fixed providers,[239] these data remain the best and most granular data available for our analysis at this point in time. In addition, we find that using a consistent unit of measurement (the census block) is an effective tool for evaluating how deployment is progressing over time. Our analysis of deployment for both fixed and mobile 4G LTE services in section III.A uses 2010 census block population data that Commission staff has updated to account for population growth and economic development.[240]

70. As the Commission has repeatedly stated, having accurate and reliable broadband deployment data is critical not only to the Commission, but also to other federal policymakers, state policymakers, and consumers.[241] We observe that, while the current FCC Form 477 deployment data are an improvement over the deployment data previously available on a national scale, questions have arisen in various contexts over the past several years regarding the accuracy of coverage reported by FCC Form 477 deployment data.[242] We note, however, that this *Report* is not the appropriate vehicle for the Commission to make changes to the data collection. Indeed, in August 2019, the Commission adopted new requirements for broadband mapping as part of its *Digital Opportunity Data Collection* proceeding for collecting granular, precise coverage data.[243] After the Commission initiated its *Digital Opportunity Data Collection* proceeding, Congress enacted the Broadband DATA Act, which largely affirmed the approach to broadband mapping the Commission adopted in the *Digital Opportunity Data Collection*.[244]

[239] *See* INCOMPAS Comments at 9-11 (critiquing use of the data, but also conceding that they are not aware of any sufficient information that is accurate and verifiable for the FCC to conduct its analysis); Common Cause/NHMC Reply Comments at 5-7; OTI Reply Comments at 2-3.

[240] Commission staff developed population estimates for 2011-19 by updating the 2010 census block population estimates. These estimates are based upon annual U.S. Census mid-year county (or county-equivalent) level population and housing unit estimates for the fifty states, the District of Columbia, and Puerto Rico. These data are used in conjunction with U.S. Census Bureau TIGER data to indicate new roads, that is, new housing development, to distribute population amongst the census blocks comprising each county (or county-equivalent). FCC, *Staff Block Estimates*, https://www.fcc.gov/reports-research/data/staff-block-estimates (last visited Oct. 27, 2020).

[241] *See Digital Opportunity Data Collection Second Order and Third Further Notice*, 35 FCC Rcd at 7461, para. 1; *Digital Opportunity Data Collection Order and Second Further Notice*, 34 FCC Rcd at 7549, para. 112; *2017 Data Collection Improvement FNPRM*, 32 FCC Rcd at 6331-32, para. 8. For purposes of this *Report*, the "*Digital Opportunity Data Collection* proceeding" refers collectively to the *Digital Opportunity Data Collection Second Order and Third Further Notice*, and the *Digital Opportunity Data Collection Order and Second Further Notice. See*, FCC, *Digital Opportunity Data Collection*, https://www.fcc.gov/digital-opportunity-data-collection-dodc (last visited Oct. 27, 2020). The Commission has also used this proceeding to implement the Broadband DATA Act's provisions since its passage.

[242] *Digital Opportunity Data Collection Second Order and Third Further Notice*, 35 FCC Rcd, 7462-63, para. 5; *Digital Opportunity Data Collection Order and Second Further Notice*, 34 FCC Rcd at 7509, para. 10; *2017 Data Collection Improvement FNPRM*, 32 FCC Rcd at 6332-33, para. 10; *see also* Rural Broadband Auctions Task Force, Mobility Fund Phase II Coverage Maps Investigation Staff Report (2019), https://docs.fcc.gov/public/attachments/DOC-361165A1.pdf.

[243] *See Digital Opportunity Data Collection Second Order and Third Further Notice*, 35 FCC Rcd at 7461, para. 1; *see generally Digital Opportunity Data Collection Report and Order and Second Further Notice*.

[244] Broadband Deployment Accuracy and Technological Availability Act (Broadband DATA Act), Pub. L. No. 116-130, 134 Stat. 228 (2020) (codified at 47 U.S.C. §§ 641-46). Under the Broadband DATA Act, the Commission must establish rules: (1) requiring the collection of granular data from providers on the availability and quality of service of broadband internet access service, which the Commission will use to create publicly available coverage maps; (2) adopting processes for challenging and verifying the coverage maps and submitted data; and (3) instructing mobile providers to submit propagation maps depicting current 4G LTE mobile broadband coverage, along with propagation model details, that consider the effect of clutter and demonstrate minimum specified parameters. 47 U.S.C. §§ 642 (b)(5), (a)(1)(B)(i), (b)(2)(B). The Act also requires the Commission to create a common dataset of all locations where fixed broadband Internet access service can be installed. 47 U.S.C. § 642 (b)(1)(A)(i).

However, the Broadband DATA Act prohibits the Commission from relying on the Universal Service Administrative Company—the administrator of the Universal Service Fund and the entity the Commission intended to carry out various administrative responsibilities in connection with the new broadband maps. As a result, the Commission must wait for Congress to appropriate necessary funding to develop these new maps.[245]

71. Starting with the December 2019 FCC Form 477 data collection, the wireless reporting requirements were changed to provide more useful information to the public and to streamline unnecessary filings.[246] Specifically, minimum advertised or expected speeds and provider-specific coverage data, reported to the FCC but previously kept confidential, are now publicly released.[247] Mobile providers are no longer required to report coverage by spectrum band as the FCC usually collects band-specific data from providers directly when needed.[248] Mobile providers now must separately report coverage that satisfies the 5G-NR standards developed by the 3rd Generation Partnership Project (3GPP).[249] In general, mobile broadband coverage data must be submitted in four streamlined categories: 5G-NR, 4G LTE, CDMA-based, and GSM-based, instead of the previous nine codes.[250] The voice coverage data reporting requirements have been simplified consistent with the revisions to the requirements for FCC Form 477 mobile broadband reporting.[251]

b. Mobile Wireless Coverage Estimates

72. *Overall Coverage by Individual Service Provider*. Figure II.A.33 presents estimates of mobile wireless coverage by individual mobile wireless service provider using any technology.[252] Because the data are from December 2019, and thus before the consummation of the merger between T-Mobile and Sprint, coverage for both firms is presented in this Report.[253] Figure II.A.33 indicates that AT&T covered census blocks containing over 99% of the population, while the comparable approximate percentages are 98% for Verizon Wireless, 98% for T-Mobile, and 93% for Sprint. AT&T and Verizon Wireless each covered approximately 92% of the road miles, T-Mobile covered approximately 85%, and Sprint covered approximately 57%. In terms of land area, AT&T and Verizon Wireless each covered over 70%, while T-Mobile covered over 60% and Sprint covered over 30%.

[245] Broadband DATA Act.

[246] *See Digital Opportunity Data Collection Second Order and Third Further Notice*, 35 FCC Rcd at 7474-83, paras. 32-51; *Digital Opportunity Data Collection Order and Second Further Notice*, 34 FCC Rcd 7521-37, paras. 35-75.

[247] *Id.* at 7521-22, paras. 36-40.

[248] *Id.* at 7523-24, paras. 41-43.

[249] *Id.* at 7524-25, paras. 44-45.

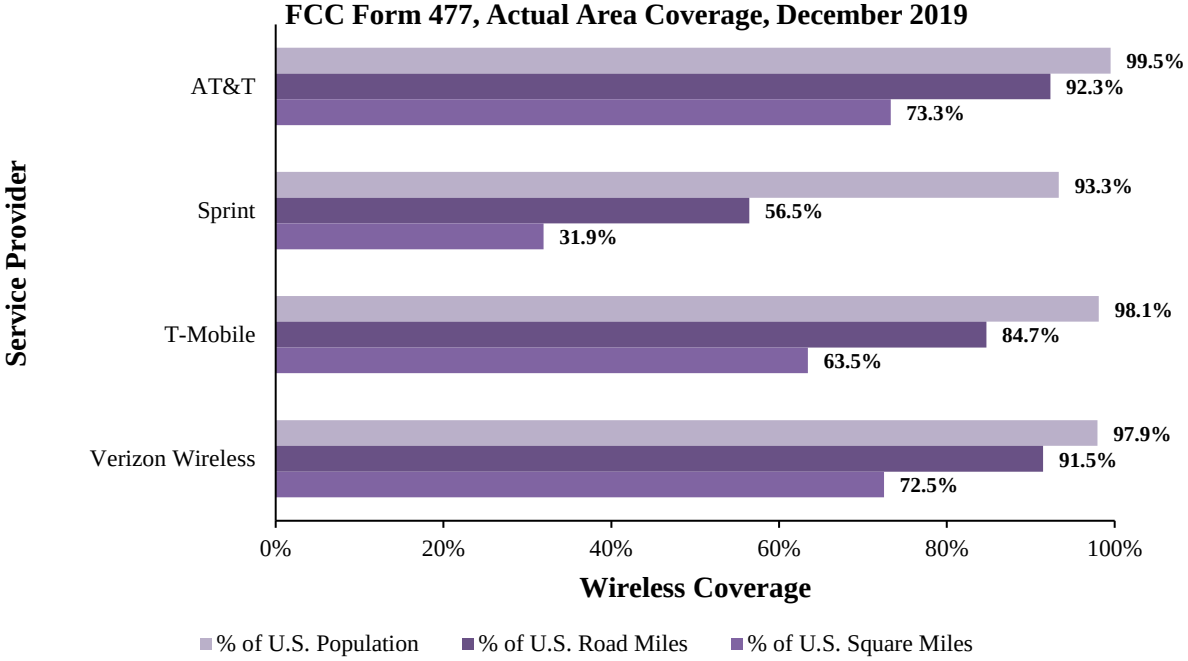
[250] *Id.* at 7525-27, paras. 46-51.

[251] *Id.* at 7527-29, paras. 52-56.

[252] Importantly, we note that even though a particular service provider has indicated that it has network coverage in a particular census block, that does not necessarily mean that it offers service to residents in that census block. This note extends to all coverage figures presented in this section.

[253] As noted above, the T-Mobile/Sprint merger closed on April 1, 2020. T-Mobile, *T-Mobile Completes Merger with Sprint to Create the New T-Mobile* (Apr. 1, 2020), https://www.t-mobile.com/news/un-carrier/t-mobile-sprint-one-company/.

Fig. II.A.33
Estimated Wireless Coverage by Provider
FCC Form 477, Actual Area Coverage, December 2019

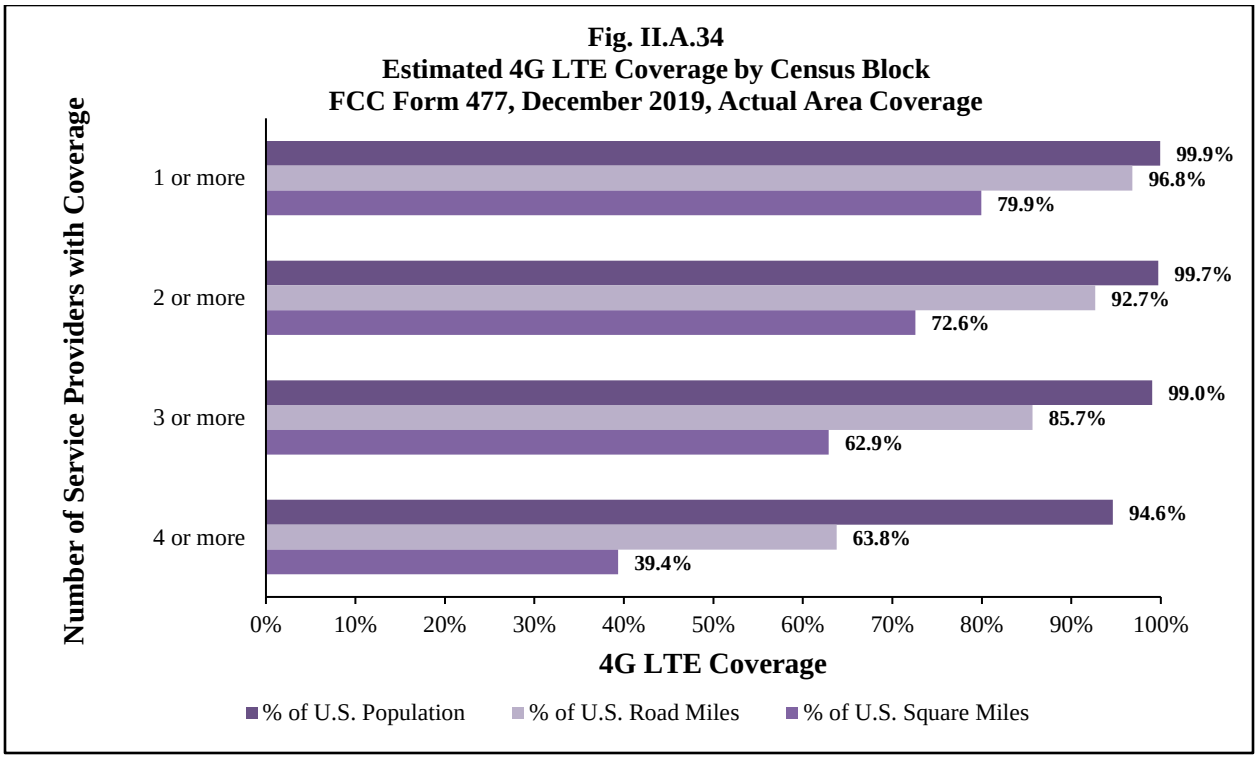


Source: Based on actual area coverage analysis of December 2019 FCC Form 477 and 2010 Census data.

73. *4G LTE Mobile Broadband Coverage*. Figure II.A.34 presents 4G LTE mobile broadband coverage by number of service providers. It shows that, as of December 2019, approximately 95% of the U.S. population lived in areas with 4G LTE coverage by at least four service providers. These census blocks, however, only accounted for approximately 64% of road miles and approximately 39% of the total land area of the United States.

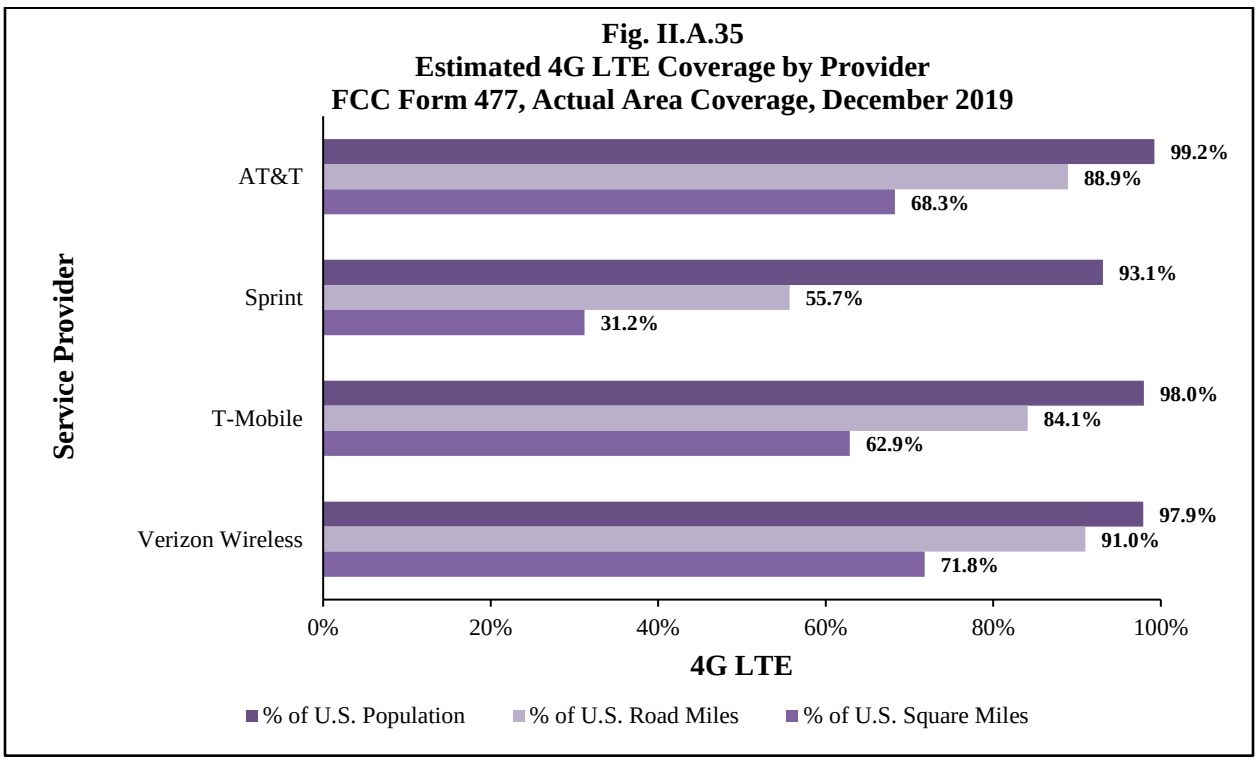
74. Figure II.A.35 presents estimates of 4G LTE mobile broadband coverage by individual mobile wireless service provider. It shows that AT&T, T-Mobile, and Verizon Wireless each provided 4G LTE coverage to census blocks containing over 97% of the population, while Sprint provided 4G LTE coverage to approximately 93% of the population. In terms of road miles and land area, Verizon Wireless covered approximately 91% of road miles and 72% of the land area, AT&T covered approximately 89% of road miles and 68% of the land area, T-Mobile covered approximately 84% of road miles and 63% of the land area, and Sprint covered approximately 56% of road miles and 31% of the land area with 4G LTE.

Fig. II.A.34
Estimated 4G LTE Coverage by Census Block
FCC Form 477, December 2019, Actual Area Coverage



Source: Based on actual area coverage analysis of December 2019 FCC Form 477 and 2010 Census data.

Fig. II.A.35
Estimated 4G LTE Coverage by Provider
FCC Form 477, Actual Area Coverage, December 2019

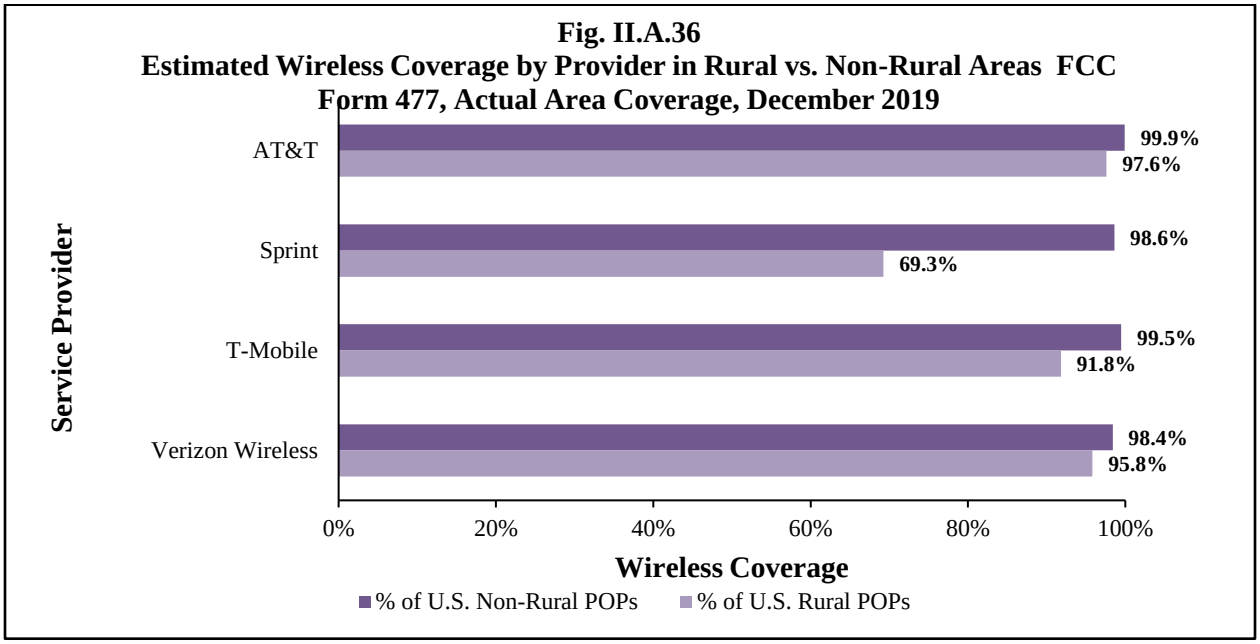


Source: Based on actual area coverage analysis of December 2019 FCC Form 477 and 2010 Census data.

75. *Rural/Non-Rural Comparisons.* Since 2004, the Commission has used a "baseline" definition of a rural county as one with a population density of 100 people per square mile or less.[254] We use this same baseline definition to analyze coverage in rural versus non-rural areas for our mobile broadband coverage analysis. To determine whether counties are rural or non-rural, we first excluded all water-only census blocks within each county. We then divided the county population by the total geographic area of the county to determine the population density. For those counties with a population density of 100 people per square mile or less, all census blocks within those counties were considered rural. Under this definition and using 2010 U.S. Census population data, approximately 56 million people, or approximately 18% of the U.S. population, live in rural counties. These counties comprise approximately 3 million square miles, or approximately 84%, of the geographic area of the United States.

76. Figure II.A.36 presents mobile wireless coverage (using any technology) of the rural and non-rural U.S. population by individual mobile wireless service provider. Our analysis indicates that each of the four nationwide service providers covered at least 98% of the non-rural population with mobile wireless service. Rural wireless coverage by service provider is more limited: AT&T covered approximately 98%, Verizon Wireless covered approximately 96%, T-Mobile covered approximately 92%, and Sprint covered approximately 69% of the rural population with wireless service.

Fig. II.A.36
Estimated Wireless Coverage by Provider in Rural vs. Non-Rural Areas FCC Form 477, Actual Area Coverage, December 2019



Source: Based on actual area coverage analysis of December 2019 FCC Form 477 and 2010 Census data.

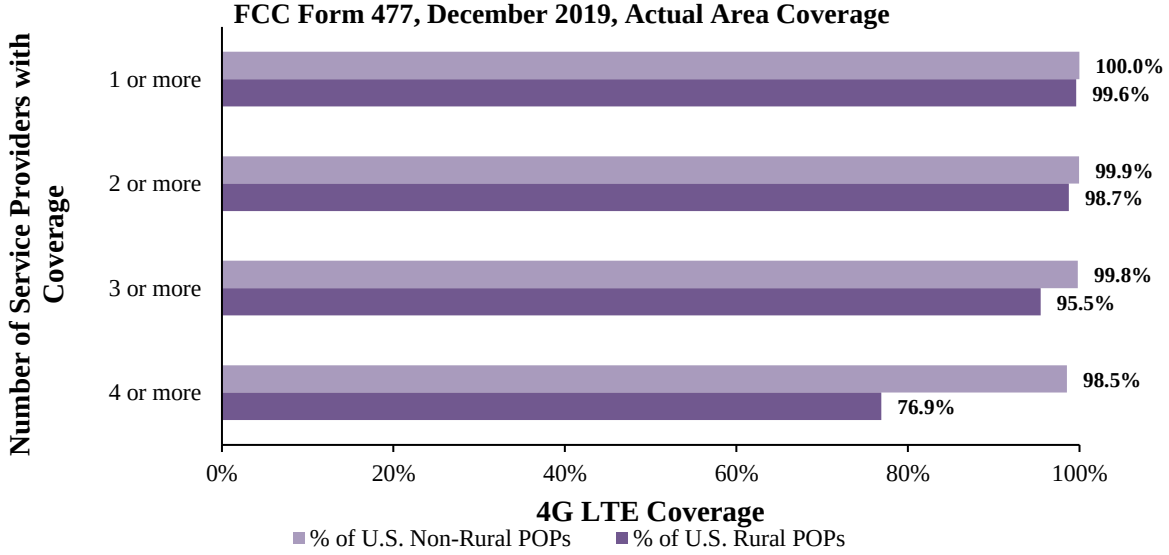
77. Figure II.A.37 presents 4G LTE population coverage in rural and non-rural census blocks by number of service providers. Our estimates show that approximately 99% of the non-rural population was covered by at least three 4G LTE service providers, while approximately 96% of the rural population was covered by at least three 4G LTE service providers. Over 98% of the non-rural American population had 4G LTE coverage from four or more service providers, while only approximately 77% of the rural population was covered by at least four 4G LTE service providers.

78. Figure II.A.38 presents 4G LTE coverage by individual service provider of both the rural and non-rural U.S. population. Our estimates show that each of the four nationwide service providers covered at least 98% of the non-rural population with 4G LTE. Regarding 4G LTE coverage in rural

[254] *See Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies To Provide Spectrum-Based Services*, WT Docket No. 02-381, Report and Order and Further Notice of Proposed Rule Making, 19 FCC Rcd 19078, 19086-88, paras. 10-12 (2004).

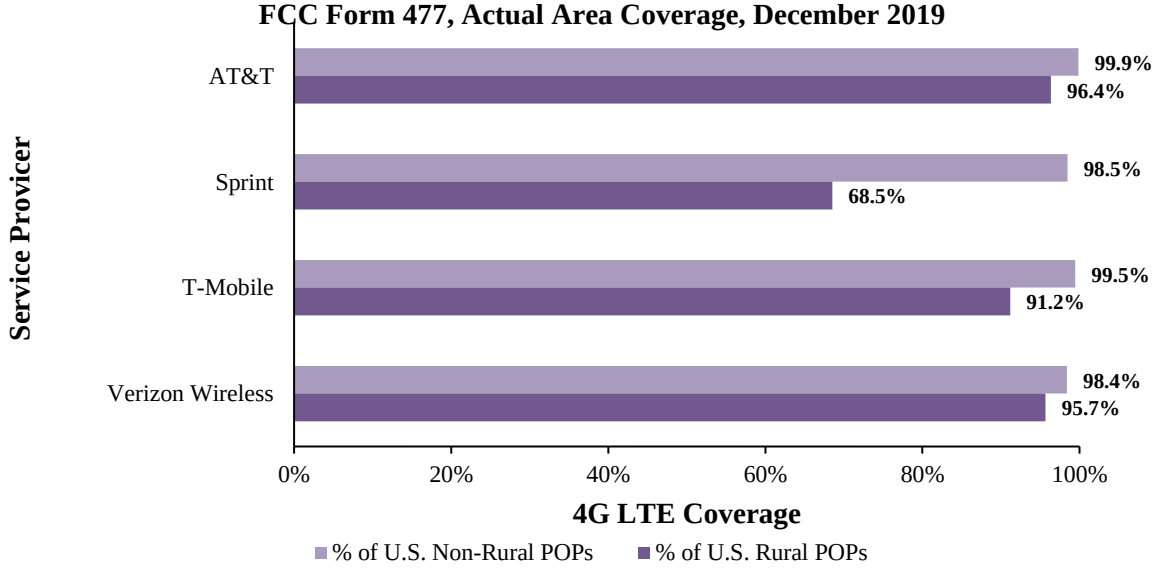
areas, Verizon Wireless covered approximately 96%, AT&T covered approximately 96%, T-Mobile covered approximately 91%, and Sprint covered approximately 69% of the rural population with 4G LTE.

Fig. II.A.37
Estimated 4G LTE Coverage by Census Block in Rural vs. Non-Rural Areas
FCC Form 477, December 2019, Actual Area Coverage



Source: Based on actual area coverage analysis of December 2019 FCC Form 477 and 2010 Census data.

Fig. II.A.38
Estimated 4G LTE Coverage by Provider in Rural vs. Non-Rural Areas
FCC Form 477, Actual Area Coverage, December 2019



Source: Based on actual area coverage analysis of December 2019 FCC Form 477 and 2010 Census data

79. *5G Coverage.* In August 2019, the Commission made certain changes to the FCC Form 477 data collection program, including directing wireless service providers to report their 5G deployment.[255] As of December 2019, these data report that T-Mobile covered 27.7% of U.S. square miles, 41.8% of road miles, and 63.5% of the population; Sprint covered 6.7% of the population, Verizon had negligible 5G coverage and AT&T reported no mobile 5G coverage at all.

[255] *See Digital Opportunity Data Collection Order and Second Further Notice,* 34 FCC Rcd at 7524, para. 44.

80. Since the beginning of 2020, Verizon,[256] AT&T, [257] T-Mobile,[258] Sprint, [259] and US Cellular[260] have reported further deployments of 5G. Other firms also provide or have the potential to provide 5G services.[261] For example, CTIA suggests that cable companies are "well positioned to deploy fixed and mobile 5G operations and compete directly with mobile network operators on a national basis."[262] As part of its acquisition of Boost Mobile, DISH has committed to deploy "a facilities-based 5G broadband network capable of serving 70 percent of the U.S. population by June 2023."[263] Starry provides fixed wireless broadband through a "pre-standard 5G, point-to-multipoint fixed wireless technology."[264]

81. Finally, as one of the conditions of approval for the T-Mobile-Sprint transaction, T-Mobile committed to covering 97% of the United States population with low-band 5G service within three years of the consummation of the merger and 99% within six years.[265] T-Mobile made commitments to deploy 5G service using mid-band spectrum, with 75% of the population being covered within three years and 88% within six years.[266] Under its commitments, 5G services with at least 50 Mbps download speeds would be available to 75% of the population within three years and 99% within six years.[267] 5G services with at least 100 Mbps download speeds would be available to 63% of the population within three years and 90% within six years.[268] Further, within three years, T-Mobile committed to deploy a 5G network to 85% of the rural population with low-band spectrum, 55% with mid-band spectrum, and to 66.7% with download speeds of at least 50 Mbps, verified by drive testing, and 55% of at least 100 Mbps downloads, verified by drive testing.[269]

B. The Fixed Broadband Services Marketplace

82. We next assess the state of competition in the fixed broadband marketplace. In section II.B.1, we will first examine the various fixed technologies that Internet service providers (ISPs) currently deploy, describe the service providers, and provide information on connections/subscribers and adoption rates. In section II.B.2, we will consider competition in fixed broadband, including a discussion of

[256] Verizon, *Verizon 5G Ultra Wideband service available in more cities* (Oct. 14, 2020), https://www.verizon.com/about/news/verizon-5g-ultra-wideband-service-available-more-cities.

[257] AT&T, *AT&T Continues to Build 5G on Nation's Best Network* (July 23, 2020), https://about.att.com/newsroom/2020/5g_announcements.html.

[258] T-Mobile coverage of Alaska was achieved via partnership with GCI. T-Mobile, *T-Mobile is First with 5G in all 50 States!* (June 1, 2020) https://investor.t-mobile.com/news-and-events/t-mobile-us-press-releases/press-release-details/2020/T-Mobile-is-First-with-5G-in-all-50-States/default.aspx.

[259] Sprint, *Sprint 5G Overview* (Feb. 11, 2020), https://newsroom.sprint.com/sprint-5g-overview-1-2.htm.

[260] U.S. Cellular, *U.S. Cellular 5G*, https://www.uscellular.com/plans/network-innovation/5g-technology (last visited Oct. 27, 2020).

[261] *See* CTIA Comments at 23-27.

[262] *Id*. at 23.

[263] DISH, *DISH to Become National Facilities-based Wireless Carrier* (Jul. 26, 2019), http://about.dish.com/2019-07-26-DISH-to-Become-National-Facilities-based-Wireless-Carrier.

[264] Starry, *Starry Wins Licenses in the 24 GHz Band, Enabling Expansion to 40 Million Households Nationwide* (June 18, 2019), https://dyajmw2sca9cs.cloudfront.net/press/pdf/Starry+Auction+102+Results+-+FINAL.pdf.

[265] *See T-Mobile-Sprint Order*, 34 FCC Rcd at 10589, 10810, para 26, Appx. G.

[266] *See id*. at 10589, 10810, para 28, Appx. G, Attach. 1.

[267] *See id*. at 10589, 10810, para 26, Appx. G.

[268] *See id*.

[269] *See id*. at 10589, 10810, para 28, Appx. G, Attach. 1.

investment trends, pricing, speed, and access to multiple providers. In addition, we will describe findings from the latest Measuring Broadband America reports, which provide a snapshot of fixed broadband Internet access service performance in the United States.

1. Overview of the Fixed Broadband Marketplace

83. Since the *2018 Communications Marketplace Report*, more Americans have access to fixed broadband services, and those who previously had access now have access to newer broadband technologies capable of faster speeds. In particular, FCC Form 477 data shows an increase in fiber and DOCSIS 3.1 cable broadband technologies available to residential consumers, both of which advertise faster speeds than other technologies do. Additionally, the total number of providers has continued to increase in both rural and urban areas.[270] Subscribership is also on the rise, with total fixed connections consistently increasing for the last five years. Most of the growth in subscribership can be attributed to cable and fiber connections, Digital Subscriber Line (DSL) connections have decreased and satellite and terrestrial fixed wireless connections have remained relatively constant. As income and population density increase, the adoption of Internet services also increases for all speed tiers.

84. This *Report* analyzes three metrics commonly thought to be affected by competition in the fixed broadband marketplace: speed, investment, and pricing. While actual speeds consumers experience vary by connection technology, consumers continue to have access to faster speeds, and this *Report* shows that connections capable of 100 Mbps have increased by a factor of six since 2015. In terms of access to multiple providers, the *Report* shows that approximately 84% of Americans have at least two options for 10/1 Mbps fixed terrestrial service; approximately 74% have at least two options for 25/3 Mbps fixed terrestrial service; approximately 67% have at least two options for 50/5 Mbps service; approximately 55% have at least two options for 100/10 Mbps service; and approximately 35% have at least two options for 250/25 Mbps service. Further, capital investment by service providers has increased in recent years. FCC Form 477 data also show that deployment of newer technologies such as DOCSISI 3.1 has increased over the past few years. Pricing is a difficult metric to capture, as it is dependent on many product characteristics and can change with time or bundle offer. This *Report* provides a snapshot of prices for Internet-only packages. We show that as broadband speeds increase, so do prices across cable, DSL, fiber, and fixed wireless technologies. For speeds under 150 Mbps, cable is generally less expensive and terrestrial fixed wireless technologies are generally the most expensive.

a. Technologies Deployed

85. Consumers access the Internet through a variety of fixed technologies, including cable broadband service, DSL, fiber to the premise, terrestrial fixed wireless service and satellite service. These services differ in their availability and characteristics, such as price, speed, and latency.[271] To compete with other providers and to meet consumer's expectations, providers are continually investing in network upgrades and implementing technological developments that improve the quality of their services and increase the speed of their networks.[272]

86. We primarily use FCC Form 477 data as of December 31, 2019 to assess the level of deployment of fixed services. Consistent with previous findings by the Commission,[273] the FCC Form 477 data are currently the most accurate and complete data available to the Commission for this

[270] Most broadband service providers serve less than 1% of the U.S. population; and only ten providers serve more than 5%.

[271] Latency refers to the time it takes for a data packet to travel back and forth through the network.

[272] The *Tenth Measuring Broadband America Fixed Broadband Report* and the *Ninth Measuring Broadband America* are attached as Appx. D to this *Report*.

[273] *See 2020 Broadband Deployment Report*, 35 FCC Rcd at 8997-98, para. 24; *2018 Communications Marketplace Report*, 33 FCC Rcd at 12651, para. 184.

analysis.[274] For purposes of FCC Form 477 analysis, a census block is classified as served if the FCC Form 477 deployment data indicate that service can be provided to some, even if not all, locations in the census block. To give context to consumer purchase patterns of these technologies, we also provide an overview of consumer subscription to these services. Figure II.B.1 reports, by technology, household deployment estimates and residential connections for any speed reported in the FCC Form 477 data.[275]

Fig. II.B.1
Deployment (millions) and Total Residential Connections (millions) of Fixed Services in the United States, by Technology, for Any Reported Speed (Dec. 31, 2019)

Technology	Deployment (Any Reported Speed)		Residential Connections
	Households	%	
Cable	111.176	88.8%	67.140
DOCSIS 3.1	105.023	83.9%	
DSL	112.520	89.9%	17.551
Fiber (FTTP)	50.896	40.7%	16.681
Satellite Services	125.119	99.9%	1.795
Terrestrial Fixed Wireless	58.508	46.7%	1.493

87. *Cable Broadband Service*. Cable broadband service uses infrastructure originally deployed for cable television to deliver broadband. This service is provisioned over coaxial cables that deliver cable TV programming and Internet service on separate channels (or frequencies). Currently, most providers of cable broadband service have deployed a hybrid fiber-coaxial (HFC) technology that transmits signals over a fiber from the provider's facility to an optical node near the consumer.[276] These providers typically use coaxial cable to send the signal from the optical node to the customer's end location. Data Over Cable Service Interface Specifications 3.1 (DOCSIS 3.1), the latest standard currently deployed to approximately 84% of U.S. households, is capable of achieving 10 Gbps download speed and a 1 Gbps upload speed. The weighted mean advertised download speed for subscribers participating in the Commission's Measuring Broadband America program was approximately 155 Mbps.[277] The industry has recently released specifications for DOCSIS 4.0 which will enable multi-gigabit symmetric services.[278]

88. *DSL*. DSL, the oldest broadband technology still in use, is commonly used by traditional telephone companies, and transmits data via a modem over traditional copper telephone lines to consumers.[279] Although widely available because it is built on the existing telephone network, this

[274] We recognize that improvements to such data are needed, and have undertaken such efforts as part of the Digital Opportunity Data Collection, but that collection is not yet available for use in this *Report*. *See generally Digital Opportunity Data Collection* proceeding.

[275] The data presented in Fig. II.B.1 are for the States, District of Columbia and U.S. Territories. The FCC Form 477 deployment data are grouped into the following categories: cable (technology codes 40, 41, 42, and 43); DOCSIS 3.1 (technology code 43); DSL (all copper based services, i.e., technology codes 10, 11, 12, 20, and 30); fiber (technology code 50); satellite (technology code 60); and terrestrial fixed wireless (technology code 70).

In contrast, the FCC Form 477 residential connection/subscriber data include only one response category for cable services. This means that we cannot separately report residential connections to a DOCSIS 3.1 technology from residential connections to older cable technologies. The maximum reported speed is capped at 1 gigabyte. As of 2019, there are 125.2 million households in the United States. FCC, *Staff Block Estimates*, https://FCC.gov/reports-research/data/staff-block-estimates (last visited Oct. 27, 2020).

[276] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12645, para. 174.

[277] *See infra* Appx. D-2: *Tenth Measuring Broadband America Report* at 12.

[278] NCTA Comments at 3. By gigabit service, we refer to service with a download speed of at least 1 Gbps.

[279] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12646, para. 175.

service is generally slower than other types of broadband services.[280] DSL service is limited by the distance between the telephone provider's central office and the consumer's home such that the speed of the service decreases as the distance between these two endpoints increases.[281] The weighted mean advertised download speed for subscribers participating in the Commission's Measuring Broadband America program was 13 Mbps.[282]

89. *Fiber*. Fiber-based Internet service may be provisioned by fiber-to-the-node (FTTN), fiber-to-the-curb (FTTC), or fiber-to-the-premises (FTTP). FTTP uses optical fiber to deliver a signal from the operator's equipment to the residential customer.[283] This service can offer the consumer the highest speed among all currently available services because the fiber connects directly to the consumer's residence.[284] In contrast, FTTN and FTTC services rely on a fiber-optic connection from a local central office to the neighborhood (node or curb) and then a twisted-pair copper wiring from the node or utility pole to the consumer's home.[285] FTTN and FTTC services are typically slower than FTTP services because the connection to the consumer is over twisted-pair copper, although they are typically faster than service provided entirely over copper.[286] FTTN and FTTC services are reported in FCC Form 477 as DSL service.[287] The weighted mean advertised download speed for subscribers participating in the Commission's Measuring Broadband America program was 208 Mbps.[288]

90. *Fixed Satellite Service*. FSS is the transmitting and receiving of communications signals from earth stations, including customer stations, that are located at fixed points on earth. The Commission has allocated specific spectrum bands for FSS, most importantly, the C-, Ku-, and Ka-bands.[289] More recently, there also has been interest in use of the V-band frequencies.[290] Examples of

[280] *See infra* Appx. D-2: *Tenth Measuring Broadband America Report* at 11.

[281] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12646, para. 175. FTTN and FTTC services are reported in FCC Form 477 as DSL service because this service is ultimately delivered to the end-user via twisted-pair copper wiring. FCC Form 477 Local Telephone Competition and Broadband Reporting Instructions for Filings as of December 31, 2019 and Beyond, at 30.

[282] *See infra* Appx. D-2: *Tenth Measuring Broadband America Report* at 12.

[283] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12643-644, para.173.

[284] *See* Internet Experts, *Differences between FTTH, FTTC, and FTTN*, https://www.attinternetservice.com/resources/different-types-fiber/ (last visited Oct. 27, 2020).

[285] *See 2018 Communications Marketplace Report*, 33 FCC Rcd at 12647, para. 176; Internet Experts, *Differences between FTTH, FTTC, and FTTN*, https://www.attinternetservice.com/resources/different-types-fiber/ (last visited Oct. 27, 2020); FCC Form 477 Local Telephone Competition and Broadband Reporting Instructions for Filings as of December 31, 2019 and Beyond, at 30.

[286] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12647, para. 176.

[287] FCC Form 477 Local Telephone Competition and Broadband Reporting Instructions for Filings as of December 31, 2019 and Beyond, at 30.

[288] *See infra* Appx. D-2: *Tenth Measuring Broadband America Report* at 12.

[289] 47 CFR § 25.103. The conventional C-band refers to the 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-space) FSS frequency bands, while the extended C-band refers to the 3600-3700 MHz (space-to-Earth), 5850-5925 MHz (Earth-to-space), and 6425–6725 MHz (Earth-to-space) FSS frequency bands. The conventional Ku-band refers to the 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 (Earth-to-space) FSS frequency bands, while the extended Ku-band refers to the 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), and 13.75-14.0 GHz (Earth-to-space) FSS frequency bands. The conventional Ka-band refers to the 18.3-18.8 GHz (space-to-Earth), 19.7-20.2 GHz (space-to-Earth), 28.35-28.6 GHz (Earth-to-space), and 29.25-30.0 GHz (Earth-to-space) frequency bands, which the Commission has designated as primary for GSO FSS operation. 47 CFR § 25.103.

[290] We use the term "V-band" to refer to frequencies ranging from 37.5 GHz to 52.4 GHz, although there is no domestic allocation for satellite services in 42.0-42.5 GHz band and there is no domestic or international allocation for satellite services in the 51.4- 52.4 GHz frequency band. We have recently approved applications for V-band (continued….)

FSS offerings include wholesale transponder services,[291] managed services (also known as enterprise services), and consumer broadband services. One of the benefits of satellite technology is its ability to deliver services in remote areas that are unserved or underserved by terrestrial services, and satellite can play a key role in delivering services in disaster areas, e.g., Puerto Rico in the aftermath of the 2017 hurricane season.[292]

91. *Terrestrial Fixed Wireless Broadband.* Terrestrial fixed wireless providers deliver broadband service to consumers using licensed, unlicensed and shared access spectrum while often relying on fiber optics to form parts of the rest of their network infrastructure.[293] Terrestrial fixed wireless providers receive broadband content from an external distribution point via fiber or microwave connections.[294] They deliver service to a customer's fixed antenna from wireless transmitters on towers that transmit the signal via licensed, shared access spectrum or unlicensed spectrum.[295] In some instances, this technology is capable of delivering gigabit speed services.[296] One terrestrial fixed wireless provider, Starry, currently advertises 200 Mbps service and is rolling out a point-to-multipoint technology that will deliver gigabit-capable service to the home.[297]

b. Service Providers

92. *Fixed Terrestrial.* As of December 2019, there were 2,052 entities of varying sizes and deployment footprints that reported providing fixed broadband services to residential consumers.[298] Figure II.B.2 presents the number of total providers, as well as the number of providers in rural and urban areas, from June 2014 through December 2019.[299] The total number of providers has consistently increased period over period, and has grown by approximately 26% since June 2014. The growth in the

systems in portions of 37.5-50.2 GHz frequency range. *See, e.g.*, *O3b Modification Order*, 33 FCC Rcd at 5519-20, para. 30; *Audacy Corporation*; *Application for Authority to Launch and Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services, Order and Authorization*, 33 FCC Rcd 5554, 5562, para. 20 (2018); *Policy Branch Information, Satellite Space Applications Actions Taken*, IBFS File Nos. SAT-LOA-20170621-00092 and SAT-AMD-20170908-00128, Public Notice, 33 FCC Rcd 2869 (2018) (granting in part and deferring in part; deferring consideration of Hughes Network Systems' request for operations in the 50.4-51.4 GHz band); *Space Exploration Holdings, LLC; Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System*, 33 FCC Rcd 11434 (2018); *Telesat Canada; Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-Band NGSO Constellation*, 33 FCC Rcd 11469 (2018).

[291] A transponder is the part of a satellite that receives signals transmitted from earth stations to the antennas onboard a satellite and retransmits these signals to the Earth. *See* Dennis Roddy, Satellite Communications 199 (4th ed. 2006). The number of transponders onboard any given satellite may vary, ranging approximately from 24 to 72. U.S. Government Accountability Office, Telecommunications: Competition, Capacity, and Costs in the Fixed Satellite Services Industry, at 5 (Sept. 2011), https://www.gao.gov/assets/330/322861.pdf.

[292] *See* SIA Comments at 15-16; SpaceX Comments at 1; SES and O3b Reply Comments at 3, 5-6.

[293] *See* WISPA Comments at 6-8; *2018 Communications Marketplace Report*, 33 FCC Rcd at 12647, para. 177.

[294] *Id.*

[295] *Id.*

[296] CTIA Comments at 25.

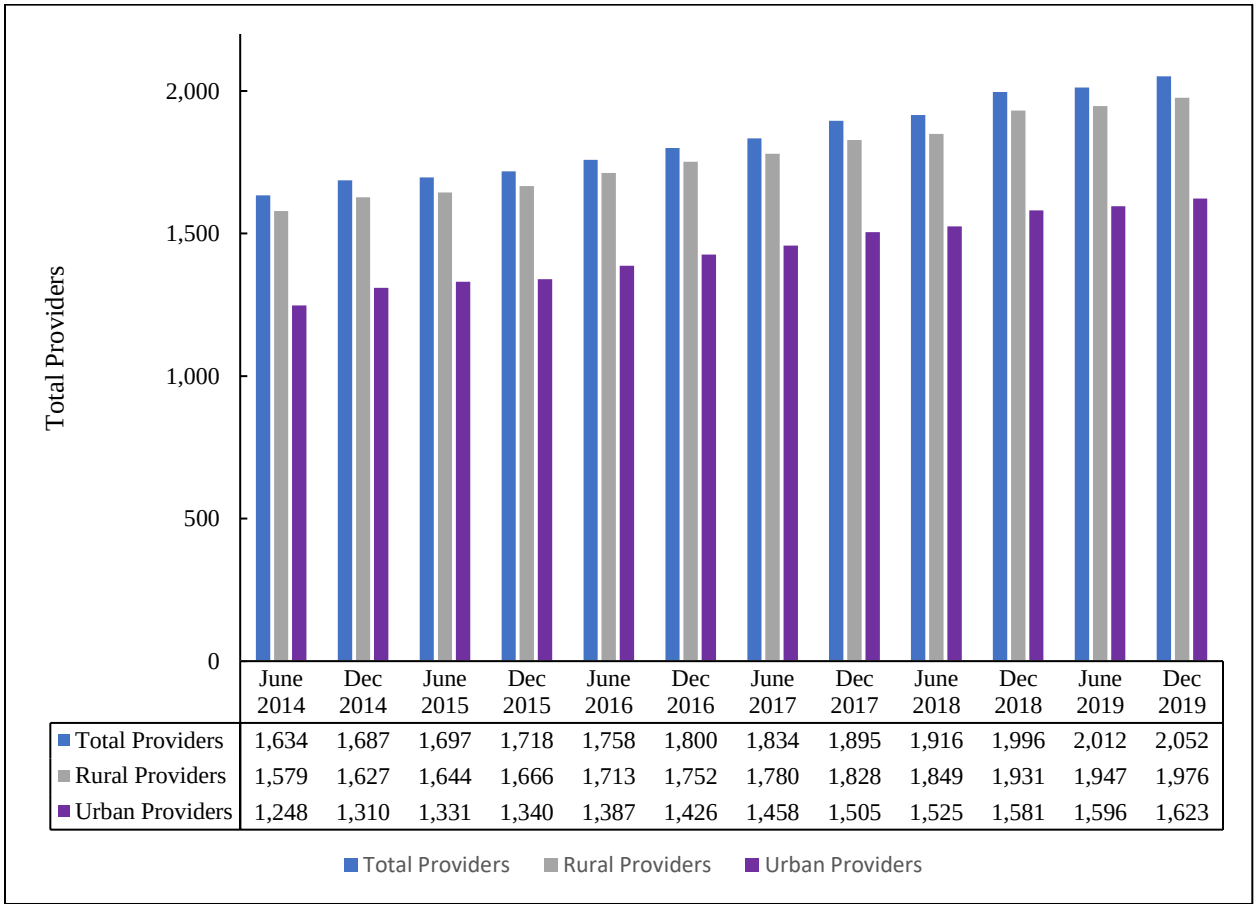
[297] *Id.*

[298] The data for this section include U.S. territories.

[299] We use FCC Form 477 deployment data for residential consumers. For a detailed description of the FCC Form 477 data collection, *see Twentieth Wireless Competition Report*, 32 FCC Rcd at 9015, para. 69. For purposes of presenting estimates for rural and urban areas, in this section we aggregate all similarly categorized areas. The designation of a census block as urban is based upon the 2010 Census. An urban census block encompasses all population, housing, and territory included within a census block categorized as in an urban area or urban cluster. A rural census block encompasses all population, housing, and territory not included within urban census blocks.

total number of providers is similar in urban and rural areas. Between June 2014 and December 2019, the number of providers in urban areas and rural areas increased by approximately 30% and 25%, respectively.

Fig. II.B.2
Total Providers of Residential Fixed Services Over Time



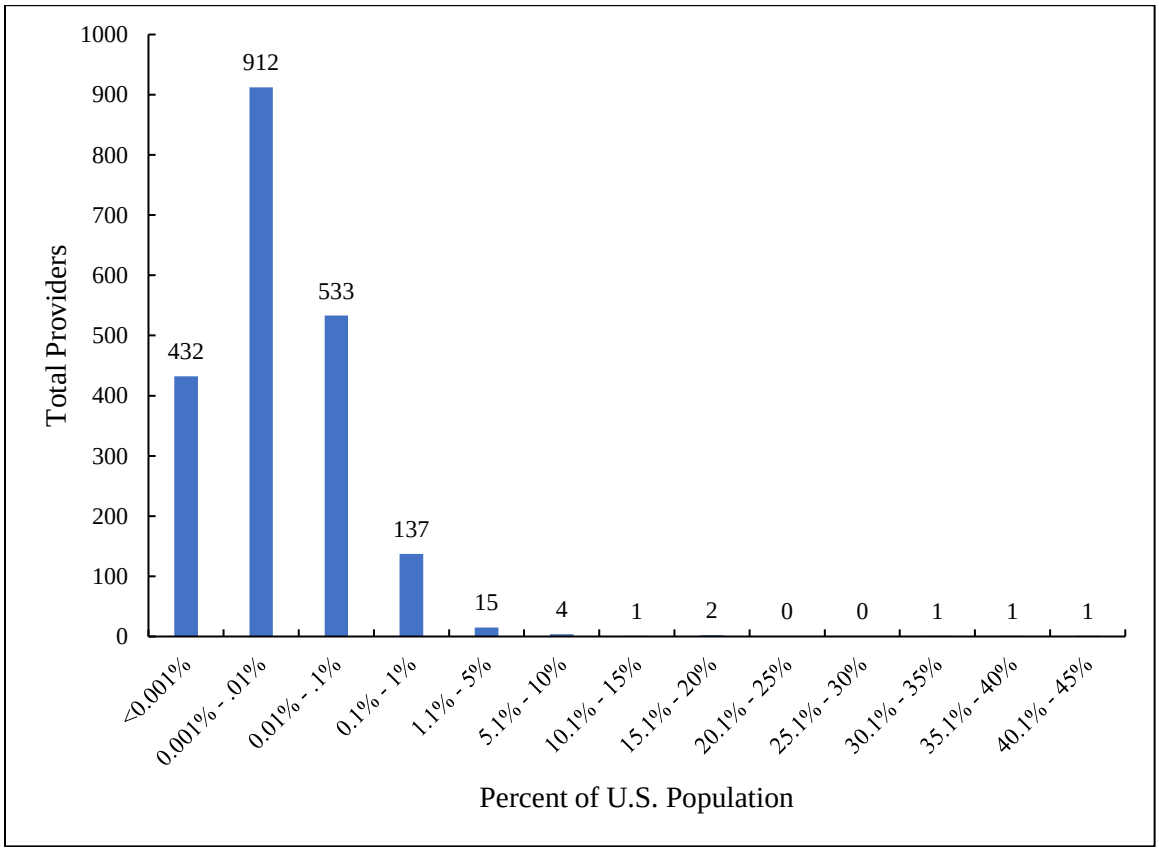
	June 2014	Dec 2014	June 2015	Dec 2015	June 2016	Dec 2016	June 2017	Dec 2017	June 2018	Dec 2018	June 2019	Dec 2019
Total Providers	1,634	1,687	1,697	1,718	1,758	1,800	1,834	1,895	1,916	1,996	2,012	2,052
Rural Providers	1,579	1,627	1,644	1,666	1,713	1,752	1,780	1,828	1,849	1,931	1,947	1,976
Urban Providers	1,248	1,310	1,331	1,340	1,387	1,426	1,458	1,505	1,525	1,581	1,596	1,623

Source: FCC Form 477 deployment data for residential consumers and 2010 Census data.

93. While there are over 2,000 providers of residential services, there is considerable variation in provider size and deployment footprint. The overwhelming majority of providers each cover less than 1% of the U.S. population. Figure II.B.3 shows that in December 2019, only ten providers covered 5% or more of the U.S. population, based on their reported deployment data. As presented in Figure II.B.4, these providers are AT&T, Comcast, Charter, Verizon, CenturyLink, Frontier, Cox, TDS, JAB Wireless,[300] and Altice. AT&T covered approximately 41% of the United States population, making it the provider with the largest fixed broadband footprint, followed closely by Comcast and Charter, covering approximately 36% and 33% of the U.S. population, respectively. Verizon reported coverage to approximately 17% of the population, followed by CenturyLink at 16%, Frontier at 12%, and TDS at 10%. The remaining three providers each covered between 5% and 7% of the U.S population.

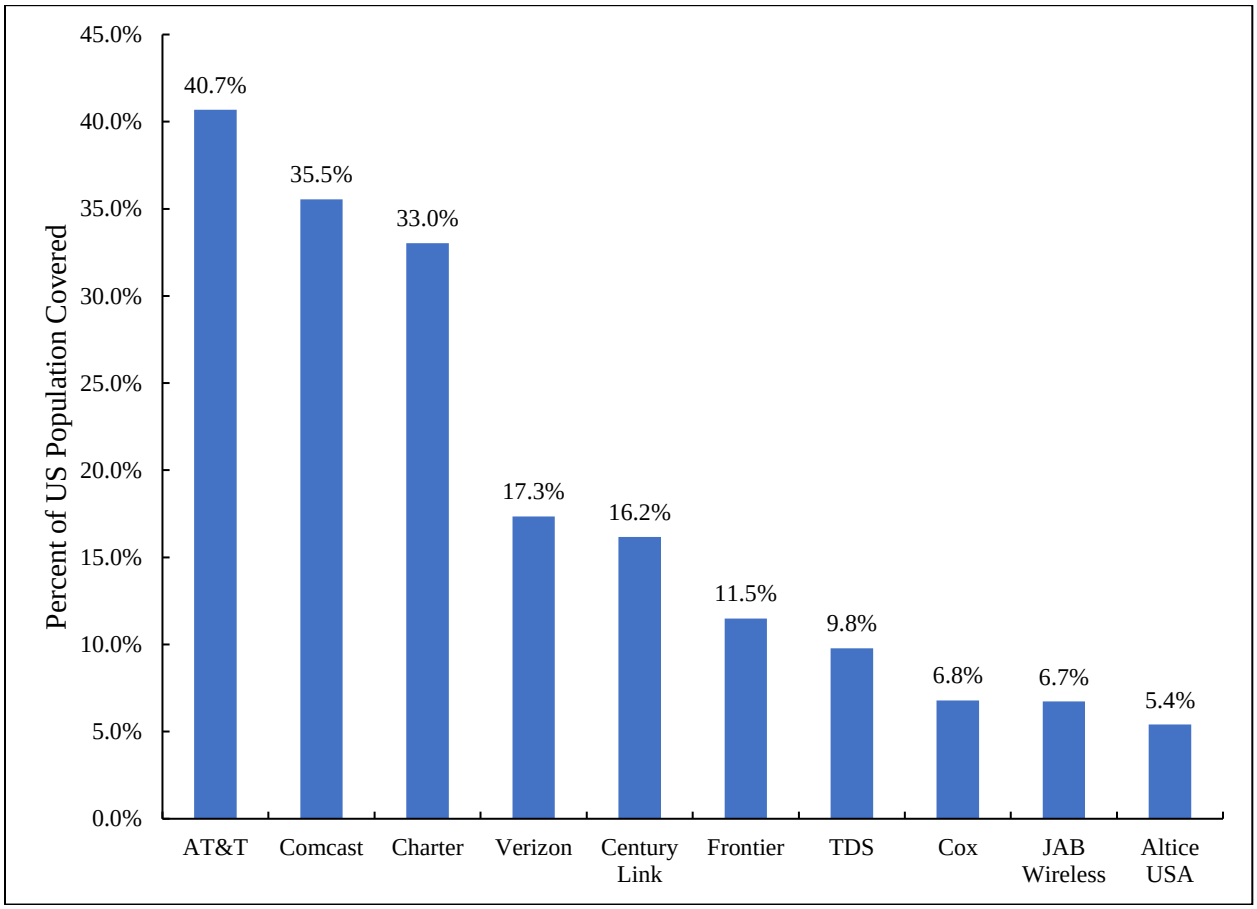
[300] Fixed wireless technology accounts for the majority of the deployment footprint for TDS and JAB Wireless; additionally 93% of TDS' deployment footprint is from the fixed wireless operations of its U.S. Cellular subsidiary.

Fig. II.B.3
Total Providers of Residential Fixed Services of the United States
by Population Coverage (Dec. 31, 2019)



Source: FCC Form 477 deployment data for residential consumers and 2010 Census data.

Fig. II.B.4
Top Ten Provider Footprints for Residential Fixed Services in the United States by Population Coverage (Dec. 31, 2019)



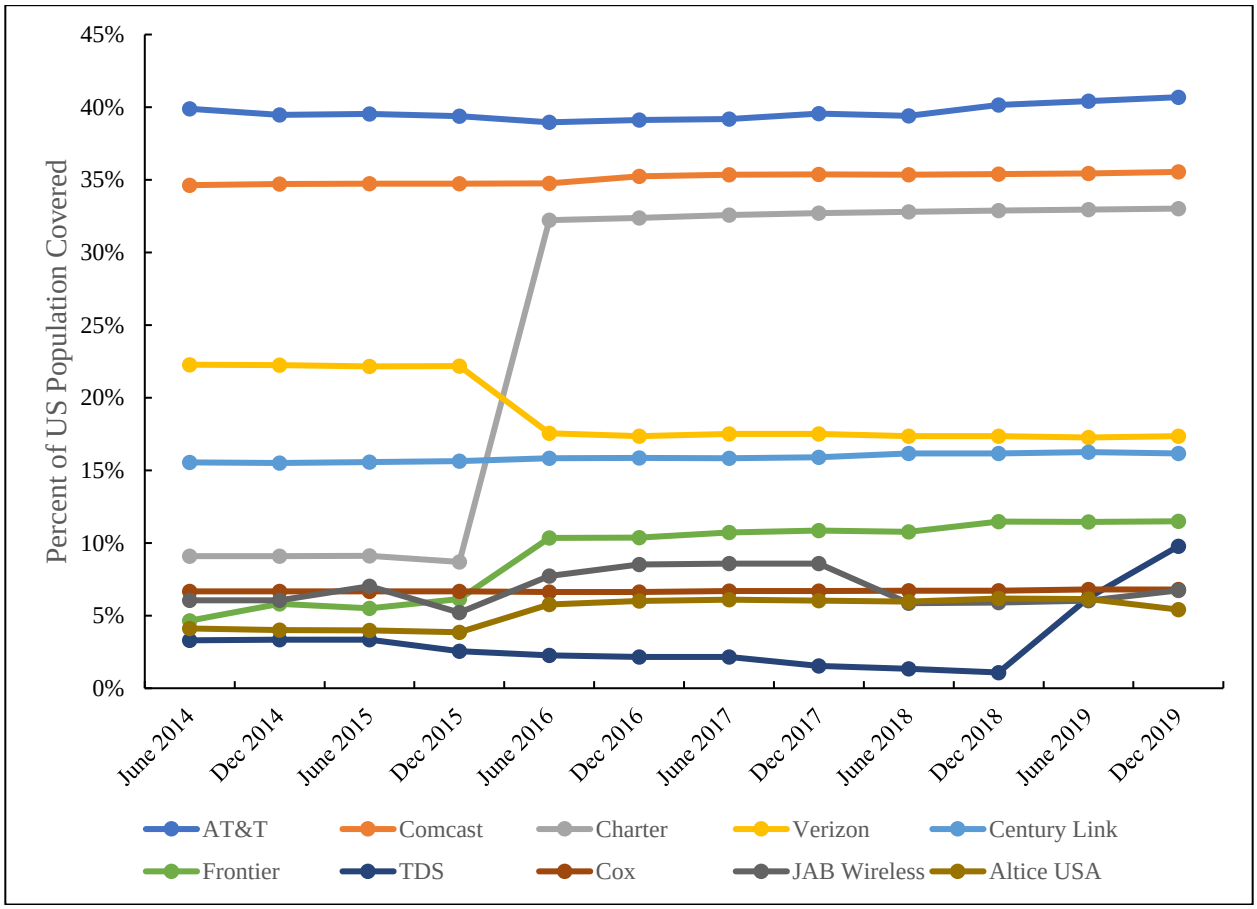
Source: FCC Form 477 deployment data for residential consumers and 2010 Census data.

94. Figure II.B.5 shows the change in U.S. population coverage over time for each of the top ten providers, as described above. For the most part, population coverage has remained constant over time, with a few significant exceptions. For example, Charter jumped from approximately 9% population coverage in June 2014 to 33% population coverage in June 2016 due to its acquisition of Time Warner Cable and Bright House Networks.[301] In addition, Frontier more than doubled its population coverage between June 2014 and December 2019, from approximately 5% to 12%. This increase was primarily driven by its acquisition of certain wireline operations from Verizon in 2016,[302] and therefore largely offset by a decrease in population covered by Verizon.

[301] *Commission Approves Charter, TWC and Bright House Merger*, MB Docket No. 15-149, Memorandum Opinion and Order, 31 FCC Rcd 6327, para. 1 (2016).

[302] *Transfer of Control Applications Granted for Frontier and Verizon*, MB Docket No.15-44, Memorandum Opinion and Order, 30 FCC Rcd 9812, para. 4 (2015).

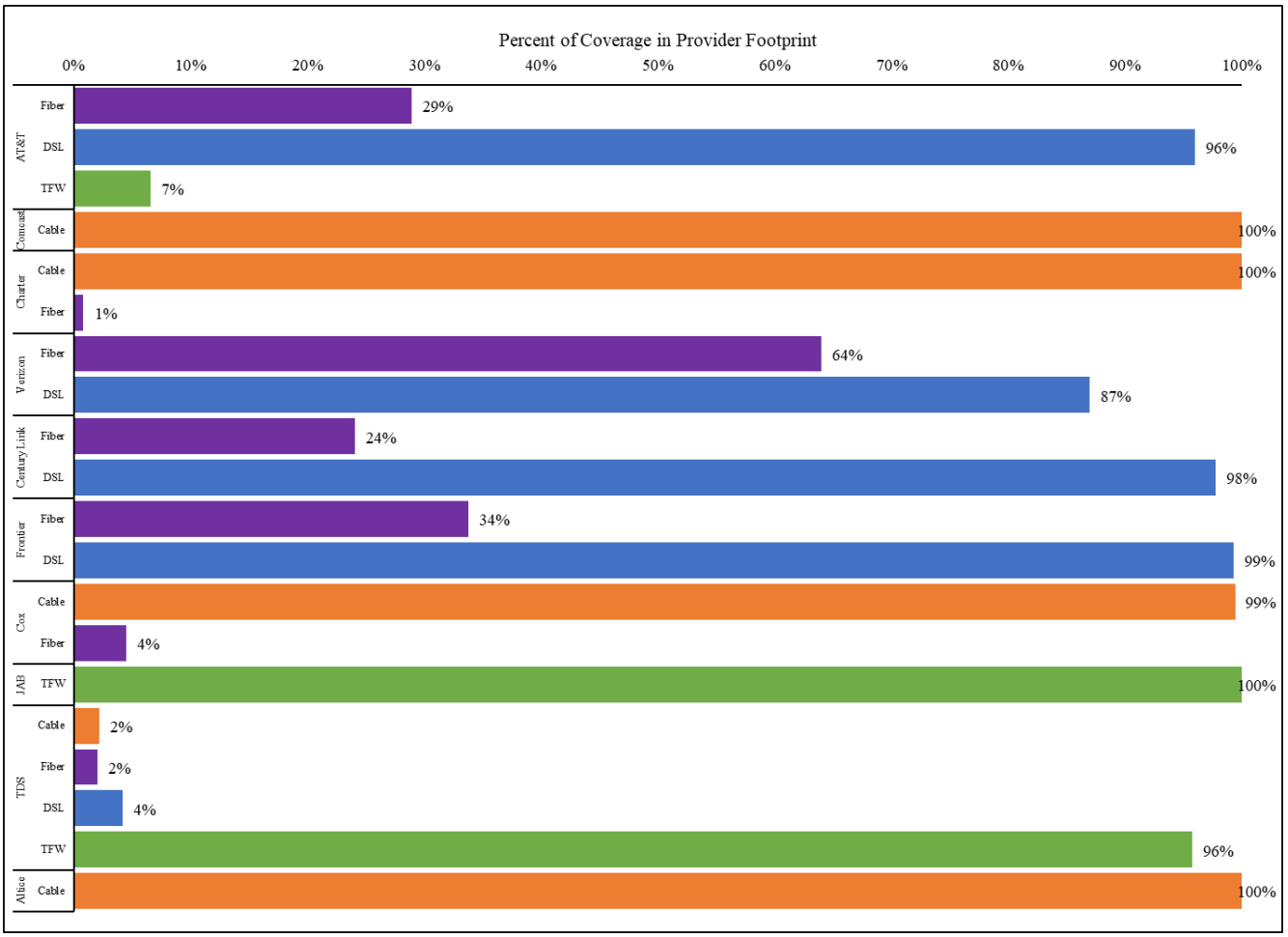
Fig. II.B.5
Provider Population Coverage for Residential Fixed Services in the United States Over Time



Source: FCC Form 477 deployment data for residential consumers and 2010 Census data.

95. Figure II.B.6 shows a detailed breakdown of the technology composition of the ten largest providers' deployment footprints. As seen in Figure II.B.6, Comcast and Charter almost exclusively provide fixed broadband through cable across their footprints. In contrast, AT&T provides broadband access with a combination of technologies, covering approximately 96% of its service area with DSL in addition to covering approximately 29% of its service area with FTTP. CenturyLink and Frontier also each use a combination of technologies, covering almost their entire service areas with DSL and also covering approximately one-fourth and one-third of their service areas with FTTP, respectively. Verizon covers almost 64% of its footprint with fiber and also covers approximately 87% of its footprint with DSL. TDS and JAB Wireless each cover approximately 6% of the U.S. population through terrestrial fixed wireless (TFW) technologies, while Altice and Cox have a similar population coverage but primarily through cable connections.

Fig. II.B.6
Technology Composition of Provider Footprint for Residential Fixed Services in the United States (Dec. 31, 2019)



Source: FCC Form 477 deployment data for residential consumers and 2010 Census data.

96. *Satellite*. Intelsat, SES, Eutelsat, Telesat, Hughes/Echostar,[303] and ViaSat currently provide nearly all of the satellite communications services in FSS spectrum in the United States.[304] Telesat provides satellite services to the U.S. government, and provides Ka-band satellite capacity to ViaSat, which uses the capacity to provide broadband services in the United States.[305] ViaSat and Hughes/EchoStar both provide wholesale and retail commercial broadband services to customers in the United States.[306] Intelsat, Telesat, SES, ViaSat, and EchoStar have high-throughput satellites serving

[303] EchoStar provides its consumer broadband and managed services through its wholly-owned subsidiary, Hughes Network Services.

[304] Intelsat 2019 SEC Form 10-K at 5-21; SES 2019 Annual Report; Eutelsat, *Satellites*, https://www.eutelsat.com/en/satellites.html (last visited Oct. 27, 2020); Telesat Canada 2019 SEC Form 20-F at 27-37; Hughes Comments at 2-4; ViaSat 2019 SEC Form 10-K at 3-14.

[305] Telesat Canada 2019 SEC Form 20-F at 34.

[306] ViaSat 2019 SEC Form 10-K at 3; Hughes Comments at 2-3. Hughes states that it is "currently constructing its next-generation, Commission-licensed, ultra-high-density satellite, EchoStar XXIV (also known as Jupiter 3), which will provide service in the United States and throughout the Americas at speeds of 100 Mbps or more" and "is expected to launch and begin commercial service in 2021." Hughes Comments at 2.

North America.[307] SES provides services using both Geostationary Orbit (GSO) and Medium Earth Orbit (MEO) satellites.[308]

97. Some FSS operators supply managed network services,[309] which are a complete, end-to-end communications system that includes leased satellite bandwidth, ground facilities, terrestrial transmission links, and management of the end-to-end communications service.[310] Customers of managed satellite services include U.S. and foreign government agencies, government contractors, and commercial entities.[311] Also, satellite provision of backhaul services is expected to grow in the coming years.[312] FSS operators in the United States provide transponder capacity for lease through complex contracts for variable quantities of bandwidth, frequency, orbital location, geographic coverage, power, and length of

[307] Through the use of small beams, high-throughput satellites are capable of reusing the same frequency band multiple times over their coverage area. This allows the use of more spectrum for each of their small beams, making higher throughput available anywhere in their coverage area. Satcom Post, *Defining High Throughput Satellites (HTS)* (May 3, 2013), http://satcompost.com/defining-high-throughput-satellites-hts/; Hughes Network Systems, LLC, *The View from JUPITER: High-Throughput Satellite Systems* at 2 (July 2013), https://www.hughes.com/sites/hughes.com/files/2017-04/JUPITER_H50283_HR_08-01-13.pdf. For example, ViaSat indicates that their "high-capacity satellite systems are designed to grow with increased global broadband demand—enabling faster service speeds, higher quality and enhanced reliability." ViaSat, *High-Capacity Satellite System: Transforming Satellite Broadband*, https://www.viasat.com/products/high-capacity-satellites (last visited Oct. 27, 2020).

[308] SES combines GEO and MEO satellite constellations to provide service, and has proposed adding Low Earth Orbit (LEO) satellites. "Our GEO HTS satellites combine with our O3b MEO fleet to create the industry's only multi-orbit, multi-band services, including network resiliency, and intelligent application-aware load balancing solutions." SES, *GEO HTS: Global reach with superior performance*, https://www.ses.com/networks/networks-and-platforms/geo-hts (last visited Oct. 27, 2020). SES launched and completed in 2019 its O3b Ka-band constellation of 20 satellites in medium earth orbit, to provide lower latency broadband connectivity for mobile use. SES plans to launch 7 next generation MEO O3b mPOWER satellites in 2021. SIA Comments at 9, 11-13; SES 2019 Annual Report at 22, 23, 34, 36; SpaceNews, *SES details LEO constellation and expanded MEO constellation to FCC* (May 29, 2020), https://spacenews.com/ses-details-leo-constellation-and-expanded-meo-constellation-to-fcc/.

[309] *See, e.g.*, SES, *Managed Network Services*, https://www.ses.com/networks/services/managed-network-services; (last visited Oct. 27, 2020); Hughes, *Hughes Managed Services*, https://business.hughes.com/resources/collateral-library/hughes-managed-services (last visited Oct. 27, 2020); Intelsat, *INTELSATOne Flex*, http://www.intelsat.com/intelsatone-flex/ (last visited Oct. 27, 2020).

[310] Examples of third-party providers of managed services include Digisat International Inc., Speedcast International Limited, and Artel, LLC. *See* Digisat, *Satellite Communications Network Management Services*, https://www.digisat.org/managed-network-services (last visited Oct. 27, 2020); Speedcast, *Managed Network Solutions*, https://www.speedcastgov.com/our-solution/managed-network-services/ (last visited Oct. 27, 2020). Artel, *HISPASAT's Amazonas Nexus Satellite will embed the Pathfinder 2 mission for the United States Space Force* (June 24, 2020) ("For 30 years, Artel has provided secure network communication services to Federal Government agencies. … Artel is a carrier-agnostic network integrator – allowing us to develop customized solutions for our customers."), https://www.artelllc.com/hispasats-amazonas-nexus-satellite-will-embed-the-pathfinder-2-mission-for-the-united-states-space-force/.

[311] *See, e.g., Third Report and Analysis of Competitive Market Conditions with Respect to Domestic and International Satellite Communications Services; Report and Analysis of Competitive Market Conditions with Respect to Domestic and International Satellite Communications Services*, IB Docket Nos. 09-16, 10-99, Third Report, 26 FCC Rcd 17284, 17304, para. 41-42 (2011) (*Third Satellite Competition Report*) (noting that value-added resellers provide managed services to government and corporate clients (e.g., U.S. Army, Federal Bureau of Investigation, commercial shipping) that need communications in "thin markets" or need to extend the reach of their corporate networks).

[312] *See* Mark Holmes, *Telcos Talk Bluntly About Satellite's Backhaul Future*, ViaSatellite (July 2020), http://interactive.satellitetoday.com/via/july-2020/telcos-talk-bluntly-about-satellites-backhaul-future/.

service of the transponders required by the customer.[313] Many wholesale customers of FSS operators only lease transponder capacity and self-supply their own earth stations and terrestrial links. Applications of leased transponder capacity include point-to-point transponder capacity for use by providers of media services, point-to-multipoint transmission of video programming to multichannel cable programming distributors, and the transport of point-to-point telecommunications transmissions to terrestrial telecommunications operators and corporate users.[314] Leased transponders can also be used for the provision of broadband to aircraft and vessels.

98. Satellite broadband providers, Hughes/Echostar and ViaSat, play a role in closing the digital divide across the United States, especially in the most rural and remote areas of the country, where it may be uneconomical to build terrestrial networks.[315] These operators now serve a combined approximately 2 million subscribers and, as their infrastructure expands, they are increasing the speeds made available to consumers.[316] The planned launches of next-generation GSO satellites Jupiter 3/EchoStar XXIV and ViaSat-3, and proposed low latency NGSO satellite constellations, may result in higher-speed satellite broadband offerings in the future.[317] Figure II.B.7 provides aggregated U.S. satellite services revenues for 2013 to 2019 with respect to fixed satellite services.

Fig. II.B.7
U.S. Fixed Satellite Services Revenue (2013-2019)

Service	Total Revenue ($ billions)						
	2013	2014	2015	2016	2017	2018	2019
Satellite Broadband	1.6	1.7	1.7	1.7	1.8	2.2	2.6
Managed Services[318]	3.4	3.5	3.8	4.1	4.7	4.9	5.1
Transponder Agreements[319]	0.3	0.3	0.3	0.3	0.3	0.3	0.2

Source: SIA Comments at 5, Appx. B; *2018 Communications Marketplace Report*, 33 FCC Rcd at 12673, Fig. F-1.[320]

c. Connections/Subscribers

99. The number of residential fixed connections in the United States increased approximately 14.5% from over 91 million connections in June 2015 to approximately 105 million connections in

[313] *See Third Satellite Competition Report*, 26 FCC Rcd at 17292-99, paras. 15-35 (discussing complexities of output produced by commercial satellite operators). The pricing of transponder services and the specific attributes of the service to be supplied to the customer are bilaterally negotiated between the customer and the satellite operator. *Id.* at 17291-92, para. 14.

[314] *See Third Satellite Competition Report*, 26 FCC Rcd at 17296-97, paras. 26-28.

[315] SIA Comments at 9-10.

[316] *Id*. at 6-7, 9-10.

[317] ViaSat 2019 SEC Form 10-K at 3-4; Echostar 2019 Annual Report at 4 (Mar. 18, 2020), http://ir.echostar.com/static-files/51503a9e-9aea-40ae-8ed5-34e8f85c8703; Hughes, *EchoStar XXIV*, https://www.hughes.com/technologies/hughes-high-throughput-satellite-constellation/echostar-xxiv (last visited Oct. 27, 2020); SIA Comments at 11-14.

[318] According to SIA, the revenue represented for "Managed Services" includes VSAT, mobility, and in-flight connectivity. *Id*. at 22.

[319] According to SIA, the revenue represented for "Transponder Agreements" includes capacity for direct-to-home satellite TV and some mobility service platforms. *Id.* at 22.

[320] SIA *Ex Parte*, Attach. SIA estimates that the U.S. share of global satellite services revenue in 2019 was 41%. *Id*. SIA's estimate of global satellite services revenue includes revenue derived from direct-to-consumer retail services (e.g., satellite TV, radio, and broadband), fixed and mobile satellite services, and remote sensing services. *Id*.

December 2019. The number of connections over time—overall and by technology—are presented in Figure II.B.8. Connections have increased for all technologies except DSL, for which the number of connections has decreased in every reporting period, and satellite, which has had periods of both growth and decline during the reporting period. FTTP has experienced approximately 89% subscriber growth since 2015, making it the fastest growing technology available to residential consumers. Figure II.B.9 shows the percentage of total residential fixed connections that each technology represents, from June 2015 to December 2019. Cable continued to be the dominant technology of residential fixed broadband subscriptions throughout this period of time. In December 2019, approximately 64% of fixed residential connections were cable, 17% were DSL, 16% were FTTP, and the remaining 3% were a combination of satellite, terrestrial fixed wireless, and other technologies.

Fig. II.B.8
Residential Connections over 200 kbps in at Least One Direction 2015-2019 (in thousands)[321]

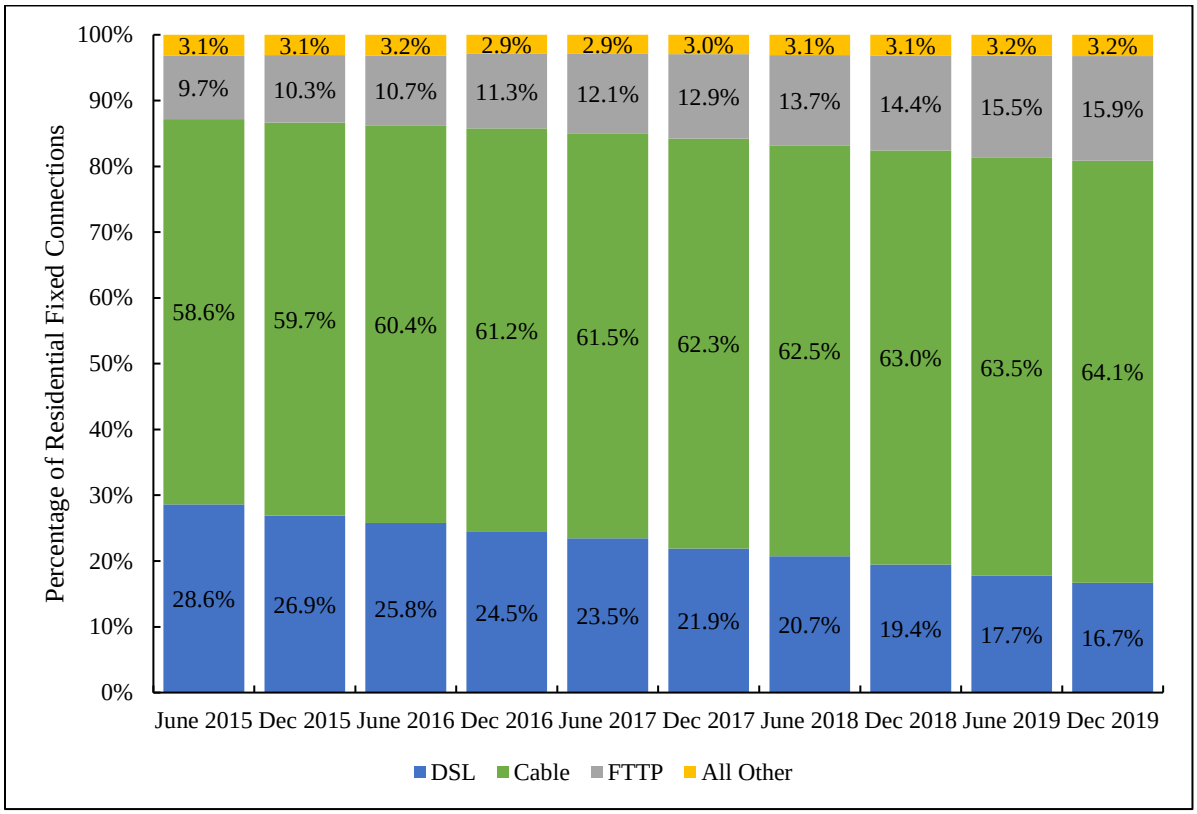
	2015		2016		2017		2018		2019	
Technology	**Jun**	**Dec**	**Jun**	**Dec**	**Jun**	**Dec**	**Jun**	**Dec**	**Jun**	**Dec**
aDSL	26,157	25,139	24,486	23,691	22,774	21,653	20,671	19,692	18,280	17,476
sDSL	18	16	10	8	12	9	9	4	4	5
Other Wireline[322]	59	54	51	32	74	67	74	74	61	74
Cable	53,544	55,799	57,358	59,145	59,687	61,567	62,320	63,802	65,476	67,140
FTTP	8,842	9,592	10,140	10,956	11,776	12,702	13,663	14,632	16,025	16,681
Satellite	1,875	1,891	1,897	1,676	1,637	1,688	1,751	1,787	1,805	1,795
Fixed Wireless	944	943	1,059	1,100	1,112	1,160	1,270	1,330	1,409	1,509
Total Fixed	**91,439**	**93,434**	**95,001**	**96,607**	**97,071**	**98,847**	**99,758**	**101,321**	**103,059**	**104,680**

Source: Staff calculations based on FCC Form 477 data.

[321] FCC Form 477 defines an Internet access connection as a wired line or wireless channel that terminates at an end-user location or mobile device and enables the end user to receive information from and/or send information to the Internet at information transfer rates exceeding 200 kilobits per second (kbps) in at least one direction. This definition is outlined in the Code of Federal Regulations regarding the scope and content of filed reports. *See* 65 FR 19684, Apr. 12, 2000; 65 FR 24654, Apr. 27, 2000, as amended at 67 FR 13224, Mar. 21, 2002.

[322] Other wireline includes: all copper-wire based technologies other than xDSL (examples include Ethernet over copper and T-1); additionally, power line technologies are included in this category to maintain confidentiality.

Fig. II.B.9
Residential Connections over 200 kbps in at Least One Direction by Technology 2015-2019



Source: Staff calculations based on FCC Form 477 data.

100. Figure II.B.10 below shows the total number of residential subscribers of each company as reported on their SEC Form 10-Ks filed with the Securities and Exchange Commission.[323] These five companies—Charter, CenturyLink, Frontier, AT&T, and Comcast—along with Verizon,[324] have the largest population coverage for residential fixed services.[325]

Fig. II.B.10
Total Residential Subscribers for the Largest Public Providers (in millions)

	2015	2016	2017	2018	2019
Charter	5.2	21.4	22.5	23.6	24.9
CenturyLink	6.0	5.9	5.7	4.7	4.8
Frontier	2.5	4.3	3.9	3.7	3.5
AT&T	12.4	12.9	14.5	14.8	14.7
Comcast	21.6	22.8	23.9	25.1	26.4

[323] All 10-K data were accessed through the SEC website. SEC, *EDGAR Company Filings*, https://www.sec.gov/edgar/searchedgar/companysearch.html, (last visited Oct. 27, 2020).

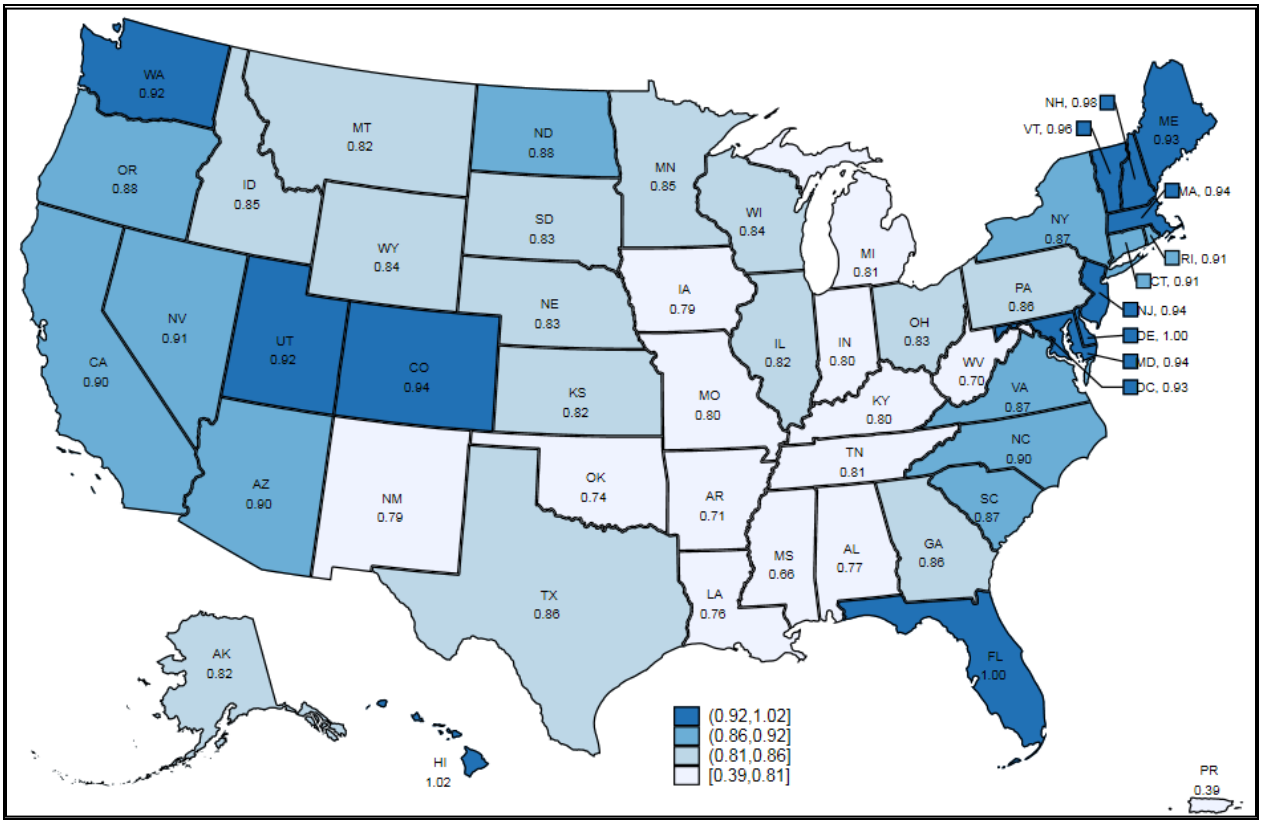
[324] Verizon does not disclose the total number of customers they have for fixed services in its 10-K. Verizon 2019 SEC Form 10-K, https://www.sec.gov/ix?doc=/Archives/edgar/data/732712/000073271220000014/a2019q410-k.htm.

[325] *See* section II.B.1.

d. Adoption Rates

101. Residential connections vary by location and largely depend on the underlying population of an area. Figure II.B.11 shows the ratio of total residential connections over 200 kbps to total households for each state, the District of Columbia, and Puerto Rico. The darker the shaded area, the more households have residential Internet connections in a state. The ratio varies from 0.39 for Puerto Rico to 1.02 for Hawaii.[326] Mississippi has the lowest connections per household of any state with a ratio of 0.66.

Fig. II.B.11
Residential Fixed Connections over 200 kbps per Household by State (Dec. 31, 2019)



Source: Staff calculations based on FCC Form 477 data as of December 31, 2019 and ACS 5-year estimates; Census 2010.

102. Our assessment of adoption from 2015-2019 is based upon FCC Form 477 subscriber/connection data that are collected at the census tract level and FCC Form 477 deployment data that is collected at the census block level. For this analysis, we aggregate data up to the geographic level reported in each of the figure, e.g., the United States, the tract level, or the county. We evaluate the adoption of fixed terrestrial services at speeds of 10/1 Mbps, 25/3 Mbps, 50/5 Mbps, 100/10 Mbps, and 250/25 Mbps. The reported adoption rates are the number of residential connections divided by the number of households in the area where the FCC Form 477 deployment data indicate that fixed terrestrial services of at least the designated speed are deployed.

[326] The denominator for these calculations is a different data source than the numerator; the ACS population data is used to normalize values between states, but the reporting years can be different than the FCC Form 477 reporting year. Normalizing values between two different data sources can result in values exceeding 1, and should not be interpreted as more connections than households.

103. Figure II.B.12 reports adoption rates based upon year-end data from 2015 to 2019 for the United States as a whole (excluding the U.S. Territories),[327] urban and non-urban core areas,[328] and Tribal lands.[329] Figure II.B.12 shows year-to-year increases in the adoption of broadband services across the vast majority of areas, including Tribal lands.

[327] We exclude data from the U.S. Territories when showing the five-year progression of deployment and adoption of broadband services because of anomalies in the historical data for Puerto Rico and the U.S. Virgin Islands whose population account for over 92% of the total combined population of the U.S. Territories. The historical data suggest a 21.7 percentage point increase in deployment between 2015 and 2016. *2020 Broadband Deployment Report*, 35 FCC Rcd at 8998, para. 28 & n.95. The year-end 2017 deployment data most likely significantly overstate deployment in Puerto Rico and the U.S. Virgin Islands at that time because the data do not reflect infrastructure damage caused by Hurricanes Maria and Irma. We include data from the U.S. Territories in figures that report data since 2018 only as we believe these FCC Form 477 data collections provide reliable estimates for the U.S. Territories.

[328] Connection data are reported at the census tract level. We aggregate deployment data up to the census tract to identify urban core and non-urban core areas. A census tract is designated as "Urban Core" if it has a land area less than three square miles and a population density of at least 1,000 people per square mile. A census tract is designated as "Non-Urban Core" if we have not designated the census tract as Urban Core.

[329] A census tract is designated Tribal lands if more than 50% of the land area is Tribal land. For purposes of the analysis of Tribal lands in this *Report*, we use the definition that was used in the *2018 Commercial Marketplace Report* and in the Commission's *Broadband Deployment Reports* since 2012. *See 2018 Communications Marketplace Report*, 33 FCC Rcd at 12652, para. 187 & n.598; *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 11-121 Eighth Broadband Progress Report, 27 FCC Rcd 10342, 10414-15 (2012). We acknowledge that the Commission has used other definitions of Tribal lands. *See, e.g., 2.5 GHz Report and Order*, 34 FCC Rcd at 5465-66, paras. 51-55 (2019), *Bridging the Digital Divide for Low-Income Consumers*, Fourth Report and Order, Order on Reconsideration, Memorandum Opinion and Order, Notice of Proposed Rulemaking, and Notice of Inquiry, 32 FCC Rcd 10475 (2017); *Connect America Fund et al.*, Report and Order, Further Notice of Proposed Rulemaking, and Order on Reconsideration, 33 FCC Rcd 11893, 11910-11, para. 55 & n.122 (2018); *Wireless Telecommunications Bureau Announces Procedures for 2.5 GHz Rural Tribal Priority Window*, Public Notice, 35 FCC Rcd 308, 313, para. 19 (WTB 2020) (*2.5 GHz Tribal Priority Window Public Notice*). However, for purposes of this *Report*, we maintain our definition as previously employed.

Our assessment of Tribal lands in this *Report* begins by examining the census blocks that have been coded by the Census Bureau as federally recognized Tribal lands for the 2010 Census. These areas fall into one of the following American Indian Area/Alaska Native Area/Hawaiian Home Land Class Code categories: (1) Joint Use Areas; (2) legal federally recognized American Indian area consisting of reservation and associated off-reservation trust land; (3) legal federally recognized American Indian area consisting of reservation only; (4) legal federally recognized American Indian area consisting of off-reservation trust land only; (5) statistical American Indian area defined for a federally recognized Tribe that does not have reservation or off-reservation trust land, specifically a Tribal designated statistical area (TDSA) or Oklahoma Tribal Statistical Area (OTSA); (6) Alaskan Native village statistical area; and (7) Hawaiian Home Lands established by the Hawaiian Homes Commission Act of 1921. We exclude state recognized areas from the analysis of Tribal lands. We note that the Tribal Statistical Areas are largely in Oklahoma, but they also include areas in California, New York, and Washington. To assess adoption rates on Tribal lands we designate a census tract as Tribal lands if more than 50% of the land area is Tribal land.

Fig. II.B.12
Overall Adoption Rate for Fixed Terrestrial Services at Different Speed Tiers

	2015	2016	2017	2018	2019
10/1 Mbps					
United States[330]	62.2%	66.3%	69.7%	73.3%	77.0%
Non-Urban Core Areas	55.8%	60.3%	63.5%	67.4%	71.8%
Urban Core Areas	67.0%	71.0%	74.7%	78.1%	81.4%
Tribal Lands	42.4%	43.1%	46.3%	51.2%	55.5%
Non-Urban Core Areas	36.1%	36.9%	40.4%	45.3%	50.1%
Urban Core Areas	56.8%	59.1%	62.3%	68.1%	71.1%
25/3 Mbps					
United States	48.1%	53.5%	60.2%	65.1%	69.4%
Non-Urban Core Areas	43.2%	48.9%	55.1%	59.9%	64.5%
Urban Core Areas	51.5%	56.9%	64.0%	69.2%	73.3%
Tribal Lands	31.7%	33.4%	37.9%	44.0%	46.5%
Non-Urban Core Areas	28.5%	30.3%	34.5%	38.7%	40.6%
Urban Core Areas	37.1%	39.4%	45.1%	56.1%	61.8%
50/5 Mbps					
United States	33.9%	44.4%	54.8%	60.6%	64.8%
Non-Urban Core Areas	27.8%	41.2%	50.8%	56.4%	60.9%
Urban Core Areas	38.0%	46.7%	57.7%	63.8%	67.7%
Tribal Lands	25.0%	28.9%	34.2%	37.8%	42.4%
Non-Urban Core Areas	20.4%	25.3%	30.9%	34.0%	38.7%
Urban Core Areas	32.0%	34.9%	40.5%	45.6%	50.3%
100/10 Mbps					
United States	16.7%	19.2%	29.6%	45.7%	50.9%
Non-Urban Core Areas	16.4%	17.9%	27.0%	44.3%	50.0%
Urban Core Areas	16.9%	20.0%	31.4%	46.6%	51.5%
Tribal Lands	7.4%	10.5%	18.3%	30.2%	36.2%
Non-Urban Core Areas	6.4%	9.8%	17.0%	26.4%	33.1%
Urban Core Areas	8.7%	11.6%	20.4%	37.3%	42.5%
250/25 Mbps					
United States	4.2%	1.8%	4.1%	5.5%	9.1%
Non-Urban Core Areas	6.7%	2.3%	4.1%	5.0%	8.3%
Urban Core Areas	3.1%	1.6%	4.1%	5.8%	9.7%
Tribal Lands	1.4%	1.8%	4.4%	7.5%	11.5%
Non-Urban Core Areas	1.7%	2.1%	4.5%	8.0%	11.8%
Urban Core Areas	0.2%	1.5%	4.3%	6.7%	11.0%

104. Figure II.B.13 reports average county-level adoption rates for fixed terrestrial services against the quartile ranking for median household income, population density, the poverty rate and the proportion of the population that resides in a rural area.[331] The data are further disaggregated by speed tier.[332] In general, these data suggest that the average household adoption rate in a county increases with median household income and population density, and decreases with increases in the poverty rate and rural population rate.[333]

[330] We present adoption data for each state, U.S. Territory, and the District of Columbia in Appx. C-1.

[331] This demographic analysis is based upon county level adoption rates and the ACS Five-Year Estimates 2014-2018 for income and poverty measures for county-level data for the states, District of Columbia, and Puerto Rico (income measures are not available for the other U.S. Territories). Median household income is based on 2018 data and is measured in 2018 Inflation-Adjusted Dollars. The household poverty rate is the proportion of households living below the poverty level. The ACS Five-Year Estimates for 2015-2019 will not be released until December 10, 2020. U.S. Census Bureau, *2019 Data Release Schedule* (Mar. 3, 2020), https://www.census.gov/programs-surveys/acs/news/data-releases/2019/release-schedule.html. Population Density is the total population residing in the county as of 2019 divided by the square miles of land in the county, where the estimate of land area is based upon the 2010 Census. The proportion of the population residing in a rural area is the total population residing in the county rural census block (based on the 2010 Census) divided by the total population in the county. A rural census block encompasses all population, housing and territory not identified as an urban census block in the 2010 Census.

[332] We note that this analysis is based upon the best data currently available and may not accurately reflect how adoption may be associated with the subscriber's demographic data. Our data is based upon the subscriber data submitted by the providers, and we do not know the demographics of the providers' subscribers to their fixed broadband services.

[333] The adoption of fixed terrestrial broadband varies across demographic groups and households with less income are less likely to subscribe to a fixed broadband service for their home. *See* Pew Research Center, *Internet/Broadband Fact Sheet* (June 12, 2019), https://www.pewresearch.org/internet/fact-sheet/internet-broadband/#who-has-home-broadband. Incomes tend to be lower in rural areas, and subscription to home broadband services is generally lower in rural areas. *See* Michael J.R. Martin, *Rural and Lower-Income Counties Lag Nation in Internet Subscription* (Dec. 13, 2018), https://www.census.gov/library/stories/2018/12/rural-and-lower-income-counties-lag-nation-internet-subscription.html. Counties with a higher proportion of rural population will tend to have lower population density because fewer people live in these counties than in counties with more urban areas. In Figure II.B.12, the quartile with the lowest population density will likely correspond to the quartile with the highest rural population rate. Thus, the observation that the average overall adoption rate for fixed terrestrial services increases with population density is akin to the observation that the average overall adoption rate for fixed terrestrial services decreases as the rural population rate increases.

Fig. II.B.13
Average County Overall Adoption Rate for Fixed Terrestrial Services by County Level Demographic Variable (Dec. 31, 2019)[334]

	10/1 Mbps	25/3 Mbps	50/5 Mbps	100/10 Mbps	250/25 Mbps
Median Household Income					
First Quartile (Lowest Median Household Income)	38.4%	28.3%	23.4%	20.2%	4.7%
Second Quartile	51.6%	41.6%	36.4%	31.0%	6.0%
Third Quartile	58.8%	47.6%	42.2%	35.2%	6.2%
Fourth Quartile (Highest Median Household Income)	71.2%	61.3%	56.7%	43.8%	8.1%
Population Density					
First Quartile (Lowest Population Density)	48.8%	34.2%	26.8%	22.7%	8.0%
Second Quartile	43.9%	34.3%	30.1%	25.0%	4.8%
Third Quartile	55.1%	46.5%	42.6%	36.0%	5.0%
Fourth Quartile (Highest Population Density)	72.0%	63.6%	58.8%	46.1%	7.8%
Household Poverty Rate					
First Quartile (Lowest Household Poverty Rate)	67.2%	55.9%	50.9%	39.8%	7.6%
Second Quartile	59.4%	48.7%	43.4%	36.0%	6.7%
Third Quartile	52.7%	43.1%	38.5%	33.1%	6.5%
Fourth Quartile (Highest Household Poverty Rate)	40.7%	31.1%	26.0%	21.5%	4.3%
Rural Population Rate					
First Quartile (Lowest Rural Population Rate)	71.0%	62.3%	57.3%	44.9%	8.0%
Second Quartile	57.4%	47.8%	43.0%	36.1%	5.7%
Third Quartile	46.8%	37.0%	32.7%	27.7%	5.0%
Fourth Quartile (Highest Rural Population Rate)	44.6%	31.5%	25.2%	21.0%	6.5%

2. Competition in Fixed Broadband

105. Internet service providers continue to invest in their networks to improve the quality and availability of their services, typically in competition with each other.[335] As we have explained previously, our data understate the benefits that come from competition because: (1) fixed Internet service providers have strong incentives, even when facing a single competitor, to capture customers or induce greater use of their networks; and (2) competitive pressures often have spillover effects across a given provider, meaning an Internet service provider facing competition broadly, if not universally, will tend to treat customers that do not have a competitive choice as if they do.[336]

[334] All data presented for the United States in Fig. II.B.13 exclude U.S. Territories other than Puerto Rico.

[335] *See Restoring Internet Freedom*, WC Docket Nos. 17-108, 17-287, and 11-42, Declaratory Ruling, Report and Order, and Order, 33 FCC Rcd 311, 385, paras. 126-27 (2017) (*Restoring Internet Freedom Order*).

[336] *Id.* at 383-85, paras. 126-27.

a. Investment Trends

106. According to USTelecom, U.S. fixed broadband providers invested approximately $80 billion in CapEx in 2018, up from approximately $75 billion in 2016.[337] Overall, broadband providers have invested more than $1.7 trillion in CapEx since 1996.[338] Multiple commenters cite this investment as a sign of a competitive marketplace. For example, NCTA notes that cable operators now "offer gigabit services to 80% of American consumers, up from just 9% in 2016."[339] NCTA also reports that "more than 73% of the population has access to 25/3 Mbps terrestrial broadband service from a non-cable service provider (fiber, DSL, or fixed wireless)."[340] Further, even during the COVID-19 pandemic "over 99% of the customers of major cable operators have not experienced any material impact,"[341] which highlights the benefits of earlier investment. America's Communications Association (ACA Connects) notes that its members invest about $1 billion annually to upgrade networks, leading to decreases in the price per Mbps for consumers.[342]

107. While deployment data are not synonymous with investment dollars, an increase in investment likely leads to an increase in deployment, and also an increase in speeds deployed. Figure II.B.14 shows how each fixed broadband technology covers the U.S. population over time. Investment in technology and infrastructure is likely a large driver of the increase in the deployment of FTTP and cable DOCSIS 3.1, two technologies that have considerable download speed capabilities.

[337] USTelecom Comments, Attach. at 12, 26.

[338] *Id*. at 12.

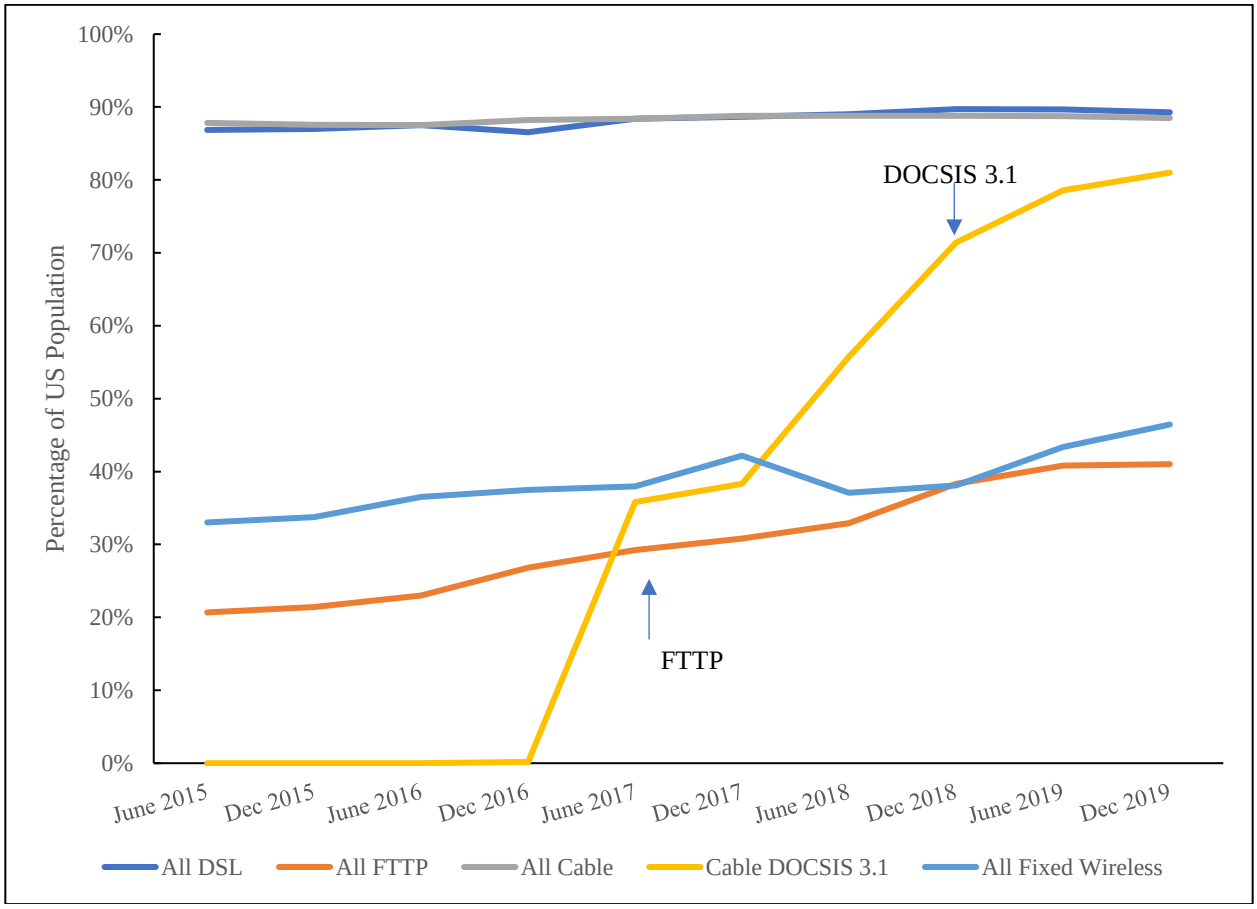
[339] NCTA Comments at 3.

[340] *Id*. at 4.

[341] *Id*. at 7.

[342] ACA Connects Comments at 4.

Fig. II.B.14
U.S. Population Coverage by Technology

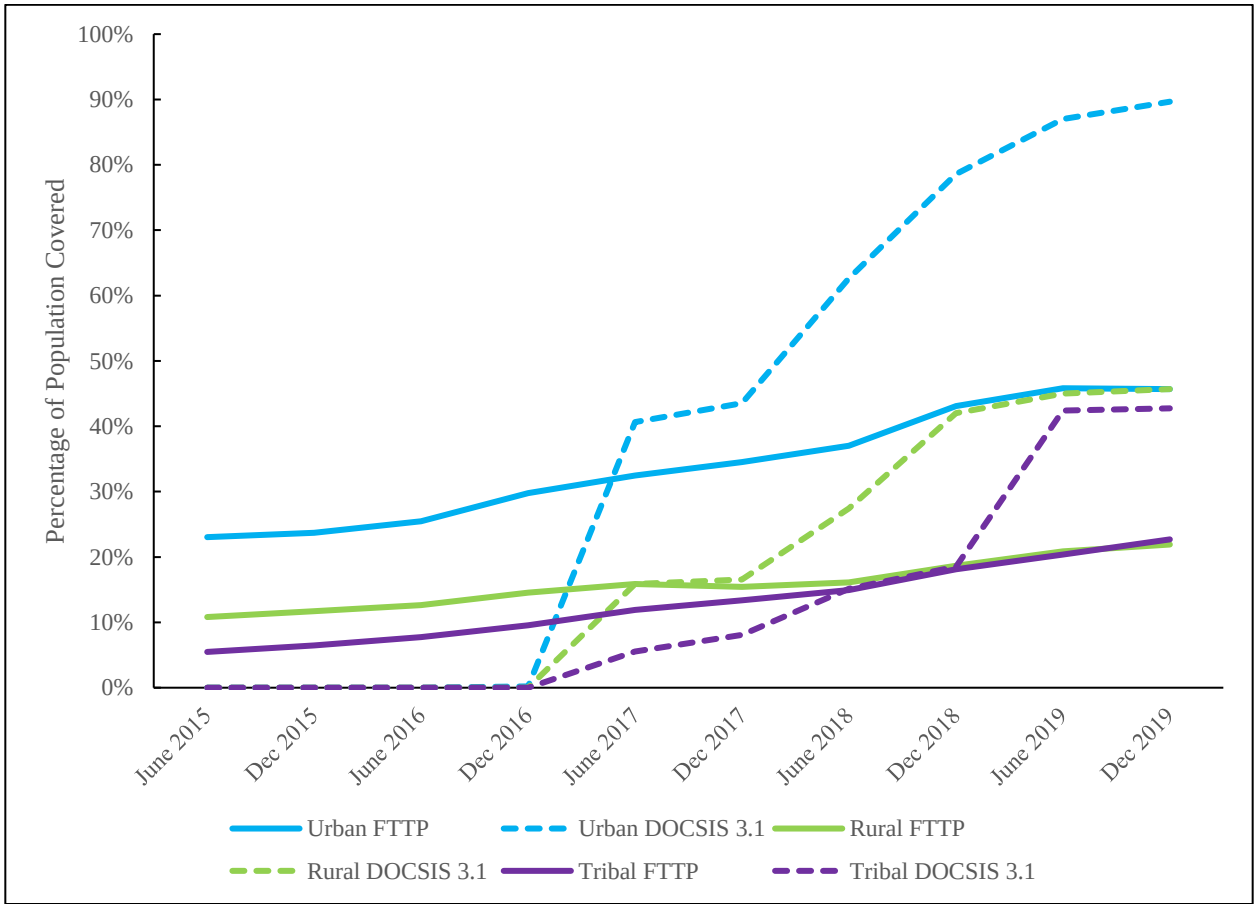


Source: FCC Form 477 data.

108. Access to FTTP and cable DOCSIS 3.1 differs in rural areas as compared to urban areas. Figure II.B.15 shows the change in population coverage of FTTP and cable DOCSIS 3.1 technology in rural, urban, and Tribal lands. The growth rate of FTTP coverage is similar in rural and urban areas: Each area's FTTP coverage has increased by a factor of over two since 2015. However, urban areas still have approximately twice the percentage of population covered by FTTP than rural areas, which suggests that providers may have invested more in FTTP technology in urban areas than in rural areas. Compared to other technologies, DOCSIS 3.1 covers the largest number of individuals in the United States as of 2019, and has seen the largest increase in growth over the last five years, suggesting providers have prioritized investment into DOCSIS 3.1 technology. The widespread deployment of this technology is likely one of the drivers of the increase in access to 250/25 Mbps speeds, as it is capable of download speeds up to 10 Gbps. However, there is disparity in where providers invest in this technology. Figure II.B.15 shows approximately 90% of urban areas have access to DOCSIS 3.1, while approximately only 46% of rural areas and 43% of Tribal lands have access.[343] We note, however, that the overall population covered by cable technologies stayed relatively constant as seen in Figure II.B.14; this is due to companies retiring older technologies as they deployed DOCSIS 3.1.

[343] These deployment patterns correspond to speed availability metrics from the *2020 Broadband Deployment Report*, which shows approximately 94% of the urban population, 52% of the rural population, and 46% of the tribal population have access to 250/25 Mbps. *2020 Broadband Deployment Report*, 35 FCC Rcd at 9007-08, para. 41 & Fig. 4.

Fig. II.B.15
Rural, Urban, and Tribal Population Coverage for Fiber and Cable DOCSIS 3.1 Technology



Source: FCC Form 477 data and Census data.

b. Pricing

109. Pricing for fixed services depends on several factors, including speed tier, technology, region of service, contract length, and an array of bundling options. USTelecom's Broadband Pricing Index compares the prices of both the most popular plans and the plans with the highest speed tiers between 2015 and 2020, and find that prices for both categories have decreased considerably during this time.[344] Prices have fallen by over 20% for the largest providers' most popular plans (which now average 16% faster speeds).[345] Prices also have decreased for the providers' highest speed offerings. Compared to 2015, these high-speed plans "are now priced 37.7% lower and offer 27.7% faster speeds in 2020 on an averaged subscriber-weighted basis."[346] One of the underlying data sources for USTelecom's pricing index is the FCC's Urban Rate Survey. The 2020 Urban Rate Survey reports the following weighted means for prices of Internet-only packages: $60.30 per month for DSL, $80.67 per month for cable, $86.48 per month for fixed wireless, and $102.63 per month for fiber.[347]

[344] Arthur Menko, *2020 Broadband Pricing Index Report*, USTelecom (Sept. 16, 2020), https://www.ustelecom.org/wp-content/uploads/2020/09/USTelecom-2020-Broadband-Pricing-Index.pdf.

[345] *Id*. at 3.

[346] *Id*.

[347] The underlying sample design and weighting methodology for the Urban Rate Survey can be found on the survey's homepage. FCC, *Urban Rate Survey Data & Resources* (July 2020), https://fcc.gov/economics-analytics/industry-analysis-division/urban-rate-survey-data-resources.

110. To undertake our pricing analysis in this *Report*, we use BroadbandNow.com data.[348] BroadbandNow.com collects price information from approximately 2,000 providers[349] on a monthly basis, from either the provider's website or in some cases directly from the provider itself.[350] The BroadbandNow data provide information on 9,185 residential plans as of July 2020.[351] We focus on prices for Internet-only packages.[352]

111. Fig. II.B.16 shows the average monthly price and download speed by technology for Internet-only plans, and indicates a positive relationship between price and download speed.[353] On average, for download speeds up to 150.9 Mbps, terrestrial fixed wireless plans are the most expensive, followed by DSL plans, FTTP plans, and then cable plans, which are priced similarly for this speed range. The price for terrestrial fixed wireless plans dips in the 151-500 Mbps range compared to slower speeds, which is likely because there are very few plans for this technology that offer these higher speeds, and therefore the small sample is limited to providers that offer lower prices.[354] Only FTTP and cable plans offer download speeds over 1 Gbps, and they cost significantly more per month than any other speed tier.

[348] While BroadbandNow is an independent website, it does receive advertising revenue and/or a referral fee from some of the companies whose information they provide. BroadbandNow, *Advertiser Disclosure*, https://broadbandnow.com/advertising-disclosure (last visited Oct. 27, 2020).

[349] BroadbandNow, *The Complete List of Internet Providers in the United States*, https://broadbandnow.com/All-Providers (last visited Oct. 27, 2020).

[350] We verified BroadbandNow prices by comparing them to data used in the *International Broadband Data Report* which was manually collected by Commission staff. The *International Broadband Data Report* includes fixed pricing set of plans across the top four providers of AT&T, Verizon, Comcast, and Charter from Los Angeles and Washington, DC, along with a manual collection of plans from each state capital.

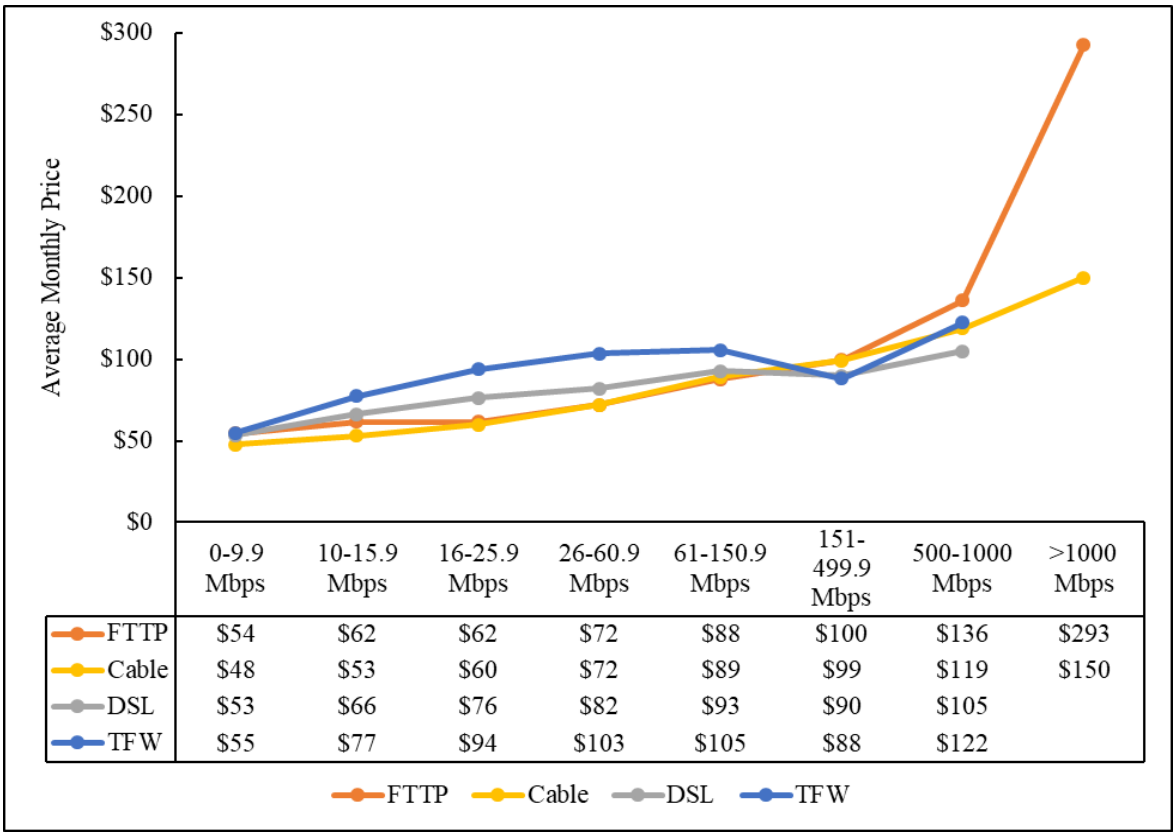
[351] Our final sample removed plans that were either part of a bundle, a package specific to a region, or missing non-promotional prices. This resulted in a sample of 8,517 plans across 1,862 providers.

[352] Google Fiber notes that "when providers offer discounts that are tied to the purchase of a bundle, it may distort consumer understanding of the true price of the individual elements of that service. Consumers may believe that the broadband element of their bundle is more expensive than it is because of how pricing is structured in a bundle." Google Fiber Comments at 7.

[353] Average monthly price is a measure of the average monthly Internet-only plan prices after the promotion period ends; both average monthly price and average promotional price are calculated by excluding $0 prices. Each plan had a specific download and upload speed, but we grouped these plans by download speed into speed tiers based on the download speed. Download tiers were chosen so that observations were smoothed across the groups.

[354] Plans are grouped by the advertised maximum download speed, in Mbps. In the final sample, there are 16 plans in the 151-500 Mbps range for terrestrial fixed wireless technology, compared to 98 in the 61-150.9 Mbps range, 358 in the 26-60.9 Mbps range, 554 in the 16-25.9 Mbps range, 878 in the 10-15.9 Mbps range, and 1,466 that are less than 10 Mbps.

Fig. II.B.16
Average Monthly Price for Internet-Only Plans by Download Speed and Technology



	0-9.9 Mbps	10-15.9 Mbps	16-25.9 Mbps	26-60.9 Mbps	61-150.9 Mbps	151-499.9 Mbps	500-1000 Mbps	>1000 Mbps
FTTP	$54	$62	$62	$72	$88	$100	$136	$293
Cable	$48	$53	$60	$72	$89	$99	$119	$150
DSL	$53	$66	$76	$82	$93	$90	$105	
TFW	$55	$77	$94	$103	$105	$88	$122	

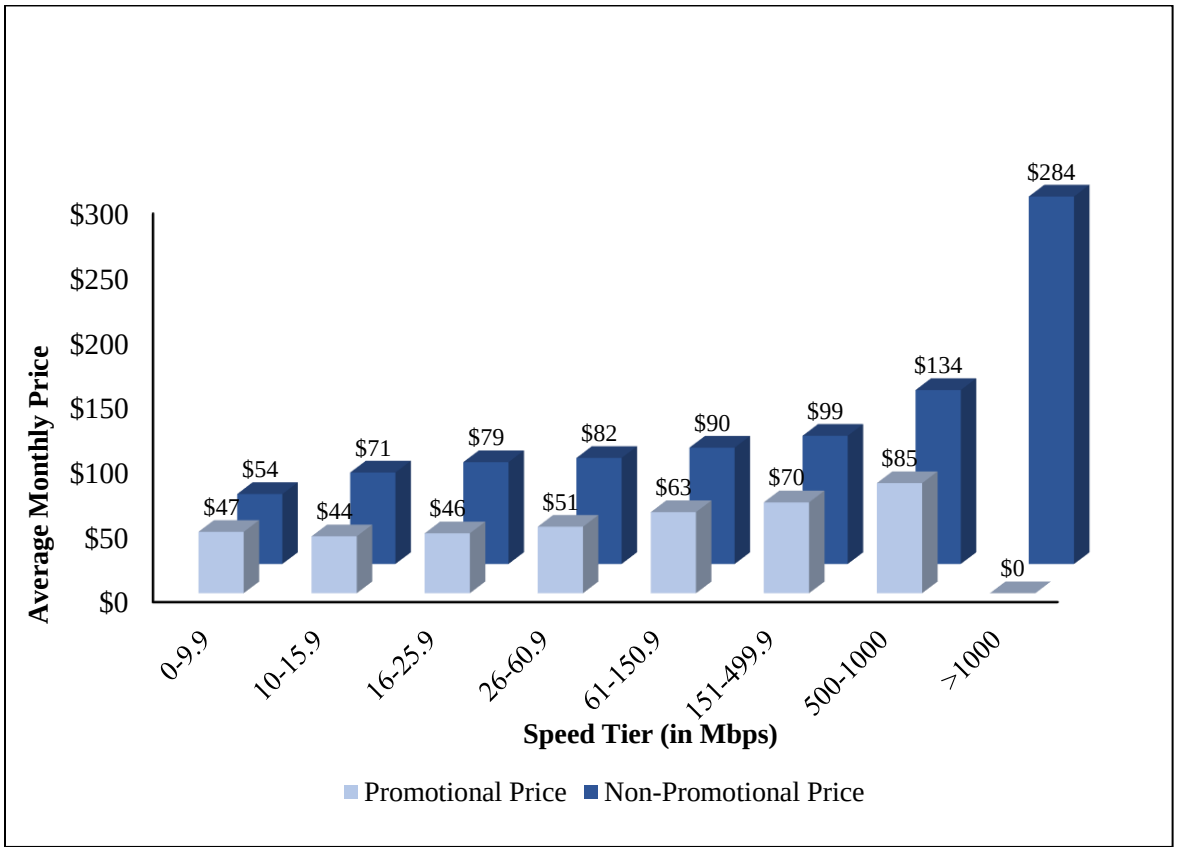
Source: Published with permission of BroadbandNow.com.

112. Many providers offer introductory promotional rates for new customers, which can be considerably discounted from the plan's regular monthly price.[355] Figure II.B.17 shows the average promotional monthly price and the average non-promotional monthly price for each speed tier.[356] On average, the promotional monthly price is discounted by 32%. There is no evidence of promotional pricing for plans with download speeds of over 1 Gbps. Packages with download speeds less than 10 Mbps have the least discounted promotional prices, averaging a 12% discount. Conversely, packages with download speeds between 16 and 26 Mbps have the most discounted promotions, averaging a 41% discount.

[355] BroadbandNow, *The Complete List of Internet Providers in the United States*, https://broadbandnow.com/All-Providers (last visited Oct. 27, 2020).

[356] Promotional prices ranged from six months to a three-year promotion period. The promotional averages along with the non-promotional averages exclude $0 values, which represented packages for which BroadbandNow did not have data.

Fig. II.B.17
Promotional Price and Non-Promotional Price by Speed Tier

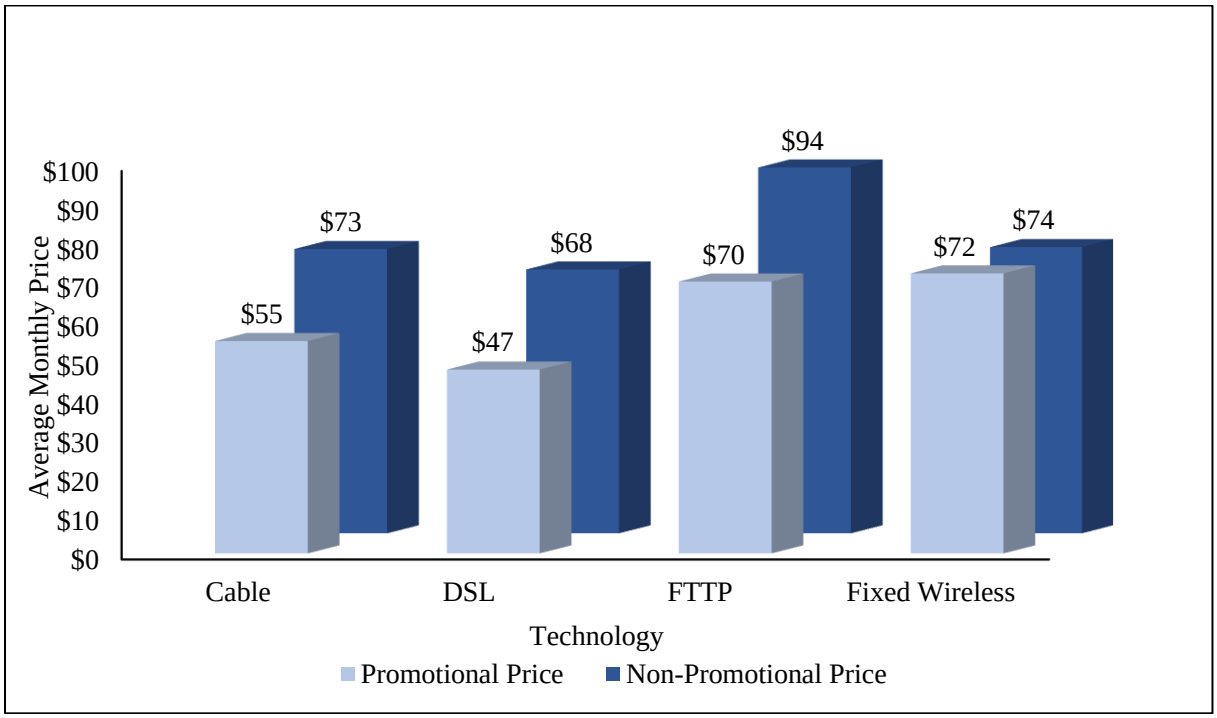


Source: Published with permission of Broadbandnow.com.

113. Figure II.B.18 illustrates the average monthly promotional price compared to the regular monthly price for Internet-only cable, DSL, fiber (as described on the provider's website),[357] and terrestrial fixed wireless packages. Terrestrial fixed wireless packages have the smallest discount for promotional pricing, averaging an approximate 2% discount. DSL, fiber, and cable have average promotional prices discounted by 30%, 26%, and 25% respectively.

[357] Fiber plans are collected by BroadbandNow and categorized as fiber by the individual provider's website. Thus, it is possible FTTC, FTTN, and FTTP are all included in the fiber category.

Fig. II.B.18
Promotional Price and Non-Promotional Price by Technology

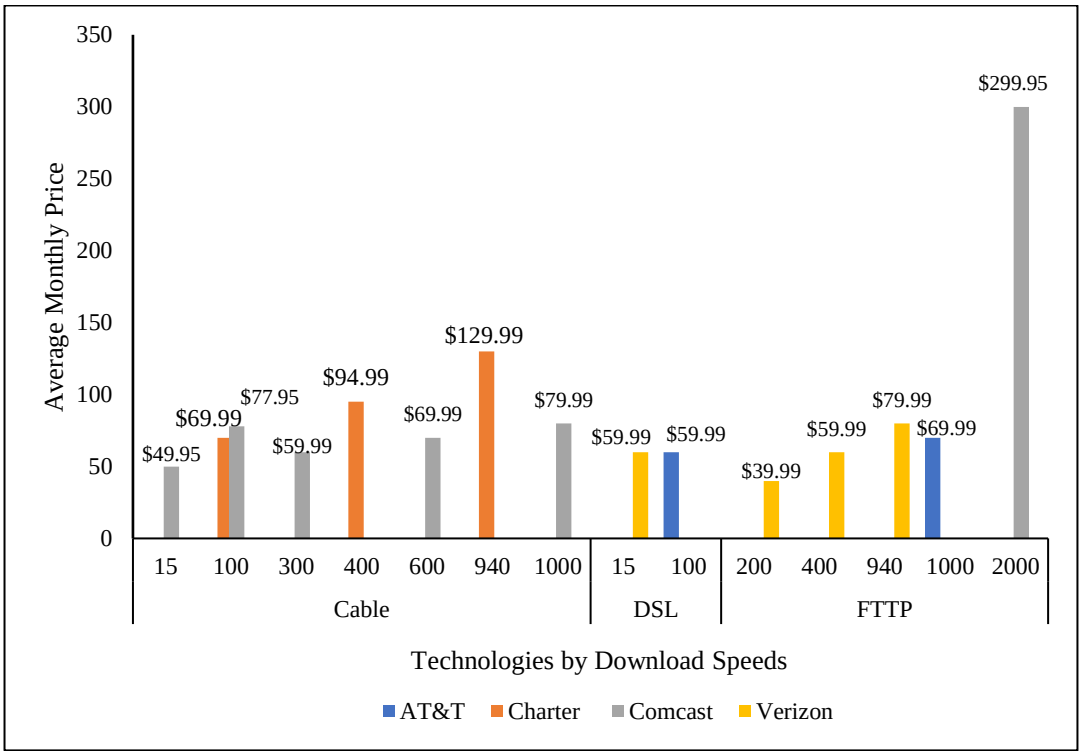


Source: Published with Permission of BroadbandNow.com.

114. Figure II.B.19 shows the average non-promotional monthly price for fixed technologies for the top four Internet providers: AT&T, Charter, Comcast, and Verizon. These prices are limited to Internet-only packages that are available throughout the provider's service area.[358] Of all the technologies, cable plans have the widest range of prices and download speeds, and are all provided by either Comcast or Charter. Charter's 940 Mbps plan is the most expensive cable package, at $129.99, and Comcast's 15 Mbps plan is the cheapest cable plan, priced at $49.95. DSL technology only has two speed plans: Verizon offers download speeds up to 15 Mbps and AT&T offers download speeds up to 100 Mbps; both plans are priced at $59.99. Unlike DSL, fiber exhibits far more variety in prices and download speeds, with plans provided by Verizon, AT&T, and Comcast. Comcast has the most expensive fiber plan, priced at $299.95 for download speeds up to 2 Gbps, while Verizon has the cheapest fiber plan at $39.99 for speeds up to 200 Mbps.

[358] This figure displays averages of non-promotional monthly prices; in some cases, BroadbandNow only had data on promotional prices without a corresponding regular rate. In these cases, promotional prices were used when non-promotional prices could not be found.

Fig. II.B.19
Average Monthly Prices for the Largest Four Providers of Fixed Services



Source: Published with Permission of BroadbandNow.com.

c. Speed

115. *Measuring Broadband America Report.* Our assessment of non-price competition in fixed broadband services considers quality measures including the actual speed of service experienced by consumers, consistency of advertised speeds, latency, and packet loss. Each one of these measures focuses on a different aspect of the consumer experience. Every page, image, and video on the Internet comes to home devices as small pieces of data, or packets. Upload and download speed refer to throughput, the rate at which packets reach their destination within a specific time period. Different types of online applications require different minimum speeds. Speeds experienced by a consumer may fluctuate during the day. This fluctuation is typically caused by increased traffic demand and the resulting stress on different parts of the network infrastructure. A significant reduction in speed for more than a few seconds can force a reduction in video resolution or an intermittent loss of service. Consistency measures examine how dramatic these fluctuations are across a particular network. Sometimes, because of the way networks are built and how much traffic they move, there can be delays in how packets travel. Latency is the time it takes for a data packet to travel across a network from one point on the network to another. Consumers using services with high latency may experience reduced quality for interactive services, e.g., voice communications, video chat, video conferencing, and online multiplayer games. Finally, packet loss measures the fraction of data packets sent that fail to be delivered to the intended destination. If packet loss occurs with interactive services and streaming applications, it may affect the consumer's perceived quality of service. These aspects of consumer experience may affect the consumer's ultimate purchasing decision when multiple technology options are available, and encourage ISPs to ensure high quality services.

116. This discussion summarizes results from the Commission's recently released *Tenth Measuring Broadband America Report*.[359] The *Tenth Measuring Broadband America Report* provides a snapshot of fixed broadband Internet access service performance in the United States. The *Tenth Measuring Broadband America Report* is based on data collected from 12 ISP/technology configurations between September 6 and October 3, 2019 (inclusive) and October 8 and 9, 2019 (inclusive).[360] We measure the network performance delivered on selected service tiers to a representative sample set of the population. The thousands of volunteer panelists are drawn from subscribers of the ISPs serving a large percentage of the residential marketplace in the United States.[361] The results presented in the *Tenth Measuring Broadband America Report* suggest that consumer experience varies noticeably with the connection technology.[362]

117. *Actual Speed*. As reported, actual speed is the median speed experienced by the sampled panelists within a specific speed tier, by ISP. Specifically, for each ISP, performance is measured by weighting the median speed for each service tier by the number of subscribers in that tier.[363] We continue to find that consumers' actual broadband service speeds are generally close to or exceed advertised speeds.[364] Of the 12 ISP/technology configurations included in the report,[365] only Cincinnati Bell DSL (at 79%) performed below 90% of its advertised speed.[366]

118. *Consistency of Service*. We summarize two measures of consistency of service discussed in the *Tenth Measuring Broadband America Report*. The first metric is the percentage of an ISP's sampled panelists who experience an actual monthly average download speed that was greater than 95%,

[359] *See generally Tenth Measuring Broadband America Fixed Broadband Report*; *see also Ninth Measuring Broadband America Fixed Broadband Report*. The Measuring Broadband America program is a rigorous, ongoing, nationwide study of consumer broadband performance that relies upon a sample that aims to include those tiers that constitute the top 80% of the subscriber base per ISP. *Tenth Measuring Broadband America Report* at 6. The *Tenth Measuring Broadband America Report* is based on data gathered from over 2,900 volunteer panelists across the United States, and includes only panelists that are subscribed to the tiers that were tested as part of the sample plan. *Tenth Measuring Broadband America Report,* Technical Appendix at 6-8.

[360] *Tenth Measuring Broadband America Report* at 6. The *Tenth Measuring Broadband America Report* is based upon data for ten ISPs: CenturyLink, Charter, Cincinnati Bell, Comcast, Cox, Frontier, Mediacom, Optimum, Verizon, and Windstream. *Id*. at 7. For the *Ninth Measuring Broadband America Report*, although AT&T did not participate, the Commission continued to evaluate AT&T's sets of tiers with sufficient numbers of panelists. *Ninth Measuring Broadband America Report*, at 6, 20. The participants in the *Ninth and Tenth Measuring Broadband America Reports* provide service by DSL, cable, or fiber (FTTP). *Tenth Measuring Broadband America Report*, at 10. Participation in the program by ISPs is voluntary. For purposes of satisfying the Commission's transparency requirements that apply to Internet service providers, fixed providers that choose to participate in the Measuring Broadband America program may disclose their results as a sufficient representation of the actual performance their customers can expect to experience. *Restoring Internet Freedom Order*, 33 FCC Rcd at 441, para. 222 & n.818.

[361] *Tenth Measuring Broadband America Report* at 6.

[362] *Id.* at 14-17.

[363] *Id.* at 7.

[364] *Id.* at 14-17, 29.

[365] The ISP/technology configurations are: DSL (CenturyLink, Cincinnati Bell DSL, Frontier DSL, Windstream); Cable (Altice Optimum, Charter, Comcast, Cox, and Mediacom); and Fiber (FTTP) (Cincinnati Bell, Frontier Fiber, Hawaiian Telcom Fiber and Verizon Fiber). *Tenth Measuring Broadband America Report* at 10. AT&T, Hughes Network Systems and Viasat/Exede have left the program. However, for the *Ninth Measuring Broadband America Report* the Commission reported raw data results using lightweight tests for Hughes Network Systems and Viasat/Exede. *Ninth Measuring Broadband America Report* at 20 & n.17; *see also Ninth Measuring Broadband America Report, Technical Appendix*. Lightweight speed tests, as compared to standard tests, use one rather than eight concurrent transfer control protocol sessions so as to provide less strain on consumer accounts that are data-capped. *Ninth Measuring Broadband America Report* at 23.

[366] *Tenth Measuring Broadband America Report* at 14, 27, 39.

between 80% and 95%, and less than 80% of advertised speeds. The seven best performing ISPs when measured by this metric were Charter, Comcast, Cox, Mediacom, Optimum, Frontier-Fiber, and Verizon-Fiber; more than 80% of their panelists were able to attain an actual median download speed of at least 95% of the advertised download speed.[367]

119. The second metric, the "80/80 consistent speed" metric, considers how speeds experienced by an ISP's sampled panelists vary during the day. The "80/80 consistent speed metric" is the minimum actual speed experienced by 80% of the sampled panelists during at least 80% of the peak usage period. Consistency of speed may be more important to consumers using applications that are both high-bandwidth and sensitive to variations in actual speed such as video content.[368] Measured by this service metric, Charter, Comcast, Cox, Mediacom, Optimum, Frontier-Fiber, and Verizon-Fiber provided greater than 90% of the advertised speed during peak usage period to more than 80% of panelists for more than 80% of the time.[369] In contrast, the 80/80 consistent download speed was 46% for Cincinnati Bell's DSL.[370]

120. *Latency*. The differences in median latency among terrestrial-based services are relatively small and unlikely to affect the perceived quality of highly interactive applications (voice communications, video chat, and interactive gaming). Thus, the median latencies ranged from 10 ms to 27 ms in our measurements (with the exception of CenturyLink-DSL and Cincinnati Bell-DSL which had median latencies of 40 ms and 34 ms, respectively).[371]

121. *Packet Loss*. The Measuring Broadband America program denotes a packet to be lost if the latency exceeds three seconds or if the packet is never received, and that a 1% standard for packet loss is the point at which highly interactive applications such as Voice over Internet Protocol (VoIP) would experience significant degradation.[372] ISPs using fiber technologies have the lowest packet loss, while ISPs using copper-based technologies, e.g., DSL, have the highest packet loss.[373]

122. *Residential Connections and Speed.* Figure II.B.20 shows total residential connections grouped by advertised download speed tier, from June 2015 to December 2019. As of December 2019, approximately 63% of the 105 million residential connections advertised download speeds of at least 100 Mbps. Thus, almost 66.4 million connections had access to download speeds of 100 Mbps in December 2019, which is more than 5.5 times the number of connections capable of 100 Mbps in June 2015. In addition, the number of connections with download speeds less than 100 Mbps declined year over year.

[367] *Id.* 16.

[368] *Id*.

[369] *Id.* at 16-17.

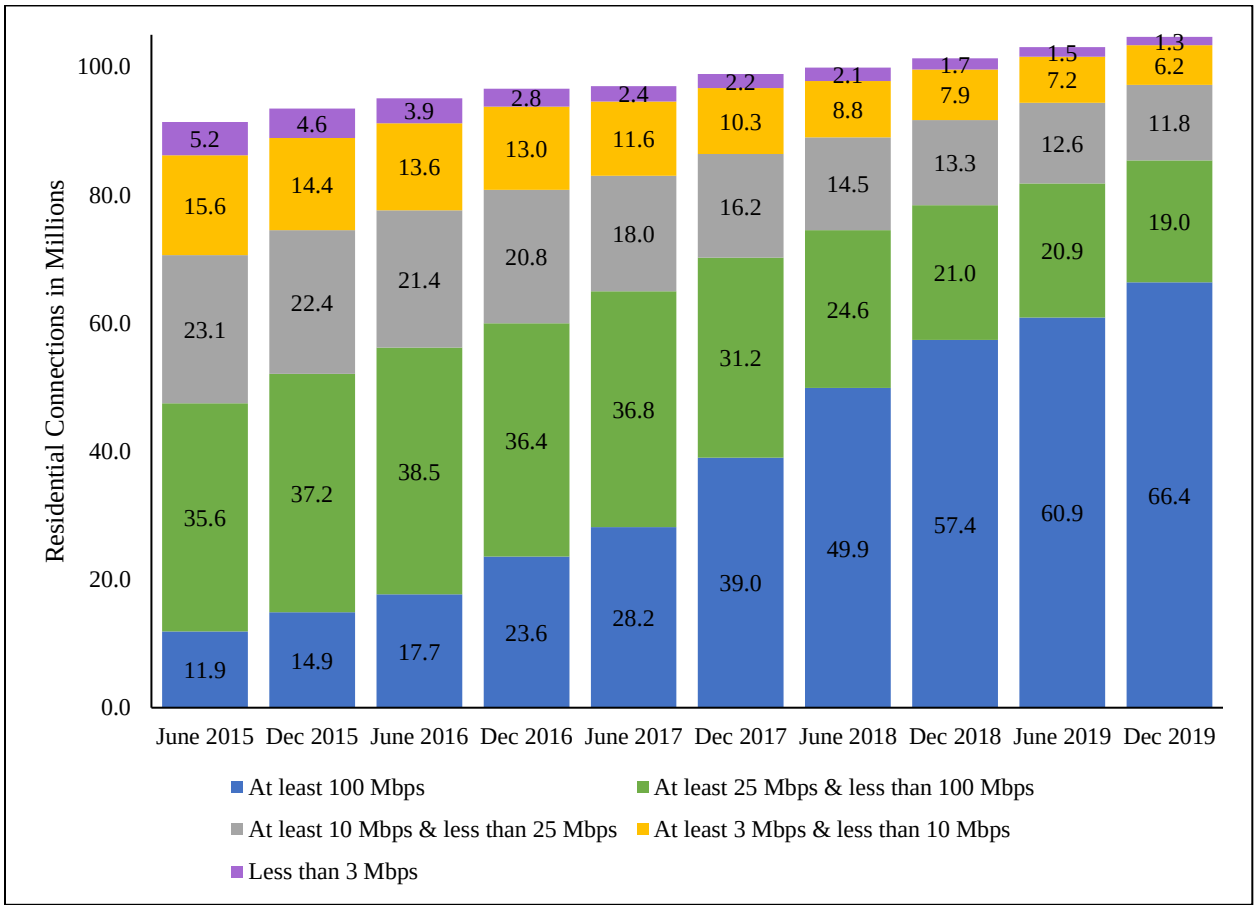
[370] *Id.* at 17.

[371] *Id*. Satellite providers no longer participate in the program; however, the *Eighth Measuring Broadband America Report* stated that, "Technology-determined latencies are typically small for terrestrial broadband services and are thus unlikely to affect the perceived quality of applications. The higher latencies of geostationary satellite-based broadband services may impair the perceived quality of such highly interactive applications." FCC, *Eighth Measuring Broadband America Fixed Broadband Report* (2018) at 8, https://data.fcc.gov/download/measuring-broadband-america/2018/2018-Fixed-Measuring-Broadband-America-Report.pdf.

[372] *Tenth Measuring Broadband America Report* at 18.

[373] *Id*.

Fig. II.B.20
Residential Fixed Connections by Download Speed 2015-2019



Source: Staff calculations based on FCC Form 477 data.

123. Figure II.B.21 shows a cross section of technology and download speed tiers for all residential connections in the United States as of December, 2019. Approximately 81% of cable connections can receive download speeds of at least 100 Mbps, while FTTP technology provides about 23% of its connections with download speeds in the 25 Mbps to 100 Mbps range, and about 68% of its connections with speeds of 100 Mbps or more. Just under one-third of fixed terrestrial fixed wireless connections fall in the 3 Mbps to 10 Mbps range, and DSL technology delivers download speeds between 10 Mbps and 25 Mbps to approximately 35% of its connections, and download speeds between 3 Mbps to 10 Mbps to approximately 28% of its connections. Satellite provides speeds between 10 Mbps and 25 Mbps to approximately 30% of its connections.

Fig. II.B.21
Residential Fixed Connections by Download Speed Tier and Technology
As of December 31, 2019 (in thousands)[374]

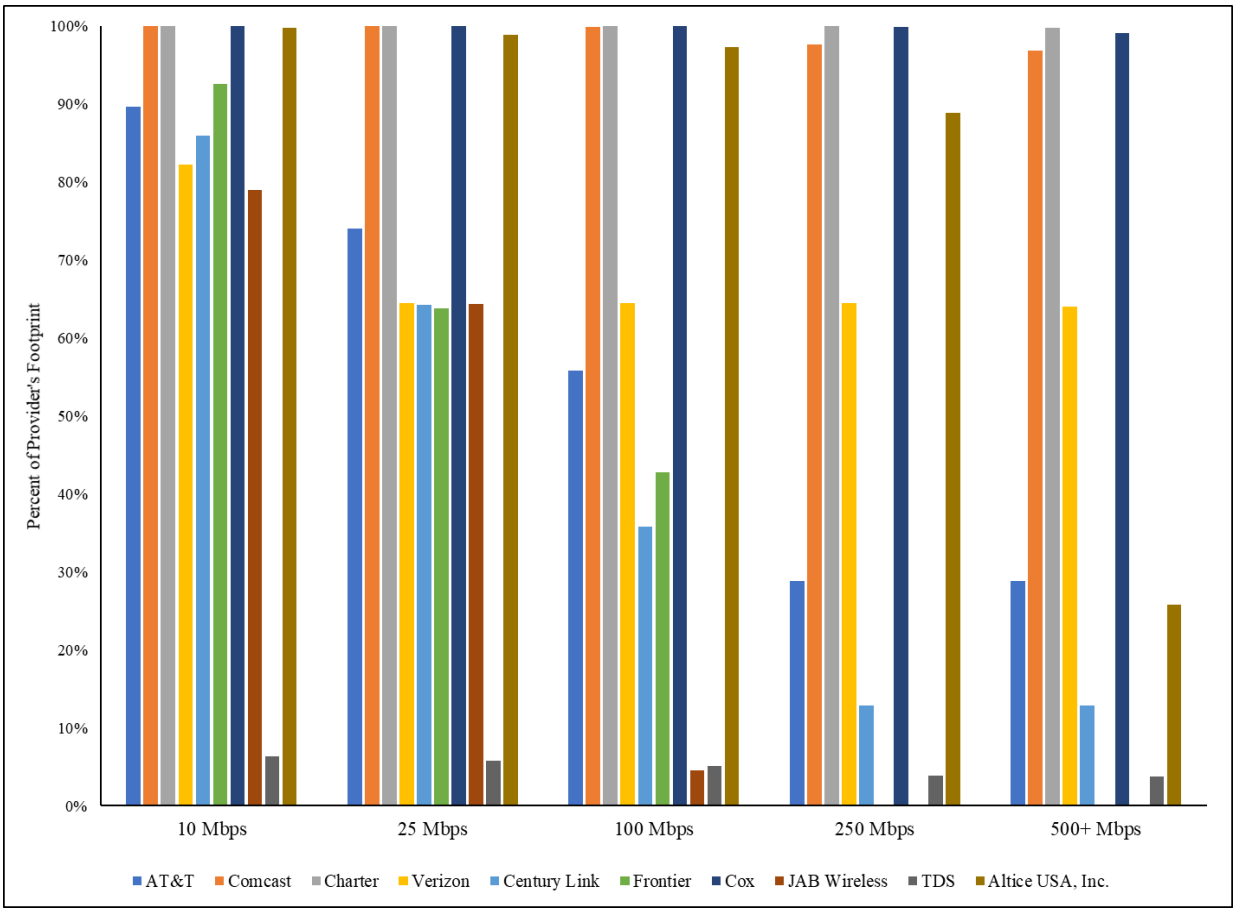
Technology	Less than 1.5 Mbps	At least 1.5 Mbps & less than 3 Mbps	At least 3 Mbps & less than 10 Mbps	At least 10 Mbps & less than 25 Mbps	At least 25 Mbps & less than 100 Mbps	At least 100 Mbps	Total
aDSL	383	701	4,893	6,194	4,951	354	17,476
sDSL	1	#	1	1	*	*	5
Other Wireline^	#	1	3	6	8	57	74
Cable	23	17	399	3,508	8,780	54,413	67,140
FTTP	29	21	388	1,043	3,773	11,426	16,681
Satellite	22	3	61	538	*	*	1,795
Fixed Wireless	29	73	446	537	316	108	1,501
Total	**489**	**817**	**6,190**	**11,826**	**18,991**	**66,367**	**104,680**

Source: Staff calculations based on FCC Form 477 data.

124. In terms of advertised download speeds available to the end user, Figure II.B.22 shows that Comcast and Charter each provide 100 Mbps throughout their entire service area, and 500 Mbps to approximately 97% and 99% of their service areas, respectively. Of the ten providers reported in Figure II.B.22, only three (AT&T, Cox, and Altice) provide 1 Gbps to a substantial portion of their footprint. Cox makes this speed tier available to approximately 99% of its service area; AT&T makes it available to almost 30% of its service area; and Altice provides this speed to approximately 17% of its service area. While Frontier and Verizon do not report 1 Gbps service within their service areas, Verizon does offer 500 Mbps to about 64% of its service area, and Frontier offers 100 Mbps to approximately 43% of its service area. JAB Wireless and TDS tend not to offer speeds over 25 Mbps, largely because it is difficult to do so through terrestrial fixed wireless technology.

[374] # = Rounds to Zero; * = Data withheld to maintain firm confidentiality; ^ Power Line and Other are summarized with Other Wireline to maintain confidentiality.

Fig. II.B.22
Available Download Speed within the Provider Footprint for Residential Fixed Services in the United States (Dec. 31, 2019)



Source: FCC Form 477 deployment data for residential consumers and 2010 Census data.

d. Access to Multiple Providers

125. We provide an assessment of the number of fixed broadband provider options available to consumers in the United States and the U.S. Territories using FCC Form 477 deployment data as of December 31, 2018 and December 31, 2019. Our analysis considers options for fixed terrestrial at five minimum speed thresholds—10/1 Mbps, 25/3 Mbps, 50/5 Mbps, 100/10 Mbps, and 250/25 Mbps. Using these data and ACS demographic data,[375] we also analyze the demographics of areas where consumers have access to multiple broadband providers.

126. Figures II.B.23 and II.B.24 report estimates of the percentage of the U.S. population where FCC Form 477 data indicate that zero, one, two, and at least three providers of fixed terrestrial broadband services are deployed as of December 31, 2018 and December 31, 2019. Focusing on the population with access to two or more providers, the 2019 data show that approximately 84% of Americans have at least 2 options for 10/1 Mbps fixed terrestrial service; approximately 74% have at least two options for 25/3 Mbps fixed terrestrial service; approximately 67% have at least two options for 50/5

[375] For this analysis, we examine population density, the number of households and median household income. We rely upon the ACS Five-Year Estimates 2014-2018 for median household income (in 2018 inflation-adjusted dollars) reported at the census block group level.

Mbps service; approximately 56% have at least two options for 100/10 Mbps service; and approximately 35% have at least 2 options for 250/25 Mbps service.[376]

Fig. II.B.23
Population (millions) by Provider Options for Fixed Terrestrial Services (Dec. 31, 2019)

	10/1 Mbps		25/3 Mbps		50/5 Mbps		100/10 Mbps		250/25 Mbps	
Providers	**pop.**	**%**	**pop.**	**%**	**pop.**	**%**	**pop.**	**%**	**pop.**	**%**
Zero	7.146	2.2%	14.520	4.4%	20.697	6.2%	27.520	8.3%	42.721	12.9%
One	46.309	14.0%	72.596	21.9%	89.659	27.0%	118.654	35.8%	172.548	52.0%
Two	153.411	46.2%	148.611	44.8%	150.411	45.3%	141.207	42.6%	103.394	31.2%
At Least Three	124.912	37.6%	96.051	29.0%	71.011	21.4%	44.396	13.4%	13.114	4.0%

Fig. II.B.24
Population (millions) by Provider Options for Fixed Terrestrial Services (Dec. 31, 2018)

	10/1 Mbps		25/3 Mbps		50/5 Mbps		100/10 Mbps		250/25 Mbps	
Providers	**pop.**	**%**	**pop.**	**%**	**pop.**	**%**	**pop.**	**%**	**pop.**	**%**
Zero	8.329	2.5%	18.310	5.5%	24.554	7.4%	32.223	9.7%	50.349	15.2%
One	51.198	15.5%	87.650	26.5%	102.548	31.0%	129.725	39.2%	179.582	54.3%
Two	161.009	48.7%	153.147	46.3%	152.212	46.0%	135.435	40.9%	89.391	27.0%
At Least Three	110.204	33.3%	71.632	21.7%	51.426	15.5%	33.357	10.1%	11.417	3.5%

127. Comparing the data year over year also shows an increase in the service options available for all speed tiers, where, for example, between 2018 and 2019, the percentage of the population with two or more provider options offering 25/3 Mbps service increased from approximately 68% to approximately 74%. If we were to include satellite broadband in the analysis below, the FCC Form 477 data indicate that nearly all areas in the country[377] have access to satellite broadband as an alternative for fixed terrestrial broadband service at both the 10/1 Mbps and 25/3 Mbps levels, but not yet at the higher speed thresholds reported in the above figures.

128. We next evaluate the population estimates and the percentage of the population with coverage of multiple fixed terrestrial broadband service providers in rural and urban areas, and on Tribal lands.[378] Our analysis of the population shows that, in general, more Americans had multiple provider

[376] The percentage of the population with an estimated number of fixed terrestrial provider options in a census block is equal to the population covered by the specific number of providers (e.g., zero, one, two, more than two) within the geographic area divided by the total population in the census block. Throughout this section, percentages provided may not sum to exactly 100% due to rounding.

[377] The FCC Form 477 deployment data for satellite broadband indicate that satellite service offering 25/3 Mbps speeds is available to all but 0.02% of the population. As we have previously noted, these data could overstate the availability of satellite services. While satellite signal coverage may enable operators to offer services to wide swaths of the country, overall satellite capacity may limit the number of consumers that can actually subscribe to satellite service at any one time. *2020 Broadband Deployment Report*, 35 FCC Rcd at 9000, para. 30 & n.99.

[378] We separately provide estimates of the percentage of the population with multiple provider options for fixed terrestrial broadband services, for each state, the District of Columbia, and U.S. territory, as of Dec. 31, 2019. *See*

(continued….)

options in 2019 than in 2018. For example, comparing Figures II.B.25 and II.B.26 below, there was approximately an 8 percentage point increase between 2018 and 2019 for 25/3 Mbps service in rural areas, and approximately a 5 percentage increase in urban areas. On Tribal lands, the change in the percentage of the population with multiple provider options increased by over 7 percentage points for 25/3 Mbps service.

Fig. II.B.25
Population (millions) by Provider Options for Fixed Terrestrial Services (Dec. 31, 2019)

	10/1 Mbps		25/3 Mbps		50/5 Mbps		100/10 Mbps		250/25 Mbps	
Providers	**POP.**	**%**	**POP.**	**%**	**POP.**	**%**	**POP.**	**%**	**POP.**	**%**
Rural Areas										
Zero	4.854	7.4%	11.261	17.2%	16.364	25.1%	21.636	33.1%	29.024	44.4%
One	19.646	30.1%	26.063	39.9%	29.095	44.5%	30.991	47.4%	29.555	45.2%
Two	24.342	37.3%	19.265	29.5%	15.570	23.8%	10.947	16.8%	6.065	9.3%
At Least Three	16.481	25.2%	8.734	13.4%	4.294	6.6%	1.749	2.7%	0.679	1.0%
Urban Areas										
Zero	2.292	0.9%	3.260	1.2%	4.333	1.6%	5.884	2.2%	13.697	5.1%
One	26.663	10.0%	46.533	17.5%	60.564	22.7%	87.663	32.9%	142.993	53.7%
Two	129.069	48.4%	129.346	48.5%	134.840	50.6%	130.260	48.9%	97.330	36.5%
At Least Three	108.431	40.7%	87.317	32.8%	66.718	25.0%	42.647	16.0%	12.436	4.7%
Tribal Lands										
Zero	0.488	12.0%	0.849	20.9%	1.254	30.9%	1.470	36.3%	2.042	50.4%
One	1.367	33.7%	1.443	35.6%	1.639	40.4%	1.753	43.3%	1.608	39.7%
Two	1.278	31.5%	1.104	27.2%	1.030	25.4%	0.759	18.7%	0.390	9.6%
At Least Three	0.920	22.7%	0.657	16.2%	0.129	3.2%	0.070	1.7%	0.013	0.3%

infra Appendices C-2, C-3, C-4, C-5, and C-6. For these figures, we aggregate census blocks within a state by competitor count category, i.e., we group census blocks within each state by the number of competitors in the census block and then sum the population in these census blocks by competitor count category. The census blocks within a state are aggregated by the number of provider options (zero, one, two, and at least three). We also provide estimates of the percentage of the population residing in urban areas with multiple provider options fixed terrestrial services, segmented by urban area type (urban clusters and urbanized areas). The Census Bureau categorizes census blocks as part of an urbanized area, an urban cluster or neither (rural). Urbanized areas are areas with populations over 50,000 and urban clusters are in areas with populations from 2500-50,000. Areas with fewer than 2500 people are considered rural. *See* U.S. Census Bureau, *2010 Census Urban Area FAQs*, https://www2.census.gov/geo/pdfs/reference/ua/2010ua_faqs.pdf (last visited Oct. 27, 2020). *See also infra* Appx. C-7. Our assessment of Tribal lands is conducted by examining the census blocks that have been identified by the Census Bureau as federally recognized Tribal lands for the 2010 Census.

Fig. II.B.26
Population (millions) by Provider Options for Fixed Terrestrial Services (Dec. 31, 2018)

	10/1 Mbps		25/3 Mbps		50/5 Mbps		100/10 Mbps		250/25 Mbps	
Providers	**Pop.**	**%**	**Pop.**	**%**	**Pop.**	**%**	**Pop.**	**%**	**Pop.**	**%**
Rural Areas										
Zero	6.032	9.3%	14.398	22.2%	19.030	29.4%	24.272	37.5%	31.468	48.6%
One	21.210	32.8%	28.121	43.4%	29.808	46.0%	30.365	46.9%	28.311	43.7%
Two	24.156	37.3%	16.709	25.8%	13.237	20.4%	8.799	13.6%	4.567	7.1%
At Least Three	13.344	20.6%	5.515	8.5%	2.667	4.1%	1.306	2.0%	0.396	0.6%
Urban Areas										
Zero	2.297	0.9%	3.912	1.5%	5.524	2.1%	7.951	3.0%	18.881	7.1%
One	29.988	11.3%	59.529	22.4%	72.740	27.3%	99.360	37.4%	151.271	56.9%
Two	136.853	51.4%	136.438	51.3%	138.975	52.2%	126.636	47.6%	84.824	31.9%
At Least Three	96.860	36.4%	66.118	24.9%	48.758	18.3%	32.051	12.0%	11.021	4.1%
Tribal Lands										
Zero	0.527	13.1%	1.117	27.7%	1.400	34.7%	1.619	40.1%	2.202	54.5%
One	1.333	33.0%	1.458	36.1%	1.646	40.7%	1.814	44.9%	1.563	38.7%
Two	1.081	26.8%	0.929	23.0%	0.861	21.3%	0.554	13.7%	0.270	6.7%
At Least Three	1.098	27.2%	0.534	13.2%	0.132	3.3%	0.051	1.3%	0.005	0.1%

129. Figures II.B.27 to II.B.31 present a demographic analysis of the average percentage of the population with coverage for the number of provider options and speed tiers by population density quartile, median household income quartile, and household count quartile.[379] We observe that the number of provider options increases with the number of households in the census block group, population density, and median household income.[380] In general, the census block groups in rural areas will have the

[379] For these figures, we include only the areas for which we have complete data. We aggregate census blocks within a census block group by competitor count category, that is, we group census blocks within a census block group by the number of competitors and then sum the population in these census blocks by competitor count category. The census blocks within a state are aggregated by provider number option groups (zero, one, two, and at least three). The census block group is the smallest geographic area for which income data is available. We use the ACS Five-Year Estimates 2014-2018 for income measures for the states, District of Columbia and Puerto Rico; income measures are not available for the other U.S. Territories. Median household income is based on 2018 data and is measured in 2018 inflation-adjusted dollars. Population Density is the total population residing in the census block group as of 2018 divided by the square miles of land in the census block group, with the estimate of land area is based upon the 2010 Census.

[380] We use the ACS Five-Year Estimates 2014-2018 for income measures. Median household income in the past twelve months is measured in 2018 inflation-adjusted dollars.

lowest population density and the lowest number of households, and are likely to have the largest percentage of the population with zero provider options, i.e., no deployment of the reported service.[381]

Fig. II.B.27
Average Percentage of Population with Multiple Provider Options for 10/1 Mbps by Census Block Group Demographic Variable (Dec. 31, 2019)

	Zero	One	Two	At Least Three
Population Density				
First Quartile (Lowest Pop. Density)	7.1%	29.9%	37.4%	25.6%
Second Quartile	1.1%	14.2%	48.5%	36.2%
Third Quartile	0.6%	9.7%	47.1%	42.6%
Fourth Quartile (Highest Pop. Density)	0.5%	6.7%	52.0%	40.7%
Median Household Income ($2018)				
First Quartile (Lowest Median Household Income)	2.9%	19.6%	42.9%	34.6%
Second Quartile	3.0%	17.6%	43.9%	35.5%
Third Quartile	2.0%	13.9%	46.3%	37.8%
Fourth Quartile (Highest Median Household Income)	0.9%	8.8%	52.2%	38.1%
Household Count				
First Quartile (Lowest Household Count)	3.1%	17.5%	46.5%	32.9%
Second Quartile	2.3%	15.5%	46.2%	36.0%
Third Quartile	2.2%	15.0%	46.0%	36.8%
Fourth Quartile (Highest Household Count)	1.8%	12.6%	46.2%	39.4%

[381] For these figures, we aggregate census blocks within a census block group by competitor count category, i.e., we group census blocks within a census block group by the number of competitors and then sum the population in these census blocks by competitor count category. The census blocks within a state are aggregated by provider number option groups (zero, one, two, and more than two). The census block group is the smallest geographic area for which income data are available.

Fig. II.B.28
Average Percentage of Population with Multiple Provider Options for 25/3 Mbps by Census Block Group Demographic Variable (Dec. 31, 2019)

	Zero	One	Two	At Least Three
Population Density				
First Quartile (Lowest Pop. Density)	16.5%	40.9%	29.6%	13.1%
Second Quartile	1.8%	25.1%	47.0%	26.1%
Third Quartile	0.8%	16.9%	48.2%	34.0%
Fourth Quartile (Highest Pop. Density)	0.7%	12.7%	51.4%	35.3%
Median Household Income ($2018)				
First Quartile (Lowest Median Household Income)	6.3%	29.1%	39.7%	24.9%
Second Quartile	6.9%	27.1%	41.2%	24.7%
Third Quartile	4.5%	23.4%	44.5%	27.6%
Fourth Quartile (Highest Median Household Income)	1.5%	15.3%	51.3%	31.9%
Household Count				
First Quartile (Lowest Household Count)	6.2%	27.0%	43.3%	23.5%
Second Quartile	5.3%	24.7%	43.6%	26.3%
Third Quartile	4.9%	23.8%	43.8%	27.5%
Fourth Quartile (Highest Household Count)	3.4%	20.0%	45.5%	31.2%

Fig. II.B.29
Average Percentage of Population with Multiple Provider Options for 50/5 Mbps by Census Block Group Demographic Variable (Dec. 31, 2019)

	Zero	One	Two	At Least Three
Population Density				
First Quartile (Lowest Pop. Density)	23.5%	46.3%	23.9%	6.3%
Second Quartile	2.3%	32.9%	47.1%	17.7%
Third Quartile	1.0%	22.5%	51.4%	25.0%
Fourth Quartile (Highest Pop. Density)	0.7%	15.3%	53.5%	30.5%
Median Household Income ($2018)				
First Quartile (Lowest Median Household Income)	7.9%	35.4%	39.1%	17.6%
Second Quartile	9.7%	32.6%	40.7%	16.9%
Third Quartile	7.1%	28.9%	44.1%	19.9%
Fourth Quartile (Highest Median Household Income)	2.3%	19.4%	52.8%	25.5%
Household Count				
First Quartile (Lowest Household Count)	8.5%	32.7%	42.3%	16.6%
Second Quartile	7.5%	30.2%	43.3%	19.0%
Third Quartile	6.9%	29.0%	43.7%	20.4%
Fourth Quartile (Highest Household Count)	4.7%	25.1%	46.7%	23.5%

Fig. II.B.30
Average Percentage of Population with Multiple Provider Options for 100/10 Mbps by Census Block Group Demographic Variable (Dec. 31, 2019)

	Zero	One	Two	At Least Three
Population Density				
First Quartile (Lowest Pop. Density)	30.7%	49.9%	16.9%	2.5%
Second Quartile	3.4%	44.7%	42.4%	9.5%
Third Quartile	1.3%	33.6%	50.3%	14.7%
Fourth Quartile (Highest Pop. Density)	0.9%	21.5%	53.8%	23.9%
Median Household Income ($2018)				
First Quartile (Lowest Median Household Income)	10.0%	43.4%	35.8%	10.8%
Second Quartile	12.7%	40.6%	36.5%	10.1%
Third Quartile	9.8%	37.5%	40.5%	12.2%
Fourth Quartile (Highest Median Household Income)	3.2%	28.0%	51.3%	17.5%
Household Count				
First Quartile (Lowest Household Count)	10.8%	40.1%	38.5%	10.6%
Second Quartile	9.9%	38.0%	39.8%	12.3%
Third Quartile	9.2%	37.2%	40.6%	13.0%
Fourth Quartile (Highest Household Count)	6.4%	34.5%	44.4%	14.7%

Fig. II.B.31
Average Percentage of Population with Multiple Provider Options for 250/25 Mbps by Census Block Group Demographic Variable (Dec. 31, 2019)

	Zero	One	Two	At Least Three
Population Density				
First Quartile (Lowest Pop. Density)	41.8%	48.1%	9.2%	0.8%
Second Quartile	8.7%	59.1%	29.1%	3.0%
Third Quartile	3.7%	54.2%	37.8%	4.3%
Fourth Quartile (Highest Pop. Density)	1.6%	45.2%	46.3%	6.9%
Median Household Income ($2018)				
First Quartile (Lowest Median Household Income)	16.4%	54.6%	26.1%	3.0%
Second Quartile	19.0%	51.7%	26.0%	3.3%
Third Quartile	14.4%	52.2%	29.7%	3.8%
Fourth Quartile (Highest Median Household Income)	5.4%	48.6%	40.9%	5.0%
Household Count				
First Quartile (Lowest Household Count)	16.0%	50.8%	30.1%	3.1%
Second Quartile	15.0%	50.4%	30.8%	3.8%
Third Quartile	14.1%	52.1%	30.1%	3.6%
Fourth Quartile (Highest Household Count)	10.7%	53.5%	31.4%	4.4%

3. Competition between Fixed and Mobile Broadband Service

130. In this section, we provide an assessment of competition between fixed and mobile broadband services. We first describe the distribution of fixed and mobile Internet usage, including trends in how consumers access the Internet. We then describe differences in service attributes, including plan characteristics, that could lead consumers to subscribe to both fixed and mobile broadband or to substitute one service for the other. Finally, we discuss technological and strategic developments that likely affect competition between fixed and mobile broadband services.

131. Technological innovation and increased deployment in both the mobile wireless and fixed broadband services markets have broadened consumers' choices of how to access the Internet. In the mobile wireless market, for example, the availability of average and median nationwide download speeds in excess of 25 Mbps by the end of 2019 have meant that in parts of the United States, consumers could rely on a mobile connection for a variety of data-intensive applications, including high quality video, that previously required fixed broadband connectivity.[382] Moreover, innovative business plans that use unlicensed spectrum have led to entry into the mobile wireless market by traditionally fixed

[382] *See supra* Fig. II.A.29. For instance, streaming high definition (HD) video generally requires a minimum download speed in the 5-8 Mbps range. *See* FCC, *Broadband Speed Guide*, https://www.fcc.gov/consumers/guides/broadband-speed-guide (last visited Oct. 27, 2020). *See also* 2020 Broadband Deployment Report, 35 FCC Rcd at 8990, para. 11.

broadband service providers.[383] Nevertheless, many households continue to subscribe to both fixed and mobile broadband service,[384] suggesting that these separate services offer benefits that are either complementary or independent of each other.[385]

132. *Distribution of fixed and mobile broadband subscribers*. Based on 2019 ACS estimates, of the estimated 122.8 million households in the United States, an estimated 106.4 million households paid for an Internet service subscription.[386] Approximately 95.8 million households paid for a cellular data plan for a smartphone or other mobile device; 15 million of these cellular data households, which represents 14% of all households with paid Internet subscriptions, relied on a mobile data plan as their only means of access.[387] In comparison, 86.9 million households subscribed to home fixed broadband Internet service in 2019; 9.1 million of these fixed broadband households, which represents roughly 9% of households with paid Internet subscriptions, relied on fixed broadband as their only means of access.[388] As Figure II.B.32 shows, the mobile-only percentage has increased somewhat from roughly 13% in 2016 whereas the fixed-only percentage declined from roughly 14% in 2016. The figure indicates that the relatively steeper decline in the fixed-only percentage compared to the relatively flat mobile-only percentage contributed to an overall decline in the percentage of households that paid for a mobile or a fixed subscription, but not for both.

[383] *See, e.g.*, CTIA Comments at 23-25; FSF Comments at 7-8. *See also 2020 Broadband Deployment Report*, 35 FCC Rcd at 8991, para. 12 (stating that "fixed broadband and mobile wireless broadband services are not functional substitutes in all cases").

[384] *See* U.S. Census Bureau, American Community Survey, *Explore Data*, https://data.census.gov/mdat/#/ (last visited Oct. 27, 2020) (overlap between households subscribing to both fixed and mobile broadband service can be assessed using the "HISPEED" and "BROADBND" variables, as discussed below).

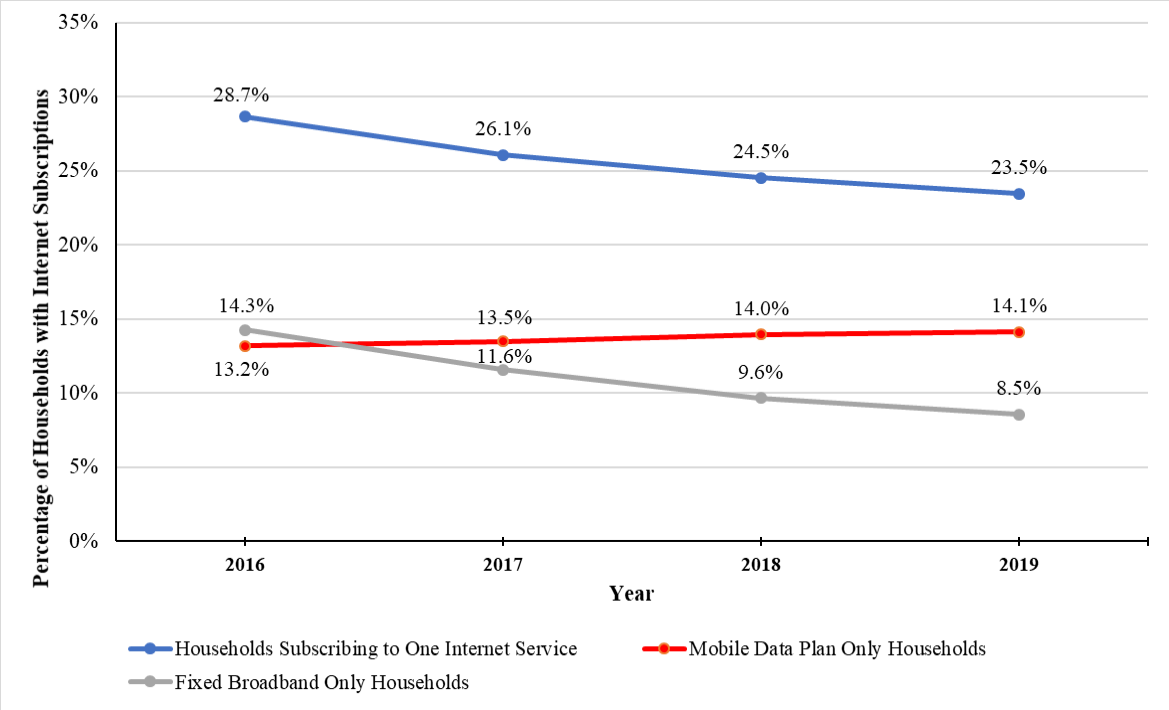
[385] *See, e.g.*, INCOMPAS Comments at 5-6; NTCA Comments at 1-3; Common Cause/NHMC Reply Comments at 3-4.

[386] The ACS asks participants who indicate that they gain access to the Internet at their "house, apartment, or mobile home" by "paying a cell phone company or Internet service provider" whether they, "or a member of [their] household have access to the Internet using" a "broadband (high speed) Internet service such as cable, fiber optic, or DSL service installed in [the] household," "cellular data plan for a smartphone or other mobile device," or other means, including satellite or dial-up Internet. *See* U.S. Census Bureau, American Community Survey, *Why We Ask Questions About Computer and Internet Use*, https://www.census.gov/acs/www/about/why-we-ask-each-question/computer/ (last visited Oct. 27, 2020). Answers to this survey question do not necessarily correspond with the Commission's current definition of advanced telecommunications capability. We note that an additional 3 million households connected to the Internet without a paid subscription. *See 2020 Broadband Deployment Report*, 35 FCC Rcd at 8987, para. 2 & n.2.

[387] Estimates based on the ACS 1-Year Estimates – Public Use Microdata Sample for year 2019. U.S. Census Bureau, American Community Survey, *Explore Data*, https://data.census.gov/mdat/#/ (last visited Oct. 27, 2020).

[388] *See* U.S. Census Bureau, American Community Survey, *Explore Data*, https://data.census.gov/mdat/#/ (last visited Oct. 27, 2020).

Fig. II.B.32
Percentage of Internet-Subscribing Households with Only One Type of Service



Source: U.S. Census Bureau, American Community Survey, 2016-2019 ACS 1-Year Estimates – Public Use Microdata Sample. Note: "Households Subscribing to One Internet Service" includes "Mobile Data Plan Only," "Fixed Broadband Only," as well as "Satellite Only," and "Other Only" subscriptions.

133. Figure II.B.33 contrasts the number of households with mobile broadband, fixed broadband, or any kind of paid Internet subscription, to, respectively, households that pay for services other than mobile broadband, households that pay for services other than fixed broadband, or households that do not have Internet service. The figure indicates that growth in mobile data subscribership helps explain the overall decline in single subscription households.

Fig. II.B.33
Total Number and Percentage of Households Accessing the Internet by Technology[389]

		2016	2017	2018	2019
Internet Subscribing Households with Mobile Data	Yes	81,016,923	87,137,750	92,022,014	95,803,806
	No	16,286,855	13,594,218	11,747,750	10,589,173
		83.3%	86.5%	88.7%	90.0%
Internet Subscribing Households with Fixed Broadband	Yes	80,039,346	82,742,020	84,693,323	86,927,655
	No	17,264,432	17,989,948	19,076,441	19,465,324
		82.3%	82.1%	81.6%	81.7%
Paid Internet Subscription Using Any Technology	Yes	97,303,778	100,731,968	103,769,764	106,392,979
	No	17,988,722	15,941,035	14,468,294	13,392,836
		84.4%	86.3%	87.8%	88.8%

Source: U.S. Census Bureau, American Community Survey, 2019 ACS 1-Year Estimates - Public Use Microdata Sample.

134. The increase in mobile-only households shown in Figure II.B.32 is consistent with findings from Pew Research. Pew reported that in 2019, 37% of Americans mostly use a smartphone when accessing the Internet, a share that has nearly doubled from 19% in 2013.[390] Among the 27% of adults surveyed who indicated that they do not subscribe to home fixed broadband, 45% stated that a smartphone does everything they need.[391] Of the 27% of survey participants who did not subscribe to home broadband in 2019, 17% were Americans who were smartphone-only Internet users and another 10% who did not use the Internet.[392] The 17% smartphone-only Internet user figure represents a decline from 20% in 2018, which marks a reversal of a generally increasing trend since 2013, when 8% of Americans were smartphone-only Internet users.[393] As Figure II.B.34 shows, the percentage of smartphone-only Internet users is higher among groups with lower levels of broadband adoption, including survey participants who were younger, black or Hispanic, or in lower income brackets.[394]

[389] The first two categories, "Internet Subscribing Households with Mobile Data" and "Internet Subscribing Households with Fixed Broadband" consist of households that paid for an Internet service. The third category, "Paid Internet Subscription Using Any Technology," consists of either households who paid for one or more Internet subscriptions ("Yes") or those who did not have Internet access ("No").

[390] Monica Anderson, *Mobile Technology and Home Broadband 2019* (June 13, 2019), https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/. This increasing trend applies to all age groups surveyed by Pew, with younger age groups more likely to have said that they mostly use a smartphone when accessing the Internet than older groups. For example, in 2019, 58% of adults aged 18-29, 47% of those aged 30-49, 27% of those aged 50-64, and 15% of those aged 65 or older responded that they mostly use a smartphone when accessing the Internet. *Id.*

[391] Monica Anderson, *Mobile Technology and Home Broadband 2019* (June 13, 2019), https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/. Pew notes that this is an increase from 27% of adults who did not subscribe to home broadband in 2015. *Id.*

[392] Monica Anderson, *Mobile Technology and Home Broadband 2019* (June 13, 2019), https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/; Pew Research Center, *Internet/Broadband Fact Sheet* (June 12, 2019), https://www.pewresearch.org/internet/fact-sheet/internet-broadband/.

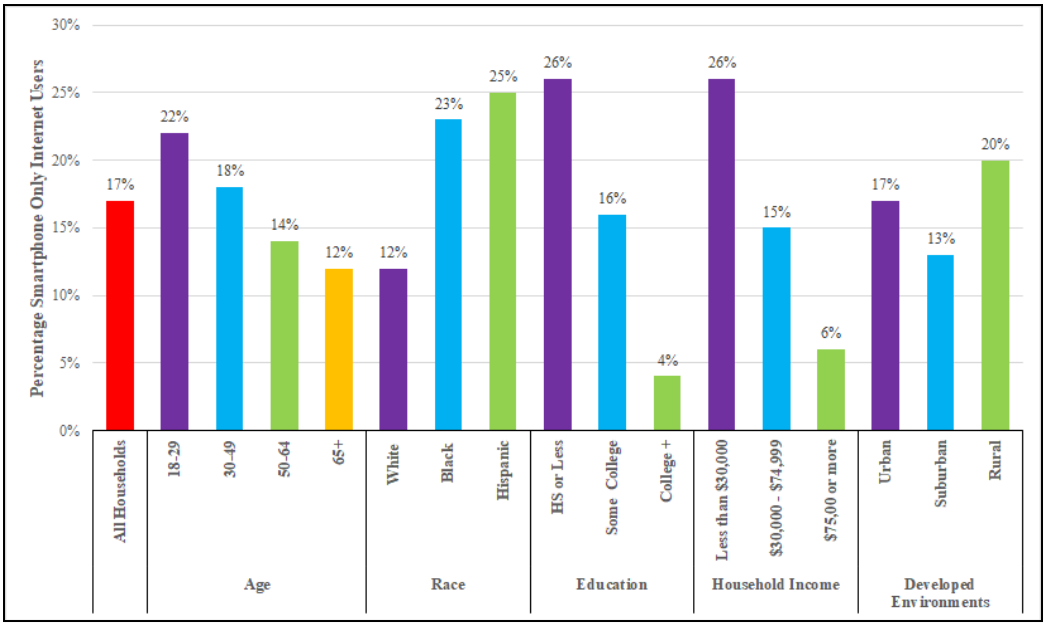
[393] *See* Pew Mobile Fact Sheet (figure illustrating smartphone dependency over time).

[394] Monica Anderson, *Mobile Technology and Home Broadband 2019* (June 13, 2019), https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/. *See also* Pew Research Center, *Internet/Broadband Fact Sheet* (June 12, 2019), https://www.pewresearch.org/internet/fact-

(continued….)

135. While the demographic trends reported in Figure II.B.34 suggest that some smartphone Internet users nevertheless view fixed and mobile broadband as complementary or independent, and only subscribe to mobile service out of budgetary considerations, additional Pew data suggest that many smartphone-only subscribers view mobile broadband as a substitute. Specifically, 6 in 10 non-fixed-broadband users say that they have never had fixed high-speed Internet service at home, and 80% say they would not be interested in having fixed broadband at home in the future.[395] We also note that, based on ACS data, it is possible that substitution goes in both directions—that is, not only might some Internet users view mobile broadband as a substitute for fixed broadband, but that fixed broadband may be viewed by some as a substitute for mobile broadband as well.[396]

Fig. II.B.34
Smartphone-Only Internet Users by Demographic, Income, and Geographic Group



Source: Mobile Technology and Home Broadband 2019, Pew Research Center, Washington, D.C. (June 13, 2019), replicated from figure entitled "17% of Americans are 'smartphone only' Internet users."

136. *Service Attributes of Fixed and Mobile Broadband.* A majority of Internet users subscribe to both fixed and mobile service. For instance, approximately 81% of the 95.8 million ACS-estimated mobile service subscribing households also subscribe to fixed broadband at home.[397] This may be driven by differences in quality and other plan characteristics, as well as complementary aspects of fixed and mobile services.

sheet/internet-broadband/ (tracking smartphone dependence over time among subgroups by age, race, gender, income, education, and community).

[395] Monica Anderson, *Mobile Technology and Home Broadband 2019* (June 13, 2019), https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/.

[396] Specifically, of an estimated 106.3 million households with smartphones, ACS estimates that only 92.8 million households subscribe to a mobile data plan, with an estimated 7.4 million of the remaining households with a smartphone not paying for Internet access, and 5.6 million subscribing to home fixed broadband. U.S. Census Bureau, American Community Survey, *Explore Data*, https://data.census.gov/mdat/#/ (last visited Oct. 27, 2020). Although some smartphone owners who indicated that they did not subscribe to a mobile data plan may have been temporary non-subscribers—for instance, due to lack of income—others may prefer to rely exclusively on Wi-Fi at home and elsewhere to access the Internet.

[397] *See* U.S. Census Bureau, American Community Survey, *Explore Data*, https://data.census.gov/mdat/#/ (last visited Oct. 27, 2020).

137. Certain commenters have emphasized that fixed broadband (particularly fiber) delivers faster speeds and permits higher consumption before data caps set in at a lower Mbps price, whereas mobile broadband offers the convenience of Internet access outside the home.[398] For example, in mid-2020, many mobile wireless 4G LTE-based "unlimited" plans stipulated that during times of network congestion, subscribers would be deprioritized if they consumed beyond a limit that was typically set to no greater than 100 GB.[399] Most plans also capped the video streaming resolution to 480p.[400] By comparison, many major fixed broadband providers either do not have a data cap or cap access at close to 1 terabyte (TB), typically charging $10 for additional 50 GB increments.[401]

138. Among mobile wireless service providers, prices for unlimited plans were typically set at $60 or more for the first line among nationwide facilities-based post-paid mobile wireless providers and $50 or more among nationwide facilities-based pre-paid providers, with a lower per-line cost for additional lines.[402] By comparison, prices among terrestrial fixed wireless providers were more localized and varied substantially with the advertised speed.[403] Whereas terrestrial fixed wireless prices typically apply to all devices at the connected premise (either through a physical connection or via Wi-Fi), mobile hotspots that allow access to devices other than those added to the mobile wireless subscription typically cost more, require a higher priced (premium) plan, or are limited in speed (e.g., to 3G).[404]

139. Speed tests also demonstrate that typical mobile broadband speeds are not yet comparable to fixed broadband speeds. In section II.A.5.d, we find that speed tests showed nationwide mean and median 4G LTE download speeds of, respectively, 36.3 Mbps and 26.2 Mbps in the second half of 2019.[405] While such speeds are comparable to fixed broadband speeds in parts of the United States, they are well below advertised speeds available in many locations, including, for instance, fiber-connected homes, where advertised speeds can reach 1 Gbps.[406] Higher speeds and greater data allowances lead many subscribers to offload their traffic to Wi-Fi connected fixed broadband networks.[407] For instance, Cisco estimates that average North American Wi-Fi speeds were 56.8 Mbps, and projected to grow to 109.5 Mbps by 2023, whereas North American mobile speeds would increase from 27 Mbps to 58.4

[398] *See* INCOMPAS Comments at 6; NTCA Comments at 3.

[399] Matt Horne, *The Best unlimited data plans in the US (October2020)* (Oct. 1, 2020), https://www.androidauthority.com/best-unlimited-data-plans-700314/.

[400] *See* Matt Horne, *The Best unlimited data plans in the US (October2020)* (Oct. 1, 2020), https://www.androidauthority.com/best-unlimited-data-plans-700314/.

[401] Dave Schafer and Peter Holslin, *Which Internet Service Providers Have Data Caps?* (Cara Haynes ed., Sept. 2, 2020), https://www.highspeedinternet.com/resources/which-internet-service-providers-have-data-caps.

[402] *See supra* section II.A.4; s*ee also* Matt Horne, *The Best unlimited data plans in the US* (Nov. 2, 2020), https://www.androidauthority.com/best-unlimited-data-plans-700314/.

[403] We note that advertised speed has also become a factor in mobile wireless pricing, with some service providers charging more for 5G speeds. *See* Matt Horne, *The Best unlimited data plans in the US* (Nov. 2, 2020), https://www.androidauthority.com/best-unlimited-data-plans-700314/.

[404] Matt Horne, *The Best unlimited data plans in the US* (Nov. 2, 2020), https://www.androidauthority.com/best-unlimited-data-plans-700314/.

[405] *See supra* section II.A.5.

[406] For instance, FSF noted that 23% of Americans can access gigabit service and over 67% can access 500 Mbps services as of the third quarter of 2019. FSF Comments at 9. *See also* Julia Tanberk, *The State of Broadband in America, Q3 2019* (Oct. 23, 2019), https://broadbandnow.com/research/q3-broadband-report-2019.

[407] *See* NTCA Comments at 3; FSF Comments at 10; USTelecom Comments, Attach. at 34 (showing percent share of U.S. IP Traffic over Wi-Fi).

Mbps during the same time period.[408] By 2022, 59% of mobile data traffic is projected to be offloaded to Wi-Fi,[409] as additional spectrum is made available for unlicensed use and with projected increases in mobile data consumption.[410]

140. *Technological and Strategic Developments*. Recent technological advancements and entry from non-traditional providers of mobile broadband are likely to further bolster competition between fixed and mobile broadband services. Two such developments are the transition to 5G and entry by traditional providers of fixed broadband into the mobile broadband market.

141. The Commission has previously found that mobile wireless providers continue to improve their networks, notably through the deployment of 5G technology, which may have performance characteristics similar to fixed services in certain environments.[411] As 5G networks become more widely available and consumers transition to 5G-capable devices, mobile connections are expected to become faster and more reliable.[412] Existing mobile broadband service providers have already begun to deploy 5G networks throughout the United States.[413] Moreover, the Commission has taken a number of actions to spur the development and deployment of 5G networks.[414]

142. In addition, major cable providers and other firms which have not previously provided mobile broadband have begun to compete with mobile broadband providers using hybrid-MVNO strategies.[415] While such competitors continue to hold a relatively small market share, some have seen their subscribership increase. For instance, Comcast has increased its number of mobile wireless broadband subscribers from 1.2 million at the end of 2018 to 2.1 million by the end of 2019, and Charter has increased its number from 134,000 at the end of 2018 to 1.1 million in 2019.[416] By bundling their

[408] Cisco, Cisco Annual Internet Report (2018–2023) at 17, Table 7, 18, Table 8 (Mar. 9, 2020), https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.html.

[409] Cisco Systems, Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2017-2022 at 17 (Feb. 2019), https://s3.amazonaws.com/media.mediapost.com/uploads/CiscoForecast.pdf.

[410] *See, e.g., Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, ET Docket No. 18-295, GN Docket No. 17-183, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 3852, 3853, para. 2 (2020) (*6 GHz Report and Order and FNPRM*).

[411] *2020 Broadband Deployment Report*, 35 FCC Rcd at 8990, para. 11.

[412] *See, e.g.*, GSMA—Global System for Mobile Communications Association, *The 5G Guide: A Reference For Operators* at 29 (Apr. 2019), https://www.gsma.com/wp-content/uploads/2019/04/The-5G-Guide_GSMA_2019_04_29_compressed.pdf.

[413] *See* Stephen Schenck, *Every 5G City and Region for Every Major Carrier in the US (Verizon, AT&T, T-Mobile, and Sprint)* (July 16, 2020), https://www.androidpolice.com/2020/03/05/verizon-att-sprint-tmobile-5g-cities/; *see also* Sarah Barry James & Taimoor Tariq, *As 5G goes nationwide, US carriers' capex, spectrum plans come into focus* (Mar. 5, 2020), S&P Global Market Intelligence, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/as-5g-goes-nationwide-us-carriers-capex-spectrum-plans-come-into-focus-57403396; Press Release, AT&T, AT&T Continues to Build 5G on the Nation's Best Wireless Network (July, 23, 2020) https://about.att.com/newsroom/2020/5g_announcements.html; Press Release, Verizon Wireless, Verizon 5G Ultra Wideband service available in more cities (Oct. 14, 2020) https://www.verizon.com/about/news/verizon-5g-ultra-wideband-service-available-more-cities.

As a condition of its merger with Sprint, T-Mobile has committed to provide 5G coverage to 99% of the population within six years, including serving 90% of the rural population with download speeds of at least 50 Mbps. *See T-Mobile-Sprint Order*, 34 FCC Rcd at 10801-28, Appx. G.

[414] *See infra* section V.A.

[415] *See supra* section II.A.

[416] *See* FSF Comments at 7-8. *See also* Press Release, Comcast, Comcast Reports 4th Quarter and Full Year 2018 Results (Jan, 23, 2019), https://www.cmcsa.com/news-releases/news-release-details/comcast-reports-4th-quarter-

(continued….)

mobile broadband services with their fixed broadband and other offerings, non-traditional competitors can provide their customers with plan options that traditional facilities-based mobile wireless providers do not offer to many of their customers.[417] At the same time, because certain cable MVNOs have only offered mobile broadband to existing residential broadband subscribers to date, their effect on nationwide mobile broadband competition has been limited.[418]

C. Voice Telephone Services

143. For decades, the public switched telephone network (PSTN) was the only means of real-time, two-way voice communications. However, due to technological advancements, such as mobile voice telephony and IP-based voice services, there now exists a multitude of other voice service options for consumers. We focus on voice services interconnected with the PSTN in our reporting, in light of the continued ubiquitous availability and use of the PSTN and interconnected services, but acknowledge that there are many other types of offerings, including apps running solely on data networks that provide similar functionality entirely outside the PSTN and nearly indistinguishable to providers and the Commission from other network data traffic.[419] Many of these apps combine the benefits of voice, video, and text communications into one data-based service.[420]

144. Modern interconnected voice services can be divided between fixed and mobile voice services. Fixed can further divided into traditional switched access connections and interconnected Voice over IP. VoIP is voice carried simply as data over an Internet Protocol network, and can be a voice service that is bundled with the underlying broadband connection or offered independent of the necessary data service (over-the-top, or OTT). Approximately 78% of the traditional switched access voice connections are provided through ILECs; conversely non-ILEC providers deliver about 82% of all VoIP subscriptions.[421]

145. *Fixed Voice*. As of December 2019, there were 1,311 providers of fixed residential voice services.[422] Of these, the five largest providers in alphabetical order are: AT&T, CenturyLink, Charter,

and-full-year-2018-results (for 1.2 million figure); Comcast Corporation, 2019 SEC Form 10-K at 4 (filed Jan. 30, 2020) (Comcast 2019 SEC Form 10-K), https://www.cmcsa.com/static-files/b5555e74-b063-4638-9503-07ebd5c1d021 (for 2.1 million figure); Press Release, Charter Communications, Charter Announces Fourth Quarter 2018 Results (Jan. 31, 2019) https://ir.charter.com/news-releases/news-release-details/charter-announces-fourth-quarter-2018-results (for 134,000 figure); Press Release, Charter Communications, Spectrum Mobile Milestone: 1.1M Subscriber Lines and Counting (Mar. 9, 2020) https://corporate.charter.com/newsroom/spectrum-mobile-mileston-1.1m-subscriber-lines-and-counting (for 1.1 million figure).

[417] For example, Comcast offers mobile wireless services using MVNO rights over Verizon's wireless network and its existing network of in-home and outdoor Wi-Fi hotspots. Comcast 2019 SEC Form 10-K at 4. We note that AT&T and Verizon mobile customers are also able to purchase fixed/mobile broadband service bundles where available in AT&T's and Verizon's fixed broadband footprints. AT&T 2019 SEC Form 10-K at 2; Verizon 2019 SEC Form 10-K at 3.

[418] Comcast 2019 SEC Form 10-K at 4.

[419] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12668, para. 203.

[420] *Id*.

[421] Based on FCC Form 477 data (*Preliminary December 2019 Voice Telephone Services Report*), the totals and percentages that are reported in this section are preliminary only, are subject to corrections as appropriate by the service provider, and the final data will be published in due course by the agency. *See, e.g.*, FCC, Wireline Competition Bureau, *Voice Telephone Services: Status as of December 31, 2018* (Mar. 6, 2020), https://www.fcc.gov/voice-telephone-services-report.

[422] *Preliminary December 2019 Voice Telephone Services Report* at Table 2.

Comcast, and Verizon. These five providers together account for approximately 68% of residential fixed voice connections.[423]

146. Retail voice subscriptions are provided through two fixed technologies: Traditional switched access and interconnected VoIP subscriptions. Our most recent data from the December 2019 FCC Form 477 shows that there are 38 million end-user switched access lines, including 15.5 million residential lines.[424] In addition, there are close to 70 million interconnected VoIP subscriptions, including 36 million residential subscriptions.[425] Of these combined 108 million fixed retail voice telephone service subscriptions, 48% were residential connections, and 52% were business connections.[426]

147. The relative growth trends between fixed switched access and interconnected VoIP services are illustrative. The number of fixed retail switched-access lines declined over the past three years at a compound annual rate of 13%, while interconnected VoIP subscriptions increased at a compound annual growth rate of 3%.[427] The number of fixed switched access providers also decreased, with 967 providers reporting fixed end-user switched access lines in December 2019, down from 992 in December 2018.[428] There were 1,457 providers of interconnected VoIP services in December 2019, up from 1,321 a year earlier.[429] As of December 2019, residential fixed voice connections were about 30% switched access and 70% interconnected VoIP, with residential switched access connections comprising only 14.4% of all fixed retail voice connections.[430]

148. *Mobile Voice*. As of December 2019, FCC Form 477 data indicate that there were 356 million mobile voice subscriptions in the United States, representing an increase in mobile voice subscriptions at a compound annual growth rate of 2% over the previous three years.[431] The number of households that eschew fixed subscriptions altogether in favor of relying solely on mobile services has been increasing. Approximately 59.2% of all households were mobile-only in late 2019, with adults in lower age-groups more likely to live in mobile-only households.[432] In the 25-29 age group, over 80% of adults lived in mobile-only households; 78.3% of those aged 30-34 lived in mobile-only households; 70.9% of those aged 35-44 lived in mobile-only households; 55.6% of those aged 45-64 lived in mobile-

[423] Staff calculations based on FCC Form 477 data.

[424] *Preliminary December 2019 Voice Telephone Services Report* at Fig. 2.

[425] *Id*.

[426] *Preliminary December 2019 Voice Telephone Services Report* at 2.

[427] *Id*.

[428] *Preliminary December 2019 Voice Telephone Services Report* at Table 2.

[429] *Id*.

[430] *Preliminary December 2019 Voice Telephone Services Report* at Fig. 2.

[431] *Preliminary December 2019 Voice Telephone Services Report* at 2. We note that the number of mobile subscriptions is larger than the population of the United States, in part because many consumers use more than one mobile device with an assigned telephone number. *See also Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 10-133, Fifteenth Report, 26 FCC Rcd 9664, 9759, para. 159 (2011).

[432] *See* U.S. Department of Health and Human Services, National Center for Health Statistics, Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January-June 2019, at 1-2 (2020).

only households; and 30.9% of those 65 and older lived in mobile-only households.[433] About 1% of households had neither mobile nor fixed voice subscriptions, as of late 2019.[434]

149. *Over-the-Top VoIP*. Fixed VoIP providers distinguish OTT VoIP, where the consumer uses an independent data service over a broadband connection, from all other types of interconnected VoIP.[435] The December 2019 FCC Form 477 data show 12.9 million OTT VoIP subscriptions and far more non-OTT VoIP, numbering 56.2 million subscriptions.[436] Mobile VoIP presents a more complicated picture, given the plethora of communications apps in smartphone app ecosystems. Data on how customers use these apps for voice communication are not reported on FCC Form 477, as many of them do not permit users to make or receive calls connecting to numbers on the PSTN, and they therefore are not classified as interconnected VoIP.[437] The dynamic nature of this subsector makes it difficult to quantify the number of users, though consumers benefit from the ever evolving choices available to meet their voice communication needs.

D. The Video Marketplace

1. Overview of the Video Programming Marketplace

150. In the United States, consumers can access video programming content from multiple sources, only some of which are licensed or regulated by the Commission. Some video providers, like broadcast television stations, have been in the marketplace for over 70 years,[438] whereas other providers, like online video providers, have more recently entered the market. The video marketplace continues to be dominated by the three categories of participants that have defined the market for the past decade: multichannel video programming distributors (MVPDs), online video distributors (OVDs), and broadcast television stations. While the three primary categories of market participants remain constant, the past two years have seen a number of changes in terms of competition among these participants, changes in consumer viewing habits, and the continued expansion of video programming options.

151. MVPDs use wireline or satellite technologies to deliver video programming to consumers. MVPDs sell channel packages, which typically include linear channels from cable networks and retransmitted broadcast television stations, as well as video-on-demand (VOD) content.[439] Traditional MVPDs include cable providers like Comcast and Charter, telephone company providers like Verizon Fios and AT&T U-verse, two direct broadcast satellite (DBS) providers—DISH and DIRECTV (owned by AT&T)—as well as numerous smaller cable and telephone company MVPDs. Continuing a downward trend that began in 2013, MVPDs shed 6.4 million video subscribers between 2018 and 2019,

[433] *See* U.S. Department of Health and Human Services, National Center for Health Statistics, Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July-December 2017, at 2 (2018).

[434] *See* U.S. Department of Health and Human Services, National Center for Health Statistics, Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January-June 2019, at 3 (2020).

[435] *Preliminary December 2019 Voice Telephone Services Report* at 1.

[436] *See Preliminary December 2019 Voice Telephone Services Report* at Fig. 3. Non-OTT interconnected VoIP service is delivered to the end-user customer's premises over a high-capacity connection by the same entity (or affiliated entity) that provides the interconnected VoIP service. OTT interconnected voice service is offered only as a stand-alone voice service while a non-OTT interconnected voice service can be offered either as a stand-alone voice service or bundled with Internet access service.

[437] 47 C.F.R. § 9.3. Examples of these services are apps such as Skype, Facebook Messenger, Facetime, and WhatsApp.

[438] Commercial television began in the late 1940s. *See* Mitchell Stephens, *History of Television*, https://stephens.hosting.nyu.edu/History%20of%20Television%20page.html (last visited Oct. 27, 2020).

[439] Linear channels offer specific video programs at a specific time of day in a manner akin to broadcast television. VOD programs are stored electronically by the provider and can be viewed by the consumer at any time, i.e., on demand.

ending 2019 with 83.4 million video subscribers. As many MVPDs also provide Internet, voice, and mobile wireless services, MVPDs continue to compete by offering discounted services to consumers who purchase video services as part of a bundle that includes some combination of other service offerings.

152. OVDs deliver video content to consumers via the Internet and have continued to proliferate and grow in the past two years. Using a variety of business models, including advertising-supported video offerings; a subscription model for access to an entire video library; and a transactional approach where consumers pay to view a movie or television episode on a per-program basis, OVDs continue to offer consumers a range of options. In addition to these models, virtual multichannel video programming distributors (vMVPDs), which deliver packages of streaming linear channels to subscribers similar to those offered by traditional MVPDs, continue to carve a foothold in the marketplace and to attract consumers away from traditional MVPDs. While OVDs often provide access to content from third-party producers, some OVDs continue to increase the amount of original and owned content they provide as a means of differentiating themselves from competitors. Subscription based OVDs and vMVPD subscriptions have risen in recent years, appearing to capture attention from consumers at the expense of traditional MVPDs. OVDs use the Internet to deliver video content to consumers.[440] OVDs include Netflix, Hulu, Amazon Prime Video, YouTube TV, Disney+, AT&T TV Now,[441] and Sling TV, as well as numerous other providers tending to focus on small or niche audiences.

153. Broadcast television stations offer linear video programming channels over the air to households that receive this programming using a television set connected to an antenna. Although many broadcast television stations are affiliated with commercial broadcast networks (e.g. ABC, CBS, FOX, and NBC), participants in this category also include independent commercial stations[442] and noncommercial educational stations. Programming aired on broadcast television stations includes local programming produced by stations, network programming, and syndicated programming. Broadcasters continue to seek to expand their video programming offerings by adding multi-cast streams, exploring new technologies, and offering content streaming via the Internet. Stations derive their revenue from the sale of advertisements during the programming and from fees paid by MVPDs for the carriage of the station's signal. Advertising revenue accounts for approximately two-thirds of revenue earned by all stations, with retransmission consent revenue accounting for the remaining one-third of revenue. While advertising revenue has remained relatively flat in recent years, retransmission consent revenue has grown substantially as the fees charged by broadcast stations to MVPDs have increased.

2. Multichannel Video Programming Distributors

a. Providers and Subscribers

154. At the end of 2019, seven MVPDs each had over one million video subscribers. These include four cable companies (Comcast, Charter, Cox, and Altice), DISH (a DBS MVPD), Verizon Fios (a telephone company MVPD), and DIRECTV (a combined DBS and telephone company MVPD).[443]

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[440] For purposes of this section, we define OVD as "an entity that distributes video programming (1) by means of the Internet or other Internet Protocol (IP)-based transmission path; (2) not as a component of an MVPD subscription or other managed video service; and (3) not solely to customers of a broadband Internet access service owned or operated by the entity or its affiliates." *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, MB Docket No. 16-247, Eighteenth Report, 32 FCC Rcd 568, 570 & n.4 (MB 2017) (*18th Video Competition Report*).

[441] AT&T's DIRECTV NOW was rebranded as AT&T TV Now in the Summer of 2019. Press Release, AT&T, DIRECTV NOW Rebrands Under AT&T TV Family (July 30, 2019), https://about.att.com/newsroom/2019/directv_now_rebrands_under_att_tv.html.

[442] Major independent stations include, for example, WGN-TV in Chicago, KCAL-TV in Los Angeles, and WHDH-TV in Boston.

[443] *See* S&P Global, *Top Cable MSOs* (last accessed Oct 27, 2020) (*Top Cable MSOs*); Ian Olgeirson, Tony Lenoir & Erica Pabst, *Multichannel Trends: Multichannel subs tank in 2019 amid shifting operator focus, viewing*

(continued….)

Twelve cable MVPDs and two telephone company MVPDs each had between 100,000 and 1 million video subscribers.[444] In addition, many small cable and telephone company MVPDs serve significantly smaller numbers of customers.[445]

155. Cable MVPDs generally serve non-overlapping franchise areas and, as a result, most consumers have access to only one cable MVPD, and cable MVPDs do not generally compete directly with one another for the same subscriber.[446] DIRECTV and DISH have national footprints and almost all consumers have access to both DBS MVPDs.[447] Telephone company MVPDs rarely compete with one another for the same subscribers; however, they almost always overbuild areas already served by at least one cable company.[448] As such, most consumers have access to one cable MVPD and two DBS MVPDs, and some consumers additionally have access to a telephone company MVPD.

156. MVPD subscribership has been declining since 2013.[449] Figure II.D.1 shows that collectively, MVPDs lost about 6.4 million video subscribers between 2018 and 2019. Cable MVPDs lost 1.8 million subscribers; DBS MVPDs lost 3.7 million subscribers; and telephone company MVPDs lost 785,000 subscribers.

Fig. II.D.1
MVPD Video Subscribers

	2018	2019	Net Change	Percentage Change
Cable	50,483,224	48,646,056	-1,837,168	-3.6%
DBS	29,127,000	25,379,487	-3,747,513	-12.9%
Telephone Company	10,223,618	9,439,003	-784,615	-7.7%
	89,833,842	**83,464,546**	**-6,369,296**	**-7.1%**

Source: S&P Global, *Multichannel Industry Benchmarks* (last accessed Oct. 27, 2020).

157. Figure II.D.2 shows the relative shares of MVPD subscribers for cable, DBS, and telephone companies. While the total number of MVPD subscribers declined from 89.8 million in 2018, to 83.5 million in 2019, cable's relative share increased, the share for DBS fell, and the share for telephone company MVPDs changed little.

priorities, S&P Global (Mar. 10, 2020) (*Multichannel Subs Tank*). We do not provide URLs for S&P Global throughout this section because it is a subscription service that cannot be publicly accessed.

[444] The twelve cable MVPDs were Mediacom, Wide Open West, Cable One, Atlantic Broadband, RCN, Midcontinent Communications, Armstrong Utilities, Service Electric Cable TV, Blue Ridge Cable Technologies, WaveDivision Holdings, TDS, and Buckeye Broadband. *Top Cable MSOs*. The telephone company MVPDs were Cincinnati Bell and Frontier Communications. *Multichannel Subs Tank*.

[445] *Top Cable MSOs*.

[446] Where cable overbuilders exist (for example, RCN) consumers have access to more than one cable MVPD. The available data, however, do not permit us to calculate how many homes have access to two cable MVPDs.

[447] We recognize that physical features (e.g., tall buildings, terrain, and trees) prevent some housing units from receiving DBS signals. *2018 Communications Marketplace Report*, 33 FCC Rcd at 12597 & n.133.

[448] S&P Global, *Cable TV Investor*, at 12-14 (Jan. 2020 Monthly Report) (*Jan. 2020 Cable Investor*).

[449] S&P Global, *U.S. Multichannel Industry Benchmarks* (last accessed Oct. 27, 2020) (*Multichannel Bechmarks*).

Fig. II.D.2
Percentage of MVPD Subscribers

Year	Cable	DBS	Telephone
2018	56.2	32.4	11.4
2019	58.3	30.4	11.3

Source: S&P Global, *U.S. Multichannel Industry Benchmarks* (last accessed Oct. 27, 2020).

158. Figure II.D.3 shows the number of subscribers at the end of 2019 for the eight largest MVPDs, which account for approximately 96% of all MVPD subscribers.

Figure II.D.3
Largest MVPDs

	2019 Subscribers
Comcast	21,641,000
AT&T[450]	19,473,000
Charter	16,320,000
Dish	12,032,000
Verizon	4,346,000
Cox	3,529,000
Altice	3,255,000
Mediacom	747,000

Source: S&P Global, *Multichannel Operator Peer Analysis* (last accessed Oct. 27, 2020).

159. According to S&P Global, many of today's legacy MVPDs experience "paper-thin margins amid ever-increasing programming costs."[451] ACA maintains that small and rural cable operators are especially challenged as they tend to pay higher rates for programming, relative to larger MVPDs.[452] Some MVPDs have discontinued selling their MVPD service to new customers.[453] These MVPDs include Google Fiber, WideOpenWest, CenturyLink, and twenty smaller MVPDs.[454]

b. Channel Packages and Bundling

160. MVPDs typically offer a variety of channel packages at different prices. For example, in mid-2020, DISH offered four packages with channel counts ranging from 190 to more than 290, priced

[450] AT&T subscribers include DIRECTV and U-verse. AT&T 2019 Annual Report at 20.

[451] *Jan. 2020 Cable Investor* at 15.

[452] ACA Connects Comments at 7-9.

[453] ATVA Comments at 5-6. *See also* John Fingas, *Google Fiber stops offering traditional TV service to new customers*, Engadget (Feb. 4, 2020), https://www.engadget.com/2020-02-04-google-fiber-drops-conventional-tv.html.

[454] *See* S&P Global, *Cable TV Investor* at 4-5 and 10-11 (Feb. 2020 Monthly Report) (*Feb. 2020 Cable Investor*); Phillip Dampier, *CenturyLink ends Prism TV Service Expansion*, Stop The Cap! (Apr. 10, 2018), https://stopthecap.com/2018/04/10/centurylink-ends-prism-tv-service-expansion/; S&P Global, *Cable TV Investor* at 7-8 (Mar. 2020 Monthly Report) (*Mar. 2020 Cable Investor*).

from $59.99 to $94.99 per month.[455] Similarly, Verizon offered three packages with channel counts ranging from 125 to more than 425, priced from $50.00 to $90.00 per month.[456] Although no two channel packages are exactly alike, there is substantial overlap in the packages offered by competing MVPDs. Traditional MVPDs tend to offer all of the major cable and broadcast networks, similar premium channels, and little in the way of exclusive content.[457] Because of their programming similarities, households typically subscribe to only one MVPD. As such, MVPDs may view competition for their channel packages as winner-take-all—an MVPD either wins the household or loses out to a rival's channel package.

161. MVPDs also generally offer VOD content and TV Everywhere services, which allows access to some channels over the Internet and to VOD programs both inside and outside the home.[458] The number of programs and channels offered on TV Everywhere varies widely among providers. For example, in early 2020, S&P Global determined that DIRECTV offered 10,625 TV Everywhere movie titles, whereas Charter offered 1,995.[459] Some MVPDs also offer their own online channel packages (e.g., Sling TV and AT&T TV Now) separate from their MVPD service. More recently, Verizon, Cincinnati Bell, and WideOpenWest began bundling online channel packages from others (e.g., YouTube TV, FuboTV, and Philo) with their Internet service offerings.[460] These online channel packages are examined more fully in our discussion of OVDs below.

162. MVPDs offer discounted rates to consumers who purchase video services as part of a bundle that includes some combination of video, Internet, voice, and mobile wireless services.[461] According to S&P Global, wireline MVPDs "have adopted a wide array of bundle options to keep the video segment relevant."[462] At the end of 2019, only approximately 10% of video subscribers from the largest cable MVPDs were standalone, approximately 40% of video subscribers purchased two services, and approximately 50% purchased at least three services.[463] Some evidence indicates that the strategy of bundling services has a positive effect on customer retention.[464]

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[455] DISH, *Satellite TV Packages, Compare Packages and Prices*, https://www.dish.com/programming/packages/ (last visited Oct. 27, 2020).

[456] Verizon, *Verizon Fios TV Packages and Plans, More than Digital Cable TV*, https://www.verizon.com/home/fiostv/ (last visited Oct. 27, 2020).

[457] The NFL Sunday Ticket, offered exclusively by DIRECTV, is perhaps the most well-known exception to this observation. *See* Todd Spangler, *DirecTV Should Retain NFL Sunday Ticket exclusively, AT&T CEO Says*, Variety (Apr. 24, 2019), https://variety.com/2019/tv/news/att-directv-nfl-sunday-ticket-exclusivity-1203196461/.

[458] TV Everywhere uses an authentication process to ensure that users subscribe to an MVPD. Outside the home refers to any location where a subscriber has access to the Internet. Some MVPDs offer fewer channels outside the home than inside the home. Charter, for example, offers all channels in the home, but fewer channels outside the home. Charter Spectrum, *Stream TV App – TV Shows, Live TV, & Movies*, https://www.spectrum.com/cable-tv/spectrum-tv-app.html (last visited Oct. 27, 2020).

[459] *Mar. 2020 Cable Investor* at 12-14.

[460] *See Jan. 2020 Cable Investor* at 14-15; *Feb. 2020 Cable Investor* at 4-5.

[461] Michelle McLean, *Cheap Cable & Internet Packages, TV Bundle Deals*, Money Saving Pro, https://www.moneysavingpro.com/internet-providers/tv-bundles/ (last visited Oct. 27, 2020); LowerMyBills, *The Best TV and Internet Bundles in 2020*, https://www.lowermybills.com/personal-finance/save-money/the-best-tv-and-internet-bundles-in-2020/ (last visited Oct. 27, 2020).

[462] Kamran Asaf, *Pricing & Packaging, Comcast bundle strategy relies on providing maximum options*, S&P Global (Mar. 30, 2020).

[463] S&P Global, *U.S. cable double-and triple-play subscribers, Q4'19* (last accessed Oct. 27, 2020).

[464] *See, e.g.*, Jeffrey Prince and Shane Greenstein, *Does Service Bundling Reduce Churn?*, 23 J. of Economics & Management Strategy, 839-75 (2014) (finding that bundling reduces subscriber churn); Jeffrey Prince, *The Dynamic*

(continued….)

c. Pricing

163. The prices displayed to consumers on MVPD websites, in mailings, or in television advertisements typically target new subscribers, and are often for a limited time, with prices increasing once the promotional period ends.[465] For example, in 2020, DIRECTV offered new subscribers price discounts for 12 months with a 24-month agreement,[466] while Comcast offered new subscribers their Signature Double Play bundle of TV and Internet for $99 per month for the first year, and $119 a month for the second year with a two-year agreement.[467]

164. With traditional MVPDs, the introductory prices are often below the prices paid by long-term subscribers whose initial contracts have expired. In addition to the advertised prices, MVPDs explain that the monthly bill may include additional broadcast fees, regional sports fees, and equipment rental fees. For example, in 2020, the Comcast Signature Double Play bundle of TV and Internet included equipment, installation, taxes and fees, Broadcast TV Fee (up to $14.95 per month), Regional Sports Fee (up to $8.75 per month) and other applicable extra charges, which were subject to change during and after the introductory term.[468] Any fees over-and-above prominently displayed advertised prices are typically included in the advertisements and listed on a subscriber's monthly billing statement.[469]

165. Subscriptions to traditional MVPD channel packages generally include the use of set-top boxes. Some MVPDs include one set-top box with the subscription and monthly rental fees for additional set-top boxes, which vary in price depending on the HD and DVR features. Some MVPDs have integrated access to a few streaming services like Netflix, Hulu, YouTube, and Amazon Video Prime into their set-top boxes, which gives MVPD subscribers the ability to access these streaming services without having to purchase additional streaming equipment.[470] The largest MVPDs also provide application software that can be downloaded to PCs, smart phones, smart TVs and streaming devices (e.g., Roku, Amazon Fire, Google Chromecast, and Apple TV) allowing subscribers to stream MVPD programming to additional TVs and other devices, without the need for additional set-top boxes.[471]

Effects of Triple Play Bundling in Telecommunications, Time Warner Cable, Research Program on Digital Communications (Winter 2012), https://pdfs.semanticscholar.org/f911/191f666a1353aad808f3a44a7c8a603718f8.pdf.

[465] This is a practice that is common in subscription and other repeat-purchase markets, in which firms exercise market power over consumers who face switching costs, while also seeking to attract existing customers of rival firms. Consumer switching costs could include transaction costs, learning costs, or contractual costs. *See, e.g.*, Paul Klemperer, *Markets with consumer switching costs*, 102 The Quarterly Journal of Economics, 375-394 (1987); Curtis R. Taylor, *Supplier surfing: Competition and consumer behavior in subscription markets*, 34 RAND Journal of Economics, 223-246 (2003).

[466] DIRECTV, *DIRECTV Official Site*, https://www.directv.com/ (last visited Oct. 27, 2020).

[467] Comcast, *Digital Cable TV Service – XFINITY*, https://www.xfinity.com/learn/digital-cable-tv (last visited Oct. 27, 2020).

[468] Comcast, *Offer Details*, https://www.xfinity.com/learn/offers/details?offerId=1776000348 (last visited Oct. 27, 2020).

[469] For example, Comcast's website offers TV and Internet for $89.99 per month. Right below the price, however, it says "Pricing and Other Info". When clicked a box opens that provides additional details including information about equipment fees, broadcast fees, and regional sports fees. Comcast, *Internet, TV, Phone, Smart Home and Security – Xfinity*, https://www.xfinity.com (last visited Oct. 27, 2020).

[470] *Mar. 2020 Cable Investor* at 4-7.

[471] For example, Charter offers the Spectrum TV App. Charter, *How to Download the Spectrum TV App – Phone, PC, & Streaming Devices | Spectrum*, https://www.spectrum.com/app (last visited Oct. 27, 2020).

166. S&P Global maintains that traditional MVPD video service has become less affordable over the past 20 years.[472] Specifically, inflation adjusted average monthly MVPD revenue per subscriber increased from $37.85 per month to $65.29 per month (approximately 73%) between 1999 and 2019.[473] Meanwhile, inflation adjusted average annual household income increased from $54,737 to $60,539 over the 20-year interval (approximately 11%).[474] However, at the same time, DVR service, VOD service, and additional channels have been added over this time period, so that service quality has changed as well.[475]

d. Video Revenue

167. *Video Revenue.* Video revenues for the largest MVPDs are shown in Figure II.D.4. According to S&P Global, video revenue from cable, DBS, and telephone company MVPDs has fallen from a peak of $116.4 billion in 2016, to $109.0 billion in 2018, and $105.0 billion in 2019.[476] Although the bulk of MVPD video revenue comes from subscriptions, MVPDs also earn revenue by selling advertising. S&P Global reports that cable MVPDs earned net local advertising revenue of $4.5 billion in 2018 and $4.2 billion in 2019.[477]

Fig. II.D.4
MVPD Video Revenue (in millions)

	2018	2019	Percentage Change
AT&T[478]	$33,357	$32,110	-3.7%
Comcast	$22,455	$22,270	-0.8%
Charter	$17,348	$17,607	1.5%
DISH[479]	$13,621	$12,808	-6.0%

Source: AT&T 2019 Annual Report at 20; Comcast 2019 SEC Form 10-K; Charter 2019 SEC Form 10-K at 32; DISH 2019 SEC Form 10-K at 81.

e. Content Ownership

168. Some traditional MVPDs have ownership interests in cable, broadcast, and regional sports networks that allow them to vertically integrate their ownership of a distribution network with ownership of video programming. For example, Comcast owns a dozen cable channels, including the NBC Sports Network, USA, E!, Syfy, MSNBC, CNBC, Bravo, Oxygen, and the Golf Channel; regional sports networks in Baltimore/Washington, Boston, Chicago, Philadelphia, Portland (Oregon), Sacramento, and San Francisco; the NBC and Telemundo broadcast networks; 11 NBC-affiliated broadcast stations, 30 Telemundo-affiliated broadcast stations; and Universal Pictures.[480] AT&T owns

[472] *Feb. 2020 Cable Investor* at 5-7.

[473] *Id*. at 5. S&P Global asserts that average monthly MVPD revenue per subscriber is a good proxy for the average monthly MVPD bill. MVPDs include cable, DBS, and telephone company MVPDs. *Id*.

[474] Calculations are derived from data from the U.S. Census Bureau and the U.S. Bureau of Labor Statistics. *Id*.

[475] *Id.* at 5-6.

[476] Tony Lenoir, *US multichannel video revenues reel from deep sub erosion in 10-year outlook*, S&P Global (Dec. 13, 2019).

[477] *Multichannel Bechmarks*.

[478] Video revenue for AT&T includes revenue from AT&T TV Now and other streaming video services.

[479] Video revenue for DISH includes revenue from Sling TV. Satellite TV 2019 revenues totaled $34 billion, a decrease from $35.5 billion in 2018. SIA Comments at 5, Appx. B; SIA *Ex Parte*, Attach. For total satellite TV revenues from 2013 through 2017, *see 2018 Communications Marketplace Report*, 33 FCC Rcd at 12673, Fig F-1.

[480] Comcast 2019 SEC Form 10-K at 6-8.

WarnerMedia, which consists of Turner, Home Box Office, Warner Bros., and regional sports networks.[481]

169. Common ownership of entities that *deliver* and entities that *supply* video programming may have implications for competition and programming diversity in the MVPD market. Thus, Congress enacted various provisions related to vertical integration between cable operators and programming networks (*e.g.*, program access, program carriage, channel occupancy limit).[482] The FCC has reviewed vertical mergers between MVPDs and owners of video content.[483] In its reviews of vertical mergers, the FCC seeks to identify and assess the potential harms and benefits that might arise. The FCC's Office of Economics and Analytics (OEA) recently commented on the analysis of vertical mergers in response to the DOJ/FTC draft vertical merger guidelines.[484] The 2020 Vertical Merger Guidelines were released on June 30, 2020.[485]

f. Commercial Availability of Equipment Used to Access MVPD Programming and Services

170. Consistent with section 629 of the Telecommunications Act of 1996,[486] and in response to a recent report from the Government Accountability Office, the Commission recently committed to gather data, solicit comments, and analyze issues relevant to whether there is a need for further regulations to ensure the commercial availability of devices to access MVPD programming.[487]

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[481] AT&T 2019 Annual Report at 22-24.

[482] *See* 47 U.S.C. §§ 533, 536, 548. In 1992, many of the most popular cable programming networks were owned by cable operators. Congress was concerned that cable operators had the ability and incentive to thwart the competitive development of additional programming networks by refusing to carry unaffiliated networks or by insisting on an ownership stake in return for carriage. *See id*. § 536. Congress was also concerned that cable operators had the ability and incentive to thwart competition in the video distribution market by withholding their most popular programming networks from rival MVPDs. *See id*. § 548.

[483] *See, e.g., Applications of Charter Communications, Inc., Time Warner Cable Inc., and Advance/Newhouse Partnership For Consent to Assign or Transfer Control of Licenses and Authorizations*, MB Docket No. 15-149, Memorandum Opinion and Order, 31 FCC Rcd 6327 (2016); *Applications of AT&T Inc. and DIRECTV for Consent to Assign or Transfer Control of Licenses and Authorizations*, MB Docket No. 14-90, Memorandum Opinion and Order, 30 FCC Rcd 9131 (2015); *Applications of Comcast Corporation, General Electric Company and NBC Universal, Inc. For Consent to Assign Licenses and Transfer Control of Licensees*, MB Docket No. 10-56, Memorandum Opinion and Order, 26 FCC Rcd 4238 (2011); *Applications of General Motors Corporation, Hughes Electronics Corporation and The News Corporation LTD*, MB Docket No. 03-124, Memorandum Opinion and Order, 19 FCC Rcd 473 (2004); *Applications for Consent to the Transfer of Control of Licenses and Section 214 Authorizations by Time Warner Inc., and America Online, Inc., et al.*, CS Docket No. 00-30, Memorandum Opinion and Order, 16 FCC Rcd 6547 (2001).

[484] Letter from Giulia McHenry, Chief, Office of Economics and Analytics, FCC, to Joseph J. Simons, Chairman, Ian R. Conner, Director, Bureau of Competition, and Andrew Sweeting, Director, Bureau of Economics, Federal Trade Commission (Mar. 2, 2020), https://www.ftc.gov/system/files/attachments/798-draft-vertical-merger-guidelines/vertical_merger_guidelines_fcc_to_ftc.pdf.

[485] *See* Vertical Merger Guidelines, U.S. Department of Justice and the Federal Trade Commission (June 30, 2020).

[486] This provision requires the Commission to "adopt regulations to assure the commercial availability—to consumers of multichannel video programming and other services offered over multichannel video programming systems—of converter boxes, interactive communications equipment, and other equipment used by consumers to access multichannel video programming and other services offered over multichannel video programming systems, from manufacturers, retailers, and other vendors not affiliated with any multichannel video programming distributor." 47 U.S.C. § 549(a).

[487] In 2016, the Commission proposed regulations for navigation devices (i.e., set-top boxes) that consumers use to access MVPD video services. *Expanding Consumers' Video Navigation Choices; Commercial Availability of Navigation Devices*, MB Docket No. 16-42 and CS Docket No. 97-80, Notice of Proposed Rulemaking &

(continued….)

Accordingly, the *2020 Public Notice* sought data and comment to "help the Commission analyze how the ongoing evolution in the video programming market affects competition in the . . . market for set-top boxes and devices, including how it affects the extent to which consumer choice for devices to access MVPD content remains a relevant aspect of the competitive environment."[488] As detailed below, our review of relevant comments and other available information revealed: A decline in consumer rental of set-top-boxes; increased usage of apps to watch MVPD programming on devices other than set-top-boxes; and increased availability of video programming services that resemble traditional MVPD products but do not require use of a set-top-box.

171. The Commission received several filings relevant to this issue,[489] each of which suggest that, due to increased competition, subscribers now rent fewer devices from their MVPDs than previously. NCTA notes that section 629 directed the Commission to "ensure that consumers have the option to purchase set-top boxes capable of accessing multichannel video programming" from entities not affiliated with their MVPD.[490] NCTA contends that "Congress's primary objective was to give consumers one new option: To buy from retail stores a device that could take the place of the device they otherwise rented from their incumbent cable operator."[491] NCTA maintains that all of the nation's largest MVPDs now support apps that can be used to watch MVPD programming without using an MVPD leased set-top box.[492] According to NCTA, in 2019, "only 47 percent of all TV sets were connected to an MVPD leased set-top box, the lowest figure ever in the era of all-digital cable television."[493] NCTA also notes that consumers now have access to video streaming services that resemble traditional MVPD services, but do not require use of a set-top box.[494] Accordingly, NCTA notes that "[f]ueled by the rise of cord-cutting, the shift to online video services, and the availability of traditional cable services through apps that run on third party devices and smart TVs, the major manufacturers of these video devices – including Roku, Apple, Google, and Amazon – now have tens of millions of active users."[495]

172. FSF notes that section 629 requires the FCC to sunset its navigation device rules when: (1) the market for MVPDs is fully competitive; (2) the market for converter boxes, and interactive equipment used for MVPDs services is fully competitive; and (3) elimination of the regulations would promote competition and the public interest.[496] FSF argues that traditional MVPDs are subject to effective competition from OVDs, including vMVPDs, device choice continues to expand, and existing

Memorandum Opinion and Order, 31 FCC Rcd 1544 (2016). In 2017, the Government Accountability Office (GAO) concluded that the Commission's proposed regulations did not sufficiently analyze "the extent to which Internet-based providers affect consumer choice for video programming and what that change means for the importance of consumer choice for devices in the context of the Act." U.S. Government Accountability Office, GAO-17-785, FCC Should Conduct Additional Analysis to Evaluate Need for Set-Top Box Regulation, at 22 (2017) (*2017 GAO Report*). Following the *2017 GAO Report*, the Commission indicated that it would use future Communications Marketplace Reports to gather data, solicit comments, and perform analysis on issues relevant to whether there is a need for further regulations to ensure the commercial availability of devices to access MVPD programming. Letter from Michelle Carey, Chief, Media Bureau, FCC to Mark Goldstein, Director, Physical Infrastructure Issues, Government Accountability Office (Sept. 21, 2017).

[488] *See 2020 Public Notice*, 35 FCC Rcd at 1580.

[489] *See generally* NCTA Comments; FSF Comments; AELP/OMI Comments.

[490] NCTA Comments at 21.

[491] *Id.*

[492] *Id.* at 21-22.

[493] *Id.* at 22.

[494] *Id.* at 23.

[495] NCTA Nov. 6 *Ex Parte* at 2.

[496] FSF Comments at 24 (citing 47 U.S.C. § 549(e)).

regulations are "unnecessary, one-sided [and] result in higher prices for consumers."[497] Accordingly, FSF maintains, the triggering conditions for section 629's sunset requirement have been met.[498] AELP/OMI argues that they "would have allowed viewers to subscribe and watch programs through applications that would reach the set-top boxes of their—not their providers'—choice while also reducing unnecessary set-top box fees," but also noting that they do "not necessarily agree with the specifics of the rule."[499]

173. Marketplace data support NCTA's assertions that MVPD subscribers are increasingly able to use applications that reach the devices of their choice and that set-top box rentals are declining. Specifically, S&P Global shows that the number of set-top boxes used by MVPD subscribers peaked in 2016 at 258 million units and declined to 222 million units in 2019.[500] Although some of the decline has been attributed to the reduction in the number of MVPD subscribers, some has been attributed to the growing usage of MVPD apps.[501] When section 629 was adopted, MVPD subscribers seeking to view their MVPD service on multiple TVs often rented a set-top box for each TV.[502] Today, MVPD subscribers can use apps to distribute MVPD service to additional TVs.

174. For example, Comcast's Xfinity TV Partner Program is expanding the range of devices that can access the Xfinity TV service and Stream app,[503] and Charter's Spectrum TV app gives subscribers the ability to access their MVPD service on a range of devices.[504] NCTA states that "[a]ll of the nation's largest MVPDs" support apps that can be used to watch their content on hundreds of millions of consumer-owned devices, such as smart TVs; tablets; streaming sticks and devices such as Apple TV, Roku, Google Chromecast, and Amazon Fire; smartphones; game consoles; and personal computers."[505] Further, NCTA asserts that almost all TV households have at least one of these devices, the average TV household has twelve of them, and consumers used more than 36.5 million such devices to watch MVPD programming without a leased set-top box in 2018—a 35% increase from the previous year.[506] In addition, the decline in the use of set-top boxes has resulted from the growth of vMVPDs which provide channel packages and VOD programming similar to those offered by traditional MVPDs, but deliver that content to consumers exclusively via the Internet and usually do not require use of any leased equipment. At the end of 2019, as shown in Figure II.D.12 below, 9.3 million households subscribed to vMVPDs. Although the data indicate that an increasing number of MVPD subscribers have the ability to use apps to view MVPD programming, whether MVPD subscribers still need a set-top box to receive their MVPD

[497] *Id.* at 24-25.

[498] *Id.* at 25.

[499] AELP/OMI Comments at 9.

[500] Ian Olgeirson & Neil Barbour, *Cable, telco and DBS set-tops dwindle in US installed forecast*, S&P Global (July 16, 2019) (*Set-Tops Dwindle*).

[501] *Id.*

[502] It was not until 2007 (11 years after section 629 was enacted) that consumers began using the Internet to stream video programming. Netflix began streaming video on demand in 2007 and PlayStation Vue and Sling TV began offering TV Channel Packages in 2015. NCTA notes that in 1996, "most consumers considered their incumbent cable operator to be their sole option for multichannel video services and set-top box equipment." NCTA Comments at 21.

[503] Comcast, *Xfinity TV Partner Program*, https://developer.comcast.com/tv-partner (last visited Oct. 27, 2020).

[504] Charter, *Stream TV App – TV Shows, Live TV, & Movies*, https://www.spectrum.com/cable-tv/spectrum-tv-app (last visited Oct. 27, 2020).

[505] NCTA Comments at 21. NCTA specifically lists Comcast, AT&T/DIRECTV, Charter, DISH, Cox, Altice, Verizon, Mediacom, and Frontier. *Id.* at 21 & n.62.

[506] *Id.* at 21-22 (citing Kagan Market Intelligence, *US Ownership of Smart TVs, SMPs, Smart Speaker Devices Continues to Climb* (Jan. 17, 2020); Kagan Market Intelligence, *US Connected Video Device Projections through 2022* (Nov. 2018); D+R International Ltd., *2018 Annual Report, Voluntary Agreement for Ongoing Improvement to the Energy Efficiency of Set-Top Boxes* at 20-22 (Aug. 13, 2019)).

programming appears to depend on the MVPD.[507] S&P Global claims, for example, that cable operators prefer to maintain at least one set-top box in the home, and offer application software to stream MVPD programming to additional televisions and other devices. [508]

175. *COVID-19 Pandemic Impact on MVPDs*. S&P Global argues that the decline in traditional MVPD subscribers did not significantly accelerate in the first half of 2020.[509] Collectively, MVPDs lost 2.1 million video subscribers in the first quarter of 2020 and another 2.2 million in the second quarter for a six month loss of 4.3 million video subscribers.[510] According to S&P Global, losses in the first six months of 2020 reflect both the impact of the economic downturn and the longer-term consumer shift to streaming services.[511]

3. Online Video Distributors

176. As noted above, an OVD is an entity that distributes video programming to consumers over the Internet, not as a component of an MVPD subscription, and not solely to customers of an ISP owned or operated by the entity or its affiliates.[512] OVD content typically is available to U.S. consumers on a nationwide basis, although in some cases (e.g., OVDs that offer cable and broadcast channels) geographic availability of OVD content can be limited.[513]

a. OVD Service Offerings

177. The OVD marketplace contains many participants, employing a variety of business models and strategies. We discuss four types of service provided by OVDs: Advertising-based Video On Demand (AVOD); Subscription Video On Demand (SVOD); Transactional Video On Demand (TVOD); and vMVPD.[514]

178. *AVOD.* These providers allow consumers to access video programming online free of charge.[515] AVODs generate revenue by including advertisements with their content.[516] Some AVOD providers are owned by large media or technology companies. For example, Google's YouTube offers a wide variety of content, including user-created videos, professionally produced video content, music

[507] *Set-Tops Dwindle*.

[508] *Id*.

[509] Ian Olgeirson, Tony Lenoir and Erica Pabst, *Traditional multichannel drop nears 2.2 million, virtual subs rebound in Q2*, S&P Global (Aug. 14, 2020) (*Traditional Multichannel Drop*).

[510] S&P Global, *US multichannel video market share trends* (last accessed Oct. 27, 2020) (*Multichannel Video Market Share Trends*).

[511] *Traditional Multichannel Drop*.

[512] Although online video includes both professional and amateur content, our focus is on content similar to the programming offered by cable and broadcast networks.

[513] For example, geographic availability may depend on contractual arrangements with cable networks, broadcast stations, and other content owners. *2018 Communications Marketplace Report*, 33 FCC Rcd at 12609, para. 86. Availability may also require building, or contracting with, content distribution networks (CDNs) to enhance the speed and quality of video content delivered to consumers. *Id.*

[514] The information in this section is current as of June 2020. We note that OVD offerings and prices continue to change.

[515] *See* Seth Shafer, *Economics of Internet: State of US online video: Ad-supported video*, S&P Global (Nov. 7, 2019) *(Shafer Ad Supported Video*); Imagen, *What are SVOD, TVOD, AVOD?*, https://imagen.io/resources/what-are-svod-tvod-avod/ (last visited June 12, 2020); Uscreen, *SVOD, AVOD, TVOD - How to Pick a Monetization Model for Your VOD*, https://www.uscreen.tv/video-business-school/svod-tvod-avod-monetization-models/ (last visited June 12, 2020).

[516] Uscreen, *SVOD, AVOD, TVOD - How to Pick a Monetization Model for Your VOD,* https://www.uscreen.tv/video-business-school/svod-tvod-avod-monetization-models/ (last visited June 12, 2020).

videos, and clips from TV shows and movies.[517] Several AVOD services provide access to movies and TV shows, including NBCUniversal's Vudu Movies On Us,[518] Amazon's IMDb TV,[519] Fox's Tubi,[520] and Crackle, which is a joint venture between Sony and Chicken Soup for the Soul Entertainment.[521] ViacomCBS's ad-supported Pluto TV service provides multi-device access to more than 250 linear channels of content, including movies, TV shows, news, and sports, as well as thousands of on-demand movies.[522] In addition, broadcast networks have branded AVOD products, including NBC News Now, CBSN, and CBS Sports HQ, which feature live news programming and news video clips.[523] Launched in July 2020, NBC's Peacock Free provides access to live and on-demand programming, including some original content.[524]

179. *SVOD.* SVOD providers charge consumers a recurring subscription fee for access to the provider's video content.[525] While it is not possible to list all providers in this report, significant SVODs include Netflix and Amazon Prime Video, both of which provide access to large libraries of video content such as television shows, movies, documentaries, and original content.[526] These services are similarly priced. Netflix costs from $8.99 to $15.99 per month,[527] while consumers can subscribe to Amazon Prime Video as a standalone service for $8.99 per month or as part to an Amazon Prime membership, which

[517] YouTube, *YouTube*, https://www.youtube.com/ (last visited June 12, 2020); *Shafer Ad Supported Video.*

[518] Vudu, *Movies On Us*, https://www.vudu.com/moviesonus (last visited June 12, 2020). NBCUniversal acquired Vudu from Walmart in April 2020. Dade Hayes, *NBCUniversal's Fandango Acquiring Vudu From Walmart*, Deadline (Apr. 20, 2020), https://deadline.com/2020/04/nbcuniversal-fandango-acquiring-vudu-walmart-comcast-streaming-1202912755/.

[519] IMDB, *IMDB TV*, https://www.imdb.com/tv/ (last visited June 12, 2020).

[520] Tubi TV, *tubi*, https://tubitv.com/home (last visited June 12, 2020).

[521] *See* Sarah Perez, *Sony's streaming service Crackle sells majority stake to Chicken Soup for the Soul*, TechCrunch (Mar. 29, 2019), https://techcrunch.com/2019/03/29/sonys-streaming-service-crackle-sells-to-chicken-soup-for-the-soul/; Janko Roettgers, *Sony Sells Stake in Crackle, Launches Joint Venture With Chicken Soup for the Soul*, Variety (Mar. 28, 2019), https://variety.com/2019/digital/news/sony-crackle-sale-joint-venture-1203174804/.

[522] Pluto TV, *Drop In. It's Free.*, https://pluto.tv/welcome (last visited June 12, 2020); Pluto TV, *Channel Lineup*, https://pluto.tv/live-tv/americas-test-kitchen (last visited June 12, 2020).

[523] NBC, *NBC News Now*, https://www.nbcnews.com/now (last visited June 12, 2020); CBS, *CBSN*, https://www.cbsnews.com/live/ (last visited June 12, 2020); CBS, *CBS Sports HQ*, https://www.cbssports.com/cbs-sports-hq/ (last visited June 12, 2020).

[524] *See* Blair Marnell, *What is Peacock?*, Digital Trends (Oct. 25, 2020), https://www.digitaltrends.com/movies/what-is-peacock/ (*What is Peacock?*); Rick Marshall, *Peacock: Everything we know about NBCUniversal's streaming video service*, yahoo!finance (Sept. 21, 2020), https://finance.yahoo.com/news/everything-know-peacock-nbcuniversal-streaming-234935742.html (*Peacock: Everything We Know*).

[525] Imagen, *What are SVOD, TVOD, AVOD?*, https://imagen.io/resources/what-are-svod-tvod-avod/ (last visited June 12, 2020); Uscreen, *SVOD, AVOD, TVOD - How to Pick a Monetization Model for Your VOD*, https://www.uscreen.tv/video-business-school/svod-tvod-avod-monetization-models/ (last visited June 12, 2020).

[526] Netflix, *What is Netflix?*, https://help.netflix.com/en/node/412 (last visited June 12, 2020); Melody Hahm, *Eye-popping chart shows how much original content Netflix is creating*, Yahoo! Finance (Dec. 17, 2019), https://finance.yahoo.com/news/netflix-original-content-disney-and-apple-plus-230418533.html; Amazon, *Prime Video*, https://www.amazon.com/gp/video/offers/ (last visited June 12, 2020).

[527] Prices vary according to how many simultaneous users are permitted and the picture quality of streamed content. Netflix, *Choose the plan that's right for you*, https://netflix.com/signup/planform (last visited June 12, 2020); Netflix, *Netflix Streaming Plans*, https://help.netflix.com/en/node/24926 (last visited June 12 2020).

costs $12.99 per month or $119 per year.[528] Amazon Prime Video also provides access to some live events, including Thursday night NFL games, as part of its membership.[529]

180. Disney controls three SVOD providers: Hulu, ESPN+, and Disney+. Like Netflix and Amazon Prime Video, Hulu provides access to a library of movies, television shows and other video content, including original programming.[530] A Hulu subscription costs $5.99 per month with commercials or $11.99 per month without commercials.[531] ESPN+ provides access to live sporting events and sports-related programing for $4.99 per month.[532] Disney+, which launched in November 2019, provides shows and movies from Disney, content Disney acquired from 20th Century Fox in March 2019, and original programming for $6.99 per month.[533]

181. Other major media companies operate SVODs as well. NBCUniversal's Peacock Premium, which costs $5 per month with commercials or $10 per month without commercials, includes approximately twice as many hours of programming as the free version and streams content in 4K.[534] CBS All Access provides access to a library of CBS shows and original content, as well as live channels such as local CBS stations, CBSN, CBS Sports HQ, and ET Live.[535] Subscribers pay $5.99 per month for the ad-supported CBS All Access service, and $9.99 monthly for a commercial-free plan.[536]

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[528] Amazon, *Amazon Prime Price Change*, https://www.amazon.com/gp/help/customer/display.html?nodeId=202213110 (last visited June 12, 2020); Amazon, *What is Prime Video? - Amazon Prime Insider*, https://www.amazon.com/primeinsider/video/prime-video-qa.html (last visited June 12, 2020); Amazon, *About the Amazon Prime Membership Fee*, https://www.amazon.com/gp/help/customer/display.html?nodeId=201910200 (last visited June 12, 2020).

[529] Amazon, *Prime Video*, https://www.amazon.com/gp/video/offers/ (last visited June 12, 2020); Amazon, *Live Events Help: Frequently Asked Questions*, https://www.amazon.com/b?ie=UTF8&node=19343854011 (last visited June 12, 2020); Amazon, *About the Amazon Prime Membership Fee*, https://www.amazon.com/gp/help/customer/display.html?nodeId=201910200 (last visited June 12, 2020).

[530] Previously, Hulu was a joint venture owned 30% each by Disney, 20th Century Fox, and Comcast, and 10% by AT&T. Laura Bradley, *How Disney Gained Full Control of Hulu—and What That Means*, Vanity Fair (May 14, 2019), https://www.vanityfair.com/hollywood/2019/05/disney-full-control-hulu-comcast-nbcuniversal-deal. Several recent transactions altered the ownership and control of Hulu, and in March 2019, Disney gained majority control of Hulu as a result of Disney's acquisition of 20th Century Fox. *Id.* Press Release, The Walt Disney Company, Disney's Acquisition of 21st Century Fox Will Bring an Unprecedented Collection of Content and Talent to Consumers Around the World (Mar. 19, 2019), https://thewaltdisneycompany.com/disneys-acquisition-of-21st-century-fox-will-bring-an-unprecedented-collection-of-content-and-talent-to-consumers-around-the-world/ (*Disney's Acquisition of 21st Century Fox*). In April 2019, AT&T sold its minority interest in Hulu back to the joint venture. Press Release, AT&T, Hulu Buys AT&T's Minority Stake in Joint Venture (Apr. 15, 2019), https://about.att.com/story/2019/hulu_buys_att_minority_stake_in_joint_venture.html. Finally, in May 2019, Comcast ceded full operational control of Hulu to Disney, with Disney committing to purchase Comcast's minority stake in Hulu in the future. Edmund Lee, *Disney to Buy Comcast's Hulu Stake and Take Full Control of Streaming Service*, New York Times (May 14, 2019), https://www.nytimes.com/2019/05/14/business/media/disney-hulu-comcast.html.

[531] Hulu, *Watch Thousands of TV Shows and Movies on Hulu*, http://hulu.com/content (last visited June 12, 2020).

[532] ESPN+, *ESPN+ Programming*, http://dtcimedia.disney.com/espn-plus/programming (last visited June 12, 2020); ESPN+, *Stream Your Favorite Sports and ESPN+ Originals*, https://plus.espn.com/sign-up-bundle (last visited June 12, 2020).

[533] *Disney+*, hulu Disney+ ESPN+, https://www.disneyplus.com/ (last visited June 12, 2020); Mike Sorrentino, Joan E. Solsman, *Disney Plus: Everything to know about the streaming service amid coronavirus lockdown*, CNET (May 6, 2020), https://www.cnet.com/news/disney-plus-everything-to-know-early-release-dates-prices-shows-movies-coronavirus/; *Disney's Acquisition of 21st Century Fox*.

[534] *See What is Peacock?*; *Peacock: Everything We Know.*

[535] CBS, *CBS All Access*, https://www.cbs.com/all-access/ (last visited June 12, 2020).

[536] Ben Moore, *CBS All Access Review*, PC Mag (Feb. 27, 2020), https://www.pcmag.com/reviews/cbs-all-access.

WarnerMedia, a subsidiary of AT&T, operates HBO Now, offering original content from HBO, including series, documentaries, and specials, and movies,[537] as well as HBO Max, which includes 10,000 hours of content, such as HBO Max originals, HBO programming, shows like *Friend*s and *The Big Bang Theory*, and movies from Studio Ghibli.[538] Both HBO services cost $14.99 per month.[539]

182. In addition, certain technology companies operate SVOD services. For example, in November 2019, Apple launched Apple TV+, which the company touted as "the first all-original video subscription service."[540] Consumers can subscribe to Apple TV+ for $4.99 per month.[541] Google's YouTube Premium provides ad-free access to YouTube, YouTube Music (YouTube's music streaming service), and some original content for $11.99 per month.[542]

183. Certain SVODs focus on niche content. For example, BritBox provides access to British television shows from ITV and the BBC for $6.99 per month or $69.99 per year.[543] DC Universe starts at $7.99 per month and provides access to TV shows and movies based on DC Comics.[544] In addition, SVODs from many sports leagues and organizations, such as the NBA, NHL, and WWE, provide online access to live and archived events and programs.[545]

184. *TVOD.* Unlike the subscription models that offer access to a catalog of programs for a set monthly price, TVOD providers allow consumers to purchase specific video content (movies, television programs, or live events) on a transactional or per-program basis.[546] Electronic-sell-through transactions provide consumers with permanent access to video content, while download-to-rent

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[537] HBO, *How to Watch HBO Max*, https://www.hbo.com/hbo-news/hbo-max-hbo-go-hbo-now-difference (last visited June 12, 2020).

[538] HBO, *How to Watch HBO Max*, https://www.hbo.com/hbo-news/hbo-max-hbo-go-hbo-now-difference (last visited June 12, 2020); *see also* Kevin Webb, *HBO Max is WarnerMedia's ambitious attempt to take on Netflix, and it's now available to stream — here's how to sign up*, Business Insider (July 31, 2020), https://www.businessinsider.com/hbo-max-streaming-service (*WarnerMedia's Ambitious Attempt*).

[539] HBO Now | Help Center, *How much does HBO NOW cost?*, https://help.hbonow.com/Answer/Detail/13 (last visited June 12, 2020); *see also WarnerMedia's Ambitious Attempt*.

[540] Press Release, Apple, Apple TV+ launches November 1, featuring originals from the world's greatest storytellers (Sept. 10, 2019), https://www.apple.com/newsroom/2019/09/apple-tv-launches-november-1-featuring-originals-from-the-worlds-greatest-storytellers/.

[541] Apple, *Apple TV+*, https://www.apple.com/apple-tv-plus/ (last visited June 12, 2020).

[542] YouTube, *YouTube Premium*, https://www.youtube.com/premium (last visited June 12, 2020); YouTube *Using YouTube Premium benefits*, https://support.google.com/youtube/answer/6308116 (last visited June 12, 2020); YouTube, *Watch YouTube Originals*, https://support.google.com/youtube/answer/6358146 (last visited June 12, 2020). YouTube Premium subscribers also can download videos to watch offline and play videos on a mobile device while using other apps or when the screen is off. YouTube, *Using YouTube Premium benefits*, https://support.google.com/youtube/answer/6308116 (last visited June 12, 2020).

[543] BritBox, *Welcome to BritBox*, https://www.britbox.com/us/ (last visited June 12, 2020).

[544] Jordan Minor, *DC Universe Review*, PC Mag (Mar. 20, 2020), https://www.pcmag.com/reviews/dc-universe; Brett White, *Everything You Need to Know about DC Universe*, Decider (Feb. 27, 2019), https://decider.com/2019/02/27/what-is-dc-universe/.

[545] *See, e.g.* NBA, *Watch the NBA On Demand*, https://www.nba.com/watch/pricing (last visited June 12, 2020); NHL, *Watch live games online with NHL GameCenter LIVE*, https://www.nhl.com/news/watch-live-games-online-with-nhl-gamecenter-live/c-500925 (last visited June 12, 2020); WWE, *WWE Network*, https://www.wwe.com/wwenetwork?gclsrc=aw.ds&gclid=EAIaIQobChMIpNKEztXl6QIVA4nICh35lwsREAAYASAAEgKYlfD_BwE&gclsrc=aw.ds (last visited June 12, 2020).

[546] Imagen, *What are SVOD, TVOD, AVOD?*, https://imagen.io/resources/what-are-svod-tvod-avod/ (last visited June 12, 2020); Uscreen, *SVOD, AVOD, TVOD - How to Pick a Monetization Model for Your VOD*, https://www.uscreen.tv/video-business-school/svod-tvod-avod-monetization-models/ (last visited June 12, 2020).

transactions give consumers access to video content for a limited period of time.[547] Examples include Amazon's Video Store,[548] Apple's iTunes Store,[549] and Google Play.[550]

185. *vMVPD.* Like traditional MVPDs, vMVPDs offer consumers access to a package of streaming linear channels.[551] While MVPDs make use of cable, fiber, or satellite infrastructure to deliver their pay television products, like other OVD services, vMVPDs deliver content to consumers via the Internet.[552] In 2015, these services launched in select metropolitan markets with comparatively limited access to local broadcast networks, sports, and news.[553] Today, however, vMVPD services often include local broadcast channels and a wide variety of cable networks, and tend to be marketed to consumers who wish to "cut the cord" and no longer subscribe to a traditional MVPD service.[554] In general, vMVPDs are available to consumers on a wide variety of devices.[555]

186. vMVPD pricing tends to vary depending on many factors, including the number and type of channels, and the availability of local broadcast stations. Some vMVPDs provide fewer channels for a lower cost. For example, Philo subscribers pay $20 per month for close to 60 channels, but the service does not include sports or broadcast channels.[556] DISH's Sling TV offers two channel packages, one with approximately 30 channels and one with approximately 50 channels, which cost $30 per month

[547] Imagen, *What are SVOD, TVOD, AVOD?*, https://imagen.io/resources/what-are-svod-tvod-avod/ (last visited June 12, 2020).

[548] Amazon, *Prime Video: Store*, https://www.amazon.com/b/?_encoding=UTF8&filterId=OFFER_FILTER%3DTVOD&node=2858778011&ref=insider_ar_video_pvqa (last visited June 12, 2020).

[549] Apple, *Buy movies and TV shows from the Apple TV app*, https://support.apple.com/en-us/HT203375 (last visited June 12, 2020).

[550] Google Play Help, *Watch Google Play movies & TV shows*, https://support.google.com/googleplay/answer/2851683?co=GENIE.Platform%3DiOS&hl=en (last visited June 12, 2020).

[551] *See, e.g.*, Susan Engleson, *When Linear TV and Digital Collide: The Rise of the Virtual MVPD*, Comscore (Aug. 14, 2018), https://www.comscore.com/Insights/Blog/When-Linear-TV-and-Digital-Collide-The-Rise-of-the-Virtual-MVPD.

[552] *See, e.g., id.*

[553] *See* Seth Shafer, *Economics of Internet: State of US online video: virtual multichannel*, S&P Global (Oct. 22, 2019) (*Shafer Virtual Multichannel*). Sony's PlayStation Vue launched in March 2015 and was one of the first vMVPDs, but the service ceased operations in January 2020. Sarah Perez, *Why Sony's PlayStation Vue Failed*, TechCrunch (Jan. 30, 2020), https://techcrunch.com/2020/01/30/why-sonys-playstation-vue-failed/.

[554] *See, e.g.*, Brad Adgate, *Virtual MVPD Subscriber Growth Is Slowing*, Forbes (Dec. 9, 2019), https://www.forbes.com/sites/bradadgate/2019/12/09/virtual-mvpd-subscriber-growth-is-slowing/#6f65a8bb7016 ("virtual MVPDs . . . have been marketed as replacement cable/satellite systems"); Sling TV, *The best of cable, for less*, https://www.sling.com/value/cable-tv-alternatives (last visited June 12, 2020) ("Between the low monthly cost, versatile lineup options and wide variety of supported streaming devices, it's no wonder that Sling is often called the best alternative to cable"); Mindy Woodall, *Philo Streaming Review 2020*, Reviews.org (Dec. 11, 2019), https://www.reviews.org/tv-service/philo-live-tv-streaming/ ("Most [vMVPDs] offer a bunch of different channels and add-ons to try to mimic your cable TV provider so you can cut the cord and stream live channels") (*Philo Streaming Review*).

[555] *See Shafer Virtual Multichannel*.

[556] *See Philo Streaming Review*; Philo, *Live and On Demand TV*, https://try.philo.com/ (last visited June 12, 2020). Users can add premium channels from Epix and Starz at additional cost. Philo, *Live and On Demand TV*, https://try.philo.com/ (last visited June 12, 2020).

individually or $45 per month for both.[557] These packages include some news and sports content, but local broadcast availability is limited to NBC and Fox stations in select markets.[558]

187. More expansive vMVPD offerings include Hulu + Live TV, which combines access to Hulu's SVOD library with more than 65 live and on-demand TV channels for $54.99 per month.[559] The service includes news and sports content, and local broadcast stations and regional sports networks are available in select markets.[560] For $64.99 per month, YouTube TV offers consumers access to more than 85 channels, including sports and news programming,[561] and asserts that it provides "complete local network coverage in over 98% of U.S. TV households."[562] AT&T TV Now offers subscription-based channel packages ranging from 45 to 125 channels, priced from $55 to $135 per month.[563] In March 2020, AT&T launched AT&T TV, which offers channel packages ranging in price from $49.99 per month to $64.99 per month, not including regional sports fees.[564] Both services continue to add local stations, but availability varies by market.[565] Fubo TV offers three plans—Family (99 channels for $59.99 per month), Ultra (168 channels for $84.99 per month) and Latino (29 channels for $29.99 per month)[566] and also offers local CBS, Fox, and NBC stations in many markets.[567] In recent years, many vMVPD providers have added more channels (including broadcast channels, news, and sports) and functionality to

[557] Sling TV, *Personalize your channel lineup*, https://www.sling.com/service (last visited June 12, 2020).

[558] Sling TV, *Personalize your channel lineup*, https://www.sling.com/service (last visited June 12, 2020); Sling TV, *Can I get local channels on Sling TV?*, https://help.sling.com/en/support/solutions/articles/460000000093-can-i-get-local-channels-on-sling-tv- (last visited June 12, 2020). For additional cost, subscribers can add focused channel packages (e.g., sports, news, kids, comedy), some premium networks (e.g., Showtime, Starz), Spanish-language channels, international programming, and world sports. Sling TV, *Customize Your Channel Lineup With Sling Extras*, https://www.sling.com/service/extras (last visited June 12, 2020).

[559] Hulu, *Watch Thousands of TV Shows and Movies on Hulu*, http://hulu.com/content (last visited June 12, 2020). Subscribers also receive 50 hours of cloud DVR storage. Hulu, *Watch Thousands of TV Shows and Movies on Hulu*, http://hulu.com/content (last visited June 12, 2020).

[560] Austin Meadows, *Hulu Live TV channel list 2020: What channels are on Hulu + Live TV?*, Soda (Mar. 14, 2020), https://www.soda.com/video/hulu-channels-list/.

[561] YouTube, *YouTube TV*, https://tv.youtube.com/welcome/ (last visited July 10, 2020). YouTube TV subscribers also can record programming with unlimited storage space. *Id*.

[562] YouTube, *YouTube TV*, https://tv.youtube.com/welcome/ (last visited July 10, 2020).

[563] AT&T, *Get More TV Freedom*, https://www.atttvnow.com/ (last visited June 12, 2020). VOD content, premium channels, and Spanish-language and international add-ons are also available. *Id*.

[564] Press Release, AT&T, AT&T TV Launches Nationwide Starting Today (Mar. 2, 2020), https://about.att.com/story/2020/att_tv.html; AT&T, *Get AT&T TV and enjoy a year of HBO® included*, https://www.att.com/tv/ (last visited June 12, 2020). AT&T TV customers also can access more than 40,000 on-demand titles. *Id*. Like a traditional cable or satellite MVPD, AT&T TV's price is good for 12 months with a two-year initial agreement, and customers are required to use equipment provided by the company. *Id*.; *see also* Michael Timmermann, *AT&T TV vs. AT&T TV Now: What's the Difference?*, Clark (Apr. 6, 2020), https://clark.com/streaming-tv/att-tv-att-tv-now-comparison/.

[565] *See* Dennis Restauro, *AT&T TV NOW Review, Channels, and Cost*, Grounded Reason (Jan. 3, 2020), https://www.groundedreason.com/att-tv-now-review-channels-and-cost/; Jess Barnes, *AT&T TV NOW and AT&T TV Add More Locals*, Cord Cutters News (Mar. 27, 2020), https://www.cordcuttersnews.com/att-tv-now-and-att-tv-add-more-locals/.

[566] Fubo TV, *Welcome*, https://www.fubo.tv/welcome (last visited July 10, 2020). Plans also provide 500 hours of Cloud DVR and the ability to watch on multiple screens simultaneously. *Id*.

[567] John-Michael Bond, *Here's how to see which local channels you'll get with FuboTV*, The Daily Dot (Feb. 25, 2020), https://www.dailydot.com/upstream/fubotv-local-channels/.

their offerings and increased their prices.[568] As a result, many vMVPD offerings available today look quite a bit like more traditional pay TV offerings.[569]

188. *Bundles and Combinations*. Sometimes OVDs are offered in bundles or in combination with other services. For example, consumers can bundle all three Disney OVD products—Hulu, ESPN+, and Disney+—for $12.99 per month.[570] AT&T TV subscribers get a free year of HBO Max, and a discount is available to customers who bundle AT&T TV with Internet access service from AT&T.[571] Amazon Prime members also can add on-demand or live streaming content from providers like HBO, SHOWTIME, STARZ, CBS, PBS, and Major League Baseball for an additional $4.99 to $14.99 per month.[572] Amazon's Twitch, a platform for live video streaming, includes a "Watch Parties" feature that allows streamers with subscriptions to Prime Video to watch movies together as part of a social online experience.[573]

b. Original Content and Content Ownership

189. As the OVD marketplace has evolved, providers have begun to include original content.[574] Recently, Apple stated that it would spend over $6 billion on original content for its rollout of Apple TV+,[575] and while estimates vary, they tend to show that OVD spending on original content is increasing generally. Figure II.D.5 shows original content spending for select OVDs[576] We also note that while Amazon's 2019 production of 70 first-run original titles and 314 hours of original content represented slight decreases from the previous year, Netflix produced 2,701 hours and 657 new titles in 2019, up 78% and 70%, respectively, from 2018.[577] As of the middle of 2020, Disney+ listed more than

[568] *See Shafer Virtual Multichannel* ("expanded availability, content and functionality has come with a price, with most virtual multichannel services significantly bumping up prices in 2018 and 2019"); Ben Munson, *An updated timeline of price hikes at YouTube TV and other vMVPDs*, Fierce Video (July 1, 2020), https://www.fiercevideo.com/video/updated-timeline-price-hikes-at-youtube-tv-and-other-vmvpds (detailing vMVPD price increases since 2018, many of which occurred when services added channels to their lineups).

[569] *See Shafer Virtual Multichannel*.

[570] Disney+, *hulu Disney+ ESPN+*, https://www.disneyplus.com/ (last visited Oct. 27, 2020). This bundle provides ad-supported access to Hulu's on-demand library and does not include Hulu + Live TV. *Id*.

[571] AT&T, *Get AT&T TV and enjoy a year of HBO® included*, https://www.att.com/tv/ (last visited Oct. 27, 2020).

[572] Amazon, *What is Prime Video? - Amazon Prime Insider*, https://www.amazon.com/primeinsider/video/prime-video-qa.html (last visited Oct. 27, 2020); *see also* David Katzmaier, *Amazon Prime Video Channels: Everything you need to know*, CNET (May 23, 2019), https://www.cnet.com/news/amazon-prime-video-channels-everything-you-need-to-know/.

[573] *See* Joseph Yaden, *What Is Twitch*, DigitalTrends (Oct. 25, 2020), https://www.digitaltrends.com/gaming/what-is-twitch/; Twitch, *Watch Parties*, https://help.twitch.tv/s/article/watch-parties?language=en_US (last visited Oct. 27, 2020).

[574] *See, e.g., 2018 Communications Marketplace Report*, 33 FCC Rcd at 12606-07, paras. 78-79.

[575] Mike Murphy, *Apple TV+ spending more than $6 billion on new shows, plans to launch before Disney+: report*, MarketWatch (Aug. 19, 2019), https://www.marketwatch.com/story/apple-tv-spending-more-than-6-billion-on-new-shows-plans-to-launch-before-disney-report-2019-08-19.

[576] Figures for 2020 and certain months in 2019 are projections.

[577] Joseph O'Halloran, *Netflix overwhelms Amazon in original programming in 2019*, Rapid TV News (Mar. 18, 2020), https://www.rapidtvnews.com/2020031858218/netflix-overwhelms-amazon-in-original-programming-in-2019.html#axzz6O9Ase0rx (citing *Omdia Original Online Production Report – 2020*).

50 original movies and shows,[578] and Apple TV+ had 30 original shows and films, with more in development and a commitment to add new content each month.[579]

Fig. II.D.5
Original Content Spending, Select OVD Providers ($ millions)

Provider	2018	2019	Percentage Change	2020	Percentage Change
Amazon	734.0	1,253.0	70.7%	1,783.0	41.3%
Apple	---	115.5	---	438.4	279.6%
Disney+	---	63.0	---	426.0	576.2%
Netflix	2,090.9	2,812.2	34.5%	3,568.1	26.9%

Source: S&P Global, *Amazon Prime, Apple TV+, Disney+, Netflix estimated streaming programming costs* (last accessed Oct. 27, 2020).

190. Additionally, spending by Amazon and Netflix on original content as a percentage of overall content spending generally has been increasing. Figure II.D.6 shows that Amazon's spending on original content has increased from approximately 6% of overall content spending in 2014 to a projected 24% in 2020. Similarly, Netflix spent approximately 7% on original content in 2014, but was projected to spend 29% in 2020.

Fig. II.D.6
Comparison of Spending on Original and Acquired Content, Amazon and Netflix
($ millions, Percentage of Overall Content Spending)

Provider and Content Type	2014	2015	2016	2017	2018	2019	2020
Amazon Original Content	$52 (5.7%)	$131 (9.0%)	$320 (13.9%)	$492 (13.4%)	$734 (14.5%)	$1,253 (19.5%)	$1,783 (23.7%)
Acquired Content	854 (94.3%)	1,330 (91.0%)	1,978 (86.1%)	3,186 (86.6%)	4,312 (85.5%)	5,177 (80.5%)	5,755 (76.3%)
Netflix Original Content	$180.2 (6.8%)	$428.9 (12.6%)	$842.3 (17.6%)	$1,449.1 (23.4%)	$2,090.9 (27.8%)	$2,812.2 (27.4%)	$3,568.1 (28.9%)
Acquired Content	2,476.1 (93.2%)	2,976.5 (87.4%)	3,946.2 (82.4%)	4,748.8 (76.6%)	5,441.2 (72.2%)	7,449.3 (72.6%)	8,773.0 (71.1%)

Source: S&P Global, *Amazon Prime, Netflix estimated streaming programming costs* (last accessed Oct. 27, 2020).

191. As larger media companies like Disney, NBCUniversal, and WarnerMedia Disney launch their own OVD services, they are working to assemble substantial libraries of programming to offer to consumers.[580] Increasingly, large content owners are electing to use their own OVD services, instead of third-party platforms, to make their content available online. For example, in advance of the Disney+ launch, Disney announced that it would pull all Disney and Pixar movie titles from Netflix, and that

[578] Disney+, *All Disney+ Originals*, https://disneyplusoriginals.disney.com/ (last visited Oct. 27, 2020).

[579] Benjamin Mayo, *Apple TV+ Guide: Here are all the Apple TV shows and movies available now*, 9 to 5 Mac Oct. 23, 2020), https://9to5mac.com/2020/05/29/apple-tv-plus-tv-shows-movies-guide/.

[580] Lesley Goldberg, *'The Office' to Leave Netflix in 2020, Stream Exclusively on NBCUniversal's Forthcoming Service*, The Hollywood Reporter (June 25, 2019), https://www.hollywoodreporter.com/live-feed/office-leave-netflix-2020-stream-exclusively-nbcuniversals-forthcoming-service-1220954 (*'The Office' to Leave Netflix*).

Disney+ would be the home for all Disney movies going forward.[581] After the company's acquisition of 21st Century Fox (later rebranded 21st Century), Disney-owned Hulu became the exclusive streaming home of FX network content.[582] *The Office*, which is owned by NBCUniversal's TV studio, currently streams on Netflix, but will stream exclusively on Peacock beginning in 2021.[583] The agreement by which NBCUniversal and Comcast gave Disney full control of Hulu allows both Hulu and Peacock to offer NBC programming, but gives NBCUniversal the right to pull programming off of Hulu in 2022.[584] Some popular shows owned by Warner Brother's Television—including *Friends* (which was pulled from Netflix at the beginning of 2020) and *The Big Bang Theory*—will now stream on WarnerMedia's HBO Max exclusively.[585]

192. This trend is not universal, however. For example, shows co-produced by Universal Television (an NBCUniversal subsidiary) and Wolf Entertainment, including *Law and Order: SVU*, several seasons of *Law and Order* and *Law and Order: Criminal Intent*, as well as *Chicago Fire*, *Chicago P.D.*, and *Chicago Med*, will stream on NBCUniversal's OVD offering Peacock, but that deal is not exclusive, allowing those series to stream on other platforms as well.[586] At least two shows produced by Warner Bros. Television—*The George Lopez Show* (which was broadcast on ABC) and *Two and a Half Men* (which was broadcast on CBS)—will stream on Peacock, not HBO Max.[587]

c. OVD Usage, Subscribers, and Revenue

193. *AVOD.* Figure II.D.7 shows widespread usage of AVOD services among U.S. consumers. 84% of respondents to the Kagan Consumer Insights Spring 2019 Survey indicated that they or someone in their household used one or more free websites or services to watch online video.[588] Among individual websites and services, YouTube, Facebook, and broadcast network websites were the most popular.[589]

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[581] Michelle Castillo, *Disney will pull its movies from Netflix and start its own streaming services*, CNBC (Aug. 9, 2017), https://www.cnbc.com/2017/08/08/disney-will-pull-its-movies-from-netflix-and-start-its-own-streaming-services.html.

[582] *See* Julia Alexander, *Disney is using FX to ensure people don't forget about Hulu*, The Verge (Nov. 17, 2019), https://www.theverge.com/2019/11/7/20954171/disney-hulu-fox-fx-series-movies-searchlight-streaming-wars-netflix-hbo; Adam B. Vary, *Disney Drops Fox Name, Will Rebrand as 20th Century Studios, Searchlight Pictures*, Variety (Jan. 17, 2020), https://variety.com/2020/film/news/disney-dropping-fox-20th-century-studios-1203470349/.

[583] *See* Joan E. Solsman, *NBC's Peacock: Everything about NBCUniversal's semi-free streaming app*, CNET (Oct. 23, 2020), https://www.cnet.com/news/nbc-peacock-streaming-prices-devices-us-launch-dates-shows-movies-originals/, (*Peacock: Everything About*); *'The Office' to Leave Netflix*.

[584] *Peacock: Everything About.*

[585] Andrea Francese, *This is the Real Reason 'The Big Bang Theory' Isn't Streaming on Netflix in the United States and Probably Never Will*, Showbiz Cheat Sheet (Jan. 6, 2020), https://www.cheatsheet.com/entertainment/this-is-the-real-reason-the-big-bang-theory-isnt-streaming-on-netflix-in-the-united-states-and-probably-never-will.html/.

[586] Jennifer Maas, *'Two and a Half Men' to Stream Exclusively on NBCUniversal's Peacock, Instead of HBO Max*, The Wrap (Jan. 16, 2020), https://www.thewrap.com/two-and-a-half-men-peacock-streaming-nbcuniversal-not-hbo-max/.

[587] *Id.*

[588] *See Shafer Ad Supported Video*; S&P Global, *Estimated US instream and outstream video ad revenues, 2014-2023* (last accessed Oct. 27, 2020) (*Estimated Instream and Outstream Revenues*). The survey of 2,511 respondents was conducted in March 2019. *See Shafer Ad Supported Video*.

[589] *See id.*; *Estimated Instream and Outstream Revenues*.

Fig. II.D.7
U.S. AVOD Usage, Kagan Consumer Insights Spring 2019 Survey

AVOD Service	Percentage of Respondents That Reported Using Service
YouTube	71%
Facebook	46%
Network TV Websites	27%
The Roku Channel	13%
Crackle	10%
IGTV (Instagram)	8%
Pluto TV	8%
Vudu Movies On Us	8%
Snapchat Discover	7%
Tubi TV	6%
Crunchyroll	5%

Source: Seth Shafer, *Economics of Internet: State of US online video: Ad-supported video*, S&P Global at 6 (Nov. 7, 2019) (last accessed Oct. 27, 2020).

194. Revenue for AVOD providers continues to increase. Figure II.D.8 shows AVOD revenue figures for instream advertisements (advertisements shown within video content) and outstream advertisements (advertisements not connected to a content video stream, e.g. video ads in social media feeds/streams, and pause, menu, and lock screens).[590]

Fig. II.D.8
U.S. AVOD Video Advertising Revenue ($ millions)

	2018	2019	Percentage Change	2020	Percentage Change
Instream Advertisements	$12,573	$14,312	13.8%	$15,660	9.4%
Outstream Advertisements	$2,865	$3,851	34.4%	$4,731	22.9%
Total	**$15,438**	**$18,163**	**17.7%**	**$20,391**	**12.3%**

Source: Seth Shafer, *Economics of Internet: State of US online video: Ad-supported video*, S&P Global at 3 (Nov. 7, 2019); S&P Global, *Estimated US instream and outstream video ad revenues, 2014-2023*.

195. *SVOD*. Figure II.D.9 shows that SVOD subscribership is increasing. In addition, it is common for households to subscribe to more than one SVOD service. 19% of the respondents to the Kagan Consumer Insights Fall 2019 Survey indicated that they subscribed to two SVODs, and 37% indicated that they subscribed to three or more.[591] According to a September 2018 S&P Global survey, 21% of U.S. consumers use two SVOD services, and 29% use three or more subscription OTT services.[592] These numbers increase for younger consumers. Among U.S. consumers aged 38 to 52, 22% use two SVOD services, and 33% use three or more SVOD services.[593] These figures are 25% and 42%,

[590] *See Shafer Ad Supported Video*; *Estimated Instream and Outstream Revenues*.

[591] Seth Shafer, *Economics of Internet: State of US online video: Subscription video on demand*, S&P Global (Oct. 31, 2019) (*Shafer Subscription Video*).

[592] Ali Choukeir and Seth Shafer, *State of US OTT*, S&P Global (Apr. 25, 2019).

[593] *Id*.

respectively, for consumers aged 18 to 37.[594] Online video subscription revenue is also increasing. This revenue was $16.11 billion in 2019, an increase of 17.3% from $13.73 billion in 2018.[595] Projected revenue for 2020 is $18.55 billion, an increase of 15.1% from the previous year.[596]

Fig. II.D.9
U.S. SVOD Subscribers

	Q4 2018	Q4 2019	Percentage Change
Subscribers (millions)	164.0	219.8.	34.1%

Source: S&P Global, *Q4'19 top US video provider rankings* (Apr. 23, 2020) (last accessed Oct. 27, 2020).

196. *TVOD.* Figure II.D.10 indicates that online rental of video content by U.S. consumers is increasing slightly, resulting in slight revenue growth for TVOD providers.[597]

Fig. II.D.10
U.S. Online Rental of Video Content

	2018	2019	Percentage Change	2020	Percentage Change
Rentals (millions)	346.3	353.2	2.0%	358.1	1.4%
Revenue ($ millions)	$1,682.1	$1,717.5	2.1%	$1,743.3	1.5%

Source: S&P Global, *US Online Video Projections* (last accessed Oct. 27, 2020).

197. Figure II.D.11 indicates that since 2018, online sale of movie titles by U.S. consumers have increased slightly, while online sale of TV television titles decreased, resulting in modest revenue growth for OVD providers.[598]

[594] *Id*.

[595] *See Shafer Subscription Video*; S&P Global, *US Online Video Projections* (last accessed Oct. 27, 2020) (*Online Video Projections*).

[596] *See Shafer Subscription Video*; *Online Video Projections*.

[597] *Id*.

[598] *Id*.

Fig. II.D.11
U.S. Online Sale of Video Content

	2018	2019	Percentage Change	2020	Percentage Change
Movie Title Purchases (millions)	109.6	117.7	7.4%	124.1	5.4%
Movie Title Revenue ($ millions)	$1,507.3	$1,619.4	7.4%	$1,710.1	5.6%
TV Title Purchases (millions)	325.2	308.9	-5.0%	301.2	-2.5%
TV Title Revenue ($ millions)	$682.9	$650.7	-4.7%	$636.3	-2.2%
Total Revenue ($ millions)	**$2,190.2**	**$2,270.1**	**3.6%**	**$2,346.4**	**3.4%**

Source: S&P Global, *US Online Video Projections* (last accessed Oct. 27, 2020).

198. *vMVPD*. Figure II.D.12 shows that both subscriber numbers and revenues for vMVPD providers have been increasing.

Fig. II.D.12
U.S. vMVPD Subscribers and Revenue

	2018	2019	Percentage Change	2020	Percentage Change
Subscriber Households (millions)	7.1	9.3	31.0%	10.8	16.1%
Revenue ($ billions)	2.78	4.64	66.9%	6.01	29.5%

Source: Seth Shafer, *Economics of Internet: State of US online video: virtual multichannel*, S&P Global at 4 (Oct. 22, 2019).

199. Finally, we provide subscriber numbers for select SVOD and vMVPD providers. With some exceptions, Figure II.D.13 indicates that individual OVDs have seen subscribership increases between 2018 and 2019.

Fig. II.D.13
Total Subscribers, Select SVOD and vMVPD Providers (millions)[599]

OVD	Q4 2018	Q4 2019	Percentage Change
Amazon *	63.1	71.6	13.5%
Netflix	58.5	61.0	4.3%
Hulu *	22.8	30.4	33.3%
Disney+ *	---	25.2	---
HBO * #	6.5	10.4	60.0%
ESPN+ *	1.4	6.6	371.4%
Starz * #	3.6	5.6	55.6%
Showtime * #	4.0	5.2	30.0%
CBS All Access *	4.0	5.0	25.0%
Hulu Live TV	1.7	3.2	88.2%
Sling TV	2.4	2.6	8.3%
YouTube TV *	0.8	2.0	150.0%

Source: S&P Global, *Top US video subscription services, ranked by Q4'19 subscribers* (last accessed Oct. 27, 2020).

200. *COVID-19 Pandemic Impact on OVDs.* MoffettNathanson reports a strong first half in 2020 for the top SVOD services, but notes that growth of these services is moderating as penetration approaches 75% of U.S. households.[600] According to S&P Global, vMVPDs collectively gained 856,000 subscribers in the second quarter of 2020, after losing 125,000 in the first quarter, for a six-month gain of 731,000 subscribers.[601] S&P Global attributes the growth in vMVPD subscriptions largely to AT&T's efforts to transition customers to AT&T TV.[602]

4. Broadcast Television Stations

201. Broadcast television stations offer linear video programming channels over the air to households. In addition, households may also receive broadcast television station programming channels from MVPDs and, in some cases, OVDs. Many commercial broadcast stations air programming produced by the station itself, typically local news, sports, and events, in addition to programming acquired from affiliated broadcast networks or syndicators.[603] Commercial broadcast television stations generate revenue from two main sources: Advertising sales and payments negotiated with MVPDs and OVDs for the right to retransmit broadcast station signals.

[599] Figures for providers marked with a * are estimates. Figures for premium networks marked with a # include all OTT sources and exclude traditional multichannel units. Figures for Hulu include subscribers who have access through a Hulu + Live TV subscription. *See* S&P Global, *Top US video subscription services, ranked by Q4'19 subscribers* (last accessed Oct. 27, 2020).

[600] Jason Aycock, *MoffettNathanson sees growth maturing for streaming VOD platforms*, Seeking Alpha (Oct. 14, 2020), https://seekingalpha.com/news/3622188-moffettnathanson-sees-growth-maturing-for-streaming-vod-platforms.

[601] *Multichannel Video Market Share Trends*.

[602] *Traditional Multichannel Drop*.

[603] *See, e.g.*, Nexstar Media Group, Inc., SEC Form 10-K at 5 (filed Mar. 13, 2020) (Nexstar 2019 SEC Form 10-K).

a. Station Licensing and Ownership

202. The Commission licenses broadcast television stations consistent with the Communications Act.[604] Licenses were formerly granted pursuant to comparative hearings among interested applicants.[605] Today, the Commission awards broadcast television licenses by auction, although the Commission has not auctioned a license for a new full-power commercial television station since 2011.[606] Figure II.D.14 shows that the number of licensed broadcast television stations has remained stable in recent years.

Fig. II.D.14
Number of Licensed Broadcast Television Stations

	2015	2016	2017	2018	2019	2020
Commercial UHF[607]	1,031	1,031	1,033	1,011	1,013	1,001
Commercial VHF	359	356	350	364	370	371
Non-Commercial	395	395	394	390	378	387
Total Stations	1,785	1,782	1,777	1,765	1,761	1,759

Source: FCC, Broadcast Totals as of Mar. 31, 2015; Mar. 31, 2016; Mar. 31, 2017; Mar. 31, 2018; Mar.31, 2019; and Mar. 31, 2020.[608]

203. Whereas Figure II.D.14 shows the number of television stations in the United States, each viewer can only access the stations in his or her market. Figure II.D.15 is a scatterplot of the number of stations per market by market size (measured in TV households), where each point represents a market.[609] The data show that the number of television stations available increases with market size. While the median market has seven stations, because the population is concentrated in the largest markets, most TV households have access to at least 13 stations. In addition, many television broadcast stations use digital transmission technologies to offer multiple programming streams (digital multicast channels) to

[604] 47 U.S.C. § 151 *et seq.* *See also* 47 CFR §§ 73.601-73.699, 73.1001-73.4280. In this section, we focus on full-power broadcast television stations. In addition to these stations, the Commission licenses Class A and low-power television stations, as well as television translator and satellite stations which are used to increase the geographic reach of the associated main station.

[605] KPMG, *History of Broadcast License Application Process* at 4 (Nov. 2000), https://transition.fcc.gov/opportunity/meb_study/broadcast_lic_study_pt1.pdf.

[606] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12613, para. 90.

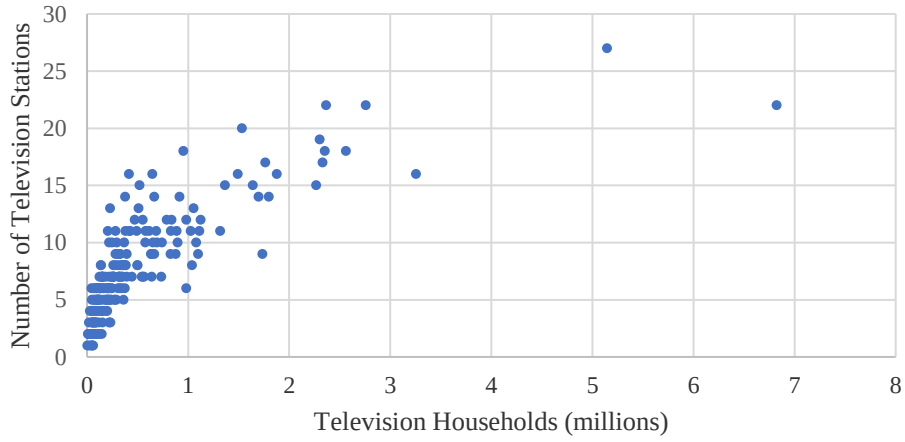
[607] Very high frequency (VHF) stations operate on channels 2-13, while ultra-high frequency (UHF) stations operate on channels 14-51.

[608] Press Release, FCC, Broadcast Station Totals as of March 31, 2015 (Apr. 9, 2015), https://docs.fcc.gov/public/attachments/DOC-332923A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2016 (Apr. 6, 2016), https://docs.fcc.gov/public/attachments/DOC-338754A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2017 (Apr. 11, 2017), https://docs.fcc.gov/public/attachments/DOC-344256A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2018 (Apr. 9, 2018), https://docs.fcc.gov/public/attachments/DOC-350110A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2019 (Apr. 2, 2019), https://docs.fcc.gov/public/attachments/DOC-356801A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2020 (Apr. 6, 2020), https://docs.fcc.gov/public/attachments/DOC-363515A1.pdf.

[609] Fig. II.D.15 defines broadcast television markets using Nielsen's designated market area (DMA) definitions. Each DMA is a group of counties that form an exclusive geographic area in which the home market television stations capture a dominance of total hours viewed. There are 210 DMAs, covering the entire continental United States, Hawaii, and parts of Alaska. The DMA boundaries and DMA data are owned solely and exclusively by Nielsen. Nielsen, *DMA Regions*, https://www.nielsen.com/us/en/intl-campaigns/dma-maps/ (last visited Oct. 27, 2020).

viewers.[610] This suggests that the number of stations shown in Figure II.D.15 is a lower bound for the number of broadcast channels available in each market.

Fig. II.D.15
Television Stations by Market Size



Source: FCC, *Licensing and Management System*; BIA, *Media Access Pro*; Nielsen, *DMA Universe Estimates 2019-2020* (Sept. 2019).

204. Most television stations are owned by companies that own multiple stations, called station groups.[611] Figure II.D.16 shows information about the twelve largest station groups in the United States by share of TV households reached. These station groups each reach more than 20% of TV households. The table lists the number of stations owned by each group and the number of markets in which the station group owns at least one station. The share of TV households reached by the station group is the total number of TV households living in markets where the station group owns at least one station divided by the total number of TV households in the United States.

[610] *See, e.g.*, Nexstar 2019 SEC Form 10-K at 9-12.

[611] About 85% of stations are part of station groups. S&P Global, *Top TV Station Owners* (last accessed Oct. 27, 2020).

Fig. II.D.16
Largest Broadcast Television Station Groups by TV Households Reached[612]

Station Group	Stations	Markets	Share of TV Households Reached
ION	71	61	69.5%
Nexstar	162	116	62.1%
Univision	40	25	45.5%
Fox	30	18	39.2%
TEGNA	62	51	39.0%
ViacomCBS	28	17	38.4%
Sinclair	115	84	38.3%
Comcast	27	20	37.5%
E.W. Scripps	48	41	31.4%
WRNN-TV Associates	11	9	25.3%
Gray	126	92	24.0%
Disney	8	8	22.7%

Source: S&P Global, *Top TV Station Owners* (last accessed Oct 27, 2020); Nielsen, *DMA Universe Estimates 2019-2020* (Sept. 2019).

b. Distribution and Delivery

205. Broadcast television stations reach viewers by broadcasting signals directly over the air to homes, as well as through carriage agreements with MVPDs and OVDs, which retransmit the signals of stations to households subscribing to their services.[613] The over-the-air reach of a broadcast television station is determined largely by the height of the transmission tower and the power of the transmitter.[614] Buildings, hills, and other objects, however, may interfere with over-the-air signals.[615]

206. MVPDs offering service within a DMA typically carry the local broadcast television stations assigned to the DMA, and each MVPD rebroadcasts the stations' signals to all its subscribers in the DMA.[616] This is because broadcast stations typically hold exclusive rights to broadcast network programming in a DMA.[617] Thus, unlike cable networks that are available nationwide, most broadcast television stations' signals are retransmitted by MVPDs only within the station's assigned DMA.[618]

[612] Fig. II.D.16 shows stations, markets, and TV households reached as of October 27, 2020. On September 24, 2020, E.W. Scripps announced its intention to purchase ION Media. Press Release, E.W. Scripps, Scripps Creates National Television Networks Business with the Acquisition of ION Media, (Sept. 24, 2020), https://scripps.com/press-releases/scripps-creates-national-television-networks-business-with-acquisition-of-ion-media/. ION submitted applications for transfer of control to the Commission on October 13, 2020. *See* FCC File Nos. BTCCDT-20201013AAO, ABV, ACH. As of October 27, 2020, the transaction had not yet been consented.

[613] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12614, para. 96.

[614] *Id.* at 12614, para. 94 & n.260.

[615] *Id.* at 12614, para. 94.

[616] *Id.*

[617] *Id.*

[618] *Id.*

Rebroadcast of television stations' signals by online vMVPDs follows a similar pattern—subscribers located in a DMA receive signals of local broadcast television stations from the same DMA.[619]

207. When a broadcast station negotiates with MVPDs and OVDs for carriage of its programming, it is in the business of content distribution—similar to a cable network.[620] When a broadcast station delivers programming over the air, it is in the business of content delivery—similar to facilities-based MVPDs.[621]

c. Programming and Content Ownership

208. *Programming.* Broadcast television stations air network programming, programming produced by the station, and syndicated programming.[622] Network programming is provided by broadcast television networks to stations through affiliation agreements. In an affiliation agreement, the station receives network programming and, in exchange, the network receives affiliation fees and the right to sell some portion of the advertising time during the programming.[623] The major broadcast television networks (ABC, CBS, Fox, and NBC) generally offer entertainment, news, and live sports programming.[624] In addition, major Spanish language networks (Telemundo and Univision) now reach most U.S. TV households and offer entertainment, news, and sports programming primarily aimed at Hispanic viewers.[625]

209. Smaller networks, including networks that air exclusively on digital multicast channels, often offer niche programming, aimed at a particular demographic group or focusing on specific subject matter. For example, Bounce offers programming primarily aimed at African-American viewers, MeTV airs classic television series, Dabl is a lifestyle network, Comet airs science fiction programming, and Justice Network airs true crime programming.[626] Much of the programming aired on smaller networks is syndicated programming, but some smaller networks also air original programming.[627]

210. In addition to network programming, many stations also produce local news programming. A joint study by the Radio Television Digital News Association and Hofstra University

[619] *Id*.

[620] *Id.* at 12614, para. 96.

[621] *Id.* at 12614, para. 96. Although we discuss the wider business of television broadcasting, we focus on competition in the market for the delivery of video programming. We therefore consider most closely the role played by the over-the-air broadcast service.

[622] *See, e.g.*, Nexstar 2019 SEC Form 10-K at 5; Sinclair Broadcast Group Inc, SEC Form 10-K at 5 (filed Mar. 2, 2020) (Sinclair 2019 SEC Form 10-K).

[623] *See, e.g.*, Nexstar 2019 SEC Form 10-K at 14.

[624] *See, e.g.*, Comcast 2019 SEC Form 10-K; Fox Corporation, SEC Form 10-K, at 2 (filed Aug. 9, 2019) (Fox SEC Form 10-K); ViacomCBS, SEC Form 10-K, at I-2 (filed Feb. 20, 2020) (ViacomCBS 2019 SEC Form 10-K).

[625] *See* Comcast 2019 SEC Form 10-K at 7; Univision, *Univision Network*, https://corporate.univision.com/blog/portfolio/properties/univision/ (last visited Oct. 27, 2020). Both Univision and Telemundo affiliated broadcast stations reach about 60% of U.S. TV households. S&P Global, *TV Stations by Market and Affiliation* (last accessed Oct. 27, 2020).

[626] The E.W. Scripps Company, SEC Form 10-K, at 10 (filed Feb. 28, 2020) (E.W. Scripps 2019 SEC Form 10-K); Weigel Broadcasting, *National Networks*, https://www.weigelbroadcasting.com/national/ (last visited Oct. 27, 2020); ViacomCBS 2019 SEC Form 10-K at I-5; Sinclair 2019 SEC Form 10-K at 12; TEGNA Inc., SEC Form 10-K, at 5 (filed Mar. 2, 2020) (TEGNA 2019 SEC Form 10-K).

[627] Marc Berman, *No longer just for reruns, diginets grab the eye of major advertisers*, Campaign (Nov. 8, 2016), https://www.campaignlive.com/article/no-longer-just-reruns-diginets-grab-eye-major-advertisers/1414937.

found that about 42% of stations produced local newscasts.[628] These stations produced newscasts that aired on their own stations and on other stations. In total, about 63% of stations aired a local newscast, and stations airing local news aired about six hours of local news per weekday.[629] Some large station groups have also established news bureaus in Washington, DC. These news bureaus provide national news coverage and interviews with members of Congress to local broadcast stations owned by the associated station group.[630]

211. In addition to providing broadcast network and local news programming, broadcast television stations negotiate with national program distributors and syndicators to be exclusive providers of first-run and rerun content in their DMAs.[631] Syndicated programming agreements are structured in a similar way to network affiliation agreements—the station obtains the rights to syndicated programming in exchange for advertising time, fees, or both.[632] Syndicated programming often represents a long-term financial commitment; stations usually purchase syndicated programming several years in advance and sometimes must make multi-year commitments.[633]

212. *Ownership of Content.* In addition to owning broadcast stations and other properties, Disney, ViacomCBS, Fox, Comcast, and Univision each own interest in at least one broadcast network (ABC, CBS and the CW, Fox, NBC and Telemundo, and Univision, respectively).[634] Further, Disney, Comcast, and ViacomCBS each own large television production studios.[635] These studios produce programming that is licensed to broadcast networks.[636] Univision also owns a television studio which produces video content for its network.[637] Owning video content allows its owner to generate revenue from fees to license the content internationally or domestically. In addition, several other broadcast groups also produce and own programming. Sinclair Broadcasting Group and Gray Television produce

[628] The study reports that 706 TV stations originated local news out of 1,685 operating, non-satellite television stations. Bob Papper, *A Shocking Development: A Small Increase in Local TV Newsrooms ... and a Record Amount of Local* News, RTDNA/Hofstra University at 1, 6 (2019), https://www.rtdna.org/uploads/files/2019%20RTDNA-Hofstra%20Survey%20TV%20News%20Numbers.pdf (*2019 RTDNA/Hofstra Study*).

[629] The study reports that 1,069 TV stations aired local news out of 1,685 operating, non-satellite television stations. *See 2019 RTDNA/Hofstra Study* at 1, 3, 6.

[630] Sinclair 2019 SEC Form 10-K at 13; Nexstar 2019 SEC Form 10-K at 6; E.W. Scripps SEC Form 10-K at 4.

[631] Nexstar 2019 SEC Form 10-K at 15; Gray Television, Inc., SEC Form 10-K at 12 (filed Feb. 27, 2020) (Gray 2019 SEC Form 10-K).

[632] Nexstar 2019 SEC Form 10-K at 13; Gray 2019 SEC Form 10-K at 11.

[633] Sinclair 2019 SEC Form 10-K at 34-35.

[634] The Walt Disney Company, SEC Form 10-K, at 4 (filed Nov. 20, 2019) (Disney SEC Form 10-K); ViacomCBS 2019 SEC Form 10-K at I-2, I-3; Fox 10-K at 8; Comcast 2019 SEC Form 10-K at 7; Univision, *Univision Network*, https://corporate.univision.com/portfolio/properties/univision/ (last visited Oct. 27, 2020).

[635] Disney SEC Form 10-K at 4; Comcast 2019 SEC Form 10-K at 7; ViacomCBS 2019 SEC Form 10-K at I-3. Fox owned its own television production studios, Twentieth Century Fox Television and Fox 21 Television Studios, until it sold the studios to Disney in 2019. *See also* Georg Szalai, Paul Bond, *Disney Closes $71.3 Billion Fox Deal, Creating Global Content Powerhouse*, The Hollywood Reporter (Mar. 19, 2019), https://www.hollywoodreporter.com/news/disney-closes-fox-deal-creating-global-content-powerhouse-1174498.

[636] Studios may license shows to either the associated broadcast network or other broadcast networks. Emily VanDerWerff, *Brooklyn Nine-Nine and Last Man Standing were saved from cancellation for the same reason*, Vox (May 15, 2018), https://www.vox.com/culture/2018/5/15/17352724/brooklyn-nine-nine-last-man-standing-cancellation-revival-saved.

[637] Univision owns W Studios, which is a production studio that develops primetime series for U.S. Hispanic audiences. Univision, *W Studios*, https://corporate.univision.com/portfolio/properties/w-studios/ (last visited Oct. 27, 2020).

weekly national political programs which air on their stations.[638] TEGNA produces a daily news and entertainment program which airs on its stations.[639]

d. Broadcast Television Revenue

213. *Advertising Revenue.* Broadcast television stations air advertising spots during breaks in programming. A station sells all the advertising spots aired during programming produced by the station itself and some of the advertising spots aired during network and syndicated programming.[640] A broadcast television station also earns advertising revenue from any banner or video ads placed on its website.[641]

214. The price of an advertising spot is generally determined by the size and demographic composition of the program's audience.[642] High demand for television advertising in a market (e.g., due to many advertisers competing for available time or the absence of alternative advertising media) raises the price of an advertising spot.[643] Demand for television ads is also higher during election years (generally even-numbered years), when national, state, and local political campaigns purchase ads,[644] and during the second and fourth quarters of the year due to consumer spending patterns.[645] Conversely, a weak local or national economy reduces demand for advertising and ad prices fall.[646]

215. Both local and national businesses buy advertising spots from broadcast television stations. Advertising spots are sold to local advertisers directly through a station's local sales staff while national advertisers generally work with national advertising sales representative firms to buy advertising time.[647] Figure II.D.17 shows annual gross revenues for broadcast stations for the period 2016-2019. Total advertising revenue was about $21.9 billion in 2019. Local advertising revenue makes up the largest share of advertising revenue. Specifically, local news programs produced by the station generate a large share of local ad revenue.[648] Advertising revenue has remained relatively flat over the past five years, but its share of total gross revenue has fallen from more than 75% in 2015 to about 65% in 2019.

[638] Sinclair Broadcasting Group produces *Full Measure with Sharyl Attkisson* and *America this week with Eric Bolling*. Sinclair SEC Form 10-K at 12. Gray Television produces *Full Court Press with Greta Van Susteren*. Gray News, *Gray Television Launches Syndicated Weekend Political Show with Greta Van Susteren* (Sept. 4, 2019), https://graytv.gcs-web.com/static-files/9375070f-3b71-48e6-a567-fedac4024f58.

[639] TEGNA produces *Daily Blast LIVE*. TEGNA, *TEGNA Announces Host Lineup, Fall Premiere Date for "Daily Blast LIVE"* (July 20, 2017), https://www.tegna.com/tegna-announces-host-lineup-fall-premiere-date-for-daily-blast-live/.

[640] *See, e.g.*, Nexstar SEC Form 10-K at 13; TEGNA SEC Form 10-K at 3.

[641] *See, e.g.*, Gray SEC Form 10-K at 39.

[642] *See, e.g.*, Nexstar SEC Form 10-K at 13; Gray SEC Form 10-K at 4; TEGNA SEC Form 10-K at 3; Sinclair SEC Form 10-K at 23.

[643] *See, e.g.*, Nexstar SEC Form 10-K at 13; Gray SEC Form 10-K at 4; Sinclair SEC Form 10-K at 23.

[644] *See, e.g.*, Nexstar SEC Form 10-K at 14; Gray SEC Form 10-K at 10; TEGNA SEC Form 10-K at 3; Sinclair SEC Form 10-K at 6.

[645] *See, e.g.*, Nexstar SEC Form 10-K at 14; Gray SEC Form 10-K at 10, 14; TEGNA SEC Form 10-K at 19; Sinclair SEC Form 10-K at 56.

[646] *See, e.g., id*. at 34; Gray SEC Form 10-K at 20; TEGNA SEC Form 10-K at 15; Nexstar SEC Form 10-K at 32.

[647] *See, e.g., id*. at 13, 14; TEGNA SEC Form 10-K at 3.

[648] *See, e.g.*, Nexstar SEC Form 10-K at 6; Gray SEC Form 10-K at 4; Sinclair SEC Form 10-K at 13.

Fig. II.D.17
Broadcast Television Station Industry Gross Revenue Trends (millions)

	2015	2016	2017	2018	2019
Total Advertising	$20,888	$22,855	$21,302	$23,516	$21,890
Local	$12,071	$12,028	$12,173	$12,124	$12,342
National	$6,211	$6,055	$5,934	$5,839	$5,921
Political	$717	$2,654	$866	$3,037	$960
Online	$1,890	$2,117	$2,329	$2,515	$2,666
Retransmission Consent	$6,423	$7,979	$9,374	$10,570	$11,715
Total	$27,312	$30,834	$30,676	$34,086	$33,605

Source: S&P Global, *U.S. TV station industry total revenue projections, 2009-2024* (June 2019).

216. *Retransmission Consent Revenue.* Many broadcast television stations generate revenue by granting MVPDs and OVDs the right to carry their signals. Pursuant to section 325 of the Act, MVPDs may not retransmit a broadcast television station's signal without the station's express permission.[649] If a station elects retransmission consent, the station and MVPD negotiate a carriage agreement, which often includes monetary or other types of compensation for the television station.[650] Monetary compensation is often based on the number of MVPD subscribers in the carriage agreement.[651] If a carriage agreement cannot be negotiated, the MVPD must stop retransmitting the station's broadcast signal and viewers lose access to the station through the MVPD, in what is known as a blackout. Figure II.D.17 also shows retransmission consent revenue over the period 2015-2019. Retransmission consent revenue continued to grow, although its growth rate had declined from nearly 25% from 2016 to 2017 to about 10% from 2018 to 2019.

217. *COVID-19 Pandemic Impact on Broadcast Television Stations.* Advertising revenue fell in both the first and second quarters of 2020 compared to the first and second quarters of 2019.[652] For a group of four prominent television broadcasters (Sinclair Broadcasting Group, Nexstar Media Group, Gray Television, and E.W. Scripps Company), advertising revenue declines, excluding political advertising revenue, ranged from 1.0% to 8.1% in the first quarter and from 16.5% to 36.0% in the second quarter.[653] Executives from these companies, however, reported improvements in advertising revenue each month of the second quarter.[654] Retransmission consent revenues have not been meaningfully affected by the COVID-19 pandemic. Although traditional MVPD subscribers declined during the first half of 2020, it is unclear whether this decline can be attributed to the COVID-19 pandemic. Even with subscriber declines, retransmission consent revenue earned by major station groups increased in both the first and second quarters of 2020 by nearly 20% compared to the first and second quarters of 2019.[655]

[649] 47 U.S.C. § 325(b). Every three years, commercial television stations must elect either the right to grant consent for the MVPDs in the DMA to retransmit the station's signal or the right to receive mandatory carriage by those MVPDs. *Id.* § 325(b)(3)(B); 47 CFR §§ 76.56(b), 76.64.

[650] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12615-16, para. 100.

[651] *See, e.g.*, Nexstar SEC Form 10-K at 14.

[652] *See* Atif Zubair, *Broadcast ad revenues to slide further post Q1 mid-single digit ad pullback*, S&P Global (June 4, 2020) (*Broadcast TV 2020 Q1 Results*); Atif Zubair, *Broadcasters see improvement in core ad revenue after double-digit dip in Q2*, S&P Global (Aug. 26, 2020) (*Broadcast TV 2020 Q2 Results*).

[653] Advertising revenue declines are based on same station results. *See Broadcast TV 2020 Q1 Results, Broadcast TV 2020 Q2 Results.*

[654] *See Broadcast TV 2020 Q2 Results*.

[655] Atif Zubair, *TV station retrans growth keeps double-digit momentum in Q2*, S&P Global (Aug. 19, 2020).

5. Competition in Video

218. We now discuss various aspects of competition among MVPDs, OVDs, and broadcast television stations. In doing so, we present data on household subscription to, and use of, multiple video services, as well as total subscription figures for the top video services. We also examine competition in advertising by presenting advertising revenue estimates by sector.

219. *Time, Location, and Device Flexibility.* As noted above, many consumers value the ability to watch video programming at any time and in any place. In response to consumer preferences, MVPDs, which traditionally offered linear video programming channels to view on a television set in the home, today also offer VOD content and DVR services as discussed above. In addition, many MVPDs offer TV Everywhere which allows subscribers to watch programming on devices other than a television set anywhere that has an internet connection. Among OVDs, vMVPDs also offer linear programming channels with some VOD programming and DVR capabilities, while AVOD, SVOD, and TVOD services are built around VOD programming. OVDs also offer location and device flexibility, as noted above, as OVDs are available via an internet connection and many are available on multiple devices. Broadcast stations offer linear video programming channels over the air and therefore cannot provide flexibility in viewing time, location, or device. However, consumers who view these stations through an MVPD or OVD may have additional flexibility.

220. *Programming Content.* MVPDs often hold significant content assets, and both OVDs and broadcast television stations have sought to own more content. Because MVPDs usually make their networks available to other MVPDs and vMVPDs, exclusive content is typically not a point of competition between MVPDs or between MVPDs and vMVPDs, as previously noted. MVPDs and vMVPDs, however, differentiate their services from other OVDs and broadcast television stations by offering a full complement of live sports programming.[656] While other OVDs offer live sports programming, these services offer a limited variety of sports and a limited number of games.[657] Broadcast television stations offer a variety of sports through network programming, but many games are aired only on national cable networks and regional sports networks.

221. To draw customers to their services, OVDs such as Netflix, Amazon, HBO Max, and Disney+ offer exclusive programming content—both new TV shows and movies and already released video content—on their services.[658] As programming content owners, like Disney, Comcast, and AT&T, develop their own online video services, they have pulled back popular video programming content licensed to competitive OVDs to offer it exclusively on their own services.[659] In addition, many OVDs develop exclusive original programming. In 2019, as shown in Figure II.D.5 above, Netflix spent an estimated $2.8 billion on original content, while Amazon and Apple spent $1.3 billion and $116 million, respectively.

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[656] MVPDs and vMVPDs offer national broadcast and cable networks as well as regional sports networks which air live sports programming.

[657] For example, Amazon continues to expand live sports programming on its service, but it is not expected to gain exclusive streaming rights to all live sports in the near term. *See* Audrey Schomer, *Amazon will be streaming the Yankees for Prime Members*, Business Insider (Mar. 5, 2020), https://www.businessinsider.com/amazon-expands-sports-streaming-ambitions-2020-3. In addition, sports league-specific OVDs offer only one sport, and games are often blacked out in the teams' home markets. *See* NBA, *Watch the NBA On-Demand*, https://www.nba.com/watch/pricing (last visited Oct. 27, 2020); MLB, *MLB.TV*, https://www.mlb.com/live-stream-games/subscribe?affiliateId=MLBTVREDIRECT (last visited Oct. 27, 2020); NHL, *NHL.TV*, https://www.nhl.com/subscribe#features (last visited Oct. 27, 2020).

[658] Allegra Frank, Alissa Wilkinson, Emily VanDerWerff, and Alex Abad-Santos, *The best and worst of the biggest streaming services*, Vox (July 24, 2020), https://www.vox.com/culture/2020/5/29/21263715/hbo-max-netflix-hulu-disney-plus-amazon-apple-cbs-all-access-streaming-service-guide.

[659] Tali Arbel, *AT&T pulls 'Friends' from Netflix for its streaming service*, AP News (July 9, 2019), https://apnews.com/557110226d10440c905f9563e70c4bc2.

222. *Pricing and Contracts.* As discussed above, MVPD subscriptions are declining. Many subscribers who cancel their MVPD subscriptions cite rising prices as a cause.[660] In contrast, vMVPDs market themselves as a cheaper alternative to a traditional MVPD subscription.[661] SVOD services are even less expensive, with some SVOD services also offering a lower priced service tier which includes ads.[662]

223. OVDs further distinguish themselves from MVPDs by prominently advertising their full subscription prices. In contrast, the service prices advertised by MVPDs typically do not include additional fees or equipment rental costs.[663] Beginning in December 2020, however, MVPDs will be subject to section 1004 of the Television Viewer Protection Act of 2019, which requires them to disclose the total monthly cost to subscribers before sign-up and to clarify promotional discounts and when they expire.[664] OVDs also offer flexible cancellation and free product trials.[665] Many MVPDs, on the other hand, offer service under long-term contracts, and consumers often pay a fee to terminate the contract before its end date.[666] Finally, initiating or terminating service from an OVD, which can be done online, is easier than initiating or terminating service from an MVPD, which may require a visit to the home by a service technician.[667]

224. *Consumer Access.* Consumer access to video providers depends on the geographic market and type of service. As noted above, most households have access to at least one cable provider and two DBS providers, and some also have access to a telephone company MVPD. To obtain service from an OVD, a consumer must have internet access. With respect to over-the-air television, the number of available stations depends both on the number of stations allocated to the consumer's DMA and the consumer's ability to receive a useable over-the-air signal from the station.[668]

225. *Video Subscription and Use Data.* In 2019, about 75% of TV households (about 90 million households) subscribed to a multichannel television service (MVPD or vMVPD service), while

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[660] James K. Willcox, *Cord Cutting Continues, Fueled By High Cable Pricing, Consumer Reports' Survey Finds*, Consumer Reports (Sept. 17, 2019), https://www.consumerreports.org/telecom-services/cord-cutting-continues-high-cable-pricing/.

[661] Sling, *Stop paying too much for TV*, https://www.sling.com/ (last visited Oct. 27, 2020); YouTubeTV, *Cut the Cord and Save $500/year**, https://tv.youtube.com/learn/switch/ (last visited Oct. 27, 2020).

[662] The top five SVOD services in the United States by subscribership are Amazon, Netflix, Hulu, Disney+, and HBO Max. *See supra* Fig. II.D.13. Among these, a premium subscription to Netflix costs the most at $15.99 per month while Hulu offers the least expensive service at $5.99 per month with commercials. Allegra Frank, Alissa Wilkinson, Emily VanDerWerff, and Alex Abad-Santos, *The best and worst of the biggest streaming services*, Vox (July 24, 2020), https://www.vox.com/culture/2020/5/29/21263715/hbo-max-netflix-hulu-disney-plus-amazon-apple-cbs-all-access-streaming-service-guide.

[663] These additional charges are, however, generally included in the fine print of the advertisement. *See, e.g.*, Comcast, *Pricing and Other Info*, https://www.xfinity.com/learn/offers/ (last visited Oct. 27, 2020).

[664] Section 1004 of the Television Viewer Protection Act of 2019, Pub. L. No. 116-94, 133 Stat. 3200 (codified at 47 U.S.C. § 562) (2019). The Commission granted an extension of the effective date of the Television Viewer Protection Act truth-in-billing requirements until December 20, 2020. *Implementation of Section 1004 of the Television Viewer Protection Act of 2019*, MB Docket No. 20-61, Order, 35 FCC Rcd 3008 (MB 2020).

[665] *See, e.g.*, HBOMax, *Where HBO Meets So Much More*, https://www.hbomax.com/ (last visited Oct. 27, 2020); YouTubeTV, Watch & DVR Live Sports, Shows, and News, https://tv.youtube.com/ (last visited Oct. 27, 2020).

[666] Clark, *How to get out of a cable or internet contract without paying a penalty* (May 13, 2019), https://clark.com/technology/get-out-cable-internet-contract-no-penalty/.

[667] *See, e.g.*, Xfinity, *Comcast Xfinity TV Packages and Plans*, https://www.cabletv.com/xfinity/cable-tv (last visited Oct. 27, 2020).

[668] FCC, *DTV Reception Maps*, https://www.fcc.gov/media/engineering/dtvmaps (last visited Oct. 27, 2020).

about the same share (74%) subscribed to SVOD service.[669] Further, about 54% of TV households (about 65 million households) subscribed to both an MVPD or vMVPD and an SVOD service.[670] That leaves approximately 21% of TV households (about 25 million households) that subscribed to an MVPD or vMVPD service but not an SVOD service and 20% of TV households (about 24 million households) that subscribed to an SVOD service but not an MVPD or vMVPD service.[671] Further, consumers who subscribe to an SVOD service are likely to subscribe to multiple SVOD services. A 2019 survey, for example, found that 63% of respondents who subscribed to at least one prominent SVOD service, subscribed to multiple SVOD services.[672]

226. By comparison, Nielsen estimates that in 2018, 16 million households (about 13% of TV households) received broadcast station signals over the air using an antenna.[673] Many over-the-air households also subscribe to OVD services. Nielsen estimates that about 60% of households that receive broadcast station signals over the air subscribe to an SVOD service, including 8% that also subscribe to a vMVPD service.[674]

227. Figure II.D.18 approximately summarizes the household subscription patterns described above.[675] Each circle represents the approximate size of the population segment subscribing to the listed service category. The overlapping areas represent population segments that subscribe to multiple service categories.

[669] Estimates referencing the share of TV households come from Leichtman Research Group. Leichtman Research Group, *4Q 2019 Research Notes* at 4 (2020), https://www.leichtmanresearch.com/wp-content/uploads/2020/01/LRG-Research-Notes-4Q-2019.pdf (*LRG Research Notes*). The number of households in parentheses is the product of Nielsen's estimate of total TV households and the TV household share estimates. Nielsen defines a TV household as a home that must have at least one operable TV/monitor with the ability to deliver video via traditional means of antennae, cable set-top-box or satellite receiver and/or with a broadband connection. Nielsen, *Nielsen Estimates 120.6 Million TV Homes in the U.S. for the 2019-2020 TV Season* (Aug. 27, 2019), https://www.nielsen.com/us/en/insights/article/2019/nielsen-estimates-120-6-million-tv-homes-in-the-u-s-for-the-2019-202-tv-season/.

[670] *LRG Research Notes* at 4.

[671] *Id.*

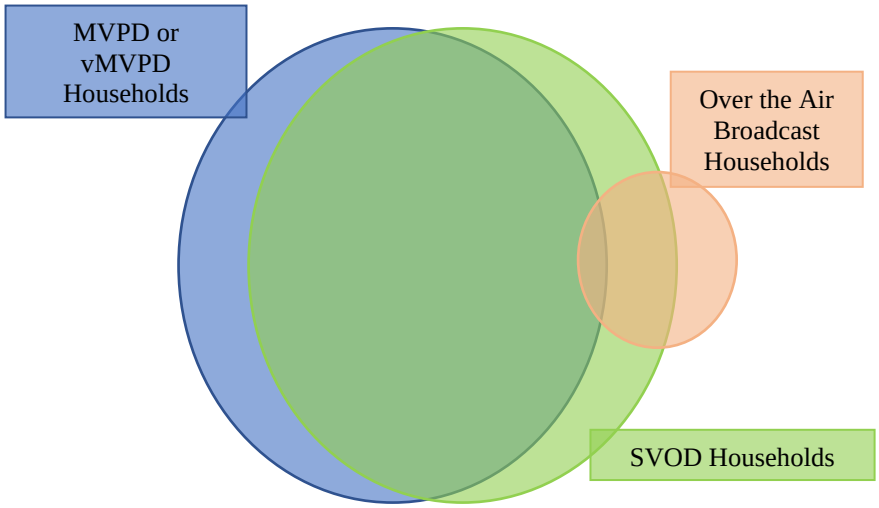
[672] The survey asked whether respondents subscribed to Amazon, HBO Now, Hulu, and Netflix. *See* Brian Bacon, *Which of the big four SVOD services do you use?* S&P Global (Apr. 8, 2020).

[673] Nielsen, *How the Growth and Evolution of the Over-the-Air TV Home Fits into Today's Viewing Landscape* (Jan. 31, 2019), https://www.nielsen.com/us/en/insights/article/2019/how-the-growth-and-evolution-of-the-over-the-air-tv-home-fits-into-media-landscape/ (*Nielsen Report on OTA Homes*). The percentage of TV households is based on Nielsen's estimate of TV households for the 2018-2019 TV season. Nielsen, *Nielsen Estimates 119.9 Million TV Homes in the U.S. for the 2018-2019 TV Season* (Sept. 7, 2018), https://www.nielsen.com/us/en/insights/article/2018/nielsen-estimates-119-9-million-tv-homes-in-the-us-for-the-2018-19-season/.

[674] *See Nielsen Report on OTA Homes*.

[675] We did not find reliable information on use of the over-the-air broadcast service by subscribers to an MVPD service. We expect the practice to be uncommon because local broadcast stations are generally available with MVPD service. However, if MVPDs do not carry all available multicast channels transmitted by broadcast stations or if disputes over retransmission consent payments cause broadcast station blackouts, households may both subscribe to an MVPD service and use the over-the-air broadcast service.

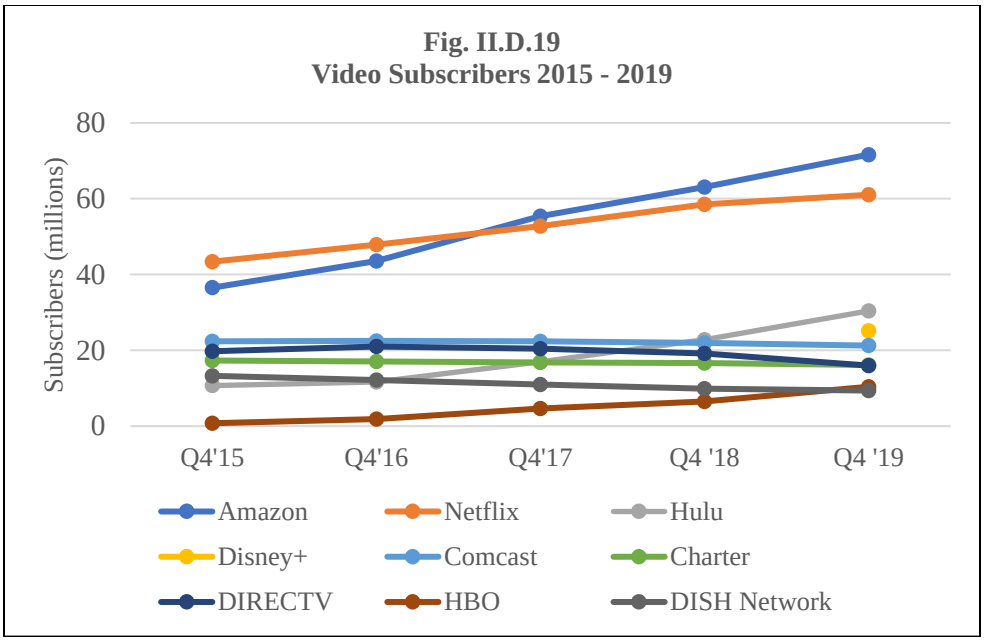
Fig. II.D.18
TV Households by Subscription to or Use of Video Programming Services



Source: LRG Research Notes; Nielsen Report on OTA Homes.

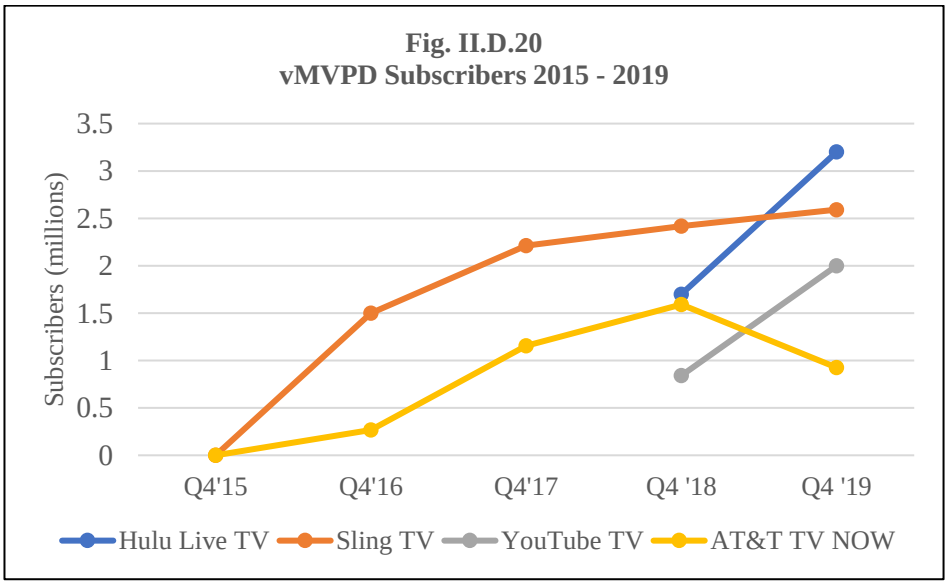
228. Figure II.D.19 shows year-end subscribers for the period 2015-2019 for all video providers with at least 10 million subscribers at some point during this time period, including major MVPDs and OVDs.[676] In 2019, Amazon and Netflix had approximately 70 and 60 million subscribers, respectively, giving each more than twice as many subscribers as the next most popular video provider, Hulu, which had about 30 million subscribers. Disney+, which entered the market in 2019, had over 25 million subscribers by the end of that year. MVPDs (Comcast, Charter, DIRECTV, and DISH) saw subscriber declines from 2015 to 2019, while OVDs (Amazon, Netflix, Hulu, and HBO) saw subscriber increases over the same period.

[676] Amazon subscribers include all Prime members, including those who do not use video. HBO subscribers include all OVD sources and exclude MVPD subscriptions.



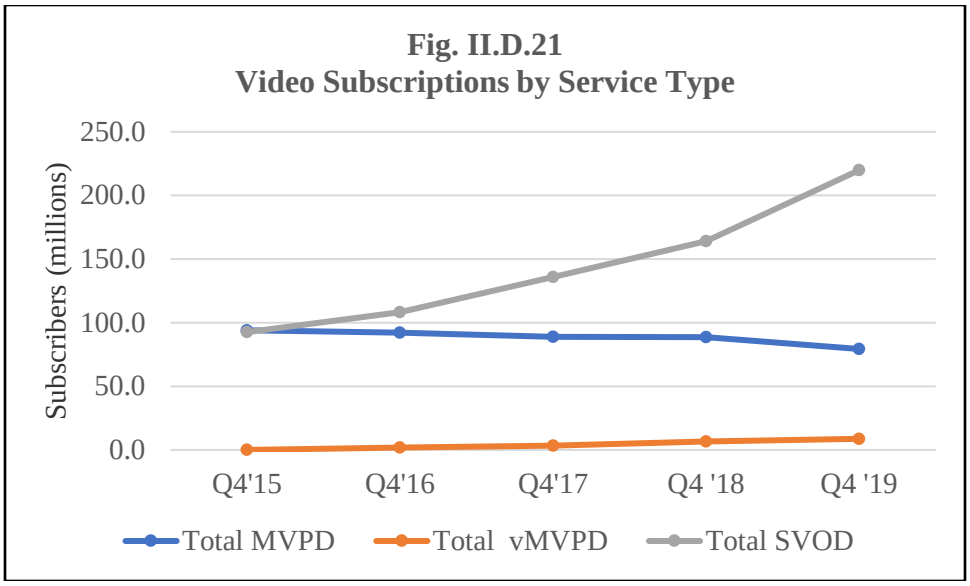
Source: S&P Global, *Q4'19 top US video provider rankings* (Apr. 23, 2020).

229. Similarly, Figure II.D.20 shows vMVPD subscribers over the period 2015-2019. Subscribers to Hulu Live TV, Sling TV, and YouTube TV increased over the full period, while subscribers to AT&T Now increased until 2018 and declined in 2019. In spite of gains since 2015, by 2019, the number of vMVPD subscriptions remained relatively small compared to the number of MVPD and SVOD subscribers. No vMVPD had more than 4 million subscribers in 2019. In total, in 2019, there were approximately 9 million vMVPD subscriptions.



Source: S&P Global, *Q4'19 top US video provider rankings* (Apr. 23, 2020).

230. Figure II.D.21 aggregates the information in Figures II.D.19 and II.D.20 to show total video subscriptions by service type. As discussed in previous sections, MVPDs subscriptions have declined over the past five years while OVD (SVOD and vMVPD) subscriptions have risen. In the fourth quarter of 2019, there were 79 million MVPD subscriptions, 9 million vMVPD subscriptions, and 220 million SVOD subscriptions.



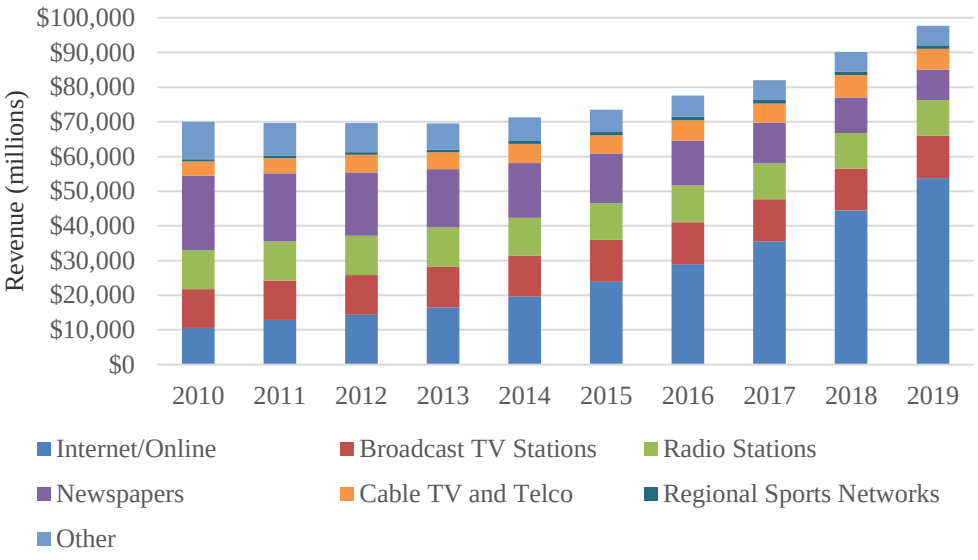
Source: S&P Global, *Q4'19 top US video provider rankings* (Apr. 23, 2020).

231. *Advertising Revenue.* Figure II.D.22 provides a breakdown of local advertising revenue by sector over the period 2010-2019.[677] Over this time period, online local advertising revenue increased to more than five times its 2010 value, and its share of local advertising revenue rose to more than 50%.[678] While local advertising revenue for most other sectors declined or remained flat, local advertising revenue earned by newspapers declined the largest amount, falling from $21.5 billion to $8.8 billion. Over the past two years, local advertising revenue earned by broadcast television stations and cable TV and telecommunications companies remained relatively flat at $12 billion and $6 billion, respectively. In contrast, online platforms earned nearly $10 billion more in local advertising revenue in 2019 than in 2018.

[677] Local advertising refers to advertising sold to businesses with a physical presence in the local market, while national advertising refers to advertising sold to national brands.

[678] Three companies, Facebook, Google, and Amazon earn almost 70% of online advertising revenue. *See* Greg Sterling, *Almost 70% of digital ad spending going to Google, Facebook, Amazon, says analyst firm*, Marketing Land (June 17, 2019), https://marketingland.com/almost-70-of-digital-ad-spending-going-to-google-facebook-amazon-says-analyst-firm-262565 (*Online Ad Spending Analysis*). Local advertising revenues earned by broadcast TV stations from online advertisements are counted in the Internet/Online category. Online advertising accounted for about 12% of all advertising (local and national) revenues for broadcast stations. *See supra* Fig. II.D.17.

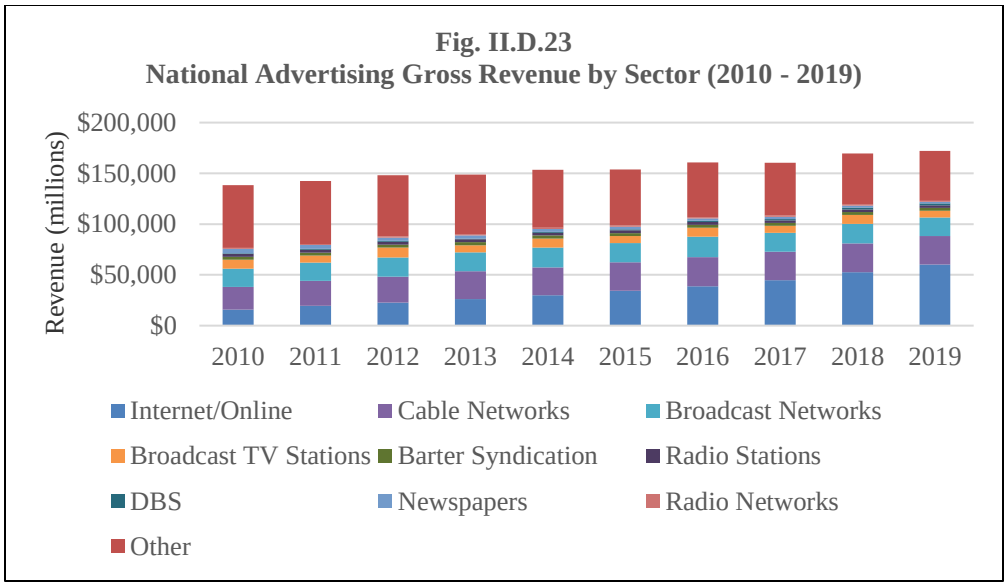
Fig. II.D.22
Local Advertising Gross Revenue by Sector (2010 - 2019)



Source: S&P Global, *Local versus National Advertising Revenues, 2010-2019* (2020).

232. Figure II.D.23 provides a breakdown of national advertising revenue by sector over the period 2010-2019. By 2019, national advertising revenue earned by online platforms increased to nearly four times its 2010 value.[679] National advertising revenues for broadcast television stations, broadcast networks, and cable networks were relatively flat over the same period. Between 2018 and 2019, national advertising earned by cable networks remained flat at $28 billion, while revenue earned by broadcast networks and broadcast television stations fell by about $1 and $2 billion, respectively, to $18.1 and $6.9 billion. Because national advertising revenue earned by broadcast television stations includes political advertising revenue, the decline in broadcast station revenue from 2018 to 2019 likely does not reflect a significant downward trend. National advertising revenue earned by broadcast stations was similar in 2010 and 2018 at slightly below $9 billion.

[679] *See Online Ad Spending Analysis*.



Source: S&P Global, *Local versus National Advertising Revenues, 2010-2019* (2020).

6. Report on Cable Industry Prices

233. In the context of the discussion of MVPDs in the video marketplace, we report on the average rates charged by cable operators for basic cable service and other cable programming, as well as cable equipment to access such programming,[680] as required by section 623(k) of the Communications Act of 1934, as amended by the Cable Television Consumer Protection Act of 1992 (Cable Act)[681] and RAY BAUM's Act of 2018.[682] Consistent with the statute, the Commission is required to compare the rates of operators subject to effective competition to the rates of operators not subject to effective competition under a statutorily defined standard (hereinafter referred to as "effective competition").[683] In

[680] A "cable operator" (or operator) refers to an entity that operates a wireline system and is a multichannel video programming distributor (MVPD) that makes available for purchase, by subscribers or customers, multiple channels of video programming. 47 U.S.C. § 522(5). "Service tier" (or service) refers to a cable service for which a separate rate applies. 47 U.S.C. § 522(l7). With regard to the statutory provision for regulation of rates, operators must provide a separately available "basic cable service" (or basic service) to which customers must subscribe before accessing any other tier of service. 47 U.S.C. § 543(b)(7)(A). "Other cable programming" service means any video programming other than programming offered with the basic service or programming offered on a per channel or per program basis. *Id.* § 543(l)(2).

[681] Section 623(k), adopted as section 3(k) of the Cable Act, Pub. L. No. 102-385, 106 Stat. 1460, codified at 47 U.S.C. § 543(k).

[682] *See* RAY BAUM'S Act of 2018, Act, Pub. L. No. 115-141, 132 Stat. 1087 § 402(e) (amending 47 U.S.C. § 543(k)).

[683] Commission findings of effective competition generally are made in reference to a cable community identified by a cable community unit identifier (CUID). The Commission assigns a unique CUID to each operator for each community the operator serves. As discussed in Appx. E, the Commission recently changed its process and presumption for determining effective competition. In 2015, the Commission adopted a rebuttable presumption that cable operators in all cable communities are subject to effective competition. *See generally Amendment to the Commission's Rules Concerning Effective Competition, Implementation of Section 111 of the STELA Reauthorization Act*, MB Docket No. 15-53, Report and Order, 30 FCC Rcd 6574 (2015) (*Effective Competition in Cable Report and Order*). As a result of this change, operators in nearly all communities became subject to effective competition. In addition, in October 2019, the Commission found, for the first time, that a cable operator was subject to effective competition from a local exchange carrier (LEC)-affiliated online video distributor (OVD) under the LEC effective competition test. *See Petition for Determination of Effective Competition in 32 Massachusetts Communities and Kauai, HI (HI0011)*, MB Docket No. 18-283, Memorandum Opinion and Order, 34 FCC Rcd 10229 (2019), *appeal pending in Massachusetts Department of Telecommunications and Cable v.*

(continued….)

addition, section 110 of the STELA Reauthorization Act of 2014 requires the Commission to report on retransmission consent fees paid by cable systems to broadcast stations or groups.[684] The following presents an overview of the Commission's findings as of January 1, 2020, and fulfills these statutory directives.[685]

234. *Average price over all communities.* Cable prices increased over the 12 months ending January 1, 2020, at a relatively high rate compared to the average annual increase over the past five years. The monthly price for cable subscribers who take only the basic service grew by 10.7%, to $34.79, over the year ending January 1, 2020. Over the five years ending January 1, 2020, basic prices rose by an average of 7.9% per year. Prices for expanded basic service increased by 7.1%, to $86.70, over the year ending January 1, 2020. This compares to an average increase of 4.7% annually over the last five years. To account for growth in the number of channels offered with cable services, we also report price per channel (service and equipment lease price divided by number of channels). Over the year ending January 1, 2020, price per channel for basic and expanded basic service grew by 8.8% and 7.0% to 55 cents and 39 cents per channel, respectively. Over the past five years, price per channel for expanded basic service declined on average by 0.1% annually. In comparison to cable prices, the rate of general inflation measured by the Consumer Price Index (all items) rose by 2.5% over the 12 months ending January 1, 2020, and at an average annual rate of 2.0% over the last five years.[686]

235. *Average price in the communities with a finding of effective competition compared to average price in communities without a finding.* On January 1, 2020, the average price of basic service was 37.8% higher in effective competition communities than in the noncompetitive communities. The average monthly price of basic service was $25.30 in noncompetitive communities and $34.88 in effective competition communities. For basic service, price per channel for the noncompetitive group was 24 cents on average. For the effective competition group, price per channel was 55 cents per channel on average. While the average price of expanded basic service was 3.5% lower in effective competition communities ($86.68) than in noncompetitive communities ($89.85), the average price per channel for expanded basic service was higher in effective competition communities (39 cents per channel) than in noncompetitive communities (31 cents per channel). These price differences likely reflect a complicated mix of factors, with operators providing different service offerings in response to competition and regulation. In noncompetitive communities, the local franchise authority may regulate the price of basic service. In addition, since the reversal of the effective competition presumption, the number of communities in the noncompetitive group has been significantly reduced in comparison to the effective competition group. More than 99% of cable communities are now subject to effective competition.[687]

FCC, No. 19-2282 (1st Cir.). Rates of an operator subject to effective competition are not subject to regulation by a local franchising authority (LFA). 47 U.S.C. § 543(a)(2); 47 CFR § 76.905(a). An LFA may elect to regulate the rate of basic service of an operator not subject to effective competition. *Id.*

[684] *See* section 110 of the STELA Reauthorization Act of 2014 (STELAR). *See* Pub. L. No. 113-200, 128 Stat. 2059 (2014) enacted December 4, 2014 (H.R. 5728, 113th Cong.). Specifically, STELAR instructs the Commission to include in its now-biennial *Report on Cable Industry Prices* "the aggregate average total amount paid by cable systems in compensation under section 325 [of the Communications Act of 1934, as amended,]" and to report such information "in a manner substantially similar to the way other comparable information is published" in the report. 47 U.S.C. § 543(k)(2), as amended.

[685] The Commission's complete *Report on Cable Industry Prices*, containing additional data, information, and findings, can be found in Appx. E.

[686] U.S. Bureau of Labor Statistics, *Consumer Price Index for All Urban Consumers: All Items in U.S. City Average (CPIAUCNS)*, https://fred.stlouisfed.org/series/CPIAUCNS (last visited Oct. 27, 2020).

[687] *See* Appx. E, Fig. 1 for the number of cable communities subject to effective competition.

236. *Broadcast retransmission consent compensation fees*. From 2018 to 2019,[688] total retransmission consent fees paid by cable systems to television broadcast stations increased, on average, by 11.2%. Annual fees paid per subscriber increased, on average, by 17.8%, rising from $109.70 to $129.27 over the same period. Average monthly retransmission consent fees per subscriber per broadcast station increased by 20.5%, increasing from $1.07 to $1.29 from 2018 to 2019. Over the period 2013-2019, the compound average annual increase in fees per subscriber was 32.3%.

237. *Comparison of DBS to cable programming services.* Direct broadcast satellite (DBS) providers, DIRECTV and DISH, offer multichannel video services similar to the services offered by cable operators. Accordingly, we compared DBS services to the most popular cable offering as part of the *Report on Cable Industry Prices*, though not explicitly required by the statute. We looked at the DBS services which appeared most comparable to expanded basic cable service: DIRECTV's Choice and DISH's America's Top 120 Plus (AT120+). [689]

238. As of January 2020, the average monthly price for cable's expanded basic service was $86.70, less than the price of DIRECTV's Choice service ($123.52) and less than the price of DISH's AT120+ service ($90.44). [690] Each cable and DBS service offered a core package of national channels along with local broadcast channels and regional sports networks depending on service location.[691] From 2019 to 2020, the average monthly price for cable's expanded basic service increased by $5.72, an annual increase of 7.1%. In comparison, Choice service increased by $6.75 (annual increase of 5.5%) and America's Top 120+ increased by $5.45 (annual increase of 7.3%). Cable's expanded basic service had an average price per channel of 39 cents. This is lower than the average price per channel for both Choice service (55 cents per channel) and AT120+ service (53 cents per channel).

239. DIRECTV's Choice service offered 225 channels and DISH's AT120+ service offered 171 channels, compared to 257 channels offered with cable's expanded basic service. Though generally comparable, there were differences in the types of channels carried by cable operators and DBS providers. On average, cable operators carried 43 local broadcast channels, while DIRECTV and DISH each carried 21 local broadcast channels. The difference mostly results from cable operators carrying relatively more broadcast multicast channels. Cable operators carried 3 regional sports networks, on average, with expanded basic service, while DIRECTV's Choice service had 3.9 regional sports networks and DISH's AT120+ had 0.6 regional sports networks, on average.[692]

E. The Audio Market

240. Three categories of audio providers dominate the audio marketplace in the United States: 1) terrestrial radio providers, 2) satellite radio, and 3) online audio providers. The numbers of AM and

[688] The data for retransmission consent fees are collected somewhat differently than the rest of the data in the *Report on Cable Industry Prices*. Retransmission consent fee data are collected for complete years, whereas all other data are collected as of a certain date (January 1) of the survey year and the previous year. As a result, the retransmission consent fee data are for the *complete years* 2018 and 2019 (the latest two years for which annual retransmission consent data were available at the time of the 2020 survey), whereas the other data in the survey, by contrast, are snapshots as of January 1, 2019 or January 1, 2020.

[689] We sampled DBS services in 40 communities separately from our cable survey, based on publicly available information. Attach. 15 to the *Report on Cable Industry Prices* reports detailed statistics and data sources regarding this DBS survey sample.

[690] The average cable service price reflects prices charged by cable operators who bundle equipment and cable service and those who do not. DBS service prices include equipment.

[691] Besides the core price of service, prices include local broadcast and regional sports network fees if these channels were billed as separate items.

[692] For the purposes of this *Report on Cable Industry Prices*, a regional sports network is a network that carries a substantial number of live games from at least one nearby professional sports team that is a member of the National Football League, Major League Baseball, National Basketball Association, or National Hockey League.

FM stations have remained steady in recent years, while the number of low-power FM stations has increased. Terrestrial radio revenue primarily depends on advertising and has generally remained steady, except for a sharp dip in 2020 associated with the COVID-19 pandemic. Satellite radio consists of one company, SiriusXM, which relies on both advertising and subscription revenue, which has been growing. Finally, online audio providers offer both interactive and non-interactive programming over the Internet and mobile devices. Online radio revenue includes both paid subscriptions and advertising, however in recent years there has been a shift toward greater reliance on paid subscriptions.

1. Overview of the Audio Programming Market

241. Consumers can access audio programming from multiple sources, from terrestrial broadcast radio stations, which have existed in the marketplace for nearly a century, to more recent marketplace entrants, such as entities that use Internet and mobile technologies to deliver audio content to consumers. Distinguishing features of audio providers include methods of delivery (which include various consumer devices), the ability to download rather than solely stream or listen live, and type and quantity of content offered. The major participants in today's marketplace for the delivery of audio programming can be divided into three categories.[693]

242. Terrestrial radio broadcasters use terrestrial radio stations licensed by the Commission to broadcast audio content over the air to consumers, who use radios to receive the stations' programming. Participants in this category include AM, FM, and low power FM (LPFM) radio stations. There are thousands of terrestrial radio stations in the United States, providing linear channels of music, news, sports, entertainment, educational, and other content.[694] As discussed below, terrestrial radio programming has become available online via computers, smartphones, and other devices accessing the Internet.

243. For satellite radio, SiriusXM is the only provider in the United States. It uses satellite technology to offer subscription-based audio programming to consumers, primarily in automobiles, where subscribers access content using specially designed receivers that come standard or can be installed by the factory/dealer for every major automaker. Consumers can also use computers, smartphones, and other devices to access this content over the Internet. SiriusXM provides multiple linear channels of programming, including exclusive content and features.[695]

244. Online audio providers use the Internet to deliver audio content to consumers. Consumers, in turn, can access this content using computers, smartphones, and other devices. Certain online audio providers offer linear audio channels similar to those offered by terrestrial radio stations. Others, such as Pandora, allow listeners to search by artist or music genre and to avoid advertisements by paying subscription fees. Certain providers also allow users to access and download audio content and listen to it at any time (e.g., podcasts). Participants in this latter category include larger, well-known entities such as Apple Music and Spotify, as well as numerous other providers, some of which focus on specialty content for niche audiences.

2. Terrestrial Radio Broadcasters

245. Terrestrial radio broadcasters, which include full power AM and FM radio stations and LPFM stations,[696] have long been the mainstay of the audio programming market. Most radio stations

[693] These three categories do not include music channels on cable and satellite TV as well as pre-recorded music (such as CDs).

[694] Linear channels provide specific audio content or programs at a specific time of day. By contrast, podcasts or audio downloads allow users to access pre-packaged audio content and listen to it at any time.

[695] Sirius XM, *Home Page*, https://www.siriusxm.com/ (last visited Oct. 27, 2020).

[696] The Commission created the LPFM radio service in January 2000. LPFM stations operate at a much lower power, and serve a much smaller area, than full power FM stations. FCC, *Low Power FM (LPFM) Broadcast Radio Stations*, https://www.fcc.gov/media/radio/lpfm (last visited Oct. 27, 2020). LPFM stations are authorized for (continued….)

broadcast analog signals over the air to consumers,[697] with some stations also transmitting high-quality digital audio to consumers.[698] FM stations that broadcast digital signals are able to provide multiple streams of programming to consumers, as well as other data, such as information about music airing on the station, weather updates, traffic reports, and other news. However, consumers must have a receiver with both an analog tuner and a digital tuner in order to receive all the broadcast signals.[699]

246. Terrestrial radio stations must receive authorization from the Commission before they may construct and operate in the United States and are subject to both the Communications Act of 1934, as amended, and regulations promulgated by the Commission thereunder.[700] In allocating and authorizing terrestrial radio stations, the Commission is charged with ensuring that such stations are distributed across the country and licensed to communities in a manner that serves the public interest.[701] In addition, licensees of terrestrial broadcast stations must comply with certain obligations and rules to ensure that the licensed spectrum is used to serve the public interest.[702] Licenses for broadcast radio stations have an eight-year term, but can be renewed by the Commission upon application by the licensee.[703]

247. As Figure II.E.1 shows, the number of AM and FM radio stations in the United States has remained steady in recent years, while the number of LPFM stations has increased. New stations are

noncommercial educational broadcasting only and must be licensed to government or non-profit educational institutions; non-profit organizations, associations, or entities with an educational purpose; or government or non-profit entities providing local public safety or transportation service. *See* 47 CFR § 73.853; FCC, *Low Power FM (LPFM) Radio*, https://www.fcc.gov/consumers/guides/low-power-fm-lpfm-radio (last visited Oct. 27, 2020). LPFM license applicants must be based in the community in which they intend to broadcast. 47 CFR § 73.853; FCC, *Low Power FM (LPFM) Radio*, https://www.fcc.gov/consumers/guides/low-power-fm-lpfm-radio (last visited Oct. 27, 2020). LPFM stations typically provide opportunities for local and niche programming. *See* Mariella Rudi, *A Homegrown Radio Station Is Keeping Venice Weird*, Los Angeleno (Aug. 15, 2019), https://losangeleno.com/strange-days/venice-fm/.

[697] The Commission has authorized a few AM radio stations to provide all-digital broadcasts on an experimental basis. As discussed in section V.C, the Commission recently authorized AM stations to adopt all-digital broadcasting voluntarily.

[698] Digital audio transmission and reception is more resistant to interference and eliminates many imperfections of analog radio transmission and reception, offering better sound quality than analog. FM digital radio can provide clear sound comparable in quality to CDs, and AM digital radio can provide sound quality equivalent to that of standard analog FM. FCC, *Digital Radio*, https://www.fcc.gov/consumers/guides/digital-radio (last visited Oct. 27, 2020).

[699] *See* FCC, *Digital Radio*, https://www.fcc.gov/consumers/guides/digital-radio (last visited Oct. 27, 2020).

[700] 47 U.S.C. § 301. The Commission licenses broadcast spectrum to applicants and approves any assignment or transfer of control of broadcast licenses. *Id*. §§ 303(c), 308(a), 309(a), 310(d). In addition, certain obligations and rules are imposed on licensees to ensure that the licensed spectrum is used to serve the public interest during each license term. *See, e.g.*, *id*. § 307(c); 47 CFR §§ 73.1020, 73.3555.

[701] 47 U.S.C. §§ 303, 307.

[702] *See, e.g.*, 47 CFR §§ 73.1020, 73.3555.

[703] 47 U.S.C. §309(k); 47 CFR § 73.1020.

possible only through new allocations and award of licenses, either via an auction in the case of commercial stations,[704] or a comparative system for non-commercial stations.[705]

Fig. II.E.1
Number of Licensed Broadcast Radio Stations[706]

	2015	2016	2017	2018	2019	2020
AM Stations	4,702	4,680	4,666	4,633	4,613	4,580
FM Commercial	6,659	6,715	6,754	6,741	6,762	6,726
FM Non-Commercial	4,081	4,096	4,112	4,125	4,139	4,172
Low Power FM	1,029	1,516	1,924	2,150	2,171	2,159
Total Stations	16,471	17,007	17,456	17,649	17,685	17,637

Source: FCC, Broadcast Station Totals, 2015-2020.

248. *Revenue.* The primary source of revenue for commercial terrestrial radio stations is advertising. To secure the highest rates and to compete for advertising market share, stations strive to gain the largest audience of listeners possible to maximize the price for ad time sold. Broadcast stations receive advertising revenue, from entities seeking to reach consumers listening to programming broadcast over-the-air, as well as listeners via Internet or mobile platforms.[707] Figure II.E.2 shows the top 10 largest

[704] *See Reexamination of the Comparative Standards for Noncommercial Educational Applicants*, MM Docket No. 95-31, Report and Order, 15 FCC Rcd 7386, 7427-33, paras. 101-11 (2000) (*NCE Comparative Standards R&O*). The Balanced Budget Act of 1997 amended section 309(j) of the Communications Act "to require the Commission to use competitive bidding to resolve application conflicts, but exempted NCE stations from this process." *Reexamination of the Comparative Standards for Noncommercial Educational Applicants*, MM Docket No. 95-31, Memorandum Opinion and Third Order on Reconsideration, 23 FCC Rcd 17423, 17424, para. 3 (2008) (citing Balanced Budget Act of 1997, Pub. L. No. 105-33, Title III, 111 Stat. 251 (1997), amending 47 U.S.C. § 307(j)).

[705] *See NCE Comparative Standards R&O*, 15 FCC Rcd at 7393-7420, paras. 16-79. The Commission recently adopted changes to its rules and procedures for considering competing applications for new and major modifications to noncommercial educational (NCE) FM radio stations. *Reexamination of the Comparative Standards and Procedures for Licensing Noncommercial Educational Broadcast Stations and Low Power FM Stations*, MB Docket No. 19-3, Report and Order, 34 FCC Rcd 12519 (2019); *aff'd Reexamination of the Comparative Standards and Procedures for Licensing Noncommercial Educational Broadcast Stations and Low Power FM Stations*, MB Docket No. 19-3, Order on Reconsideration, 35 FCC Rcd 10180 (2020). With these changes in place, the Commission intends to open a filing window in 2021 for FM reserved band (channels 201–220) applications for NCE FM new station applications. The Media Bureau will issue a forthcoming Public Notice to announce the specific dates of the 2021 window. The Media Bureau will also provide detailed information about filing procedures and requirements by a future Public Notice.

[706] Press Release, FCC, Broadcast Station Totals as of March 31, 2015 (Apr. 9, 2015), https://docs.fcc.gov/public/attachments/DOC-332923A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2016 (Apr. 6, 2016), https://docs.fcc.gov/public/attachments/DOC-338754A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2017 (Apr. 11, 2017), https://docs.fcc.gov/public/attachments/DOC-344256A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2018 (Apr. 9, 2018), https://docs.fcc.gov/public/attachments/DOC-350110A1.pdf; Press Release, FCC, Broadcast Station Totals as of March 31, 2019 (Apr. 2, 2019), https://docs.fcc.gov/public/attachments/DOC-356801A1.pdf; ; Press Release, FCC, Broadcast Station Totals as of March 31, 2020 (Apr. 6, 2020), https://docs.fcc.gov/public/attachments/DOC-363515A1.pdf.

[707] musicFIRST Coalition and Future of Music Coalition note that terrestrial broadcast radio station clusters in small markets "find it difficult to sell advertising revenue when competing against larger local clusters. musicFIRST/FMC Comments at 6-7. A "cluster" refers to several stations owned by the same broadcaster in a particular geographic market.

radio station owners,[708] ranked by revenue. These owners control stations that are not confined to particular geographic regions; they are spread out across various geographical markets.

Fig. II.E.2
Top 10 Radio Station Owners

Ultimate Parent	Stations	Markets	Station Net Ad Revenue ($M)
iHeartMedia, Inc.	746	150	2,328
Entercom Communications Corp.	219	48	1,294
Cumulus Media Inc.	366	87	602
Beasley Broadcast, Inc.	58	14	263
Apollo Global Management, Inc.	45	10	238
Hubbard Broadcasting, Inc.	33	8	222
Townsquare Media, Inc.	223	52	211
Univision Communications Inc.	48	15	206
Urban One, Inc.	47	14	197
Salem Media Group, Inc.	63	32	138

Source: S&P Global, *Top Radio Station Owners* (last accessed Oct. 27, 2020).

249. We show U.S. radio broadcast revenues from 2004 to 2020 in Figure II.E.3. Total radio broadcast advertising revenue had been virtually flat between 2010 and 2019, going from $17.3 billion in 2010 to $17.8 billion in 2019, for an average annual growth rate of approximately 0.32%.[709] However, preliminary projections for 2020 indicate that total radio broadcast revenue will likely drop to $15.1 billion, a decline of 15.2% from 2019. This can be primarily attributed to the COVID-19 pandemic and the consequent drop in demand for advertising.[710] While these numbers are preliminary, the predicted decline in advertising revenue is substantial. Figure II.E.3 also indicates that the advertising revenue in the radio industry never fully recovered from the decline in advertising experienced during the recession following the 2008 financial crisis. In a recent report, S&P Global predicts that advertising revenue for terrestrial radio stations will face a tougher road to recovery from the pandemic-induced recession compared to broadcast television stations.[711]

250. Figure II.E.3 also breaks down radio revenues between over-the-air radio (which includes network, national spot, and local spot advertising) and digital or online broadcasting (which includes online versions of broadcasts). Online broadcast radio has had more substantial revenue growth than over-the-air radio, i.e., 13.1 % between 2010 and 2019. The share of online broadcast advertising within total advertising revenue has also grown from 3.6% in 2010 to 7.6% in 2019.[712] Online radio is considered to be an important area of potential growth for radio advertising revenue, especially given the

[708] The Commission recently granted Cumulus Media Inc. approval to permit up to and including an aggregate of 100% direct and/or indirect foreign ownership. *Petition for Declaratory Ruling Under Section 310(b)(4) of the Communications Act of 1934, as Amended*, MB Docket No. 19-143, Declaratory Ruling, 35 FCC Rcd 5461 (2020). The Commission granted similar approval for iHeart Media to have aggregate direct and/or indirect foreign ownership up to 100%. *Petition for Declaratory Ruling Under Section 310(b)(4) of the Communications Act of 1934, as Amended*, MB Docket No. 20-51, Declaratory Ruling, DA 20-1318 (Nov. 5, 2020).

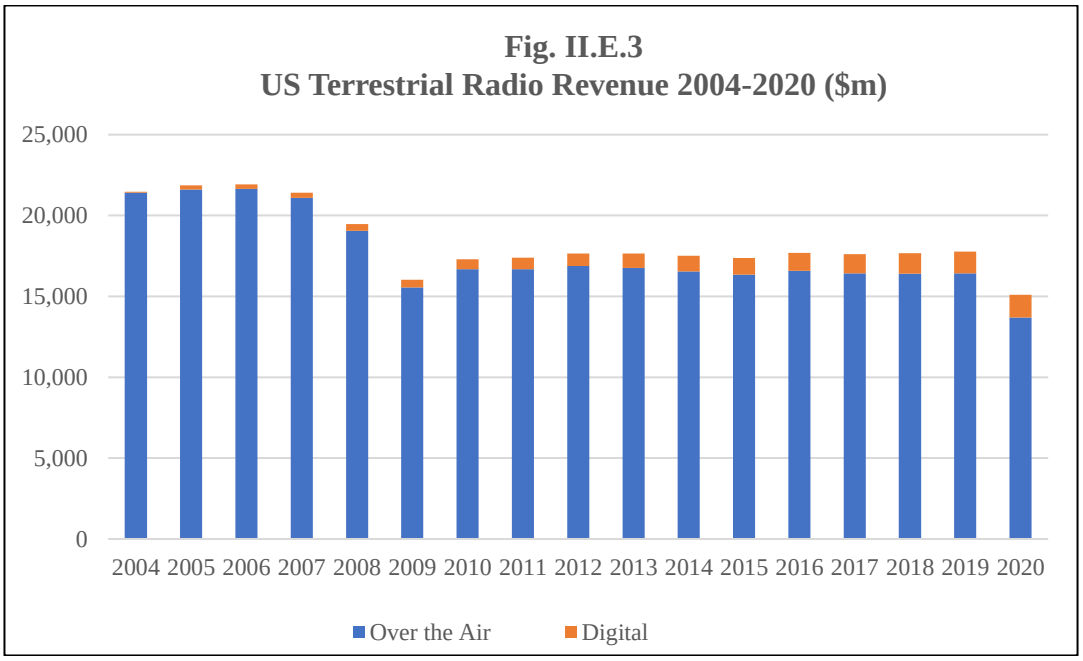
[709] For Fig. II.E.3, total US radio ad revenues include advertising for network, national spots, local spots, and digital/online advertising, and off-air radio advertising. Revenue for off air advertising includes sponsoring events such as concerts or contests that are covered by the station.

[710] Justin Nielson, *Radio/TV station annual outlook*, S&P Global at 1 (Aug. 4, 2020).

[711] *Id*.

[712] S&P Global projections for 2020 indicate an even higher share of 9.8%.

various new devices for accessing online radio, which include smartphones, tablets, and smart speakers. Several large owners of radio stations view podcasting as an important growth opportunity.[713]



Source: S&P Global, *US Radio Station Ad Revenues, 1970-2030* (last accessed Oct. 27, 2020).

251. *Programming.* Types of radio programming include categories of music and talk. In addition, this programming may be live or taped. Further, because terrestrial stations are located in specific geographic markets, its programming may target local listeners in that market.[714] Alternatively, some stations may choose to broadcast non-local programming that is not specifically targeted to listeners living in a particular market.[715] Since producing a show specific for a market is likely more costly (per broadcast) than distributing a similar show across many stations, cost considerations may favor non-local programming. On the other hand, promoting a local on-air personality as the "face" of a station may be an important way for a station to distinguish or brand itself from other stations in its market. Some stakeholders have argued that stations that are part of a group of stations whose owner is not local to that market broadcast less programming produced in that market and may be less sensitive to the needs and interests of that market.[716]

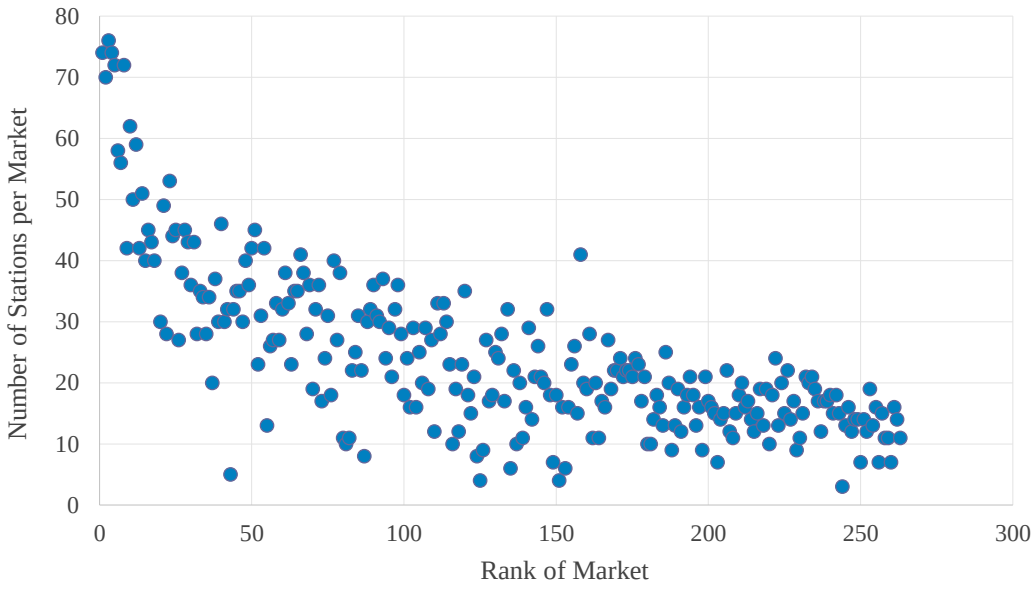
[713] *See* Justin Nielson, *Radio in Transition Phase as Podcasting, Smart Speakers Show Growth Potential*, S&P Global at 1 (Oct. 3, 2018).

[714] Because stations have a duty to serve the needs of their local communities, localism has been a cornerstone of broadcast regulations for decades. *In the Mater of Broadcast Localism*, Report on Broadcast Localism and Notice of Proposed Rulemaking, MB Docket No. 04-233, 23 FCC Rcd 1324, 1328, para 5. The Commission has heard complaints from public interest groups that practices such as voice tracking and national playlists have diminished localism. *Broadcast Localism*, Notice of Inquiry, 19 FCC Rcd 12425, at para 38, 39.

[715] An example of programming that is both live and local would be a live DJ who alternatively plays music and provides commentary on local events, local traffic, and/or the weather.

[716] Advocates of musicians and radio personnel have argued that the consolidation of ownership among AM/FM radio stations has led to reduced local staff, including DJs, in favor of programming that is selected and distributed from a central office. musicFIRST/FMC Comments at 20-22.

Fig. II.E.4
Number of Stations per Market versus Market Size (Rank)



Source: Generated by Commission staff using BIA Media Access Pro (BIA) data on radio stations using BIA's measure of geographic market rank. Geographic markets with larger populations are ranked lower, with New York City holding market rank 1.

252. Terrestrial radio allows listeners to switch to other stations within their geographic markets.[717] Figure II.E.4 shows a scatterplot of the number of stations within a market against the market size, measured by rank.[718] The number of radio stations available decreases as the market size decreases, suggesting more choice in markets with higher populations. Not shown in the table, however, are additional choices that listeners have that include satellite and online radio, as discussed below.

253. We have noted in previous proceedings that AM broadcasting services face persistent interference issues.[719] Such interference may have contributed to AM stations favoring talk formats relative to music formats, which are more common on FM stations. This is illustrated in Figure II.E.5, which presents the distribution of different kinds of programming across AM, FM, and LPFM stations.[720] 63% of FM stations identify with a music format, while only approximately 34% of AM stations identify as a music format. However, as Figure II.E.5 shows, AM stations favor Spanish and Ethnic, News, Sports, and Talk formats relative to FM stations (13.6% versus 5.5%, 17.6% versus 6.1%, 12.5% versus 1.4%, and 5.6% versus 0.8%, respectively). The percentages of stations that use a Religion format, which

[717] The terrestrial radio markets are generally named for the largest city within a geographic region, which includes areas outside of the city. Such geographical markets for terrestrial radio are identified by The Nielsen Company (Nielsen). Nielsen, *Radio Market Survey Population, Rankings & Information* (Fall 2019), https://www.nielsen.com/wp-content/uploads/sites/3/2019/09/market-populations-and-rankings.pdf.

[718] Geographical market rank is determined by its population size. New York, which has the largest population among radio markets, is assigned rank 1 by Nielson. *See* Nielsen, *Radio Market Survey Population, Rankings & Information* (Fall 2019), https://www.nielsen.com/wp-content/uploads/sites/3/2019/09/market-populations-and-rankings.pdf.

[719] *See generally Revitalization of the AM Service*, MB Docket No. 13-249, First Report and Order, Further Notice of Proposed Rulemaking, and Notice of Inquiry, 30 FCC Rcd 12145 (2015).

[720] This analysis was based on data downloaded from BIA Media Access Pro, www.biakelsy.com/data-platforms/media-access-pro/media-access-pro-login/ (June 22, 2020). These data included 4,500 AM stations, 10,881 FM stations, and 2,149 LPFM stations.

involves both music and talk, are more similar for AM and FM stations (16.6% for AM and 21.6% for FM). The Public and Education format stations predominantly use FM frequencies, reflecting the fact that most non-commercial educational stations are FM stations.[721] Approximately 1.5% of FM stations are designated Public and Education format, while there are only four AM stations within that format.

254. Figure II.E.5 also presents the distribution of programming formats for LPFM stations, which have much smaller geographic reach than conventional FM stations. Because LPFM stations are authorized for non-commercial educational broadcasting only, they may provide programming of interest to listeners and community stakeholders that other FM or AM stations do not provide. As Figure II.E.5 shows, nearly half of LPFM stations are classified as Music stations. However, the music LPFM stations are predominantly classified as Miscellaneous, as opposed to music formats such as Rock and Country.[722] Further, 36.2% provide religious community programming (considerably more, in percentage terms, than AM or FM stations), reflecting local churches' or local religious organizations' use of the medium. Additionally, 4.8% of LPFM stations are classified as Public and Education format.

Fig. II.E.5
Programming Formats for Terrestrial Radio[723]

Format	AM	FM	LPFM
Music	33.9%	63.0%	46.6%
Spanish and Ethnic	13.6%	5.5%	11.2%
Religion	16.6%	21.6%	36.2%
Public and Education	0.1%	1.5%	4.8%
News	17.6%	6.1%	0.7%
Sports	12.5%	1.4%	0.1%
Talk	5.6%	0.8%	0.4%

Source: Generated by Commission staff using BIA data from June 22, 2020.

3. Satellite Radio

255. In 1995, the Commission allocated spectrum in the 2310–2360 MHz band for satellite digital audio radio service (SDARS).[724] This delivery of service using satellite technology is distinct from the digital radio offered by terrestrial radio stations as a supplement to their analog signals. The

[721] *See* FCC, *The Licensing of TV and Radio Stations, The Public and Broadcasting*, https://www.fcc.gov/media/radio/public-and-broadcasting#NCECOMM (last visited Oct. 27, 2020).

[722] Approximately 75% of music LFPM stations are classified as Miscellaneous. These stations play a wider range of music than what might fall into a particular category, such as Country, Rock, Adult Contemporary, and so forth. Thus, with Miscellaneous, programming decisions are not restricted by a particular format or marketing strategy.

[723] Staff analysis based on BIA data, accessed June 22, 2020. BIA assigns each radio station a Category Format, which is a relatively broad format designation. Examples of these include Country, Jazz, Talk, and Ethnic. The Music category in Table II.E.2.e is constructed by combining the following BIA music category formats: Adult Contemporary, Album Oriented Rock/Classic Rock, Alternative, Classical, Contemporary Hit Radio/Top 40, Country, Easy Listening/Beautiful Music, Jazz/New Age, Middle of the Road, Miscellaneous, Nostalgia/Big Band, Oldies, Rock, and Urban. The Spanish and Ethnic format categories were combined to create Spanish and Ethnic. The Miscellaneous category is most often used by stations that play music that does not necessarily fall into one of the other music formats.

[724] *Amendment of the Commission's Rules with Regard to the Establishment and Regulation of New Digital Audio Radio Services*, GEN Docket No. 90-357, Report and Order, 10 FCC Rcd 2310, 2310, para. 1 (1995) (*SDARS Rules Order*).

Commission established rules for SDARS in 1997.[725] Two SDARS licensees—Sirius and XM—purchased their licenses at auction, successfully launched their satellite systems, and commenced commercial service to the public.[726] SDARS provides nationally distributed subscription radio service and requires a significant investment of capital for operation.[727] In 2008, Sirius and XM merged and formed SiriusXM,[728] which is currently the only provider of SDARS in the audio marketplace. SiriusXM acquired Pandora Media, a streaming service, on February 1, 2019.[729] SiriusXM reports that it had nearly 30 million U.S. subscribers paying for Pandora at the end of 2019.[730]

256. *Revenue*. SiriusXM has historically relied on subscription fees as its primary revenue source.[731] However, since its acquisition of Pandora, a streaming service which has substantial advertising revenue, advertising has accounted for an increasing share of SiriusXM's revenues. In 2019, the SiriusXM unit (which excludes Pandora) reported $6.2 billion in revenue,[732] a 7.2% increase from 2018, and approximately 13% of total U.S. satellite services revenue.[733] Subscription revenue was the largest source of revenue, constituting $5.6 billion, while advertising revenue represented $205 million.[734] Pandora's subscriber and advertising revenue for 2019 was $476 million and $1.1 billion, respectively.[735] SiriusXM's total revenue, including Pandora, was $7.8 billion for 2019.[736]

257. *Programming and Subscription Plans*. SiriusXM offers over 150 channels via satellite and online streaming, as well as over 250 additional channels that are available only through online

[725] *See generally Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, GEN Docket No. 90-357, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5754 (1997) (*SDARS MO&O and FNPRM*).

[726] XM began nationwide commercial service on November 12, 2001; Sirius began commercial service on February 14, 2002. *See Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, IB Docket No. 95-91, Second Further Notice of Proposed Rulemaking, 22 FCC Rcd 22123, para. 1, n. 4 (2007) (*SDARS Second FNPRM*).

[727] *See id. at* 22150, Appx. B.

[728] *See Applications for Consent to the Transfer of Control of Licenses from XM Satellite Radio Holdings Inc. to Sirius Satellite Radio Inc.*, MB Docket No. 07-57, Memorandum Opinion and Order and Report and Order, 23 FCC Rcd 12348, 12349, para. 1 (2008) (*XM/Sirius Order*).

[729] Press Release, SiriusXM, SiriusXM Completes Acquisition of Pandora (Feb. 1, 2019), http://investor.siriusxm.com/investor-overview/press-releases/press-release-details/2019/SiriusXM-Completes-Acquisition-of-Pandora/default.aspx.

[730] Press Release, SiriusXM, SiriusXM Reports Fourth Quarter and Full-Year 2019 Results (Feb. 4, 2020), http://investor.siriusxm.com/investor-overview/press-releases/press-release-details/2020/SiriusXM-Reports-Fourth-Quarter-and-Full-Year-2019-Results/default.aspx.

[731] SiriusXM, *Will I hear commercials on SiriusXM?*, https://listenercare.siriusxm.com/app/answers/detail/a_id/3562/~/will-i-hear-commercials-on-siriusxm%3F (last visited Oct. 27, 2020).

[732] SiriusXM, SEC Form 10-K, at 33 (filed Feb. 4, 2020) (SiriusXM 2019 SEC Form 10-K), https://sec.report/Document/0000908937-20-000011/. Its revenues for 2013-2017 can be found in the *2018 Communications Marketplace Report*, 33 FCC Rcd at 12673, Fig F-1.

[733] SIA Comments at 5, Appx. B; SIA *Ex Parte*, Attach.

[734] Equipment revenue of $173 million and $165 million in other revenue made up the remainder. SiriusXM 2019 10-K at 33.

[735] *Id*. at 33.

[736] *Id*.

streaming.[737] These provide content and features not available from other sources. SiriusXM offers consumers three principal subscription packages: Select ($16.99/month), All Access ($21.99 per month), and Mostly Music ($10.99 per month).[738] All three packages offer access to all of SiriusXM's commercial-free music channels; Select and All Access also offer exclusive artist-dedicated channels, comedy channels, news channels, college sports, and traffic and weather.[739] All Access additionally includes Howard Stern's channels and professional sports channels.[740] These channels available online and in automobiles follow a linear format, so that (like terrestrial stations) various programs are scheduled to play at particular times during the day. Unlike commercial terrestrial stations, this programming is ad-free. And while such linear programming does not include interactive features, the acquisition of Pandora has allowed SiriusXM to also offer customized, ad-free music stations online and on an app. SiriusXM also offers two standalone non-satellite (i.e., online audio) streaming plans: SiriusXM Essential ($8.00 per month) and SiriusXM Premier at ($13.00 per month).[741]

258. Pandora continues to offer plans for listening to music and podcasts online. Listeners can have free access to ad-supported music and podcasts. Consumers can upgrade to ad-free programming with Pandora Plus ($4.99 per month) or Pandora Premium ($9.99 per month), which allows the creation and sharing of playlists.[742]

4. Online Audio Providers

259. In addition to terrestrial broadcast radio stations and satellite-delivered radio service, audio programming delivered via the Internet and mobile devices has emerged as a third provider category in the audio marketplace. Generally, online audio providers may be classified as non-interactive or interactive, with the latter involving user choice, such as choosing specific songs and downloading content. In addition, as discussed above, both terrestrial radio broadcasters and SiriusXM have supplemented their traditional offerings with online audio access.

260. Online audio providers generally offer various options that include subscription payments for services or free service accompanied by advertising. In general, these providers make their content available on various mobile applications and smart speakers. Some higher priced packages are designed for multiple users, such as family members. The providers with the top three largest number of paid subscribers are Spotify (124 million), Apple (68 million), and Amazon (55 million).[743]

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[737] *See* SiriusXM, *SiriusXM Select, View the Channel Lineup*, https://www.siriusxm.com/packages/siriusselect (last visited Oct. 27, 2020).

[738] *See* SiriusXM, *Our Packages*, https://www.siriusxm.com/ourmostpopularpackages?intcmp=GN_HEADER_NEW_Subscriptions_SubscribeNow_CompareAllPackages (last visited Oct. 27, 2020).

[739] *See* SiriusXM, *Our Packages*, https://www.siriusxm.com/ourmostpopularpackages?intcmp=GN_HEADER_NEW_Subscriptions_SubscribeNow_CompareAllPackages (last visited Oct. 27, 2020).

[740] *See* SiriusXM, *Our Packages*, https://www.siriusxm.com/ourmostpopularpackages?intcmp=GN_HEADER_NEW_Subscriptions_SubscribeNow_CompareAllPackages (last visited Oct. 27, 2020).

[741] *See* SiriusXM, *Our Packages*, https://www.siriusxm.com/ourmostpopularpackages?intcmp=GN_HEADER_NEW_Subscriptions_SubscribeNow_CompareAllPackages (last visited Oct. 27, 2020). SiriusXM Essential provides ad-free music as well as various news, talk, entertainment, and sports channels. Sirius XM Premier offers additional features, such as personalized stations and two Howard Stern channels.

[742] *See* Pandora, *Choose how you want to listen*, https://www.pandora.com/plans (last visited Oct. 27, 2020).

[743] These figures are year-end subscriptions for 2019. S&P Global, *Leading Digital Music Subscriptions Services, Global* (last accessed Oct. 27, 2020).

261. *Revenues*. Online audio providers' sources of revenue include both paid subscriptions and advertising for ad-supported tiers that are free to consumers. However, in recent years, a shift toward paid subscriptions has led to revenue streams less reliant on advertising. This trend has demonstrated a willingness by consumers to pay for monthly subscriptions to such popular streaming services as Apple Music, Spotify, Amazon Music, and Pandora. For music revenue, paid subscriptions grew by 33%, up from $3.5 billion in 2017 to $4.66 billion in 2018.[744] Streaming music services in 2018 contributed 75% of total U.S. music revenue, according to the Recording Industry of America.[745] In the United States, Spotify achieved the highest revenue of any music service, reporting $2.26 billion in total U.S. revenues in 2018, compared to Pandora's $1.57 billion.[746]

262. *Programming.* Online audio providers allow listeners to access a wide range of music. The most popular music streaming services, which include Spotify, Apple Music, Google Play, and Amazon Prime Music, provide listeners with access to music libraries of approximately 40 million songs.[747] Users on premium plans create their own playlists or genre stations, where they may discover new music within a small preference niche. Some streaming services have also experimented with exclusives such as album launches, live events, artist commentary, and interviews.[748] With competing major online audio providers generally each offering a wide range of music and programming around music, subscribers tend to use only a single streaming service.[749]

263. *Music.* The widespread availability of most songs through a variety of services and sources has created a challenge for music services seeking to differentiate themselves.[750] The fact that online music providers share a large common pool of music tracks likely contributes to why their subscribers usually chooses only one service. In order to differentiate themselves, online audio providers have experimented with various exclusives such as live events, artist commentary, and interviews.[751]

264. *Podcasting.* Podcasting, which offers a large variety of spoken word programming, has provided another option for differentiation among online audio providers. Podcasts can be streamed on a personal device at any time, in contrast to audio programs on linear channels. There is a wide range of content and personalities featured, with subjects that include economics,[752] scientific research, slice of life journalism, self-help, fringe topics, comedy, stories and many others. Recently, among the U.S. population aged 12 and over, the number of people who have ever listened to a podcast passed 50% for the first time.[753] Approximately 90 million users listen to podcasts each month.[754] According to one

[744] Peter Leitzinger, *Economics of Internet Music and Radio 2019*, S&P Global at 4 (Sept. 5, 2019) (*Economics of Internet Music and Radio*).

[745] *Id*. (Sept. 5, 2019).

[746] *Id*. at 2 (Sept. 5, 2019).

[747] S&P Global, *US Internet Music & Radio Service Profiles and Statistics* (last accessed Oct. 27, 2020).

[748] *Economics of Internet Music and Radio* at 1.

[749] A recent S&P Global survey suggests that, unlike listeners consuming radio from a variety of terrestrial broadcast stations, most users of online music services tend to use just one service, especially those who use a pay music service. The survey found that of those that subscribed to a pay music service, 74% subscribed to one service only. *See* Brian Bacon, *Online Music User Profiles*, S&P Global, (July 12, 2018), at 1.

[750] *Economics of Internet Music and Radio* at 1.

[751] *Id*.

[752] *See, e.g.*, Stephen J. Dubner, *Can You Hear Me Now*, Freakonomics Radio (Feb. 19, 2020), https://freakonomics.com/podcast/ajit-pai/.

[753] *See* The Infinite Dial 2019, *Podcasting and Audiobooks Both Attain 50% Reach; Facebook Usage Continues to Drop*, Edison Research (Mar. 6, 2019), https://www.edisonresearch.com/infinite-dial-2019/.

[754] *Id*.

report, monthly podcast listeners increased by 123% from 2015 to 2019.[755] Podcasting is seen as an important growth area by Spotify, Pandora, and other streaming services. Both Spotify and Pandora have made investments in podcasting over the last few years.[756]

5. Competition in Audio Programming

265. Although providers in these three main categories of audio services all deliver audio programming to consumers, there are significant differences in the availability, reach, consumer engagement, and cost of the services. In its 2018 audio report, Nielsen estimated weekly reach among audio marketplace participants as follows: 228.5 million consumers for terrestrial broadcast radio, 35.7 million for satellite radio, 68.5 million for streaming audio, and 21.9 million for podcasts (note that streaming music and podcasts are both delivered via the Internet).[757] In 2019, 92% of Americans ages 12 and older listened to terrestrial broadcast (AM/FM) radio in a given week, a percentage that has held steady in recent years.[758] Edison Research's most recent "Share of Ear" report allocates the share of time spent listening to audio sources for Americans 13 and over as follows: 46% for terrestrial broadcast radio, 14% streaming audio, 12% owned music, 11% YouTube, 7% SiriusXM satellite radio, 5% TV Music channels, 3% podcasts, and 2% other sources.[759]

266. *Music as Input*. As noted above, the ubiquity of music creates a challenge for music providers seeking to differentiate themselves. Streaming services allow their subscribers access to a much larger range and quantity of music than listeners to terrestrial stations, which are constrained within a linear format, can expect to hear.[760] The large range and quantity of music of online audio providers likely also exceeds what listeners can experience with satellite radio when the latter is confined to a linear format, despite the relatively large number of channels offered. In addition to their large libraries, online audio providers offer their subscribers the flexibility to choose particular songs anytime, create playlists, or listen to songs chosen by algorithm-generated radio stations.

267. *Regulations*. Different audio marketplace participants are subject to different regulatory regimes, which may affect how they compete with one another. For example, because they use the public airwaves, terrestrial broadcast radio must comply with a wide range of FCC regulations that impose costs on licensees. Online audio providers, on the other hand, are not regulated by the FCC and thus do not incur the same regulatory compliance costs.

268. *Music Licensing*. Different marketplace participants are subject to different music licensing conditions under law, which means they face different costs in gaining access to the music they distribute. For example, terrestrial broadcast radio—as non-subscription, non-interactive audio transmission—is exempted from paying royalties for the use of sound recordings over the air.[761] In

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[755] Paul Heine, *Podcasting Is Growing Faster but Streaming Audio Audience Is Bigger*, Inside Radio (Sept. 3, 2019), http://www.insideradio.com/podcasting-is-growing-faster-but-streaming-audio-audience-is-bigger/article_d9894e74-ce0c-11e9-934b-0f2e1e9e8f74.html.

[756] *Economics of Internet Music and Radio* at 1.

[757] The Nielsen Company, *Audio Today 2018: How America Listens* (Apr. 5, 2018), https://www.nielsen.com/us/en/insights/reports/2018/state-of-the-media--audio-today-2018.html#.

[758] The Nielsen Company, *Audio Today 2019: How America Listens* (June 2019), https://www.nielsen.com/wp-content/uploads/sites/3/2019/06/audio-today-2019.pdf.

[759] Edison Research, *Share of Ear*, https://www.shareofear.com/#audiomesurement (last visited Oct. 27, 2020).

[760] According to a recent S&P Global report, Apple Music makes 60 million tracks available to their listeners and listeners to Spotify and Amazon Music have access to 50 million tracks. *See* John Fletcher, Rob Parungo & Theodore Vincent Calaor, *Economics of Mobile Music, 2020*, S&P Global at 4 (July 2, 2020) (*Economics of Mobile Music*).

[761] *See* Jason B. Baznet, et al., *Putting the Band Back Together – Remastering the World of Music*, Citi-GPS, at 18 (Aug. 2018), https://www.citivelocity.com/citigps/music-industry/ (Citi GPS); musicFIRST/FMC Comments at 18.

contrast, SiriusXM pays a copyright royalty for the use of sound recordings, but the Digital Millennium Copyright Act granted pre-existing services such as SiriusXM a compulsory copyright license for sound recordings,[762] the rate for which is set by the Copyright Royalty Board through a rate determination proceeding.[763] Subscription interactive services like Spotify must reach commercial agreements with music labels. Despite its increased licensing costs, Spotify's licensing cost as a percent of its total revenue has declined from 83% in 2013 to 75% in 2019, as reported by S&P Global.[764]

269. *Platforms as Factors for Competition.* Before the advent of satellite radio and various streaming platforms, listeners of audio programming had access to AM or FM radio through radio devices that included car radios. Easy access to AM/FM radio inside automobiles presented terrestrial radio with an advantage over other forms of media such as television and newspapers. However, new technology has allowed other modes of audio, specifically satellite radio and online audio providers, to gain a foothold, not just in new platforms such as tablets and smartphones, but also within automobiles. In terms of partnerships with manufacturers, one unique aspect of SiriusXM's marketplace position is that the service comes as a standard (or factory/dealer-installed) option with every major automaker,[765] and car dealerships have long offered free trials or free year-long subscriptions when customers buy a satellite-equipped new or pre-owned vehicle.[766] In recent years, streaming services such as Spotify and Apple Music have also become available in automobiles integrated with cellular technology.[767] S&P Global estimates that AT&T has added over 8 million cars integrated with cellular to its network, including over 2 million in the first quarter of 2019.[768]

270. Audio streaming service platforms connected to the Internet via workstations, laptops, tablets, and smartphones have also contributed to audio competition. Audio streaming services such as Spotify, Pandora, and Apple Music provide their diverse music libraries and podcasts through applications downloaded from the Internet. As noted above, certain platforms also create access to online AM/FM stations and satellite radio programming. Additionally, some terrestrial broadcasters have adapted online mediums. An example is iHeartMedia repurposing its broadcasts as podcasts, resulting in low-cost programming that contributes additional advertising revenue.[769] iHeartMedia has also released an application on Apple iOS for discovering new podcasts using machine learning inputs such as music preferences, favorite stations, and liked songs.[770]

271. However, online audio providers generally have stronger relationships (perhaps in some cases through direct ownership) with some of the most popular platforms. For example, the widespread use of Apple's iPhone has facilitated its relatively rapid growth in listeners for its Apple Music streaming service. Apple was able to leverage its customer base of iPhone users to grow Apple Music to 50 million

[762] Dana A. Scherer, *Money for Something: Music Licensing in the 21st Century*, Congressional Research Service, at 22 (June 7, 2018), https://crsreports.congress.gov/product/pdf/R/R43984.

[763] Dana A. Scherer, *Money for Something: Music Licensing in the 21st Century*, Congressional Research Service, at 22-23 (June 7, 2018), https://crsreports.congress.gov/product/pdf/R/R43984.

[764] John Fletcher, Rob Parungo, and Theodore Vincent Calaor, *Economics of Mobile Music, 2020*, S&P Global at 1 (July 2, 2020).

[765] NAB Comments at 9-11.

[766] Nicole Lyn Pesce, *These companies are now offering free Netflix, Hulu, Spotify and more*, Moneyish (Sept. 9, 2017), https://moneyish.com/upgrade/these-companies-are-now-offering-free-netflix-hulu-spotify-and-more/.

[767] Connected cars access digital audio programming through wireless technology (3G, 4G, and 5G). *See* Peter Letzinger, *Connected Car Projections through 2024: Connectivity Growing as Cars Get Smarter*, S&P Global (July 11, 2019).

[768] *Id.* at 2.

[769] *Economics of Mobile Music* at 2.

[770] *Id*.

subscribers.[771] Spotify, in turn, has partnered with electronics manufacturer, Samsung, to integrate Spotify into Galaxy phones, tablets and watches, as well as Samsung's smart refrigerators, smart TVs, Galaxy Home smart speakers, and the Bixby digital assistant.[772]

272. Smart speakers have also begun to emerge as an important focus for audio marketplace participants. These devices provide users with voice-controlled interaction and are able to connect with a wide range of other devices in the home via Wi-Fi and Bluetooth. Listeners can use their smartphones to navigate programming on streaming services that are in turn played through their smart speakers. According to a recent survey, 24% of adults 18 and over (approximately 60 million people) own a smart speaker, a substantial increase from 2017, when only 7% owned one.[773] This survey also finds that the share of time spent listening to music has declined by 5% from 2014 to 2019, while the share of time spent listening to spoken word content, such as podcasting, has increased by 20% over the same time period.[774] However, for those listening using a smart speaker, the shares of time listening to music and spoken word audio are 77% and 23%, respectively.[775] The survey also finds that the share of time listening to different audio sources on a smart speaker is broken down as follows: 46% streaming audio, 24% terrestrial audio, 10% owned music, 8% SiriusXM satellite, 5% podcasts, and 7% other.[776] Overall, if adoption of smart speakers continues, more users will have access to a platform that provides access to various audio providers.

273. We note that many popular smart speakers are produced by some of the owners of major audio streaming service platforms. This link is relevant, given that, as noted above, paid subscribers of streaming music or podcasting likely subscribe to just one service. A recent survey found that Amazon's Echo and Google's Home had the highest shares (28% and 14%, respectively) among owners of smart speakers.[777] Samsung's Smart Things and Apple's HomePod were a distant third and fourth (3% and 2%).[778] Both Amazon and Google announced free ad-supported streaming built in (Amazon Music Unlimited and YouTube Music, respectively) to their respective smart speakers.[779]

274. While broadcast terrestrial radio remains dominant in some respects, as Figure II.E.6 illustrates, the gap in usage between broadcast terrestrial and online audio has declined over time. Figure II.E.6 shows the number of weekly listeners to broadcast radio in the US remained relatively stable, while the audience for online radio grew steadily. According to this figure, over the past decade, the number of listeners to terrestrial broadcast radio grew annually around 0.55% on average, while the annual growth in online radio was 29%. However, it is important to note that online radio here included online AM or FM

[771] Adam Levy, *Your Smart Speaker Now Comes with Free Music*, The Motley Fool (Apr. 22, 2019) https://www.fool.com/investing/2019/04/22/your-smart-speaker-now-comes-with-free-music.aspx.

[772] Eli Blumenthal, *Spotify stock pops after company links up with Samsung to take on Apple, Amazon and Google*, USA Today (Aug. 9, 2018), https://www.usatoday.com/story/money/2018/08/09/spotify-and-samsung-partner-up-take-apple-amazon-and-google/949470002/.

[773] National Public Radio and Edison Research, *The Smart Audio Report, Winter 2019*, (Jan. 8, 2020), https://www.edisonresearch.com/the-smart-audio-report-winter-2019-from-npr-and-edison-research/. Findings are based on a 1,002 person telephone survey of adults age 18 and older conducted December 31, 2019 to January 5, 2020. *Id*.

[774] *Id*.

[775] *Id*.

[776] *Id*.

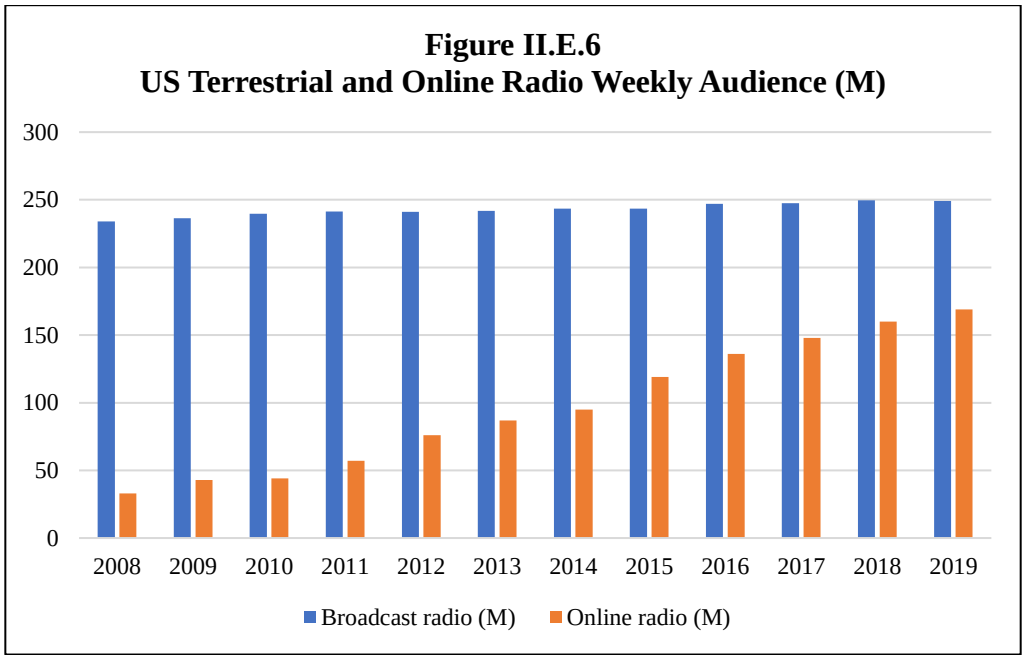
[777] S&P Global, *Consumer Insights U.S. 1Q 2020 Survey Summary Report*, Table 30 (last accessed Oct. 27, 2020).

[778] *Id*.

[779] *Id*.

broadcasts;[780] thus, part of this growth was due to listeners accessing AM/FM broadcasts online. Nevertheless, Figure II.E.6 illustrates the dynamic nature of audio as listeners continue to access online radio across a diverse range of devices.

Figure II.E.6
US Terrestrial and Online Radio Weekly Audience (M)



Source: Peter Leitzinger, *Economics of Internet Music and Radio 2019*, S&P Global at 5 (Sept. 5, 2019). Audience includes listeners 12 years and older.

III. ASSESSMENT OF BROADBAND DEPLOYMENT

275. We assess in this section the state of deployment of communications capabilities as required by RAY BAUM'S Act of 2018.[781] We also provide comparative international data on broadband services, and, where possible, a year-to-year measure of the extent of broadband service capability, including speeds and prices, in the United States and select communities and countries abroad.[782]

A. Access to Advanced Telecommunications Capability

276. We rely primarily on the FCC Form 477 deployment data to evaluate consumers' broadband options for fixed terrestrial and mobile services because, notwithstanding its flaws, these data currently remain the most reliable and comprehensive data to assess the availability of broadband services to American consumers.[783] We provide deployment estimates for fixed terrestrial services at speeds of 10/1 Mbps, 25/3 Mbps, 50/5 Mbps, 100/10 Mbps, and 250/25 Mbps based upon year-end data from 2015

[780] *See Economics of Internet Music and Radio* at 5. The table comparing terrestrial and online radio defines online radio as "listening to AM/FM radio stations and/or listening to streamed audio content only on the [I]nternet." *Id.*

[781] This assessment is not intended to fulfill the Commission's statutory responsibility under section 706 of the Telecommunications Act of 1996 to "determine whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion." 47 U.S.C. § 1302(b).

[782] 47 U.S.C. § 1303(b). The Broadband Data Improvement Act, Pub. L. No. 110-385, 122 Stat. 4096 (2008), is codified in Title 47, Chapter 12 of the United States Code. 47 U.S.C. § 1301 *et seq.*

[783] *See, e.g.*, 2020 *Broadband Deployment Report*, 35 FCC Rcd at 8997-8, para. 24; *2019 Broadband Deployment Report*, 34 FCC Rcd at 3868, para. 25; *2018 Communications Marketplace Report* 34 FCC Rcd at 12651, para.184. For this *Report*, we exclude Barrier Communications Corporation's deployment data because the Commission proposed a $163,912 forfeiture penalty based on a finding that the company had vastly overstated its data, failed to provide accurate FCC Form 477 data, and failed to provide response and accurate responses to the Enforcement Bureau's Letters of Inquiry. *Barrier Communications Corporation d/b/a BarrierFree*, Notice Of Apparent Liability for Forfeiture, FCC 20-123, at 1-2, para. 2 (Sept. 2, 2020).

to 2019. We exclude the U.S. Territories from the figures that report the five-year progression of deployment because of anomalies in the historical deployment data for Puerto Rico and the U.S. Virgin Islands.[784] However, we include the U.S. Territories in the figures that report current deployment estimates wherever possible,[785] including in Figure III.A.3e where we present the overall state of fixed and mobile deployment data for the entire United States.[786]

277. *Satellite Services*. We find that FCC Form 477 deployment data for satellite broadband service may overstate the extent to which satellite broadband is available. The FCC Form 477 deployment data for satellite broadband indicate that satellite service offering 25/3 Mbps speeds is available to nearly all of the population.[787] However, other FCC Form 477 data indicate that satellite services have a relatively low subscription rate despite their apparent widespread availability.[788] In Appendix F-7, we provide deployment estimates for all fixed services, including satellite, from 2015 to 2019.[789] Unless stated otherwise, our analysis in this section is based on all fixed terrestrial services, which do not include satellite.

278. *Terrestrial Fixed Wireless Services*. We note that the FCC Form 477 data for terrestrial fixed wireless services appear to show that these services are widely available. However, these services have a sufficiently low subscription rate to potentially support a conclusion that the FCC Form 477 deployment data may overstate the extent to which terrestrial fixed wireless services are available.[790] In Appendix F-8, we provide deployment estimates for terrestrial fixed wired services, that is, fixed services excluding fixed wireless and satellite services, for 2015 to 2019.[791]

279. *Mobile Services*. We continue to conclude that the best way to evaluate mobile broadband deployment and availability is to rely on FCC Form 477 data with a minimum advertised

[784] *See 2020 Broadband Deployment Report*, 35 FCC Rcd at 8999, para. 28. The historical data suggests a 21.7 percentage point increase in deployment between 2015 and 2016. *2019 Broadband Deployment Report*, 34 FCC Rcd at 3878, para. 39, Fig. 5. In addition, the year-end 2017 deployment data most likely significantly overstate deployment in Puerto Rico and the U.S. Virgin Islands at that time, because the data do not reflect infrastructure damage caused by Hurricanes Maria and Irma. *See 2019 Broadband Deployment Report*, 34 FCC Rcd at 3877-78, para. 39.

[785] Ookla data are unavailable for the U.S. Territories, thus figures and appendices presenting 10/3 Mbps mobile broadband based on Ookla data will not include the U.S. Territories, even for 2019.

[786] We also include data for Puerto Rico in our presentation of demographic data. Further, Appendices F-1–F-5 include data for the U.S. Territories.

[787] More specifically, the FCC Form 477 data indicate that satellite service offering 25/3 Mbps speeds is available to 331.274 million of the 331.777 million Americans, or approximately 100% of the U.S. population.

[788] FCC Form 477 data show that the adoption rate for satellite services (residential subscriptions divided by deployed households) for 10/1 Mbps is 1%. FCC Form 477 Data as of Dec. 31, 2019. While satellite signal coverage may enable operators to offer services to wide swaths of the country, overall satellite capacity may limit the number of consumers that can actually subscribe to satellite service at any one time. *2020 Broadband Deployment Report*, 35 FCC Rcd at 9000, para. 30 & n.99; *2019 Broadband Deployment Report*, 34 FCC Rcd at 3870, para. 28 & n.98; *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 17-199, 2018 Broadband Deployment Report, 33 FCC Rcd 1660, 1681, para. 51 & n.48 (2019) (*2018 Broadband Deployment Report*)). For this reason, we will continue to report satellite broadband deployment data separately.

[789] *See infra* Appx. F-7.

[790] For example, as of December 31, 2019, the adoption rate for fixed wireless services of at least 10/1 Mbps was 2%. This contrasts with the 60% adoption rate for cable and the 32% adoption rate for fiber-based services at the same speeds where these services are available in the United States. FCC Form 477 Data as of Dec. 31, 2019.

[791] *See infra* Appx. F-8.

speed of 5/1 Mbps,[792] supplemented with Ookla's speed test data. These data sets serve as a proxy for the likely consumer experience in a given area while providing objective data to assess deployment progress. In future *Reports*, we anticipate using the data arising from the *Digital Opportunity Data Collection* as they become available.[793] As the Commission has done in previous analyses of advanced telecommunications capability, we employ the centroid methodology in evaluating the FCC Form 477 4G LTE deployment data.[794] We consider a census block to be covered by 4G LTE services if there is at least one service provider serving that census block that reports 5/1 Mbps as the minimum advertised speed, based on their FCC Form 477 submission.

280. We recognize, however, that actual speeds may be considerably faster than the minimum advertised speed. Therefore, we also present estimates based on Ookla speed test data to evaluate the availability of 4G LTE with a median actual speed of 10/3 Mbps or higher.[795] We rely on the Ookla data to supplement our FCC Form 477 analysis primarily because they provide us with a large set of observations of actual speeds that customers receive.[796] As the Commission has done previously, our analysis of the availability of mobile 4G LTE services with a median speed of 10/3 Mbps includes actual speed test data in counties with at least 300 test observations.[797] The more densely populated counties

[792] For fixed services, the Commission has been able to rely upon FCC Form 477 reported maximum advertised speeds to track actual speeds. However, we note that the relationship between actual speeds and the advertised speed reported in the FCC Form 477 for mobile services is more complex, because minimum advertised speed is reported by the mobile providers, and different mobile providers estimate their minimum advertised speed based on various points of their actual speed distribution. *2020 Broadband Deployment Report*, 35 FCC Rcd at 9000-01, para. 32 & n.104. By contrast, the Ookla data provide us with the actual speeds that consumers experience.

[793] *See generally Digital Opportunity Data Collection* proceeding.

[794] *See, e.g., 2020 Broadband Deployment Report*, 35 FCC Rcd at 9000-01, para. 32.

[795] The data collected by the Ookla Speedtest mobile app include test results for download speed, upload speed, and latency, as well as other information, such as the location of the test and operating system of the handset. *2020 Broadband Deployment Report*, 35 FCC Rcd at 9001-02, para. 33 & n.107; *see also* https://www.speedtest.net/about (last visited Oct. 27, 2020). The Ookla results presented in this *Report* are based on tests that were executed in the second half of the year for 2015, 2016, 2017, 2018, and 2019 on the smartphone's cellular connection, and using 4G LTE technology. Test data were excluded if they had missing GPS location data or if the reported download or upload speed was less than zero. For all years up to and including 2017, test data were excluded if the reported download or upload speed was greater than 100 Mbps; however, beginning in 2018 this rule was no longer applied, due to changes in network engineering that increased the theoretical maximum upload and download speeds. Multiple tests by a single phone in the same locality and in the same day were averaged (using the median). All Ookla speed tests are user-initiated.

[796] We note that, in general, crowd-sourced data can offer the advantage of generating a large volume of data at a very low cost, and of measuring actual consumer experience on a network in a wide variety of locations, indoor and outdoor. Crowd-sourced data, however, often are not collected pursuant to statistical sampling techniques, and may require adjustments to construct a representative sample from the raw data. For instance, crowd-sourced mobile data come from a self-selected group of users, and there often is little control for most tests regarding such parameters as when people implement the test, whether the test is performed indoors or outdoors, the geographic location of the tester, and the vintage of the consumer's device. *2020 Broadband Deployment Report*, 35 FCC Rcd at 9000-01, para. 33 & n.109.

[797] *See 2020 Broadband Deployment Report*, 35 FCC Rcd at 9000-01, para. 33. This sample size threshold applies to each county for each time frame (2H2015, 2H2016, 2H2017, 2H2018, and 2H2019). If a county does not have at least 300 observations during one of these time frames, the county is not included in the actual speed analysis for the period during which the number of observations falls below 300. The 300 observations threshold is a conservative threshold and is based on a general mean and median sample size analysis. We consider a county to have a sufficient sample size if there are at least 300 total observations in a given year, after the cleaning and trimming rules have been applied. In contrast, in prior reports we considered a county to have a sufficient sample size if there were at least 300 total observations in *all* of the five years after cleaning and trimming rules had been applied. *See 2020 Broadband Deployment Report*, 35 FCC Rcd at 9000-01, para.33 & n.111. This change in methodology

(continued….)

have a higher likelihood of being included in this analysis because there generally are more observations in those geographical areas with a higher population density.[798] Although we do not have reliable on-the-ground speed data for every county in the United States, the Ookla data cover approximately 97% of the population of the United States, excluding the U.S. Territories, for which we do not have data.[799] Using the existing FCC Form 477 data combined with on-the-ground speed testing data provides the most reliable and comprehensive available data that are currently available on the extent of mobile coverage,[800] and our continued use allows for a consistent measure of progress over time.

1. Broadband Deployment Estimates

281. In Figures III.A.1 through III.A.3 below, we compare deployment in the most recent year of data available to deployment in the previous four years.[801] For purposes of this *Report*, we also report results for federally-recognized Tribal lands as identified in the 2010 Census. We aggregate federally recognized Tribal lands into four Tribal lands categories (the Lower 48 States,[802] Tribal Statistical

increases the population considered in this analysis; thus, the results reported in prior *Reports* cannot be compared to the results reported in this *Report*. *See, e.g., 2020 Broadband Deployment Report*, 35 FCC Rcd at 9004-05, para.37. County geography is assigned using the latitude and longitude coordinates that are collected during each Ookla speed test, via the device's GPS. This allows us to evaluate actual median upload and download speeds at the county level, in each year of the five-year time period, for counties in which approximately 97% of the U.S. population live (not including the U.S. Territories). If a census block has 4G LTE coverage of at least 5/1 Mbps based on the FCC Form 477 minimum advertised speeds, it is assigned the median upload and download speeds that are calculated for the county in which it is located, which allows us to evaluate the mobile broadband speeds for each census block within the United States.

[798] Wireless mobile speeds vary over even small local areas. Therefore, ascribing the median county Ookla speed to an entire county will sometimes overestimate or underestimate realized local speeds. Use of Ookla data alone would overestimate coverage as counties with only partial coverage would be represented as having 100% coverage. Use of FCC Form 477 data alone would necessitate reliance on the 5/1 Mbps reporting standard.

[799] The percentage of the population in our analysis is based on the total U.S. population, not including the U.S. Territories, for which we separately report our results. The Ookla speed data population in Fig. III.A.2b is a subset of the total U.S. population evaluated in Fig. III.A.2a and refers to the population in the counties for which we believe there are a statistically significant number of on-the-ground speed test observations. In 2019, for example, the U.S. population, not including the U.S. Territories, was 328.210 million, whereas in Fig. III.A.2b, we use 319.341 million as the basis for our 2019 calculations. The population evaluated figure, 319.341 million, is the population for the U.S., excluding the U.S. Territories and the population in the counties without a sufficient number of reliable on-the-ground speed test data observations.

[800] *See 2020 Broadband Deployment Report*, 35 FCC Rcd at 9000-01, paras. 32-33 (discussing use of FCC Form 477 combined with Ookla data to account for limitations in both data sets).

[801] Unless otherwise noted, the deployment percentage estimate for fixed terrestrial services and/or mobile services is the population in the census blocks with coverage for the service divided by the total population in the area being considered (e.g., United States, all rural areas, and all urban areas).

[802] These areas include: (1) Joint Use Areas; (2) legal, federally-recognized American Indian Area consisting of reservation and associated off-reservation trust land; (3) legal, federally recognized American Indian Area consisting of reservation only; and (4) legal, federally recognized American Indian Area consisting of off-reservation trust land only.

Areas,[803] Alaskan Villages,[804] and Hawaiian Home Lands)[805] and report deployment for these four geographic categories separately and jointly.[806]

a. Deployment of Fixed Advanced Telecommunications Capability

282. Figure III.A.1 shows the deployment of fixed terrestrial broadband at speeds of 25/3 Mbps, the Commission's current benchmark for fixed advanced telecommunications capability.[807] As of year-end 2019, approximately 96% of the overall population had coverage of such services, up from 94% in 2018. Nonetheless, the gap in rural and Tribal America remains notable: The data demonstrate, however, that the gap between urban and rural or Tribal areas has narrowed each year over the last five years. Approximately 17% of Americans in rural areas and 21% of Americans in Tribal lands lack coverage from fixed terrestrial 25/3 Mbps broadband, as compared to only 1% of Americans in urban areas.[808] Indeed, while the gap between urban and rural areas was 30 percentage points as of year-end 2016, it was approximately 16 percentage points only as of year-end 2019.

Fig. III.A.1
Deployment (millions) of Fixed Terrestrial 25/3 Mbps Services

	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	287.853	89.9%	296.320	91.9%	304.473	93.5%	309.000	94.4%	313.749	95.6%
Rural Areas	38.271	61.5%	42.628	67.7%	46.982	73.7%	50.146	77.7%	53.834	82.7%
Urban Areas	249.582	96.7%	253.692	97.7%	257.491	98.3%	258.854	98.5%	259.915	98.8%
Tribal Lands	2.290	57.8%	2.520	63.1%	2.734	68.1%	2.922	72.3%	3.203	79.1%
Pop. Evaluated	320.289	100.0%	322.518	100.0%	325.716	100.0%	327.167	100.0%	328.210	100.0%

b. Deployment of Mobile 4G LTE

283. Figure III.A.2a shows that almost all of the American population lives in geographical areas covered by mobile 4G LTE with a minimum advertised speed of at least 5/1 Mbps. From 2015 to 2019, the percentage of Americans living in rural areas with coverage of 4G LTE at 5/1 Mbps increased from approximately 98% to 99%. Figure III.A.2b shows that between 2018 and 2019, the percentage of Americans living in the United States with mobile 4G LTE services coverage at median speeds of 10/3 Mbps increased from approximately 94% to 97%. In addition, gains have been made in rural areas, where

[803] Tribal Statistical Areas are statistical American Indian Areas defined for a federally recognized Tribe that does not have reservation or off-reservation trust land; specifically a Tribal Designated Statistical Area (TDSA) or Oklahoma Tribal Statistical Area (OTSA).

[804] Alaskan Native Village Statistical Area.

[805] Hawaiian Home Lands were established by the Hawaiian Homes Commission Act of 1921.

[806] *See infra* Figs. III.A.9 and III.A.10.

[807] Unless stated otherwise, all references in this Report to data for the "United States," include the 50 States and the District of Columbia, but not the U.S. Territories. The estimates reported for years prior to 2019 may differ slightly from those reported in the *2020 Broadband Deployment Report* and the *2018 Communications Marketplace Report* because these estimates are based upon the most recent updates of the fixed broadband data previously released by the Commission.

[808] For purposes of presenting estimates for rural and urban areas, in this section, we aggregate all similarly categorized areas. The designation of a census block as urban is based upon the 2010 Census. An urban census block encompasses all population, housing, and territory included within a census block categorized as in an urban area or urban cluster. A rural census block encompasses all population, housing, and territory not included within urban census blocks. U.S. Census Bureau, *Urban and Rural*, https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural.html (last visited Oct. 27, 2020).

coverage increased from approximately 80% to almost 91% between 2018 and 2019.[809] And between 2017 and 2019, deployment of mobile 4G LTE services at median speeds of 10/3 Mbps expanded to cover an additional 16.6 million Americans living in rural areas.

Fig. III.A.2a
Deployment (millions) of Mobile 4G LTE with a Minimum Advertised Speed of 5/1 Mbps

Area	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	318.923	99.6%	321.347	99.6%	325.117	99.8%	326.727	99.9%	327.817	99.9%
Rural Areas	60.969	97.9%	61.802	98.2%	63.204	99.1%	64.097	99.4%	64.722	99.4%
Urban Areas	257.954	100.0%	259.545	100.0%	261.912	100.0%	262.630	100.0%	263.095	100.0%
Tribal Lands	3.722	93.9%	3.788	94.9%	3.896	97.0%	3.937	97.5%	3.959	97.7%
Pop. Evaluated	320.289	100.0%	322.518	100.7%	325.716	100.0%	327.167	100.0%	328.210	100.0%

Fig. III.A.2b
Deployment (millions) of Mobile 4G LTE with a Median Speed of 10/3 Mbps[810]

Area	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	247.649	82.2%	265.270	86.4%	275.091	86.8%	298.401	93.8%	310.923	97.4%
Rural Areas	33.260	68.4%	35.112	68.1%	36.585	64.3%	45.904	79.7%	53.156	90.8%
Urban Areas	214.389	84.8%	230.158	90.1%	238.506	91.8%	252.497	96.9%	257.767	98.8%
Pop. Evaluated	301.457	92.6%	307.067	95.2%	316.793	97.3%	318.269	97.3%	319.341	97.3%

[809] We present additional deployment data for mobile 4G LTE services for each state, the District of Columbia, U.S. Territory, and each category of Tribal land in the appendices. *See infra* Appendices F-1, F-2, and F-3 (reporting figures by state, the District of Columbia, and U.S. Territory), Appendices F-4 and F-5 (reporting figures by county and county equivalent, state, the District of Columbia, and U.S. Territory), and Appx. F-6 (reporting figures for Tribal lands).

[810] The analyses in Figs. III.A.2a to III.A.3d exclude the U.S. Territories. The analyses in Figs. III.A.2a, III.A.3a, and III.A.3c are based on FCC Form 477 data. In contrast, the analyses in Figs. III.A.2b, III.A.3b, and III.A.3d are based on Ookla data, and exclude any county (and its associated census blocks) for which there is insufficient Ookla data. In addition, we do not report results for Tribal lands in Figs. III.A.2b, III.A.3b, and III.A.3d because we have concerns with the reliability of the Ookla data for these areas. Tribal areas not only typically have fewer speed tests, but there are also fewer of these areas relative to urban and rural areas. Thus, deployment estimates for tribal areas are more sensitive to sample variance. The population figure reported in the bottom row of Figures III.A.2b, III.A.3b, and III.A.3d is the population evaluated for the reported time period and the percentage is the percentage of the U.S. population evaluated. Figures that include the availability of 4G LTE with a median speed of 10/3 Mbps show less than 100% of the population evaluated due to the unavailability of such Ookla data in certain places. Thus, for example, the 319.341 million population evaluated figure for 2019 in Fig. III.A.2b represents approximately 97% of the overall population in the 50 U.S. states and the District of Columbia (319.341/328.210=0.973). Regardless of our deployment estimates for mobile 4G LTE with a median speed of 10/3 Mbps, Americans residing in the counties without sufficient Ookla data to create a statistically significant county sample to be included in Fig.III.A.2b, III.A.3b, and III.A3d, receive minimum advertised speeds of 5/1 Mbps, and likely receive mobile services with speeds higher than 5/1 Mbps.

c. Deployment of Fixed Services and Mobile 4G LTE

284. Figure III.A.3a shows deployment across all geographic areas for both fixed terrestrial 25/3 Mbps services *and* 5/1 Mbps mobile 4G LTE.[811] Overall, as of year-end 2019, approximately 313.6 million Americans, or 96% of the population, are covered by both 25/3 Mbps fixed terrestrial service and mobile 4G LTE with a minimum advertised speed of 5/1 Mbps. In rural areas, approximately 82% of Americans are covered by both services, up from 78% in 2018. On Tribal lands, approximately 79% of Americans have coverage from both services, up from 72% in 2018. Figure III.A.3b shows deployment of fixed terrestrial speeds of 25/3 Mbps *and* mobile 4G LTE with median speed of 10/3 Mbps. As of December 31, 2019, approximately 94% of Americans live in geographic areas covered by both services, an increase of four percentage points since 2018. Further, these data indicate that, between 2018 and 2019, deployment increased from approximately 66% to over 77% for Americans living in rural areas.

285. Figure III.A.3c reports deployment of fixed terrestrial 25/3 Mbps service *or* mobile 4G LTE with a minimum advertised speed of 5/1 Mbps, and shows that services have been deployed to well over 99% of Americans since 2015. Figure III.A.3d shows that approximately 99% of the population in the evaluated areas are covered by either 25/3 Mbps fixed terrestrial service or mobile 4G LTE with a median speed of at least 10/3 Mbps.

Fig. III.A.3a
Deployment (millions) of Fixed Terrestrial 25/3 Mbps *and* Mobile 4G LTE with a Minimum Advertised Speed of 5/1 Mbps

Area	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	287.387	89.7%	295.853	91.7%	304.216	93.4%	308.811	94.4%	313.579	95.5%
Rural Areas	37.840	60.8%	42.182	67.0%	46.731	73.3%	49.981	77.5%	53.686	82.4%
Urban Areas	249.547	96.7%	253.671	97.7%	257.485	98.3%	258.830	98.5%	259.892	98.8%
Tribal Lands	2.258	57.0%	2.491	62.4%	2.722	67.8%	2.914	72.1%	3.196	78.9%
Pop. Evaluated	320.289	100.0%	322.518	100.7%	325.716	100.0%	327.167	100.0%	328.210	100.0%

[811] We present additional deployment data for fixed terrestrial 25/3 Mbps and/or mobile 4G LTE services in the appendices. *See infra* Appendices F-1, F-2 and F-3 (reporting figures by state, District of Columbia, and U.S. Territory), Appx. F-4 (reporting figures by state, county and county equivalent), Appx. F-5 (reporting figures by urban and rural areas within each state, county or county equivalent, state, the District of Columbia, and U.S. Territory), and Appx. F-6 (reporting figures for Tribal lands).

Fig. III.A.3b
Deployment (millions) of Fixed Terrestrial 25/3 Mbps *and* Mobile 4G LTE with a Median Speed of 10/3 Mbps

Area	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	231.815	76.9%	252.232	82.1%	264.364	83.5%	287.046	90.2%	300.156	94.0%
Rural Areas	23.134	47.6%	26.241	50.9%	29.223	51.4%	37.780	65.6%	45.346	77.4%
Urban Areas	208.681	82.5%	225.991	88.5%	235.142	90.5%	249.266	95.6%	254.810	97.7%
Pop. Evaluated	301.457	92.6%	307.067	95.2%	316.793	97.3%	318.269	97.3%	319.341	97.3%

Fig. III.A.3c
Deployment (millions) of Fixed Terrestrial 25/3 Mbps *or* Mobile 4G LTE with a Minimum Advertised Speed of 5/1 Mbps

Area	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	319.389	99.7%	321.814	99.8%	325.373	99.9%	326.916	99.9%	327.987	99.9%
Rural Areas	61.400	98.6%	62.248	98.9%	63.455	99.5%	64.262	99.6%	64.869	99.7%
Urban Areas	257.989	100.0%	259.567	100.0%	261.919	100.0%	262.653	100.0%	263.117	100.0%
Tribal Lands	3.753	94.7%	3.817	95.6%	3.907	97.3%	3.944	97.7%	3.967	97.9%
Pop. Evaluated	320.289	100.0%	322.518	100.7%	325.716	100.0%	327.167	100.0%	328.210	100.0%

Fig. III.A.3d
Deployment (millions) of Fixed Terrestrial 25/3 Mbps *or* Mobile 4G LTE with a Median Speed of 10/3 Mbps

Area	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	293.287	97.3%	299.722	97.6%	309.194	97.6%	313.987	98.7%	317.452	99.4%
Rural Areas	42.270	86.9%	45.431	88.1%	50.185	88.2%	53.719	93.3%	56.816	97.0%
Urban Areas	251.017	99.3%	254.291	99.5%	259.008	99.7%	260.269	99.8%	260.635	99.9%
Pop. Evaluated	301.457	92.6%	307.067	95.2%	316.793	97.3%	318.269	97.3%	319.341	97.3%

286. Figure III.A.3e reports deployment over the entire United States, including the U.S. Territories, for both fixed terrestrial 25/3 Mbps services and 5/1 Mbps mobile 4G LTE as of December 31, 2019. These data show year-end 2019 deployment rates comparable to those presented in Figures III.A.1, III.A.2a, III.A.3a and III.A.3c in which the U.S. Territories are excluded.[812]

[812] Appendices F-1 through F-5 include data for the U.S. Territories.

Fig. III.A.3e
Deployment (millions) of Fixed Terrestrial 25/3 Mbps and Mobile 4G LTE with a Minimum Advertised Speed of 5/1 Mbps for the United States, Including U.S. Territories (Dec. 31, 2019)

	Fixed Terrestrial 25/3 Mbps		Mobile 4G LTE 5/1 Mbps		Fixed Terrestrial 25/3 Mbps and Mobile 4G LTE 5/1 Mbps		Fixed Terrestrial 25/3 Mbps or Mobile 4G LTE 5/1 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	317.257	95.6%	331.333	99.9%	317.035	95.6%	331.554	99.9%
Rural Areas	54.062	82.8%	64.952	99.4%	53.906	82.5%	65.108	99.7%
Urban Areas	263.195	98.8%	266.381	100.0%	263.129	98.8%	266.447	100.0%
Pop. Evaluated	331.777	100.0%	331.777	100.0%	331.777	100.0%	331.777	100.0%

d. Additional Deployment Estimates

287. Figure III.A.4 shows deployment of fixed terrestrial services at various speed tiers from year-end 2015 through 2019.[813] As of December 2019, fixed terrestrial 50/5 Mbps service is deployed to approximately 94% of the population, up from 93% in 2018. Between 2018 and 2019, the deployment of 100/10 Mbps increased from approximately 91% to 92% of the population, and the deployment of 250/25 Mbps also increased from approximately 86% to over 87% of the population. While deployment in rural areas and on Tribal lands lags behind deployment in urban areas at all five speed tiers, the data show year-over-year improvements for all speeds in these areas. For example, between 2018 and 2019, the deployment of 250/25 Mbps increased from approximately 52% to almost 56% in rural areas, and from approximately 46% to almost 50% on Tribal lands.

[813] We present deployment estimates for all fixed services, including satellite broadband, in Appx. F-7, and deployment estimates for all fixed wired services, excluding satellite and fixed wireless services, in Appx. F-8. *See infra* Appendices F-7, F-8. The data in Fig. III.A.4 and Appendices F-7 and F-8 exclude the U.S. Territories.

Fig. III.A.4
Deployment (millions) of Fixed Terrestrial Services at Different Speed Tiers

Area	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
10/1 Mbps										
United States	302.138	94.3%	309.095	95.8%	315.656	96.9%	318.854	97.5%	321.066	97.8%
Rural Areas	48.361	77.7%	52.424	83.3%	56.169	88.1%	58.480	90.7%	60.231	92.5%
Urban Areas	253.777	98.4%	256.671	98.9%	259.487	99.1%	260.373	99.1%	260.835	99.1%
Tribal Lands	2.886	72.8%	3.201	80.2%	3.348	83.3%	3.511	86.9%	3.565	88.0%
25/3 Mbps										
United States	287.853	89.9%	296.320	91.9%	304.473	93.5%	309.000	94.4%	313.749	95.6%
Rural Areas	38.271	61.5%	42.628	67.7%	46.982	73.7%	50.146	77.7%	53.834	82.7%
Urban Areas	249.582	96.7%	253.692	97.7%	257.491	98.3%	258.854	98.5%	259.915	98.8%
Tribal Lands	2.290	57.8%	2.520	63.1%	2.734	68.1%	2.922	72.3%	3.203	79.1%
50/5 Mbps										
United States	283.329	88.5%	291.260	90.3%	298.242	91.6%	303.268	92.7%	307.736	93.8%
Rural Areas	35.316	56.7%	39.147	62.2%	42.312	66.3%	45.569	70.6%	48.742	74.9%
Urban Areas	248.013	96.1%	252.114	97.1%	255.930	97.7%	257.699	98.1%	258.994	98.4%
Tribal Lands	2.116	53.4%	2.269	56.9%	2.462	61.3%	2.639	65.3%	2.799	69.1%
100/10 Mbps										
United States	215.582	67.3%	244.110	75.7%	288.497	88.6%	296.249	90.5%	300.933	91.7%
Rural Areas	20.481	32.9%	25.781	41.0%	37.223	58.4%	40.390	62.6%	43.476	66.8%
Urban Areas	195.101	75.6%	218.329	84.1%	251.275	95.9%	255.859	97.4%	257.457	97.8%
Tribal Lands	1.669	42.1%	1.875	47.0%	2.198	54.7%	2.420	59.9%	2.582	63.7%
250/25 Mbps										
United States	67.912	21.2%	140.577	43.6%	190.041	58.3%	280.162	85.6%	286.185	87.2%
Rural Areas	5.460	8.8%	9.871	15.7%	17.991	28.2%	33.267	51.6%	36.209	55.6%
Urban Areas	62.452	24.2%	130.707	50.4%	172.050	65.7%	246.895	94.0%	249.976	95.0%
Tribal Lands	0.276	7.0%	1.330	33.3%	1.604	39.9%	1.837	45.5%	2.011	49.6%
Pop. Evaluated	320.289	100.0%	322.518	100.0%	325.716	100.0%	327.167	100.0%	328.210	100.0%

B. Demographic Data

288. In Figures III.A.5, III.A.6, III.A.7, and III.A.8, we present demographic data with our deployment analysis.[814] Figures III.A.5 and III.A.6 compare the available demographic data for Americans with and without coverage by fixed terrestrial 25/3 Mbps service and mobile 4G LTE. Figure III.A.5 presents this analysis for the United States (excluding U.S. Territories other than Puerto Rico) as a whole, urban and rural areas, and Tribal lands for fixed terrestrial 25/3 Mbps service and mobile 4G LTE with a minimum advertised speed of 5/1 Mbps in 2019.[815] The data show that, generally, Americans living in areas where these services are deployed typically live in census block groups with lower poverty rates and with higher average populations, population densities, per capita incomes, and median household incomes than Americans living in areas without coverage by these services.

[814] To present demographic data and compare the demographic data between areas where services are and are not deployed, we aggregate the census block data up to the census block group level, the lowest aggregation level for which demographic information is available. This unavoidable aggregation leads to census blocks with differing characteristics being grouped together. In the case of differing levels of deployment, we designate a census block group as without deployment if more than 5% of the population in the census block group is without services, regardless of the level of deployment in any particular census block in the group. Further, some census block groups are a mix of census blocks that are designated as rural and urban. In such instances, we designate a census block group as rural if more than 50% of the population in the census block group resides in census blocks designated as rural. Finally, we designate a census block group as Tribal lands if more than 50% of the land area in the census block group is designated as Tribal lands. We use the most recently available Census Bureau's ACS Five-Year Estimates 2014-2018 for income and poverty measures for the states, District of Columbia and Puerto Rico; income measures are not available for the other U.S. Territories. Per capita income and median household income for 2018 are measured in 2018 Inflation-Adjusted Dollars. The household poverty rate is the proportion of households living below the poverty level. Population Density is the total population residing in the census block group as of 2019 divided by the square miles of land in the census block group, with the estimate of land area is based upon the 2010 Census.

[815] Demographic data are not available for U.S. Territories other than Puerto Rico. We provide state-by-state and county-by-county demographic deployment information (including for Puerto Rico) in Appendices F-4 and F-5.

Fig. III.A.5
Comparison of Demographic Data Between Areas With and Without Fixed Terrestrial 25/3 Mbps and Mobile 4G LTE with a Minimum Advertised Speed of 5/1 Mbps (Dec. 31, 2019)

	Population	Population Density	Per Capita Income ($2018)	Median Household Income ($2018)	Household Poverty Rate
United States[816]					
With	1,517.0***	7,182.3***	$33,074.43***	$67,442.92***	14.7%***
Without	1,423.5	1,171.7	$27,342.03	$53,894.49	15.7%
Rural Areas					
With	1,438.1***	185.9***	$31,608.93***	$64,190.42***	11.3%***
Without	1,353.9	69.3	$26,919.99	$53,285.35	14.6%
Urban Areas					
With	1,527.7***	8,142.5***	$33,275.44***	$67,895.73***	15.1%***
Without	1,588.4	3,780.4	$28,276.33	$55,406.90	18.6%
Tribal Lands (Rural and Urban Areas)					
With	1,397.2**	1,886.6***	$27,122.36***	$53,463.90***	16.3%***
Without	1,333.9	295.9	$21,963.42	$44,749.57	21.9%
Tribal Rural Areas					
With	1,387.8	159.3***	$25,673.49	$53,020.00	16.4%
Without	1,346.3	65.0	$22,471.52	$45,821.08	21.0%
Tribal Urban Areas					
With	1,401.3**	2,593.1***	$27,714.10***	$53,607.11***	16.2%***
Without	1,292.2	1,074.7	$20,262.86	$41,129.25	24.7%

We test for a statistical difference in the reported means between areas with and without deployment of these services. The level of statistical significance is indicated by the number of stars. The absence of a star indicates no statistical difference between the reported figures. * signifies statistical significance at a 90% level of confidence, ** signifies statistical significance at a 95% level of confidence, and *** signifies statistical significance at a 99% level of confidence.

289. Figure III.A.6 compares the available demographic data across urban and rural areas for Americans in the 50 states and the District of Columbia with and without coverage by both fixed terrestrial 25/3 Mbps service and mobile 4G LTE service with a median speed of 10/3 Mbps in 2019.[817] Like Figure III.A.5, Figure III.A.6 shows that Americans living in areas where these services are deployed typically live in census block groups where there are lower poverty rates, and where there are higher average populations, population densities, per capita incomes, and median household incomes than areas without such service deployment.

[816] Data exclude U.S. Territories other than Puerto Rico.

[817] As above, we exclude the U.S. Territories from this analysis due to a lack of Ookla data for these areas, and we do not report separately for Tribal lands because of concerns with the representativeness of the Ookla data for these areas.

Fig. III.A.6
Comparison of Demographic Data Between Areas With and Without Fixed Terrestrial 25/3 Mbps and Mobile 4G LTE with a Median Speed of 10/3 Mbps (Dec. 31, 2019)

	Population	Population Density	Per Capita Income ($2018)	Median Household Income ($2018)	Household Poverty Rate
United States[818]					
With Deployment	1,517.7***	7,194.7***	$33,336.42***	$67,970.89***	14.3%***
Without	1,439.8	1,302.2	$27,441.02	$54,245.57	15.7%
Rural Areas					
With Deployment	1,407.7***	172.9***	$31,212.33***	$63,254.26***	11.6%***
Without	1,385.0	78.1	$27,291.17	$54,067.27	14.1%
Urban Areas					
With Deployment	1,533.7	8,221.2***	$33,646.93***	$68,669.25***	14.7%***
Without	1,543.21	3,615.0	$27,728.41	$54,599.34	18.7%
We test for a statistical difference in the reported means between areas with and without deployment of these services. The level of statistical significance is indicated by the number of stars. The absence of a star indicates no statistical difference between the reported figures. * signifies statistical significance at a 90% level of confidence, ** signifies statistical significance at a 95% level of confidence, and *** signifies statistical significance at a 99% level of confidence.					

290. Figure III.A.7 shows, for 2019, how the average proportion of the population with coverage by fixed terrestrial 25/3 Mbps service and mobile 4G LTE service with a minimum advertised speed of 5/1 Mbps varies with median household income, population density, and poverty rate at the census block group level.[819] On average, deployment is highest in census block groups with the highest median household incomes, the highest population densities, and the lowest poverty rates.

[818] Data exclude U.S. Territories other than Puerto Rico.

[819] We present these results at the census block group, the smallest geographic areas for which income data are available, to examine how the deployment rate varies with income measures in the geographic area.

Fig. III.A.7
Average Percentage of Population with Fixed Terrestrial 25/3 Mbps and Mobile 4G LTE with a Minimum Advertised Speed of 5/1 Mbps by Census Block Group Level Demographic Variables (Dec. 31, 2019)[820]

	Fixed Terrestrial 25/3 Mbps	Mobile 4G LTE 5/3 Mbps	Both Fixed and Mobile 4G LTE
Median Household Income ($2018)			
First Quartile (Lowest Median Household Income)	93.7%	99.7%	93.5%
Second Quartile	93.1%	99.8%	93.0%
Third Quartile	95.5%	99.9%	95.5%
Fourth Quartile (Highest Median Household Income)	98.5%	100.0%	98.5%
Population Density			
First Quartile (Lowest Pop. Density)	83.5%	99.3%	83.2%
Second Quartile	98.2%	100.0%	98.2%
Third Quartile	99.2%	100.0%	99.2%
Fourth Quartile (Highest Pop. Density)	99.3%	100.0%	99.3%
Household Poverty Rate			
First Quartile (Lowest Household Poverty Rate)	97.4%	99.9%	97.3%
Second Quartile	95.3%	99.9%	95.2%
Third Quartile	93.5%	99.8%	93.4%
Fourth Quartile (Highest Household Poverty Rate)	94.6%	99.7%	94.4%

291. Figure III.A.8 depicts how the average proportion of the population with coverage by fixed terrestrial services by speed tier varies with median household income population density, and household poverty rate at the census block group level. On average, deployment is highest in census blocks with the highest median household incomes, the highest population densities, and the lowest household poverty rates.

[820] Data exclude U.S. Territories other than Puerto Rico.

Fig. III.A.8
Average Percentage of Population With Fixed Terrestrial Services by Census Block Group Level Demographic Variables (Dec. 31, 2019)[821]

	10/ 1 Mbps	25/ 3 Mbps	50/ 5 Mbps	100/ 10 Mbps	250/ 25 Mbps
Median Household Income ($2018)					
First Quartile (Lowest Median Household Income)	97.1%	93.7%	92.1%	90.0%	83.6%
Second Quartile	97.0%	93.1%	90.3%	87.3%	81.0%
Third Quartile	98.0%	95.5%	92.9%	90.2%	85.6%
Fourth Quartile (Highest Median Household Income)	99.1%	98.5%	97.7%	96.8%	94.6%
Population Density					
First Quartile (Lowest Pop. Density)	92.9%	83.5%	76.5%	69.3%	58.2%
Second Quartile	98.9%	98.2%	97.7%	96.6%	91.3%
Third Quartile	99.4%	99.2%	99.0%	98.7%	96.3%
Fourth Quartile (Highest Pop. Density)	99.5%	99.3%	99.3%	99.1%	98.4%
Household Poverty Rate					
First Quartile (Lowest Household Poverty Rate)	98.6%	97.4%	95.9%	94.3%	91.1%
Second Quartile	97.9%	95.3%	92.9%	90.4%	85.6%
Third Quartile	97.2%	93.5%	90.9%	88.2%	82.4%
Fourth Quartile (Highest Household Poverty Rate)	97.4%	94.6%	93.2%	91.3%	85.6%

1. Tribal Lands Data

292. In Figures III.A.9 and III.A.10, we present additional deployment estimates for Americans living on Tribal lands for each Tribal lands category.[822] The Commission's data indicate that deployment in rural Tribal lands continues to lag behind deployment on urban Tribal lands, although this gap is shrinking. Figure III.A.9 presents deployment on Tribal lands from 2015 to 2019 of fixed terrestrial 25/3 Mbps services and mobile 4G LTE service with a speed of at least 5/1 Mbps. Overall, in 2019, approximately 79% of Tribal lands are covered by fixed terrestrial 25/3 Mbps services and mobile 4G LTE with a speed of 5/1 Mbps, an increase from 72% in 2018 based on FCC Form 477 data. Deployment on rural Tribal lands continues to lag behind urban Tribal lands, with only approximately 65% of all Tribal lands in rural areas having deployment of both services, as compared to 95% of Tribal lands in urban areas. But this Tribal urban-rural divide is narrowing: the gap between the percentage of Americans living on urban Tribal lands and the percentage of Americans living on rural Tribal lands with access to 25/3 Mbps fixed broadband and Mobile 4G LTE with a minimum advertised speed of 5/1 Mbp has been nearly halved between 2015 and 2019, falling from more than 55 points to 30 points.

[821] Data exclude U.S. Territories other than Puerto Rico.

[822] We present more granular state-by-state Tribal lands data in Appx. F-6.

Fig. III.A.9
Deployment (millions) on Tribal Lands of Fixed Terrestrial 25/3 Mbps and Mobile 4G LTE with a Minimum Advertised Speed of 5/1 Mbps

	2015		2016		2017		2018		2019	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Tribal Lands	2.258	57.0%	2.491	62.4%	2.722	67.8%	2.914	72.1%	3.196	78.9%
Rural Areas	0.614	30.1%	0.780	37.8%	0.954	45.7%	1.114	52.9%	1.364	64.5%
Urban Areas	1.644	85.6%	1.711	88.8%	1.768	91.6%	1.799	93.1%	1.831	94.5%
Alaskan Villages	0.110	42.7%	0.135	51.5%	0.151	57.0%	0.176	65.9%	0.185	69.3%
Rural Areas	0.039	23.7%	0.061	36.2%	0.073	42.4%	0.093	54.1%	0.102	59.3%
Urban Areas	0.071	76.7%	0.074	79.0%	0.079	83.3%	0.083	87.3%	0.083	87.5%
Hawaiian Home Lands	0.030	88.9%	0.030	88.6%	0.030	89.4%	0.030	89.1%	0.032	93.1%
Rural Areas	0.002	43.9%	0.002	43.5%	0.003	47.7%	0.003	47.8%	0.004	64.6%
Urban Areas	0.027	98.0%	0.027	98.0%	0.027	98.2%	0.027	98.2%	0.028	99.5%
Lower 48 States	0.452	41.5%	0.508	46.1%	0.595	53.3%	0.638	56.5%	0.758	66.8%
Rural Areas	0.207	28.4%	0.239	32.3%	0.311	41.3%	0.344	45.1%	0.434	56.5%
Urban Areas	0.245	67.8%	0.270	74.1%	0.284	78.1%	0.293	80.2%	0.324	88.4%
Tribal Statistical Areas	1.666	64.5%	1.818	70.2%	1.946	74.8%	2.070	79.4%	2.221	84.9%
Rural Areas	0.365	32.0%	0.478	41.5%	0.567	49.0%	0.674	57.9%	0.824	70.5%
Urban Areas	1.301	90.3%	1.341	93.0%	1.378	95.4%	1.396	96.6%	1.397	96.5%
Pop. Evaluated	3.964	100.0%	3.991	100.0%	4.017	100.0%	4.039	100.0%	4.052	100.0%

293. In Figure III.A.10, we present deployment estimates for fixed terrestrial 25/3 Mbps service and mobile 4G LTE service with a speed of at least 5/1 Mbps on Tribal lands. As of December 31, 2019, fixed terrestrial 25/3 Mbps services was deployed to over 79% of Americans on Tribal lands, almost 98% were covered by mobile 4G LTE at speeds of at least 5/1 Mbps, and almost 79% were covered by both services. The figures show variability in deployment across the Tribal lands categories, with the least deployment in Alaskan Villages.

Fig. III.A.10
Deployment (millions) of Fixed Terrestrial 25/3 Mbps and/or Mobile 4G LTE with a Minimum Advertised Speed of 5/1 Mbps on Tribal Lands (Dec. 31, 2019)

	Pop. Evaluated	Fixed 25/3 Mbps		Mobile 4G LTE 5/1 Mbps		Fixed 25/3 Mbps and Mobile 4G LTE 5/1 Mbps		Fixed 25/3 Mbps or Mobile 4G LTE 5/1 Mbps	
		Pop.	% of Pop.	Pop.	% of Pop.	Pop.	% of Pop.	Pop.	% of Pop.
All Tribal Lands	4.052	3.20	79.1%	3.959	97.7%	3.196	78.9%	3.967	97.9%
Alaskan Villages	0.267	0.187	69.9%	0.208	78.0%	0.185	69.3%	0.210	78.6%
Hawaiian Home Lands	0.034	0.032	93.2%	0.034	99.9%	0.032	93.1%	0.034	100.0%
Lower 48 States	1.134	0.763	67.3%	1.104	97.3%	0.758	66.8%	1.109	97.8%
Tribal Statistical Areas	2.617	2.222	84.9%	2.613	99.9%	2.221	84.9%	2.614	99.9%

C. International Broadband Data Report

294. As part of its statutory requirement for the *Communications Marketplace Report*, the Commission must include "information comparing the extent of broadband service capability (including data transmission speeds and price for broadband service capability) in a total of 75 communities in at least 25 countries abroad for each of the data rate benchmarks for broadband service used by the Commission to reflect different speed tiers."[823] We must choose international communities comparable to various communities in the United States with respect to population size, population density, topography, and demographic profile.[824] The Commission is required to include "a geographically diverse selection of countries" and "communities including the capital cities of such countries."[825] The Commission must "identify relevant similarities and differences in each community, including their market structures, the number of competitors, the number of facilities-based providers, the types of technologies deployed by such providers, the applications and services those technologies enable, the regulatory model under which broadband service capability is provided, the types of applications and services used, business and residential use of such services, and other media available to consumers."[826]

295. *Selection of Comparison Countries.* We selected 35 Organisation for Economic Co-operation and Development (OECD) countries to meet the statutory directive of developing a geographically diverse set of countries for comparison with the United States concerning international broadband services capability.[827] These 35 comparison countries in alphabetical order are Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.[828] The 28 comparison countries in the *2018 Communications Marketplace Report* are a subset of the 35 comparison member countries chosen for the current *Report*.[829] Retaining these same 28 countries for comparison will facilitate and enhance consistent assessments of international broadband developments over time. For the fixed and mobile broadband price comparisons, we rely on a smaller subset of 25 comparison countries.[830] For the fixed and mobile deployment

[823] 47 U.S.C. § 1303(b)(1).

[824] 47 U.S.C. § 1303(b)(2). Fig. III.A.8 depicts how the average proportion of the U.S. population with coverage by fixed terrestrial services at different speed tiers varies with median household income population density, and the household poverty rate at the census block group level. On average, deployment is highest in census blocks with the highest median household incomes, the highest population densities and the lowest household poverty rates. *See supra* Fig. III.A.8.

[825] 47 U.S.C. § 1303(b)(2).

[826] 47 U.S.C. § 1303(b)(3).

[827] Colombia, the 37th OECD member country, joined the OECD in April 2020 and is not included in any *International Broadband Data Report* analysis due to unavailability of the data. OECD, *List of OECD Member countries Ratification of the Convention on the OECD*, https://www.oecd.org/about/document/list-oecd-member-countries.htm (last visited Oct. 27, 2020).

[828] OECD, *List of OECD Member countries - Ratification of the Convention on the OECD*, https://www.oecd.org/about/document/list-oecd-member-countries.htm (last visited Oct. 27, 2020).

[829] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12563, para. 267.

[830] The countries excluded from the pricing analysis are Chile, Hungary, Israel, Japan, Lithuania, Poland, Slovakia, Slovenia, South Korea, and Turkey. Due to the time intensive nature of collecting both fixed broadband and mobile broadband pricing data from multiple providers in each country, we limited the pricing analysis to the same countries analyzed in the *2018 International Broadband Data Report* except for Chile, Japan, and South Korea. *See generally International Comparison Requirements Pursuant to the Broadband Data Improvement Act, International Broadband Data Report*, GN Docket No. 17-199, Sixth Report, 33 FCC Rcd 978 (2018) (*2018 International Broadband Data Report*).

comparison, we rely on the 26 European comparison countries (EU26).[831] A complete list of comparison countries is presented in Appendix G-1.

1. Broadband Speed and Performance Comparison

296. In Appendix G-2, based on Ookla data, we present a comparison of fixed broadband and a comparison of mobile broadband performance metrics in terms of data transmission speeds (download and upload speeds) and latency for the United States and the 35 comparison countries. For fixed broadband, we consider all technologies accounted for by Ookla,[832] and for mobile broadband, we consider 4G LTE only, which is the baseline industry standard for the marketing of mobile broadband service during the period under consideration.[833] Our analysis covers a five-year time horizon for fixed broadband and a four-year time horizon for mobile broadband.[834] We rank speeds from fastest (1st) to slowest (36th) and latency from shortest (1st) to longest (36th).[835]

297. *Fixed Broadband Results.* The mean download speed in the United States in 2019 was 119.6 Mbps, ranking 5th—a substantial improvement from 14th out of 35 countries in 2015 when the mean download speed was 40.4 Mbps.[836] The mean upload speed in the United States in 2019 was 46.3 Mbps, ranking 17th—a slight improvement from 18th out of 35 countries in 2015. For latency, although the United States maintained the same ranking at 24th out of the 36 countries in both 2015 and 2019, latency improved significantly from 37.5 ms in 2015 to 23.7 ms in 2019.

298. *Mobile Broadband Results.* The mean download speed in the United States in 2019 was 37.0 Mbps, ranking 25th, compared to 35th in 2016. The U.S. rankings in upload speed and latency remained stable between 2015 and 2019. The mean upload speed in the United States in 2019 was 11.1 Mbps, with a ranking of 35th. For latency, the United States ranked 34th in 2019 at 46.7 ms, although latency improved from 52.5 ms in 2016.

2. Broadband Price Comparison

299. In Appendix G-3, we present analyses of fixed broadband and mobile broadband prices for the United States and 25 comparison countries. We collected fixed broadband and mobile broadband prices from the websites of the largest providers in each country between February and September 2020. We compare broadband prices using two methods: (1) a broadband price index and (2) a hedonic price index. The broadband price index ranks countries by their weighted average price, while the hedonic price index accounts for quality differences as well as market-level cost and demographic differences, such as population density, income, terrain ruggedness, and education levels, that are likely to affect

[831] Relative to the *2018 International Broadband Data Report*, this *2020 International Broadband Data Report* also includes five additional European OECD member countries: Hungary, Lithuania, Poland, Slovakia, and Slovenia. Non-European OECD member countries are not included in the deployment analysis due to data comparability issues with these other countries.

[832] Ookla does not specify which technologies are included in their fixed results because Ookla is unable to distinguish which technology the test taker is on. Data based on Wi-Fi-using devices are included in these results.

[833] Prior IBDRs considered all mobile technologies available. This 2020 IBDR has been updated to present 4G LTE data only.

[834] We use a shorter time horizon for mobile broadband because the Ookla 4G LTE data are available from 2016 to 2019.

[835] In the *2018 Communications Marketplace Report*, our fixed broadband and mobile broadband speed analysis considered 28 OECD comparison countries, but as noted in the *2018 Communications Marketplace Report Data Update*, we have access to Ookla data with seven additional OECD countries: Hungary, Israel, Lithuania, Poland, Slovakia, Slovenia, and Turkey.

[836] For both fixed broadband download and upload speeds, Luxembourg is excluded in 2015 due to data concerns.

pricing across countries. Compared to earlier *International Broadband Data Reports*,[837] these analyses seek to better assess how the U.S. market performed relative to other markets. We rank the countries from the least expensive (1st) to most expensive (26th) based on the two price indexes.

300. *Fixed Broadband Results.* Based on the broadband price index approach, the United States ranked 21st among the 26 comparison countries. However, using the hedonic price index approach, which adjusted for cost, demographics, and quality differences across countries, the United States ranked 2nd among the 26 countries.

301. *Mobile Broadband Results.* Based on the broadband price index approach, the United States ranked 21st among the 26 comparison countries. However, using the hedonic price index approach which adjusted for cost, demographics, and quality differences across countries, the United States ranked 7th among the 26 countries.

3. Broadband Deployment Comparison with Europe

302. In Appendix G-4, we compare fixed high-speed broadband deployment and mobile broadband deployment in the United States and 26 European comparison countries. We relied on European Commission (EC) deployment data published in the *European Commission Broadband Report* and FCC Form 477 data for the United States.

303. *Fixed Broadband Results*. Between 2015 and 2019, the United States fixed high-speed broadband coverage for all households increased from 89% to 94%. In 2019, the United States ranked 8th among the 27 countries—a slight drop from 7th out of 27 countries in 2018. The percent high-speed coverage of rural households in the United States in 2019 was 77%, ranking 9th—a slight drop from 8th out of 27 countries in 2018. During this period, the 26 European comparison countries increased their high-speed coverage for all households from 72% to 84%.

304. *Mobile Broadband Results*. The United States continued to have nearly 100% 4G LTE coverage for all households, including those in rural areas, through June 2019. The 26 European comparison countries increased their 4G LTE broadband coverage from 99% in 2018 to a rounded 100% for all households in 2019. Similarly, the 26 European comparison countries increased their 4G LTE broadband coverage for rural households from 97% in 2018 to 99% in 2019.

4. Demographics

305. As discussed above, the comparison countries selected are geographically diverse, but comparable to the United States in terms of population size, population density, terrain ruggedness, topography, and demographic profile. We summarize the demographic information, including income, population density, and educational levels, at the country-level for the United States and the 25 countries used to compare broadband prices in Figure G-43 of Appendix G-3. During the reference period, the United States ranked as the 5th richest country in terms of income measured by the gross national income (GNI) per capita after adjusting for purchasing power parity. With an average population density of 93 persons per square mile, the United States ranked as the 17th most densely populated country among the 26 countries. The United States ranked as the 17th most rugged country among the comparison countries. With regards to educational attainment, the United States was one of the most highly educated countries, with 36.7% of the U.S. labor force attaining the level of tertiary education. For detailed demographic

[837] *See, e.g., 2016 International Broadband Data Report*, which only looked at simple averages in different speed and/or bundle combinations. *See generally International Comparison Requirements Pursuant to the Broadband Data Improvement Act, International Broadband Data Report*, GN Docket No. 15-191, Fifth Report, 31 FCC Rcd 2667 (2016) (*2016 International Broadband Data Report*).

information by country or city for selected variables, please refer to prior *International Broadband Data Reports* as well as the OECD website.[838]

5. International Regulatory Developments

306. Below, we discuss several new market and regulatory developments, including national broadband, satellite, and 5G developments.[839] We limit our discussion to developments that have occurred since the *2018 Communications Marketplace Report*, and identify the relevant similarities and differences between the United States and the comparison countries based on multiple criteria.[840]

307. *Market Developments*. Providers in a number of countries have continued to launch new broadband services and increase broadband speeds through the deployment of additional broadband technologies.[841] For example, in July 2019, NBN Co, the company managing the construction of Australia's National Broadband Network (NBN), reported 1 Gbps download speeds in a DOCSIS 3.1 trial.[842] In January 2020, Mexico's Comisión Federal de Electricidad (CFE) awarded Italian vendor Prysmian Group a $38 million cable supply contract to extend broadband services to 52 Mexican towns and cities.[843] In June 2020, Technicolor announced that Megacable, the Mexican cable operator and provider of Internet and phone offerings, is deploying the country's first DOCSIS 3.1 services.[844] In July 2020, Shaw Communications in Canada introduced a new service under the Shaw Mobile brand,[845] which integrates Shaw's home broadband/Wi-Fi services and a public Wi-Fi infrastructure with more than

[838] In prior *International Broadband Data Reports* we included a demographics Appendix which presented the following additional variables for the United States and comparison countries, both nationwide and for select regions: Households with Broadband (%); Total Population; Population Density; Total GDP; Per Capita GDP; and Education (% of Labor Force with Tertiary Education). *See 2018 Communications Marketplace Report*, Appx. E-5. Updated demographic data are available for the comparison countries, excluding the United States and Canada, on the OECD's website. OECD, *OECD.Stat*, https://stats.oecd.org/ (last visited Oct. 27, 2020). Updated U.S. data are available on the U.S. Census Bureau website. U.S. Census Bureau, *Explore Census Data*, https://data.census.gov/cedsci/ (last visited Oct. 27, 2020). Updated Canadian data are available on the Canadian Radio-television and Communications Commission data website. Canadian Radio-television and Telecommunications Commission, *Communications Monitoring Report 2019*, https://crtc.gc.ca/eng/publications/reports/policymonitoring/2019/index.htm (last visited Oct. 27, 2020).

[839] 47 U.S.C. § 1303(b)(3) ("The Commission shall identify relevant similarities and differences in each community, including their market structures, the number of competitors, the number of facilities-based providers, the types of technologies deployed by such providers, the applications and services those technologies enable, the regulatory model under which broadband service capability is provided, the types of applications and services used, business and residential use of such services, and other media available to consumers.").

[840] *2018 Communications Marketplace Report*, 33 FCC Rcd at 12707-13, paras. 280-89.

[841] *See* TeleGeography GlobalComms Database (*TeleGeography GlobalComms Database*), http://www.telegeography.com (last updated Aug. 2020).

[842] TeleGeography CommsUpdate, *NBN Co Records 1 Gbps Downlink Speeds in DOCSIS 3.1 Trial* (July 17, 2019), https://www.commsupdate.com/articles/2019/07/17/nbn-co-records-1gbps-downlink-speeds-in-docsis-3-1-trial/.

[843] TeleGeography CommsUpdate, *Mexican govt awards Prysmian USD38m broadband contract* (Jan. 17, 2020), https://www.commsupdate.com/articles/2020/01/17/mexican-govt-awards-prysmian-usd38m-broadband-contract/.

[844] LightReading, *Mexico's Megacable Deploys Technicolor Gateway for DOCSIS 3.1* (Jan. 23 2020), https://www.lightreading.com/cable/mexicos-megacable-deploys-technicolor-gateway-for-docsis-31-/d/d-id/757037

[845] TeleGeography CommsUpdate, *Shaw launching second cellular service, Shaw Mobile* (July 28, 2020), https://www.commsupdate.com/articles/2020/07/28/shaw-launching-second-cellular-service-shaw-mobile/.

450,000 hotspots and its own 4G LTE network.[846] Vodafone Germany and the United Kingdom's Virgin Media successfully launched new services offering broadband at higher speeds via DOCSIS 3.1.[847]

308. Providers in several countries are in the process of increasing fiber deployment, with fiber deployment now exceeding copper broadband connections in at least one country. In June 2020, for example, the largest UK incumbent, BT's Openreach subsidiary, put the upgrade of its copper network to G.fast on hold, and will instead focus on deploying FTTP technology to 3.2 million rural homes by 2025.[848] The United Kingdom and Italy have begun formulating proposals to retire copper to accelerate investment in fiber.[849] As of September 2019, fiber became the dominant fixed broadband technology in New Zealand, with fiber broadband connections outnumbering copper broadband connections for the first time.[850]

309. The use of Internet services such as online news, video on demand, voice and video calling, social networks participation, online shopping, and online banking has also continued to grow in many countries. For example, the proportion of Internet users in Austria that read news online increased from 70% in 2015 to 75% in 2019.[851] The proportion of Internet users in Greece that use video calls increased from 61% in 2018 to 67% in 2019.[852] Downloads of video calling applications have surged during the COVID-19 pandemic.[853] And with online and mobile banking common in many countries, mobile operators themselves started to offer banking and financial services, as Orange has done in France

[846] LightReading, *Shaw Mobile banks on network convergence* (July 30, 2020), https://www.lightreading.com/4g3gwifi/shaw-mobile-banks-on-network-convergence-/d/d-id/762794.

[847] *See* Jeff Baumgartner, *DOCSIS 3.1 Takes Hold in Europe* (Nov. 13, 2019), https://www.lightreading.com/cable/docsis-31-takes-hold-in-europe-/d/d-id/755575; Ken Wieland, *Virgin Media Makes DOCSIS 3.1 Upgrade Splurge* (July 2, 2020), https://www.lightreading.com/cable-video/docsis/virgin-media-makes-docsis-31-upgrade-splurge/d/d-id/762133.

[848] *See* Mark Jackson, *Openreach Confirm G.fast Broadband Rollout Paused Until 2021 UPDATE* (June 24, 2020), https://www.ispreview.co.uk/index.php/2020/06/openreach-confirm-g-fast-broadband-rollout-paused-until-2021.html; TeleGeography, *Openreach to Extend Full Fibre to 3.2m More Rural Premises; Ofcom Proposes New Regulations* (July 30, 2020), https://www.commsupdate.com/articles/2020/07/30/openreach-to-extend-full-fibre-to-3-2m-more-rural-premises-ofcom-proposes-new-regulations/.

[849] *See* TeleGeography CommsUpdate, *Ofcom Consulting on Copper Retirement Regulation Proposals* (June 26, 2020), https://www.commsupdate.com/articles/2020/06/26/ofcom-consulting-on-copper-retirement-regulation-proposals/; Giuseppe Fonte, *Exclusive: Italy up the Ante in Plan to Create Single Broadband Network, Sources Say* (Aug. 6, 2020), https://www.reuters.com/article/us-italy-broadband-telecom-italia-enel-e/exclusive-italy-ups-the-ante-in-plan-to-create-single-broadband-network-sources-say-idUSKCN2520M1.

[850] Commerce Commission, *Annual Telecommunications Monitoring Report: 2019 Key Facts* (Mar. 12, 2020), https://comcom.govt.nz/regulated-industries/telecommunications/monitoring-the-telecommunications-market/annual-telecommunications-market-monitoring-report.

[851] Reuters Institute, Digital News Report 2019 at 70 (2019), https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2019-06/DNR_2019_FINAL_0.pdf.

[852] European Commission, Digital Economy and Society Index (DESI) 2020, DESI Country Profile Greece at 9, https://ec.europa.eu/digital-single-market/en/scoreboard/greece (last visited Oct. 27, 2020).

[853] Sarah Perez, *Videoconferencing Apps Saw a Record 62M Downloads During One Week in March* (Mar. 30, 2020), https://techcrunch.com/2020/03/30/video-conferencing-apps-saw-a-record-62m-downloads-during-one-week-in-march/.

and Spain.[854] The proportion of Internet users in Canada that shop online remains quite high – 87% in 2019, and 85% in 2020.[855]

310. *National Broadband Developments*.[856] Many countries continue to develop comprehensive broadband agendas,[857] increasingly with a view towards future applications and services such as 5G, IoT, and artificial intelligence .[858] For example, in August 2019, Austria released its new Broadband Strategy 2030 that emphasizes nationwide availability of gigabit broadband.[859] In November 2019, Ireland partnered with private investment firm, Granahan McCourt, to deliver its National Broadband Plan to connect areas without high-speed fiber broadband and provide free Wi-Fi in public places in all 26 counties.[860] In May and June 2020, Hungary opened its window for receiving bids for building broadband connections above 100 Mbps to 62,000 households in 72 districts using $13 million in funding in the second phase of its Superfast Internet Program.[861] Canada issued its spectrum outlook plan for the period 2018 to 2022, which discusses the development of the digital economy and 5G

[854] TeleGeography CommsUpdate, *Orange Bank Launches in Spain; Offers Best Interest Rate in the Country* (Nov. 26, 2019), https://www.commsupdate.com/articles/2019/11/26/orange-bank-launches-in-spain-offers-best-interest-rate-in-the-country/.

[855] Canadian Internet Registration Authority (CIRA), CIRA Internet Factbook 2020 (2020), https://www.cira.ca/resources/factbook/canadas-internet-factbook-2020.

[856] Many countries continue to adopt national broadband plans to expand broadband access and use. According to the ITU, as of September 2019, 164 countries have national broadband plans, digital strategies, or ICT plans that include broadband, up from 159 countries the previous year. *See* Broadband Commission for Sustainable Development, The State of Broadband: Broadband as a Foundation for Sustainable Development at 33 (2019), https://www.itu.int/dms_pub/itu-s/opb/pol/S-POL-BROADBAND.20-2019-PDF-E.pdf (*State of Broadband Report 2019*). The United Nations' Broadband Commission for Sustainable Development has set seven global broadband targets, including a target for all countries to have a funded national broadband plan or strategy, or to include broadband in their universal access and services definition, by 2025. *See generally State of Broadband Report 2019* (discussing overall progress towards the targets). Progress towards these targets has been challenging. Carlos Iglesias, *As Internet Access Proves Critical, We are Missing Targets to Connect Everyone* (Apr. 17, 2020), https://a4ai.org/as-internet-access-proves-critical-we-are-missing-targets-to-connect-everyone/.

[857] *State of Broadband Report 2019* at 33.

[858] Some countries, such as Korea, have also developed separate strategies directed towards individual future applications and services. *See, e.g.*, Ministry of Science & ICT, *National Strategy for Artificial Intelligence* (Dec. 17, 2019), http://english.msip.go.kr/english/msipContents/contentsView.do?cateId=tst60&artId=2771576.

[859] Federal Ministry for Transport, Innovation and Technology, Broadband Strategy 2030 (2019), https://www.bmlrt.gv.at/dam/jcr:b4b67c21-89c5-48e5-b344-c0ccf37d6d16/broadbandstrategy2030_ua.pdf. According to the EU's common broadband targets, by 2025, all schools, transport hubs, and main providers of public services, as well as digitally intensive enterprises, should have access to Internet connections with download/upload speeds of 1 Gbps/second. Additionally, all European households should have access to networks offering a download speed of at least 100 Mbps, which can be upgraded to 1 Gbps. *See* European Commission, *Digital Single Market: Connectivity for a European Gigabit Society*, https://ec.europa.eu/digital-single-market/en/policies/improving-connectivity-and-access (last visited Oct. 27, 2020).

[860] Department of the Environment, Climate, and Communications, National Broadband Plan (last updated Oct. 13, 2020), https://www.gov.ie/en/publication/c1b0c9-national-broadband-plan/; TeleGeography CommsUpdate, *NBI Inks Contract with Government to Deliver National Broadband Plan* (Nov. 20, 2019), https://www.commsupdate.com/articles/2019/11/20/nbi-inks-contract-with-government-to-deliver-national-broadband-plan/.

[861] Stephen Hardy, *Hungary Opens Tender Process for Superfast Internet Program 2.0* (Apr. 20, 2020), https://www.lightwaveonline.com/fttx/ftth-b/article/14174386/hungary-opens-tender-process-for-superfast-internet-program-20.

deployment, among other topics.[862] Sweden is offering €150 million in subsidies to support rollouts in rural areas, and Greece is offering vouchers to business and residential users.[863] Under the Iceland Initiative, the country created a fund to help cover 99.9% of premises with next generation broadband with download speeds of 100 Mbps.[864] The United Kingdom has established a Universal Service Obligation for broadband that provides UK residents and businesses with a legal right to a "decent" and "affordable" connection, defined as 10/1 Mbps connection with a 100 GB per month minimum data allowance at a cost of £45 per month.[865]

311. Over the past several years, as part of modernization of its universal service programs, the Commission has instituted a number of reforms to target support for broadband expansion and adoption in the United States.[866] Other regulators are likewise increasingly including broadband in their universal service obligations. For example, in July 2020, the Australian government finalized the legislative framework for its Universal Service Guarantee, introduced in December 2018, which extends not only to voice telephony, but also broadband access.[867]

312. *Satellite Developments.* Many countries are also increasingly recognizing the possible impact of innovative satellite technologies, such as nanosatellites[868] and advanced laser communication networks. In August 2019, for example, the European Space Agency launched the second European Data Relay System, EDRS-C, into geostationary orbit.[869] EDRS-C and its sister satellite, EDRS-A, use lasers to communicate with Earth-observation satellites that are closer to the planet's surface and circle the Earth approximately every 90 minutes. This enables them to beam their data back to Europe in almost real time. These satellites offer an almost constant connection with Earth-observation satellites, without

[862] Government of Canada, Spectrum Outlook 2018 to 2022 (last updated June 6, 2018), https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11403.html

[863] *See* TeleGeography CommsUpdate, *Sweden to Offer EUR150m Broadband Subsidy This Year* (Jan. 21, 2020), https://www.commsupdate.com/articles/2020/01/21/sweden-to-offer-eur150m-broadband-subsidy-this-year/; TeleGeography CommsUpdate, *Greece Expands Broadband Subsidy Scheme* (Feb. 12, 2020), https://www.commsupdate.com/articles/2020/02/12/greece-expands-broadband-subsidy-scheme/.

[864] TeleGeography CommsUpdate, *Iceland Grants ISK450M to 24 Municipalities for Fibre Optic Rollouts* (Mar. 28, 2018), https://www.commsupdate.com/articles/2018/03/28/iceland-grants-isk450m-to-24-municipalities-for-fibre-optic-rollouts/.

[865] Georgina Hutton, *The Universal Service Obligation (USO) for Broadband* (Oct. 02, 2020), https://commonslibrary.parliament.uk/research-briefings/cbp-8146/.

[866] For a more detailed description of the Commission's recent universal service reforms, *see* https://www.fcc.gov/general/universal-service (last visited Oct. 27, 2020).

[867] TeleGeography CommsUpdate, *New Legislation Guarantees Broadband Access for All Australians* (July 3, 2020), https://www.commsupdate.com/articles/2020/07/03/new-legislation-guarantees-broadband-access-for-all-australians/; Press Release, Department of Infrastructure, Transport, Regional Development and Communications, New Universal Service Guarantee Announced (Dec. 5, 2018), https://www.communications.gov.au/departmental-news/new-universal-service-guarantee-announced.

[868] Nanosatellites are small satellites that have a small fraction of the mass and cost of a more traditional satellite. They were originally developed as educational tools but are increasingly being used in orbit for technology demonstrations, scientific studies, and commercial purposes. European Space Agency, *CubeSats*, https://www.esa.int/Enabling_Support/Preparing_for_the_Future/Discovery_and_Preparation/CubeSats (last visited Oct. 27, 2020).

[869] Press Release, European Space Agency, Data-relay satellite beams at light speed (July 16, 2020), https://www.esa.int/Applications/Telecommunications_Integrated_Applications/Data-relay_satellite_beams_at_light_speed.

which reportedly there would be delays of close to 90 minutes. Norway,[870] Finland,[871] France,[872] and Slovenia[873] are all developing and launching nanosatellites for increased communication capabilities while other countries are building partnerships for cooperation to expand their space programs. For example, in October 2019, the Polish Space Agency signed a Joint Statement of Intent for Space with NASA.[874] In December 2019, Luxembourg followed suit by signing a Memorandum of Understanding with NASA.[875] Likewise, the United Kingdom[876] and Finland[877] have both engaged in private development of satellite manufacturing services with U.S. companies.

313. Regulators in other countries are examining how best to deploy this new generation of satellite technologies, both independently and collectively. In August 2020, for example, the Canadian Radio-Television and Telecommunications announced that its Broadband Fund will support satellite projects in Northern Manitoba, Yukon, and the Northwest Territories.[878] In July 2020, the EC agreed to reduce its space budget to focus on continuing the Galileo and Copernicus satellite programs, and other initiatives include GovSatCom, an initiative aimed at providing secure satellite communications for EC members, and the European space situational awareness investments.[879] As part of its Five-Year Spectrum Outlook 2019-2023, the Australian Communications and Media Authority is considering how best to address spectrum management challenges in response to the deployment of novel satellite systems, including possible changes to the Ku- and Ka-bands.[880]

314. *5G Developments.* Many countries have been examining regulatory frameworks to consider and address possible barriers to broadband infrastructure investment and deployment, with a particular focus on 5G infrastructure. Approaches to 5G development and the status of deployment efforts vary across countries. As of August 2020, 92 operators had launched commercial 5G networks in

[870] Rachel Jewett, *GomSpace to Develop Norwegian Military Satellite* (June 11, 2020), https://www.satellitetoday.com/government-military/2020/06/11/gomspace-to-develop-norwegian-military-satellite/.

[871] YLE, *Finland needs its own space research centre, gov't report says* (Feb. 16, 2020), https://yle.fi/uutiset/osasto/news/finland_needs_its_own_space_research_centre_govt_report_says/11206877.

[872] Annamarie Nyirady, *Arianespace to Launch ANGELS, France's 1st Nanosatellite (*Jan. 9, 2019) https://www.satellitetoday.com/launch/2019/01/09/arianespace-to-launch-angels-frances-1st-nanosatellite/.

[873] STA, *Slovenia to launch its first nanosatellite this summer* (Apr. 5, 2019), https://english.sta.si/2623691/slovenia-to-launch-its-first-nanosatellite-this-summer.

[874] Spacewatch Europe, *Polish Space Agency Signs Cooperation Agreement With NASA*, https://spacewatch.global/2019/10/polish-space-agency-signs-cooperation-agreement-with-nasa/ (last visited Oct. 27, 2020).

[875] Jeff Foust, *Luxembourg expands its space resources vision* (Dec. 6, 2019), https://spacenews.com/luxembourg-expands-its-space-resources-vision/.

[876] Caleb Henry, *British government and Bharti Global buy OneWeb, plan $1 billion investment to revive company*, (July 3, 2020), https://spacenews.com/british-government-and-bharti-global-buy-oneweb-plan-1-billion-investment-to-revive-company/.

[877] Debra Werner, *Iceye establishes U.S. office, considers U.S. manufacturing* (Feb. 13, 2020), https://spacenews.com/iceye-us-opens/.

[878] Mirage News, *Over 10,100 households in northern communities to have access to improved broadband Internet service* (Aug. 18, 2020), https://www.miragenews.com/over-10-100-households-in-northern-communities-to-have-access-to-improved-broadband-internet-service/.

[879] Austria in Space, *Space Law*, https://austria-in-space.at/en/space-law/ (last visited Oct. 27, 2020).

[880] Australian Communications & Media Authority (ACMA), *Five-Year Spectrum Outlook 2019-2023: The ACMA's Spectrum Management Work Program* (Sept. 2019), https://www.acma.gov.au/publications/2019-09/publication/five-year-spectrum-outlook-2019-23.

38 countries.[881] The Commission's 5G strategy includes three key components: (1) making additional spectrum available for 5G services, (2) updating infrastructure policy and encouraging the private sector to invest in 5G networks, and (3) modernizing outdated regulations to promote 5G backhaul deployment and promote digital opportunity for all Americans.[882] Some countries and regions have developed or are developing 5G plans that cover a range of policy initiatives, such as the EC's 2016 5G Action Plan, and Chile's July 2018 consultation to develop a national 5G plan.[883] In line with its 5G Action Plan and the 2018 European Electronic Communications Code, in June 2020 the EC adopted an implementing regulation that defines the small cells that should be exempt from local planning permits.[884]

315. As well as in the United States, regulators around the world are also in the midst of allocating, auctioning, and/or licensing additional spectrum across various bands to support 5G services.[885] As of February 2020, 40 countries had completed allocations of dedicated or technology-neutral 5G-suitable spectrum, and 54 countries had announced plans for allocating 5G-suitable frequencies by the end of 2022.[886] For example, in June 2020, Korea announced plans to reallocate spectrum in the 3.7-4 GHz range, currently used for satellite communications, for 5G wireless use.[887] Similarly, in May 2020, Australia outlined plans to reallocate the 850 MHz and 900 MHz bands for 5G services, culminating in an auction planned for late 2021.[888] Australia also intends to auction spectrum in the 26 GHz band in March 2021.[889] Israel concluded its auction of 5G-suitable spectrum in August 2020, with three operator partnerships each winning spectrum in the 700 MHz, 2.6 GHz, and 3.5 GHz bands.[890] In April 2019, Japan approved the allocation of 5G spectrum in the 3.7 GHz and 28 GHz bands to

[881] Global Mobile Suppliers Association (GMSA), 5G Market Snapshot (Aug. 2020), https://gsacom.com/paper/5g-market-snapshot-august-2020/.

[882] FCC, The FCC's 5G FAST Plan, https://www.fcc.gov/5G (last visited Oct. 27, 2020). For a detailed discussion of 5G, *see* section II.A.5.b.

[883] TeleGeography CommsUpdate, *Subtel opens consultation on 5G plan*, (July 26, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/07/26/subtel-opens-consultation-on-5g-plan/.

[884] European Commission, *The Commission Adopts Implementing Regulation to Pave the Way for High Capacity 5G Network Infrastructure* (June 30, 2020), https://ec.europa.eu/digital-single-market/en/news/commission-adopts-implementing-regulation-pave-way-high-capacity-5g-network-infrastructure.

[885] *See generally* Global Mobile Suppliers Association, *5G Spectrum Report: February 2020* (2020), https://gsacom.com/paper/5g-spectrum-report-february-2020/.

[886] *See id*.

[887] *See* Cho Mu-Hyun, *South Korea to Reallocate Spectrum for 5G Use*, ZDNet (June 29, 2020), https://www.zdnet.com/article/south-korea-to-reallocate-spectrum-for-5g-use/. MSIT previously concluded a 5G auction in the 3.5 GHz and 28 GHz bands. TeleGeography CommsUpdate, *MSIT Announces Results of 5G Spectrum Auction* (June 19, 2018), https://www.telegeography.com/products/commsupdate/articles/2018/06/19/msit-announces-results-of-5g-spectrum-auction/.

[888] ACMA, 850/900 MHz Band, https://www.acma.gov.au/850900-mhz-band (last visited Oct. 27, 2020).

[889] ACMA, 26 GHz Band, https://www.acma.gov.au/26-ghz-band (last visited Oct. 27, 2020). ACMA previously allocated 5G spectrum in the 3.6 GHz band in Dec. 2018. TeleGeography CommsUpdate, *Australia's 3.6 GHz 5G Auction Earns AUD853m* (Dec. 10, 2018), https://www.commsupdate.com/articles/2018/12/10/australias-3-6ghz-5g-auction-earns-aud853m/.

[890] TeleGeography CommsUpdate, *Israel Concludes 5G Spectrum Auction; MoC Approves Cellcom's Purchase of Golan Telecom* (Aug. 14, 2020), https://www.commsupdate.com/articles/2020/08/14/israel-concludes-5g-spectrum-auction-moc-approves-cellcoms-purchase-of-golan-telecom/.

various companies, including Softbank, and a new fourth operator, Rakuten Mobile, which is part of the local e-commerce company Rakuten.[891]

316. In line with the EC's 5G Action Plan,[892] European Union member states are focusing on several "pioneer band[s]" to harmonize the initial launch of 5G services across Europe,[893] with an initial emphasis on the 700 MHz, 3.4-3.8 GHz, and 26 GHz bands.[894] Spectrum in the 700 MHz band has been licensed in Denmark, France, Finland, Germany, Hungary, Italy, and Sweden, as has spectrum in the 3.4-3.8 GHz band in Austria, Czech Republic, Finland, Germany, Hungary, Ireland, Italy, Latvia, Spain, and the United Kingdom.[895] Italy and Finland have auctioned spectrum in the 26 GHz band,[896] and auctions are planned in several countries including Poland and Portugal by the end of 2020.[897] 5G is now commercially available in at least 10 European countries.[898] Operators around the world are looking at using open radio access networks (ORAN) to upgrade their networks to 5G.[899] Recognizing that ORAN networks offer an alternative to traditional cellular network architecture and could enable diversity in suppliers, better network security, and lower costs, in September 2020, the Commission convened a forum on 5G ORANs for leading experts in this area to discuss related technologies and the path forward. The forum also featured U.S. Secretary of State Michael Pompeo and reflects the FCC's efforts to ensure the United States leads the way in researching and developing innovative approaches to mobile network deployment.[900]

317. In the Americas, in August 2020, Chile established a timeline for four separate, parallel 5G spectrum auctions, to take place in the 4th quarter of 2020 for the following bands: 700 MHz, AWS

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[891] TeleGeography CommsUpdate, *MIC Approves Allocation of 5G Spectrum to Japanese Operators, with Conditions* (Apr. 11, 2019), https://www.commsupdate.com/articles/2019/04/11/mic-approves-allocation-of-5g-spectrum-to-japanese-operators-with-conditions/.

[892] *See generally* European Commission, *5G for Europe: An Action Plan (*Sept. 14, 2016*)*, https://ec.europa.eu/digital-single- market/en/news/communication-5g-europe-action-plan-and-accompanying-staff-working-document.

[893] Radio Spectrum Policy Group, *Strategic Roadmap Towards 5G for Europe: Opinion of Spectrum-Related Aspects for Next-Generation Wireless Systems (5G)* (Nov. 9, 2016), https://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion_5G.pdf (identifying the following "pioneer band[s]": 3400-3800 MHz; below 1 GHz, particularly the 700 MHz band; 24.25-27.5 GHz; and upper bands, including 31.8-33.4 GHz and 40.5-43.5 GHz).

[894] Radio Spectrum Policy Group, *Strategic Spectrum Roadmap Towards 5G in Europe: RSPG Second Opinion on 5G Networks* (Jan. 30, 2018), https://circabc.europa.eu/sd/a/fe1a3338-b751-43e3-9ed8-a5632f051d1f/RSPG18-005final-2nd_opinion_on_5G (identifying the 3.4-3.8 GHz band as the "key for success of 5G in Europe").

[895] Press Release, European 5G Observatory, Some European 5G Spectrum Auctions Postponed Due to COVID-19 (Apr. 3, 2020), https://5gobservatory.eu/some-european-5g-spectrum-auctions-postponed-due-to-covid-19/.

[896] *Id.*; *see also* TeleGeography CommsUpdate, *Finland's 26GHz Auction Concludes Swiftly* (June 9, 2020), https://www.commsupdate.com/articles/2020/06/09/finlands-26ghz-auction-concludes-swiftly/.

[897] TeleGeography CommsUpdate, *Poland Still Expects 5G Auction and Network Launches this Year* (May 13, 2020), https://www.commsupdate.com/articles/2020/05/13/poland-still-expects-5g-auction-and-network-launches-this-year/; TeleGeography CommsUpdate, *Portuguese 5G Auction Earmarked to Start in October* (July 14, 2020), https://www.commsupdate.com/articles/2020/07/14/portuguese-5g-auction-earmarked-to-start-in-october/.

[898] *See e.g.*, GSMA Intelligence, The Mobile Economy 2020 at 13 (2020), https://www.gsma.com/mobileeconomy/wp-content/uploads/2020/03/GSMA_MobileEconomy2020_Global.pdf.

[899] Eugina Jordan, *Open RAN 101–Open RAN Adoption in in different regions: Why, What, When, How? (Reader Forum)* (Aug. 6, 2020), https://www.rcrwireless.com/20200806/opinion/readerforum/open-ran-101-open-ran-adoption-in-different-regions-why-what-when-how-reader-forum.

[900] FCC, *Forum on 5G Open Radio Access Networks*, https://www.fcc.gov/news-events/events/forum-5g-virtual-radio-access-networks.

(1.7/2.1 GHz), 3.5 GHz, and 28 GHz.[901] I Canada will start the country's 3500 MHz 5G spectrum auction on June 15, 2021, with an April 6, 2021 deadline for receipt of applications and pre-auction financial deposits. The new 3500 MHz licenses will be valid for 20 years.[902] Similarly, Mexico has prepared its 5G roadmap with a specific set of milestones for the industry.[903] Mexico's plan to license 70 megahertz of the 600 MHz band and 150 megahertz of the 3.4 GHz band for fixed internet 5G deployment has been delayed until 2021.[904]

318. *COVID-19*. In response to the COVID-19 pandemic, the Commission has undertaken a variety of initiatives to keep Americans connected.[905] Regulators worldwide have likewise leveraged broadband technologies as a critical component in coronavirus response and recovery.[906] For example, in August 2020, New Zealand allocated US$33 million for rural broadband connectivity as part of its COVID Response and Recovery Fund.[907] Saudi Arabia offered temporary spectrum or additional spectrum for the service providers to successfully handle the increase in demand and any interferences to Internet traffic in March 2020.[908] Europe took a different approach at the beginning of the pandemic. In March 2020, the EC asked Netflix, YouTube, and Amazon Prime to temporarily downgrade the quality of their services to reduce load on broadband networks.[909] In September 2020, France announced that its next COVID-19 stimulus bill would include €240 million for fiber networks in addition to €280 million for fiber already allocated to local governments.[910] Nigeria called on service providers to share resources such as fiber optic cables and align their corporate social responsibility programs to help mitigate the spread of the virus.[911] And South Africa engaged with licensees and requested service providers to

[901] Press Release, Subsecretaría de Telecomunicaciones, Presidente Pinera anuncia la primera licitación 5G de Latinoamérica y la creación de un ecosistema digital público privado (Aug. 17, 2020), https://www.subtel.gob.cl/presidente-pinera-anuncia-la-primera-licitacion-5g-de-latinoamerica-y-la-creacion-de-un-ecosistema-digital-publico-privado/.

[902] TeleGeography CommsUpdate, *Canada delays 3500MHz 5G auction to June 2021* (June 8, 2020), https://www.commsupdate.com/articles/2020/06/08/canada-delays-3500mhz-5g-auction-to-june-2021/.

[903] IFT, *Panorama del Espectro Radioeléctrico en México para servicios móviles de quita generación* (Mar. 2019), http://www.ift.org.mx/sites/default/files/panoramadelespectroradioelectricoenmexicopara5g.pdf.

[904] *Id.*

[905] *See* section V; *see generally* FCC, Keep Americans Connected, https://www.fcc.gov/keep-americans-connected (last visited Oct. 27, 2020).

[906] *See generally e.g.*, ITU, COVID-19 Response and Recovery, https://www.itu.int/en/Pages/covid-19.aspx (last visited Oct. 27, 2020) (providing an overview of global actions to use digital technologies to respond to and recover from the coronavirus pandemic).

[907] TeleGeography CommsUpdate, *UFB Programme Hits 1m Connections; Govt Allocates Further NZD50m for Rural Broadband* (Aug. 6, 2020), https://www.commsupdate.com/articles/2020/08/06/ufb-programme-hits-1m-connections-govt-allocates-further-nzd50m-for-rural-broadband/.

[908] Press Release, Communications and Information Technology Commission, CITC Provides Additional Spectrum for Saudi Telecom Providers to Boost Mobile Network Performance (Mar. 31, 2020), https://www.citc.gov.sa/en/mediacenter/pressreleases/Pages/20200330.aspx.

[909] Foo Yun Chee, *YouTube, Amazon Prime Forgo Streaming Quality to Relieve European Networks* (Mar. 20, 2020), https://www.reuters.com/article/us-health-coronavirus-youtube-exclusive/youtube-amazon-prime-forgo-streaming-quality-to-relieve-european-networks-idUSKBN2170OP.

[910] Anne Morris, *France Stokes Fiber's Embers with Extra €240M* (Sept. 4, 2020), https://www.lightreading.com/opticalip/fttx/france-stokes-fibers-embers-with-extra-euro-240m/d/d-id/763703.

[911] Press Release, Nigerian Communications Commission, What We're Doing to Support Stakeholders' Efforts to Deal with COVID-19 (Mar. 26, 2020), https://www.ncc.gov.ng/media-centre/news-headlines/813-press-release-what-we-re-doing-to-support-stakeholders-efforts-to-deal-with-covid-19-by-ncc.

facilitate easy and affordable access to data. South Africa released emergency spectrum in the 700 MHz, 800 MHz, 2600 MHz, and 3500 MHz bands as a key intervention to stimulate economic recovery.[912]

IV. ENTRY AND EXPANSION CONDITIONS IN THE COMMUNICATIONS MARKETPLACE

319. New entry and incumbent expansion occurs in the context of underlying regulatory and market conditions that directly influence the total number of firms that can successfully compete and grow. To evaluate the competitiveness of any market, one must consider multiple factors, including, as discussed in section II, prices and trends in prices, non-price competition, investment, innovation, as well as any barriers to entry or expansion by incumbents.[913] While there is no single definition in the economics literature of what constitutes a barrier to entry,[914] it is nonetheless the case that high barriers to entry reduce the threat to incumbents of new entry.[915] In addition, barriers to expansion reduce the ability of existing competitors to successfully enter new geographic areas.

A. The Mobile Wireless Communications Marketplace

320. In the mobile wireless marketplace, there are both regulatory and non-regulatory factors that can affect entry or expansion. Regulatory barriers to entry arise from government regulations, rules, and restrictions that may have the effect of discouraging entry or expansion. For the most part, they are related to the inputs necessary to offer mobile wireless services. Spectrum policy, which affects the spectrum capacity available for mobile wireless services and infrastructure regulations that govern tower and antenna siting may constitute barriers to entry or expansion. As discussed in more detail in section V.A., the Commission has made significant efforts to make more spectrum available and to reduce the cost of infrastructure deployment.

321. Non-regulatory or market conditions that may determine the number of providers that can operate in the market, or may deter entry or expansion, include efficiencies of size and scale, permanent asymmetries across service providers' costs, and capital cost requirements, such as those costs incurred in acquiring spectrum or deploying a nationwide network.[916]

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[912] Press Release, Independent Communications Authority of South Africa, Temporary radio frequency spectrum issued to qualifying applicants in an effort to deal with covid-19 communication challenges (Apr. 17, 2020), https://www.icasa.org.za/news/2020/temporary-radio-frequency-spectrum-issued-to-qualifying-applicants-in-an-effort-to-deal-with-covid-19-communication-challenges.

[913] *Applications of AT&T Inc. and DIRECTV For Consent to Assign or Transfer Control of Licenses and Authorizations*, Memorandum Opinion and Order, 30 FCC Rcd 9131, 9140, paras. 19-20 (2015); *Applications of AT&T Wireless Services, Inc. and Cingular Wireless Corporation*, Memorandum Opinion and Order, 19 FCC Rcd 21522, 21544-45, paras. 41-42 (2004).

[914] *See, e.g.*, Joe S. Bain, Barriers to New Competition (1950); George J. Stigler, The Organization of Industry (1968); Carl Christian von Weizsacker, *A Welfare Analysis of Barriers to Entry*, 11 Bell Journal of Economics 399 (1980); Richard Gilbert, *Mobility Barriers and the Value of Incumbency*, Handbook of Industrial Organization 475 (Richard Schmalensee and Robert Willig eds. 1989); R. Preston McAfee, Hugo M. Mialon & Michael A. Williams, *What is a Barrier to Entry?*, 94 AEA Papers and Proceedings, 461 (2004).

[915] High economic profits encourage entry into the market, low economic profits discourage entry, and prolonged negative economic profits induce exit from the market. *See e.g.*, Hal R. Varian, Intermediate Microeconomics: A Modern Approach, 433-34 (9th ed. 2014); Dennis W. Carlton and Jeffrey M. Perloff, Modern Industrial Organization, 61, 76 (4th ed. 2005). *See also* George S. Ford, et al., *Competition After Unbundling: Entry, Industry Structure, and Convergence*, 59 Fed. Com. L.J. 344 (2007).

[916] Relatively high fixed costs in relation to the number of customers may limit the number of firms that can enter and survive in a market. *See, e.g.*, John Sutton, *Sunk Costs and Market Structure* (1991); Luis Cabral, *Introduction to Industrial Organization* (2000); Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* 41 (4th ed. 2005); George S. Ford, et al., *Competition After Unbundling: Entry, Industry Structure, and Convergence*, 59 Fed. Com. L.J. 59:2, 332, 337 (2007).

322. *Spectrum*. As already noted, spectrum is a critical input in the provision of mobile wireless services. Increasing the total supply of spectrum bandwidth that the Commission allocates and licenses is important, and since the release of the *2018 Communications Marketplace Report*, the Commission has continued its efforts to expand access to spectrum to support 5G and other advanced wireless services. The Commission has pursued a comprehensive strategy that emphasizes the need to free up spectrum in the low-, mid-, and high-frequency bands.[917]

323. In July 2020, for example, the Commission announced the successful completion of the 39-month transition period following the broadcast incentive auction, which identified 70 megahertz of licensed spectrum in the 600 MHz band for repurposing from television broadcasting to commercial wireless operations.[918] This milestone signals that all of the valuable low-band airwaves sold in the ground-breaking broadcast incentive auction are now available for wireless mobile broadband services.[919] In addition to low-band spectrum, the Commission also has taken significant steps to improve access to high-band spectrum. Since 2019, the Commission has conducted three *Spectrum Frontiers* auctions to make mmW spectrum available to mobile providers for licensed use. Auctions 101, 102, and 103 collectively made available nearly five gigahertz of spectrum in the 28 GHz, 24 GHz, and Upper 37 GHz, 39 GHz, and 47 GHz bands.[920]

324. The demand for mid-band spectrum for 5G networks has especially increased in recent years.[921] The Commission's comprehensive mid-band spectrum strategy will further the deployment of 5G, IoT, and other advanced spectrum-based services. In July 2019, for example, the Commission reformed the regulatory framework for a portion of the 2.5 GHz band to make this spectrum more conducive for advanced wireless services, including 5G.[922] Auction 105, an auction of Priority Access Licenses in the Citizens Broadband Radio Service in the 3550-3650 MHz band (3.5 GHz band), concluded at the end of August of this year,[923] and offered the greatest number of spectrum licenses ever made available for bidding in a single auction. In addition, the Commission has freed up spectrum in the

[917] *Expanding Flexible Use of the 3.7 to 4.2 GHz*, GN Docket No. 18-122, Report and Order and Order of Proposed Modification, 35 FCC Rcd 2343, 2344, para. 1 (2020) (*3.7 GHz Report and Order*).

[918] Press Release, FCC, Post-Incentive Auction Transition Successfully Meets 39-Month Deadline (July 13, 2020), https://docs.fcc.gov/public/attachments/DOC-365479A1.pdf (Post-Incentive Auction Transition Press Release).

[919] Post-Incentive Auction Transition Press Release.

[920] *Auction of 28 GHz Upper Microwave Flexible Use Service Licenses for Next-Generation Wireless Services Closes; Gross Winning Bids Amounts Announced for Auction 101*, AU Docket No. 18-85, Public Notice, 34 FCC Rcd 75 (WTB 2019) (*28 GHz Auction Public Notice*); *Auction of 24 GHz Upper Microwave Flexible Use Service Licenses Closes, Winning Bidders Announced for Auction 102*, AU Docket No. 18-85, Public Notice, 34 FCC Rcd 4294 (OEA, WTB 2019) (*24 GHz Auction Public Notice*); *Incentive Auction of Upper Microwave Flexible Use Service Licenses in the Upper 37 GHz, 39 GHz, and 47 GHz Bands for Next-Generation Wireless Services, Notice of Filing Requirements, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 103*, AU Docket No. 19-59, Public Notice, 34 FCC Rcd 5532 (2019) (*37 GHz, 39 GHz, and 47 GHz Auction Procedures Public Notice)*; *Incentive Auction of Upper Microwave Flexible Use Service Licenses in the Upper 37 GHz, 39 GHz, and 47 GHz Bands for Next-Generation Wireless Services, Winning Bidders Announced for Auction 103*, AU Docket No. 19-59, Public Notice, 35 FCC Rcd 2015 (OEA, WTB 2020) (*37 GHz, 39 GHz, and 47 GHz Auction Public Notice*); *see also* CTIA Comments at 59.

[921] CTIA and CCA assert that in order to meet exponential growth in mobile data demand driven by consumers and reap the benefits of the 5G economy, wireless providers need resources to build high-capacity, low-latency 5G networks and emphasized mid-band spectrum for exclusive licensed use. CTIA Comments at 58-60; CCA Comments at 14-15.

[922] *2.5 GHz Report and Order*, 34 FCC Rcd at 5447, para. 3.

[923] *3.5 GHz Public Notice*.

3.45-3.55 GHz band[924] and reformed the use of the 3.7-4.2 GHz band, commonly known as the C-band, to make 280 megahertz of that band available for the next generation of wireless services.[925]

325. *Infrastructure*. Wireless infrastructure constitutes another major input in the provision of mobile wireless services. State and local zoning rules for deploying new wireless towers or attaching equipment to existing towers or other structures can pose an impediment to the deployment of mobile wireless networks. Delays in local approvals can lengthen the time and cost for deployment, which increases the costs for new or existing providers to enter into new markets. Section 706 of the Telecommunications Act of 1996 directs the Commission to encourage deployment of advanced communications capability by "remov[ing] barriers to infrastructure investment."[926] Encouraging investment in broadband deployment is essential to closing the digital divide, and the Commission has continued its efforts to facilitate the deployment of infrastructure necessary to support modern wireless networks.

326. The Commission has continued to help reduce barriers to infrastructure investment that can impede the deployment of mobile wireless networks. For example, in June 2020, the Commission clarified the meaning of its rules[927] implementing in section 6409(a) of the Spectrum Act of 2012,[928] which recognized the efficiency of using existing infrastructure for the expansion of advanced wireless networks.[929] The Commission recognized that uncertainty regarding application of federal law to aspects of State and local government review of modifications to existing wireless equipment remained a deterrent to rapid deployment of 5G wireless infrastructure.[930]

B. The Fixed Communications Marketplace

1. Fixed Terrestrial

327. *Wireline Broadband Services.* In the fixed marketplace, as in the mobile wireless marketplace, there are both regulatory and non-regulatory barriers to entry. Regulatory barriers include provider difficulties in obtaining the legal right to deploy facilities (such as on poles, in rights-of-way, and in Multiple Tenant Environments–MTEs) and unequal regulatory treatment of providers. Geography, the general cost of deploying wireline networks, and access to spectrum (for terrestrial fixed wireless providers) are examples of non-regulatory barriers. Issues concerning the cost of deploying networks include access, rates, terms and conditions to pole attachments, limitations to access to rights of way, and

[924] *Facilitating Shared Use in the 3100-3550 MHz Band*, WT Docket No. 19-348, Report and Order and Further Notice of Proposed Rulemaking, FCC 20-138, at 2, paras. 2-4 (Oct. 2, 2020) (*3.45-3.55 GHz Order and FNPRM*).

[925] *3.7 GHz Report and Order*, 35 FCC Rcd at 2345, para. 4.

[926] 47 U.S.C. § 1302(a).

[927] 47 U.S.C. § 1455(a); 47 CFR § 1.6100; *Acceleration of Broadband Deployment by Improving Wireless Facilities Siting Policies*, WT Docket Nos. 13-238 and 13-32, WC Docket No. 11-59, Report and Order, 29 FCC Rcd 12865, 12922-66, paras. 135-241 (2014), *aff'd*, *Montgomery Cty. v. FCC*, 811 F.3d 121 (4th Cir. 2015).

[928] Section 6409(a) of the Spectrum Act of 2012 provides that a state or local government may not deny, and shall approve, any request for collocation, removal, or replacement of equipment on a wireless tower or base station that does not substantially change the physical dimensions of the tower or base station. Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, Title VI (Spectrum Act of 2012), § 6409(a), 126 Stat. 156 (Feb. 22, 2012) (codified as 47 U.S.C. § 1455(a)).

[929] *Implementation of State and Local Governments' Obligation to Approve Certain Wireless Facility Modification Requests Under Section 6409(a) of the Spectrum Act of 2012*, WT Docket No. 19-250, Declaratory Ruling and Notice of Proposed Rulemaking, 35 FCC Rcd 5977, 5979, para. 3 (2020) (*Section 6409 Declaratory Ruling and Notice*), pets. for review pending, *League of California Cities et al. v. FCC et al.*, No. 20-71765 (9th Cir. filed June 22, 2020); *City of Seattle, Washington et al. v. FCC et al.*, No. 20-1300 (D.C. Cir. filed Aug. 7, 2020); *City of Boston, Massachusetts et al. v. FCC et al.*, No. 20-1301 (D.C. Cir. filed Aug. 10, 2020).

[930] *Section 6409 Declaratory Ruling and Notice* at 2-3, para. 2.

incumbent providers' exclusive agreements to inside wiring with multi-unit dwellings and multi-tenant environments.

328. Commenters primarily point to the high cost of deploying networks.[931] In particular, commenters argue that, without high-cost subsidies, providers cannot make the business case to build and maintain high-quality networks at affordable prices in hard-to-serve areas.[932] INCOMPAS claims that the high cost of network deployment means that competitive entry frequently requires leasing portions of incumbents' networks (as unbundled network elements–UNEs) at cost-based rates or obtaining finished incumbent services at a wholesale discount for resale.[933] With regard to providers' needs for network access, we note that the Commission recently conducted its first comprehensive examination of competitive access to UNEs and services for resale at regulated rates in nearly 16 years, updating the Commission's rules to better account for what is required of a reasonably efficient competitor.[934] With respect to challenges specifically facing fixed wireless providers, WISPA argues that while the costs of network deployment are much lower, access to licensed and unlicensed spectrum over which to provide service is arguably the biggest challenge that terrestrial fixed wireless providers face.[935]

329. Commenters acknowledge the Commission's efforts to remove regulatory barriers to entering and competing in the provision of fixed communications, particularly the provision of broadband Internet service.[936] The record also reflects notable remaining regulatory obstacles. Multiple commenters contend that access to poles and government rights of way should be further streamlined to relieve these obstacles.[937] Commenters allege that the current regulatory environment still allows pole and right-of-way owners to impose unreasonable fees[938] and unnecessary delays,[939] sometimes creating restrictions that serve as outright refusals to provide access,[940] and excluding broadband-only providers.[941]

330. Commenters submit that further work remains to be done with respect to access barriers to apartment buildings, condominium complexes, and office buildings, collectively known as multi-tenant environments, or MTEs. According to these commenters, current obstacles include exclusive agreements between MTE owners and incumbent providers pertaining to inside wiring,[942] marketing and revenue

[931] ACA Connects Comments at 6; INCOMPAS Comments at 27-28; NTCA Comments at 6.

[932] NTCA Comments at 6. *See also* ACA Comments at 7 (discussing, without reference to subsidies, how certain areas are cost-prohibitive to serve).

[933] INCOMPAS Comments at 32-34.

[934] *Modernizing Unbundling and Resale Requirements in an Era of Next-Generation Networks and Services*, WC Docket No. 19-308, Report and Order, FCC 20-152 (Oct. 28, 2020) (*Modernizing Unbundling Order*).

[935] WISPA Comments at 6, 8-9.

[936] ACA Comments at 5; NCTA Comments at 8; USTelecom Comments at 1, 7.

[937] ACA Comments at 6, NCTA Comments at 10; INCOMPAS Comments at 28-32; USTelecom Comments at 8-9.

[938] INCOMPAS Comments at 29; USTelecom Comments at 8-9.

[939] INCOMPAS Comments at 29; NCTA Comments at 10 (although not seeking formal Commission action, observing that the COVID-19 pandemic has led to delays in responding to permitting requests, and asking the Commission to "consider using its persuasive powers to remind local governments and pole owners that broadband providers are actively working to ensure that all consumers can work and learn from home and that flexibility would be helpful in situations where normal processes have been disrupted").

[940] INCOMPAS Comments at 31-32. ACA Connects suggests that the Commission should monitor implementation of reforms already undertaken. ACA Connects Comments at 6 & n.16.

[941] Google Fiber Comments at 2-3, 6; INCOMPAS Comments at 28 & n.75; WISPA Comments at 21.

[942] Google Fiber Comments at 4-5.

sharing arrangements,[943] and rooftop access.[944] In addition, WISPA argues that all current and future state and local mandatory access laws, which permit certain providers to access MTEs over owners' objections, should be technologically neutral.[945]

331. Some commenters allege that Commission and state regulations unnecessarily favor or disfavor certain types of providers, which ultimately distorts competition. For example, USTelecom argues that asymmetric regulation of incumbent LECs, as compared to their competitors, distorts competition, citing ex ante price regulation as an example.[946] USTelecom also suggests that the Commission "work with states to bring their regulations current with modern competitive realities."[947] Others assert that the Commission's universal service policies unnecessarily disadvantage certain providers.[948] Further, some commenters discuss legal barriers to entry by public-private partnerships and public entities, contending that state laws limiting or blocking public-private partnerships and community or municipal broadband networks inhibit competition in the fixed broadband marketplace.[949]

2. Satellite

332. *Satellite Services*. In recent years, there has been an expanded interest in NGSO orbits, ESIMs, and commercial use of small, short-duration satellites for the provision of broadband services to

[943] INCOMPAS Comments at 34-35; WISPA Comments at 13.

[944] INCOMPAS Comments at 34.

[945] WISPA Comments at 14-15.

[946] USTelecom Comments at 9-10 (referring specifically to *Eliminating Ex Ante Pricing Regulation and Tariffing of Telephone Access Charges*, WC Docket No. 20-71, Notice of Proposed Rulemaking, 35 FCC Rcd 3165 (2020) (*Telephone Access Charges Notice*). Other commenters also encouraged the Commission to take actions which have now been taken. These actions include: waiving certain letter of credit requirements for the CAF Phase II and Stage 2 funding for the Uniendo a Puerto Rico and Connect USVI Fund auction winners (*see* WISPA Comments at 21-22); completing the order responding to the remand of the *Restoring Internet Freedom Order* (*see* FSF Comments at 15); and reducing incumbent LEC obligations to provide UNEs at cost-based rates (*see* FSF Comments at 16, USTelecom Comments at 8). *See also* Connect *America Fund et al.*, Order, WC Docket No. 10-90, 35 FCC Rcd 6556 (WCB 2020); The *Uniendo a Puerto Rico Fund and the Connect USVI Fund*; *Connect America Fund*, Order on Reconsideration and Order, WC Docket Nos. 18-143, 10-90, DA 20-838 (WCB Aug. 6, 2020); *Restoring Internet Freedom; Bridging the Digital Divide for Low-Income Consumers; Lifeline and Link Up Reform and Modernization*, WC Docket Nos. 17-108, 17-287 & 11-42, Order, FCC 20-151 (Oct. 29, 2020) (*Restoring Internet Freedom Remand Order*); *Modernizing Unbundling Order*. Commenters also point to the importance of completing the establishment of the Digital Opportunity Data Collection. ACA Connects Comments at 19-20; USTelecom Comments at 9. The Commission has taken further important steps in that regard and is well-positioned to complete the process, particularly once we receive sufficient Congressional appropriations. *See generally Digital Opportunity Data Collection Second Order and Third Further Notice*. Further, USTelecom requests that the Commission prioritize completing Phase I of the Rural Digital Opportunity Fund auction which began on October 29, 2020. USTelecom Comments at 9; Press Release, FCC, FCC Announces Kickoff of Groundbreaking $16 Billion Rural Digital Opportunity Fund Phase I Auction (Oct. 29, 2020), https://docs.fcc.gov/public/attachments/DOC-367851A1.pdf.

[947] USTelecom Comments at 9.

[948] NCTA Comments at 9-10 (Eligible Telecommunications Carrier obligations artificially limit potential recipients of universal service by requiring providers to offer retail voice services); WISPA Comments at 16-19 (government-subsidized overbuilding).

[949] Google Fiber Comments at 3 ("Partnerships between providers and municipalities (or municipal utilities) are one way that local governments can encourage new providers to offer the service their customers most need—broadband—while facilitating access to streets and sidewalks by those providers"); OTI Reply at 9-11 ("The Commission must recognize that state laws that inhibit localities' ability to create these networks are deeply anti-competitive; they often only serve to strengthen the position of an incumbent; and they can also prevent improvements to internet service and consumer benefits that community networks and public-private partnerships bring.").

remote locations, Earth observation, and IoT. Some operators are planning to provide services, such as intersatellite connectivity, to other satellite service providers to provide data backhaul or satellite mission extension capability. As discussed in Section V, the Commission has acted to remove regulatory barriers in order to enable market-based efficient use of spectrum and facilitate the deployment of these systems.

333. *Technological Developments*. Recent trends in the satellite industry include the increased use of LEO and MEO satellite systems.[950] For example, in April 2019, SES completed its first generation MEO O3B 20 satellite constellation.[951] In 2021, SES plans on launching its next general MEO constellation with seven O3B satellites.[952] In February 2019, Iridium completed its Iridium® NEXT program, replaced its first generation fleet of 66 LEO satellites with a new fleet of 75 LEO satellites (including, nine on-orbit spare satellites).[953] As of June 13, 2020, SpaceX has launched 540 LEO Starlink satellites, including two prototypes.[954] SpaceX anticipates that before the end of 2020 it will begin offering commercial service in the northern United States and southern Canada, and then will rapidly expand to near global coverage of the populated world in 2021, offering high-speed, low-latency broadband service direct to customers in rural and other underserved locations.[955] Kepler launched two demonstration LEO cubesats in 2018.[956] In January 2018, Telesat launched a LEO satellite as part of its planned advanced global LEO constellation, and is using that satellite for testing and live demonstrations.[957] Telesat entered into an agreement with the Government of Canada to enter a partnership to ensure access to affordable high-speed internet connectivity in rural and remote areas of Canada with the Telesat LEO satellite constellation.[958]

334. Other developments include new satellite launch technologies, and next generation high throughput satellite systems.[959] Advances in launch technology include the development of reusable hardware and vehicles designed to launch smaller satellites.[960] In addition, several high throughput systems are under construction or have been recently launched. For example, Telesat's Telestar 19 VANTAGE satellite launched in July of 2018 and entered into service in August 2018. It is part of a new generation of Telesat satellites that combine broad regional beams and powerful high throughput satellite

[950] SIA Comments at 13.

[951] SIA Comments at 13-14. Caleb Henry, *Soyuz Launch Completes first-generation O3b Constellation*, SpaceNews (Apr. 4, 2019), https://spacenews.com/soyuz-launch-completes-first-generation-o3b-constellation/. SES 2019 Annual Report at 34 (filed Feb. 29, 2020) (SES 2019 Annual Report), https://www.ses.com/sites/default/files/2020-04/SES_Annual_Report_2019_HighRes_1.pdf.

[952] SES 2019 Annual Report at 36.

[953] Iridium Comments at 2-3.

[954] Caleb Henry, *SpaceX launches 58 Starlink satellites, three Planet SkySats on Falcon 9*, SpaceNews (June 13, 2020), https://spacenews.com/spacex-launches-58-starlink-satellites-three-planet-skysats-on-falcon-9/.

[955] SpaceX Comments at 1-2.

[956] Caleb Henry, *Kepler Communications opens launch bids for Gen-1 LEO constellation*, SpaceNews (Aug. 29, 2018), https://spacenews.com/kepler-communications-opens-launch-bids-for-gen-1-leo-constellation/; Kepler, *A Network to Connect the Globe*, https://www.keplercommunications.com/network (last visited Oct. 27, 2020).

[957] SIA Comments at 14. Telesat Canada 2019 SEC Form 20-F at 50.

[958] Telesat Canada 2019 SEC Form 20-F at 32.

[959] Organisation of Economic Cooperation and Development (OECD) (2019) at 108, *The Space Economy in Figures: How Space Contributes to the Global Economy*, https://doi.org/10.1787/c5996201-en. SIA Comments at 11-14. HTS capacity is becoming increasingly available and HTS rely on multiple spot beams and frequency reuse to deliver greatly increased throughput versus traditional satellites for the same amount of allocated frequency. Telesat Canada 2019 SEC Form 20-F at 30.

[960] Organisation of Economic Cooperation and Development (OECD), *The Evolving Role of Satellite Networks in Rural and Remote Broadband Access* (2017) at 21-22, https://www.oecd-ilibrary.org/science-and-technology/the-evolving-role-of-satellite-networks-in-rural-and-remote-broadband-access_7610090d-en.

(HTS) spot beams in a design optimized for high bandwidth applications.[961] In early 2019, Intelsat placed in service Horizons 3e, the sixth of the company's fleet of Intelsat EpicNG high throughput satellites.[962] EchoStar XXIV (Jupiter 3), a next generation, high throughput geostationary satellite is under construction with a planned 2021 launch.[963] SES will be launching its first GSO Ka-band HTS satellite, SES-17, in early 2021.[964]

335. *Other Developments.* The current period of innovation in the space industry has resulted and will likely continue to result in a significant increase in the number of satellites and types of operations in orbit. The development of less expensive delivery systems, along with the production of small imaging satellites such as CubeSats, has lowered the cost of entry into the satellite imaging business.[965] The Commission has implemented amateur and experimental satellite rules to facilitate use of satellites for scientific and research missions and experimental testing.[966] The Commission recently made available a new, optional licensing process for commercial deployment of small satellites, which allowed small satellite applicants to choose a streamlined part 25 licensing procedure and thereby take advantage of an easier application process, a lower application fee, and a shorter timeline for review.[967] There is also ongoing development of optical laser technologies for satellite communications, which may well enhance the capacity, flexibility, and reliability of satellite communications.[968] Proposed deployments of large satellite constellations in the intensely used LEO region, along with other satellites

[961] SIA Comments at 12; *see also* Telesat Canada SEC Form 20-F at 5, 53.

[962] SIA Comments at 12. Horizons 3e, Intelsat's final first generation HTS, is a joint venture with JSAT. Intelsat 2019 SEC Form 10-K at 91.

[963] EchoStar, SEC Form 10-K at 4 (filed Feb. 20, 2020), https://www.sec.gov/ix?doc=/Archives/edgar/data/1415404/000141540420000005/sats12311910kdocument1.htm; *see also* Hughes Comments at 2.

[964] SES Reply Comments at 9; *see also* SES 2019 Annual Report at 36.

[965] *Streamlining Licensing Procedures for Small Satellites*, IB Docket 18-86, Report and Order, 34 FCC Rcd 13077, 13078 at para. 1 (2019) (*Small Satellites Report and Order*),

[966] The Commission's rules set forth three different procedures for licensing satellites. Part 25 of the Commission's rules govern licensing and operation of space stations and earth stations for the provision of satellite communication services, including commercial communication and remote sensing satellites. 47 CFR §§ 25.101-25.702. Part 5 of the Commission's rules govern experimental operations. 47 CFR §§ 5.1-5.602. Part 97 of the Commission's rules govern amateur radio service satellite operations. *See generally* 47 CFR §§ 97.111-97.117, 97.207. *See also Guidance On Obtaining Licenses For Small Satellites*, Public Notice, 28 FCC Rcd 2555 (2013).

[967] *Streamlining Licensing Procedures for Small Satellites*, IB Docket 18-86, Report and Order, 34 FCC Rcd 13077, 10378, para. 2 (2019) (*Small Satellites Report and Order*). The streamlined licensing process is available to commercially deployed small satellite systems as well as other small satellite systems that that also have the option of applying under the amateur or experimental rules. *Small Satellites Report and Order*, 34 FCC Rcd 13080-81, para. 12.

[968] *See* TNO, *Superfast Internet Using Laser Satellite Communications*, (May 18, 2018), https://www.tno.nl/en/tno-insights/articles/superfast-internet-using-laser-satellite-communications/; Sydney J. Freedberg, Jr., *Army, NASA Want Laser Micro-Satellites For 50 Times The Bandwidth* (Aug. 2, 2018), https://breakingdefense.com/2018/08/army-nasa-want-laser-micro-satellites-for-50-times-the-bandwidth/. *See Streamlining Licensing Procedures for Small Satellites*, IB Docket 18-86, Notice of Proposed Rulemaking, 33 FCC Rcd 4152, 4176 at para. 58 (2018) *(Small Satellites NPRM)*; Space Exploration Holdings, LLC, Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, IBFS File No. SAT-LOA-20161115-00118 (filed Nov. 15, 2016), Narrative at 2 (*"*The system will also employ optical inter-satellite links for seamless network management and continuity of service, which will also aid in complying with emissions constraints designed to facilitate spectrum sharing with other systems.").

deployed in the LEO region, will have the potential to increase the risk of debris-generating events.[969] In April 2020, the Commission updated the Commission's existing rules regarding orbital debris mitigation, which were adopted in 2004, to provide a clear regulatory framework for applicants for non-Federal satellite communications.[970]

C. The Video and Audio Communications Marketplace

336. *Regulatory Barriers*. Many video and audio marketplace participants need authorization to operate from either the federal government or a local municipality. In addition, they often are subject to a range of regulations, including technical and interference standards, as well as programming and public interest obligations. As a result, some market participants face barriers to entry or compliance costs that are greater than or different from those of other participants. Many regulated entities, however, often enjoy a strong position as the legacy service provider in the marketplace. We discuss below a few of the basic regulatory issues that industry participants confront.

337. Broadcast television and radio stations operate pursuant to a license from the Commission and must receive authorization before they may construct and operate in the United States.[971] Further, broadcast stations are subject to the Communications Act of 1934, as amended, and regulations promulgated by the Commission thereunder. In allocating and authorizing broadcast stations, the Commission is charged with ensuring that such stations are distributed across the country and licensed to communities in a manner that serves the public interest.[972] In addition, licensees of broadcast stations must comply with certain obligations and rules to ensure that the licensed spectrum is used to serve the public interest.[973] These include structural limits governing ownership of broadcast television and radio stations.[974] Broadcast licenses are awarded for an eight-year term that can be renewed upon application and Commission approval.[975]

338. Licenses for new broadcast television and radio stations are awarded by auction, however the Commission has not auctioned a license for a new full power commercial television station since 2011. While authorizations for new radio stations are available from the Commission periodically, frequencies for radio stations are typically in high demand. In fact, in many areas of the country no frequencies are available on which a new station could commence operation without causing impermissible interference to existing stations.[976] As a result, the Commission does not allocate many new broadcast radio stations, and stations that are allocated tend to be outside the top markets and for lower power. Given the limited number of new broadcast licenses, particularly in the television service or

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[969] *Mitigation of Orbital Debris in the New Space Age*, IB Docket No. 18-313, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156, 4158-9 at para. 3-4 (2020) *(Orbital Debris Report and Order and FNPRM*). Orbital debris, also known as "space debris," consists of artificial objects orbiting the Earth that are not functional spacecraft. *Mitigation of Orbital Debris in the New Space Age; Mitigation of Orbital Debris*, IB Docket No. 18-313, IB Docket No. 02-54 (Terminated), Notice of Proposed Rulemaking and Order on Reconsideration, 33 FCC Rcd 11352, 11353-4 at para. 2 (2018) (*Orbital Debris NPRM*).

[970] *Mitigation of Orbital Debris in the New Space Age*, IB Docket No. 18-313, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156, 4157 at para. 2 (2020) (*Orbital Debris Report and Order and FNPRM*).

[971] 47 U.S.C. § 301. The Commission licenses broadcast spectrum to respective applicants and approves any assignment or transfer of control of broadcast licenses. *Id.* §§ 303(c), 308(a), 309(a), 310(d).

[972] *Id.* §§ 303, 307.

[973] *Id.* §§ 301, 303(c), 308(a), 309(a), 310(d).

[974] 47 CFR § 73.3555.

[975] *Id.* § 73.1020.

[976] *See, e.g.*, FCC, *How to Apply for a Radio or Television Broadcast Station*, https://www.fcc.gov/media/radio/how-to-apply (last visited Oct. 27, 2020).

in large metropolitan areas, new entrants typically enter the broadcast television or radio business by purchasing a construction permit, a station, or a group of stations on the secondary market (i.e., by purchasing from an existing permitee or station owner).

339. MVPDs must obtain appropriate regulatory authority before providing video services and are subject to several Commission rules implicating the operation of their services, which vary depending on whether the entity is a cable MVPD or a non-cable MVPD.[977] These rules include regulations that govern an MVPD's franchising and licensing, effective competition, program carriage, program access, must-carry and retransmission consent, protection of exclusive broadcast distribution rights, public interest programming, access to multiple dwelling units, and over-the-air reception devices.[978]

340. In addition to broadcast radio stations, the Commission has authorized satellite-delivered digital radio service. After the Commission allocated spectrum for SDARS in 1995[979] and established general service rules for the service in 1997,[980] two licensees—Sirius Satellite Radio Inc. and XM Radio Inc.—were awarded licenses at auction, successfully launched satellite systems, and commenced commercial service to the public.[981] In 2008, these two entities merged and formed SiriusXM,[982] which is currently the only provider of SDARS in the audio marketplace. Because there are no additional SDARS licenses available, any new entity wishing to provide SDARS service would be required to purchase licenses from SiriusXM. In addition, because the service is delivered via satellite, SDARS requires a significant capital investment for operation.[983]

341. Because they do not use public spectrum, online audio and video providers generally are not subject to Commission regulation.[984] Nonetheless, statutes and regulations that are outside of the Commission's purview can also have a competitive impact on non-broadcast service providers. For example, federal copyright law requires streaming and satellite audio providers, but not terrestrial radio licensees, to pay royalties to music creators for the use of sound recordings.[985] MusicFirst Coalition and Future of Music Coalition argue that this gives broadcast radio stations a significant competitive advantage over their non-broadcast competitors.[986] The National Association of Broadcasters disagrees that this differential treatment under copyright law confers any significant competitive advantage to terrestrial radio broadcasters, because terrestrial radio broadcasters have many other costs and burdens that do not apply to satellite and online marketplace competitors.[987]

342. *Marketplace Barriers*. Some commenters argue that consolidation and vertical integration raise barriers to entry and expansion in video and audio markets. ACA Connects asserts that programming fees have risen more rapidly than prices that consumers pay for MVPD services and that

[977] *See, e.g., 18th Video Competition Report*, 32 FCC Rcd at 578, para. 25.

[978] *See, e.g., id*. at 578-79, para. 25.

[979] *SDARS Rules Order*, 10 FCC Rcd at 2310, para. 1.

[980] *See generally SDARS MO&O and FNPRM.*

[981] XM began nationwide commercial service on November 12, 2001. Sirius began commercial service on February 14, 2002. *See SDARS Second FNPRM*, 22 FCC Rcd at 22123, para. 1 & n. 4.

[982] *XM/Sirius Order*, 23 FCC Rcd at 12349, para. 1.

[983] *See SDARS Second FNPRM* at 22150, Appx. B.

[984] There are some exceptions. For example, the Commission's closed captioning rules, 47 CFR § 79.4, require programming distributed via IP to be captioned if the programming was previously shown on television with captions.

[985] musicFIRST/FMC Comments at i-ii, 17; musicFIRST/FMC Reply Comments at 9-10.

[986] musicFIRST/FMC Comments at i-ii, 17-20; musicFIRST/FMC Reply Comments at 9-10.

[987] NAB Reply Comments at 19-22.

this has been particularly harmful for smaller cable operators, which tend to pay higher rates for programming than larger ones.[988] ACA Connects maintains that the situation is especially dire in the retransmission consent marketplace, where retransmission fees and station blackouts have continued to increase.[989] The major factor driving these trends, according to ACA Connects, is industry consolidation where large station groups have continued to grow nationally and use their leverage to extract ever-increasing fees from MVPDs in exchange for "must-have" broadcast programming.[990] ACA Connects contends that some MVPDs have found the situation so untenable they have exited the video business.[991] ACA Connects also maintains that MVPDs that are vertically integrated with broadcast and cable networks enjoy cost advantages and have incentives to raise prices to harm their MVPD rivals.[992]

343. The American Television Alliance also reports that broadcasters have continued to consolidate in local markets.[993] ATVA claims that the use of multicast feeds on a single station and the use of low-power or Class A stations have enabled TV broadcasters to acquire top-four duopolies, triopolies, or quadropolies.[994] ATVA claims that with these consolidations, broadcasters control negotiations with MVPDs, and this has led to an increasing disruption of service, rising retransmission consent rates, and the exit of some smaller MVPDs from the video business.[995]

344. Media Captioning Services asserts that the number of captioning companies providing both real-time and offline (post production) captioning has contracted sharply.[996] MCS maintains that the decline can be attributed to anticompetitive business practices creating barriers to entry, and curtailing the competitive expansion of existing providers.[997] Specifically, MCS argues that the consolidation of cable and sports networks by media entities has led to processes designed to lower the captioning rates charged by captioning services, which in turn has led to consolidation in the captioning services industry.[998] MCS contends that two or three companies in the captioning industry have developed significant market power through vertical integration in providing captioning for offline and real-time (live) captioning, and through horizontal integration by providing captioning across national and local markets.[999] MCS argues that industry sourcing practices prevent the entry and growth of small-business captioning companies.[1000]

345. With respect to intramodal competition, musicFIRST/FMC maintains that consolidation of radio station ownership harms independent radio stations and smaller regional artists and music communities.[1001] According to musicFIRST/FMC, additional consolidation will harm ownership diversity and create barriers to entry for minority broadcasters.[1002] Additional consolidation, they argue, will also

[988] ACA Connects Comments at 7-8.

[989] *Id.* at 8.

[990] *Id*.

[991] *Id*.

[992] *Id.* at 11.

[993] ATVA Comments at 1.

[994] *Id.* at 2.

[995] *Id.* at 2-6.

[996] MCS Comments at 1.

[997] *Id*.

[998] *Id.* at 1-2.

[999] *Id.* at 2.

[1000] *Id.* at 2-3.

[1001] musicFIRST/FMC Comments at 4-5.

[1002] *Id.* at 9; musicFIRST/FMC Reply Comments at 11-12.

create barriers to smaller radio entities and cause harm to those stations that are not able to take advantage of economies of scale.[1003]

346. The American Economic Liberties Project (AELP) and the Open Markets Institute (OMI) assert that telecommunications markets are concentrated.[1004] According to ALEP/OMI, the top four radio broadcasters have over 50% market share, the top four broadcast television stations have 40% national market share, the top four cable networks have almost 60% national market share, and the top three cable providers have almost 50% market share.[1005] AELP/OMI maintain that economic benefits follow from having multiple competitors and dispersed market structures, and they oppose removing local television and radio ownership rules.[1006]

347. American Independent Media argues that the video market has been negatively impacted by vertical integration, especially independent media companies and the underserved communities they serve.[1007] They maintain that the marketplace practices used by vertically integrated conglomerates inhibit entrepreneurial initiatives and stifle innovation.[1008] Specifically, AIM asserts that small MVPDs and vMVPDs are harmed by vertically integrated conglomerates that leverage their most popular channels to distribute less popular channels via entry level MVPD and vMVPD packages.[1009] AIM also asserts that vertically integrated MVPDs impose onerous contract terms on programmers, including most favored nations requirements and restrictions on alternative means of content distribution that stifle innovation and reduce diversity and competition.[1010]

348. Common Cause and the National Hispanic Media Coalition stress that the free nature of radio and local television broadcasting continues to make those services relevant for communities of color, low-income families, and those on the wrong side of the digital divide.[1011] According to Common Cause/NHMC, large media conglomerates have proven their inability to provide unbiased, unique, and locally sourced news programming, and they oppose further consolidation.[1012] Common Cause/NHMC contend that streaming services are a source of news and programming only if one can afford reliable access to the Internet, which continues to be a barrier for low income individuals, communities of color, and other marginalized groups.[1013] Without reliable, affordable, and universal access to the Internet at home, Common Cause/NHMC assert that disadvantaged populations of our country will continue to rely on free broadcast programming.[1014]

349. The Internet & Television Association (formerly the National Cable & Telecommunications Association-NCTA) maintains that further consolidation of the top-four broadcast

[1003] musicFIRST/FMC Comments at 11; musicFIRST/FMC Reply Comments at 2-4.

[1004] AELP/OMI Comments at 2.

[1005] *Id.* at 2-3.

[1006] *Id.* at 3-6.

[1007] AIM Comments at 1.

[1008] *Id.*

[1009] *Id.* at 2-3.

[1010] *Id.* at 7-9.

[1011] Common Cause/NHMC Reply Comments at 9.

[1012] *Id.* at 11.

[1013] *Id.*

[1014] *Id.* at 12-13.

stations in local markets would harm competition, lead to unfair increases in retransmission consent costs, and ultimately raise consumer prices.[1015]

350. In contrast to statements by other commenters discussed above, NAB asserts that competition from online video and audio services for audiences and advertising revenue has placed significant financial stress on television and radio broadcasters.[1016] NAB also argues that the pandemic has negatively impacted advertising, resulting in a number of radio companies laying off or furloughing employees and/or reducing salaries, and some stations going silent.[1017] To help radio and television stations remain meaningful competitors, NAB argues that the Commission and other government agencies should adopt a broad definition of the relevant competitive markets, including the advertising market, and allow broadcasters greater economies of scale, thereby enabling necessary investments in data-driven and automated sales operations, programming and physical plants.[1018]

V. COMMISSION ACTIONS ALREADY TAKEN TO CLOSE DIGITAL DIVIDE, ENHANCE COMPETITION, AND ENCOURAGE DEPLOYMENT OF COMMUNICATIONS SERVICES

351. RAY BAUM'S Act of 2018 requires the Commission to describe the actions it has taken over the previous two years in addressing the challenges and opportunities in the communications marketplace.[1019] In this *Report*, we take this opportunity to describe the significant steps the Commission has taken since the *2018 Communications Marketplace Report* was released to close the digital divide, enhance competition and encourage the deployment of communications services.

A. The Mobile Wireless Communications Marketplace

1. Universal Service Support

352. The Commission has continued its work to ensure universal access to mobile services since the release of the *2018 Communications Marketplace Report*. In April 2020, the Commission adopted a notice of proposed rulemaking proposing to establish a "5G Fund for Rural America" to retarget universal service funding for mobile broadband and voice in high cost areas and support deployment of advanced networks in rural areas.[1020] And in October 2020, the Commission adopted a Report and Order establishing the 5G Fund rules, that will use a multi-round reverse auction to distribute a total of $9 billion through the Universal Service Fund across rural America for voice and 5G wireless broadband connectivity.[1021] Phase I of the auction will make $8 billion available to support 5G deployment in rural areas that are unlikely to see unsubsidized deployment of 5G-capable networks,[1022] while Phase II will make at least $1 billion available to facilitate connected precision agriculture technologies in high cost and hard to serve areas.[1023] The *5G Fund Report and Order* will also make $680 million of Phase I funds available to support networks serving eligible areas in Tribal lands.[1024] Furthermore, the *5G Fund Report and Order* adopted a framework to determine which areas will be

[1015] NCTA Reply Comments at 8-9.

[1016] NAB Comments at 1-5.

[1017] *Id.* at 23.

[1018] *Id.* at 26-28, 33-34; NAB Reply Comments at 1-2.

[1019] *See* RAY BAUM'S Act of 2018.

[1020] *See 5G Fund NPRM and Order*, 35 FCC Rcd at 3995-96, para. 1.

[1021] *Establishing a 5G Fund for Rural America*, GN Docket No. 20-32, Report and Order, 35 FCC Rcd 12174, 12176, para. 4 (2020) (*5G Fund Report and Order*).

[1022] *See id.* at 12184, 12185, 12187, paras. 22, 28, 31.

[1023] *Id.* at 12187, para. 31.

[1024] *Id.* at 12188, para. 35.

eligible for 5G Fund support through improved mobile broadband coverage data that will be gathered through the Commission's *Digital Opportunity Data Collection* proceeding, and adopted an adjustment factor to ensure that sufficient support will be available to the hardest-to-serve areas such as those with rugged terrain or sparse populations.[1025]

353. In the *Digital Opportunity Data Collection* proceeding, the Commission established a new data collection and created more granular geospatial broadband availability maps specifically targeted toward advancing the Commission's universal service goals.[1026] The *Digital Opportunity Data Collection* implements the Broadband DATA Act and will significantly improve the Commission's collection of mobile broadband deployment data.[1027]

2. Spectrum Challenges

354. Congress requires that the Commission implement spectrum policies that promote competition, innovation, and the efficient use of spectrum to serve the public interest, convenience, and necessity.[1028] Therefore, the Commission has established policies to make spectrum available to mobile providers and new entrants through initial licensing, primarily by competitive bidding,[1029] and through secondary market transactions.[1030] Over the past two years, the Commission has worked vigorously to make spectrum available in the low-, mid-, and high-frequency bands for mobile providers to develop and deploy new technologies like 5G and support existing 4G LTE networks.

355. With respect to low-band spectrum, the Commission successfully met the July 2020 deadline established for transitioning television stations from their pre-auction channel assignments in the 600 MHz band following the broadcast incentive auction.[1031] The completion of this transition makes all of this valuable 600 MHz spectrum available for wireless mobile broadband.[1032] In May 2020, the Commission took further action to make low-band spectrum available for the development of critical wireless broadband technologies and services.[1033] Specifically, the Commission realigned the 900 MHz band to make available six of the band's ten megahertz for the deployment of broadband services and

[1025] *See Id.* at 12176, 12179-81, paras. 4, 11-16; *see also generally* WC Docket No. 19-195.

[1026] *Digital Opportunity Data Collection Order and Second Further Notice*, 34 FCC Rcd at 3506, para. 2.

[1027] *See Digital Opportunity Data Collection Order and Second Further Notice*, 34 FCC Rcd at 7524, 7530, 7549-59, paras. 44, 58, 112-34.

[1028] 47 U.S.C. § 309(j)(3)(B).

[1029] The Commission generally provides a bidding credit—or discount—to promote participation by small businesses and rural service providers, including businesses owned by members of minority groups and women. 47 U.S.C. § 309(j)(3)(B), (j)(4)(D); *see also* 47 CFR § 1.2110; *Updating Part 1 Competitive Bidding Rules et al.*, WT Docket No. 14-170 et al., Report and Order, Order on Reconsideration of the First Report and Order, Third Order on Reconsideration of the Second Report and Order, and Third Report and Order, 30 FCC Rcd 7493 (2015) (modified by *erratum*, Aug. 25, 2015).

[1030] *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd 6133, 6143-44, 6167-68, 6190, 6193, 6221-22, 6223-24, paras. 17, 67-69, 135, 144, 225-27, 231-32. The Commission generally has adopted "flexible use" policies, thereby allowing licensees to decide which services to offer and what technologies to deploy on spectrum used for the provision of mobile wireless services.

[1031] FCC, *Broadcast Incentive Auction and Post-Auction Transition*, https://www.fcc.gov/about-fcc/fcc-initiatives/incentive-auctions (last visited Oct. 27, 2020); Press Release, FCC, Post-Incentive Auction Transition Successfully Meets 39-Month Deadline (July 13, 2020), https://docs.fcc.gov/public/attachments/DOC-365479A1.pdf (Post-Incentive Auction Transition Press Release).

[1032] Post-Incentive Auction Transition Press Release.

[1033] *Review of the Commission's Rules Governing the 896-901/935-940 MHz Band*, WT Docket No. 17-200, Report and Order, Order of Proposed Modification, and Orders, 35 FCC Rcd 5183 (May 14, 2020) (*900 MHz Report and Order*); Press Release, FCC, FCC Transforms 900 MHz Band to Enable Broadband Deployment by Utilities and Other Industries (May 13, 2020), https://docs.fcc.gov/public/attachments/DOC-364320A1.pdf.

technologies to meet the spectrum capacity demands of a wide range of industries, including utilities and railroads.[1034]

356. The Commission also has taken significant steps to make high-band spectrum available. In March 2019, the Commission concluded the first of its *Spectrum Frontiers* auctions, Auction 101, which made a total of 850 megahertz of 28 GHz band spectrum available.[1035] Shortly thereafter, Auction 102 made 700 megahertz of 24 GHz band spectrum available.[1036] The Commission's third *Spectrum Frontiers* auction, Auction 103, concluded in March 2020 and made 3,400 megahertz of mmW spectrum available in the Upper 37 GHz, 39 GHz, and 47 GHz bands—the largest amount of spectrum offered in an auction in U.S. history.[1037] These three auctions made more spectrum available than is currently used for terrestrial mobile broadband by all wireless service providers in the United States combined.[1038] In addition, the Commission has explored new commercial uses of the 70/80/90 GHz bands for wireless 5G backhaul and broadband services on-board aircraft and ships.[1039]

357. The Commission also has pursued a comprehensive strategy to make available more mid-band spectrum, which is uniquely suited for 5G deployment because of its propagation characteristics.[1040] The *2.5 GHz Report and Order*, for example, adopted rules to facilitate advanced wireless services, including 5G, in the 2.5 GHz band—the largest swath of contiguous spectrum in the country below 3 GHz.[1041] The *2.5 GHz Report and Order* included a pre-auction priority window for Tribal Nations to apply to obtain unassigned spectrum on rural Tribal lands to address the needs of their communities.[1042] The Wireless Telecommunications Bureau received over 400 applications through the Rural Tribal Priority Window, has already granted 154 of those applications, and accepted another 60 applications for filing.[1043] The Commission plans to schedule an auction of the 2.5 GHz band in 2021.[1044]

[1034] *900 MHz Report and Order*, 35 FCC Rcd at 5184, para. 1.

[1035] *28 GHz Auction Public Notice* 34 FCC Rcd 75; *see also 2020 Broadband Deployment Report*, 35 FCC Rcd at 9007-08, paras. 41-42.

[1036] *24 GHz Auction Public Notice*, 34 FCC Rcd 4294.

[1037] *37 GHz, 39 GHz, and 47 GHz Auction Procedures Public Notice*, 34 FCC Rcd 5532; *37 GHz, 39 GHz, and 47 GHz Auction Public Notice*, 35 FCC Rcd 2015.

[1038] Press Release, FCC, FCC Concludes Largest Ever Spectrum Auction, Advancing American Leadership in 5G (Mar. 12, 2020), https://docs.fcc.gov/public/attachments/DOC-363000A1.pdf.

[1039] *Modernizing and Expanding Access to the 70/80/90 GHz Bands et. al.*, WT Docket No. 20-133, Notice of Proposed Rulemaking and Order, 35 FCC Rcd 6039 (2020) (*70/80/90 GHz NPRM*).

[1040] *See, e.g.*, CTIA Comments at 32-33.

[1041] *2.5 GHz Report and Order*, 34 FCC Rcd at 5447, para. 3.

[1042] *2.5 GHz Report and Order*, 34 FCC Rcd at 5463-69, paras. 47-65; *2.5 GHz Tribal Priority Window Public Notice*, 35 FCC Rcd at 308; *see also* FCC, *2.5 GHz Rural Tribal Window*, https://www.fcc.gov/25-ghz-rural-tribal-window (last visited Oct. 27, 2020). The Tribal priority window was extended until September 2, 2020 due to the COVID-19 pandemic. *Transforming the 2.5 GHz Band*, WT Docket No. 18-120, Memorandum Opinion and Order, 35 FCC Rcd 8112, 8113, para. 3 (WTB July 31, 2020).

[1043] *Wireless Telecommunications Bureau Announces First Round of 2.5 GHz Rural Tribal Priority Window License Applications Accepted for Filing*, Public Notice, 35 FCC Rcd 10294 (WTB Sept. 15, 2020); Press Release, FCC, FCC Grants First Licenses in 2.5 GHz Rural Tribal Priority Window (Oct. 23, 2020), https://docs.fcc.gov/public/attachments/DOC-367726A1.pdf; *Wireless Telecommunications Bureau Announces Additional 2.5 GHz Rural Tribal Priority Window License Applications Accepted for Filing*, Public Notice, DA 20-1335 (WTB Nov. 10, 2020).

[1044] Press Release, FCC, FCC Announces Close of First-Ever Rural Tribal Priority Window for Spectrum (Sept. 3, 2020), https://docs.fcc.gov/public/attachments/DOC-366657A1.pdf.

358. In addition, in August 2020, the Commission concluded its auction of Priority Access Licenses in the 3.5 GHz band.[1045] This auction offered the greatest number of spectrum licenses ever made available for bidding in a single auction.[1046] Earlier in 2020, the Wireless Telecommunications Bureau and the Office of Engineering and Technology announced that they had certified Spectrum Access System Administrators to coordinate operations among different tiers of users in the 3.5 GHz band, which paved the way for full commercial operations in the band.[1047] The auction's net proceeds exceeded $4.54 billion, with a total of 228 bidders winning 20,625 of 22,631, or more than 91%, of available licenses.[1048]

359. In December 2019, the Commission released a Notice of Proposed Rulemaking regarding shared use in the 3.45-3.55 GHz band between federal operations and commercial wireless services.[1049] In August 2020, the White House announced that, in collaboration with the Department of Defense, it would make available 100 megahertz of contiguous spectrum in the 3.45-3.55 GHz band for mobile wireless providers to build and operate 5G networks.[1050] The Commission subsequently adopted the *3.45-3.55 GHz Order and FNPRM* in October 2020 to take steps to bring this mid-band spectrum to market.[1051] The Order eliminated the non-federal radiolocation service and non-federal amateur allocations in the 3.3-3.5 GHz band as a step toward future shared use between federal incumbents and commercial operators.[1052] The Further Notice proposed to make 100 megahertz of spectrum in the 3.45-3.55 GHz band available for flexible use.[1053]

360. In March 2020, the Commission adopted an order to make 280 megahertz of the 3.7-4.2 GHz band (C-band) available for next-generation wireless services, to compensate incumbent operators for relocating out of that portion of the band, and to provide accelerated relocation payments to incumbent satellite operators that meet early clearance benchmarks for the band.[1054] By repacking existing satellite operations into the upper 200 megahertz of the C-band, the Commission is making a significant amount of spectrum available for flexible terrestrial use throughout the contiguous United States in a manner that ensures the continuous and uninterrupted delivery of services currently offered in the band.[1055] The

[1045] *Auction of Priority Access Licenses for the 3550-3650 MHz Band*; *Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 105*; *Bidding in Auction 105 Scheduled to Begin June 25, 2020*, AU Docket No. 19-244, Public Notice, 35 FCC Rcd 2140 (2020) (*3.5 GHz Procedures Public Notice*) (rescheduled from June 25, 2020 to July 23, 2020 due to the COVID-19 pandemic); *3.5 GHz Public Notice* at 1, para. 1.

[1046] *3.5 GHz Procedures Public Notice*, 35 FCC Rcd at 2142, para. 1.

[1047] Press Release, FCC, FCC Authorizes Full Commercial Deployment in 3.5 GHz Band, Advancing American 5G Leadership (Jan. 27, 2020), https://www.fcc.gov/document/fcc-authorizes-full-commercial-deployment-35-ghz-band.

[1048] *Auction of Priority Access Licenses in the 3550-3650 Mhz Band Closes*; *Winning Bidders Announced for Auction 105*, AU Docket No. 19-244, Public Notice, 35 FCC Rcd 9287 (OEA & WTB 2020), https://docs.fcc.gov/public/attachments/DA-20-1009A1.pdf; Press Release, FCC, FCC Announces Winning Bidders of 3.5 GHz Band Auction (Sept. 2, 2020), https://docs.fcc.gov/public/attachments/DOC-366624A1.pdf.

[1049] *Facilitating Shared Use in the 3.45-3.55 GHz Band*, WT Docket No. 19-348, Notice of Proposed Rulemaking, 34 FCC Rcd 12662 (2019).

[1050] Press Release, Exec. Off. of President, President Donald J. Trump Is Unleashing America's 5G Potential (Aug. 10, 2020), https://www.whitehouse.gov/briefings-statements/president-donald-j-trump-unleashing-americas-5g-potential/; *see also* Press Release, FCC, Chairman Pai Statement on the Administration Announcement Freeing Up 3.45-3.55 GHz Band for 5G (Aug. 10, 2020), https://docs.fcc.gov/public/attachments/DOC-366068A1.pdf.

[1051] *See generally 3.45-3.55 GHz Order and FNPRM*.

[1052] *Id.* at 11079, para. 4.

[1053] *Id.* at 11091, para. 38.

[1054] *3.7 GHz Report and Order*, 35 FCC Rcd at 2345, 2413, paras. 3-4, 168.

[1055] *3.7 GHz Report and Order*, 35 FCC Rcd at 2345, para. 4.

Commission established competitive bidding procedures for the auction of this valuable mid-band spectrum, Auction 107, which will begin in December 2020.[1056]

361. The Commission has also pursued ways to promote innovative and efficient uses of spectrum. In October 2020, the Commission revised its rules to facilitate the development of new and innovative narrowband Internet of Things devices in TV white spaces and expand the ability of unlicensed white space devices to deliver wireless broadband services in rural areas and areas where fewer broadcast stations are on the air.[1057]

362. The Commission also adopted new rules in April 2020 to allow unlicensed devices to operate in the 6 GHz band (5.925-7.125 GHz) without interfering with the operation of the licensed services that will continue to use this spectrum.[1058] The Commission's actions made 1,200 megahertz of spectrum available for unlicensed operations, such as Wi-Fi. Under the *6 GHz Report and Order*, unlicensed devices operating at low power levels indoors would have access to the full 1,200 megahertz of spectrum.[1059] In the 5.925-6.425 GHz and 6.525-6.875 GHz sub-bands, unlicensed access points are permitted to transmit both indoors and outdoors at standard power levels that are currently permitted in the 5 GHz band when operated under an automated frequency control (AFC) system.[1060] The Commission sought comment on several additional issues in the *6 GHz FNPRM*, including permitting unlicensed devices to operate both indoors and outdoors across the entire 6 GHz band at very-low power levels and increasing the transmit power of indoor access points.[1061] The new rules will facilitate deployment of Wi-Fi 6, the next generation of Wi-Fi that allows for speeds more than two-and-a-half times faster than the current standard while improving performance.

363. Similarly, in December 2019, the Commission adopted a Notice of Proposed Rulemaking that proposed rule changes to allow unlicensed and innovative uses like next-generation Wi-Fi in the 5.850-5.925 GHz band.[1062] The Commission allocated this 75 megahertz of spectrum for Dedicated Short-Range Communications over 20 years ago.[1063] Since that time, however, the technology has not enjoyed widespread commercial adoption or deployment.[1064] Meanwhile, demand for unlicensed services, such as Wi-Fi has grown exponentially.[1065] During the COVID-19 pandemic, the Commission granted requests for Special Temporary Authority to more than 100 Wireless Internet Service Providers for temporary access to the lower 45 megahertz of the 5.9 GHz band to expand and improve broadband service provided largely in rural and suburban communities.[1066] On November 18, 2020, the Commission

[1056] *Auction of Flexible-Use Service Licenses in the 3.7-3.98 GHz Band for Next-Generation Wireless Services*; *Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 107*; *Bidding in Auction 107 Scheduled to Begin December 8, 2020*, AU Docket No. 20-25, Public Notice, 35 FCC Rcd 8404, 8406, paras. 1-2 (Aug. 7, 2020) (*C-Band Auction Public Notice*).

[1057] *Unlicensed White Space Device Operations in the Television Bands*, ET Docket No. 20-36, Report and Order, 35 FCC Rcd 12603, 12604, para. 1 (2020).

[1058] *6 GHz Report and Order and FNPRM*, 35 FCC Rcd at 3853, para. 1.

[1059] *Id.* at 3860, para. 18.

[1060] *Id.* at 3860, paras. 17-18.

[1061] *Id.* at 3938-45, paras. 231-55.

[1062] *See generally Use of the 5.850-5.925 GHz Band*, ET Docket No. 19-138, Notice of Proposed Rulemaking, 34 FCC Rcd 12603 (2019).

[1063] *Id.* at 12604, para. 3.

[1064] *Id.* at 12604-05, para. 4.

[1065] *Id.* at 12606, para. 6.

[1066] *See* Press Release, FCC, 5.9 GHz Band Boosts Consumer Internet Access During COVID-19 Pandemic (May 4, 2020), https://docs.fcc.gov/public/attachments/DOC-364138A1.pdf.

adopted the *5.9 GHz Order*, designating the lower 45 megahertz of the band for unlicensed use and the upper 30 megahertz of spectrum for Intelligent Transportation System services, and in particular Cellular Vehicle-to-Everything technology.[1067] The Commission allowed for immediate indoor use of the lower 45 megahertz for unlicensed use while creating a regulatory process for outdoor operations contingent upon protection for federal incumbents and pending adoption of technical rules proposed in the *Further Notice*. When combined with existing Wi-Fi spectrum in the adjacent 5 GHz band, the Commission's action will allow for near-term deployment of a high-throughput, 160-megahertz channel that will enable gigabit connectivity for schools, hospitals, small businesses, and other consumers.

364. On March 5, 2020, the Commission concluded Auction 103, its auction of Upper 37 GHz, 39 GHz, and 47 GHz licenses.[1068] Auction 103 offered licenses made available, in part, because existing 39 GHz band licensees committed to relinquishing their 39 GHz spectrum usage rights in exchange for incentive payments determined by bidding in the auction; the incentive payments reduced the amount of any winning bids for new licenses by the entity making the commitment (and the balance payable in cash through auction proceeds).[1069] As a result of the auction, 28 bidders won a total of 14,142 licenses.[1070] Auction 103 resulted in 3,400 megahertz of mmW spectrum being made available for flexible use services, including 5G—the largest amount of spectrum offered in an auction in U.S. history.[1071]

365. Moreover, in June 2020 the Commission adopted a *Notice of Proposed Rulemaking and Order* proposing rules to allow for new uses of the 71-76 GHz, 81-86 GHz, 92-94 GHz, and 94.1-95 GHz bands (the 70/80/90 GHz bands).[1072] The Commission sought comment on potential changes to its antenna standards in the 70 and 80 GHz bands and its current link registration rules for the 70/80/90 GHz bands that could allow for the provision of wireless backhaul for 5G.[1073] The Commission also proposed to authorize point-to-point links to endpoints in motion in the 70GHz and 80 GHz bands to support the deployment of broadband services to aircraft and ships.[1074]

3. Wireless Infrastructure Siting

366. Wireless providers will need to deploy a vast amount of new equipment and will need to modify older equipment to upgrade networks within a relatively short amount of time in order to match the demand for advanced wireless technologies. The Commission has therefore sought to clarify its rules relating to federal, state, and local zoning requirements with the goal of reducing regulatory barriers to mobile broadband deployment, encouraging upgrades to physical infrastructure, and spurring investment in new facilities.

[1067] *See* Press Release, FCC, FCC Modernizes 5.9 GHz Band for Wi-Fi and Auto Safety (Nov. 18, 2020), https://docs.fcc.gov/public/attachments/DOC-368228A1.pdf; *see also Use of the 5.850-5.925 GHz Band*, ET Docket No. 19-138, First Report and Order, Further Notice of Proposed Rulemaking, and Order of Proposed Modification, FCC 20-164 (Nov. 20, 2020).

[1068] *Incentive Auction of Upper Microwave Flexible Use Service Licenses in the Upper 37 GHz, 39 GHz, and 47 GHz Bands for Next-Generation Wireless Services Closes*; *Winning Bidders Announced for Auction 103*, AU Docket No. 19-59, Public Notice, 35 FCC Rcd 2015 (2020).

[1069] *Id.* at 2016-17, para. 5.

[1070] *Id.* at 2015, para. 2.

[1071] Press Release, FCC, FCC Concludes Largest Ever Spectrum Auction, Advancing American Leadership in 5G (Mar. 12, 2020), https://docs.fcc.gov/public/attachments/DOC-363000A1.pdf.

[1072] *Modernizing and Expanding Access to the 70/80/90 GHz Bands, et al*., WT Docket No. 20-133, *et al*., Notice of Proposed Rulemaking and Order, 35 FCC Rcd 6039 (2020).

[1073] *Id.* at 6045, para. 9.

[1074] *Id*.

367. In August of this year, the U.S. Court of Appeals for the Ninth Circuit substantially upheld two Commission orders removing unnecessary barriers to deployment of telecommunications infrastructure in furtherance of facilitating the provision of advanced 5G wireless broadband service.[1075] Among the court's holdings, the Ninth Circuit affirmed the Commission's interpretation of its authority under sections 253(a) and 332(c)(7) of the Communications Act to preempt state or local measures that "have the effect of prohibiting" personal wireless or telecommunications services.[1076] The Commission had stated that an effective prohibition includes a measure that "materially inhibits or limits the ability of any competitor or potential competitor to compete in a fair and balanced legal and regulatory environment."[1077] The court upheld that standard and the Commission's discussion of how it applies to 5G technology.[1078]

368. In June 2020, the Commission issued a Declaratory Ruling clarifying its rules implementing section 6409(a) of the Spectrum Act and a Notice of Proposed Rulemaking that sought comment on certain aspects of those rules.[1079] The Commission sought to balance the need for wireless providers to have clear rules when they upgrade existing infrastructure with the need for state and local governments to enforce legitimate zoning requirements.[1080] Specifically, the declaratory ruling clarified: (1) when the shot clock for an eligible facilities request commences, (2) what constitutes a "substantial change" in the physical dimensions of wireless infrastructure, and (3) the extent to which certain elements of a proposed modification to existing infrastructure affect the eligibility of that proposed modification for streamlined state or local government review.[1081] The declaratory ruling also clarified that an environmental assessment is not required when the Commission and applicants proposing to build communications facilities have entered into a memorandum of agreement to mitigate effects on historic properties.[1082] The *Section 6409 Notice of Proposed Rulemaking* sought comment on rule changes to better define the boundaries within which an applicant can excavate or deploy when making a modification under section 6409(a).[1083] In October 2020, the Commission adopted a Report and Order

[1075] *City of Portland v. United States*, 969 F3d 1020 (9th Cir. 2020); *see also Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*; *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WT Docket No. 17-79, WC Docket No. 17-84, Declaratory Ruling and Third Report and Order, 33 FCC Rcd 9088 (2018) (*Small Cell Order*); *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment; Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, WT Docket No. 17-79, Third Report and Order and Declaratory Ruling, 33 FCC Rcd 7705 (2018).

[1076] *City of Portland v. United States*, 2020 WL 4669906, at 33-36. *See infra* section V.A for further discussion of the court's decision.

[1077] *Small Cell Order*, 33 FCC Rcd at 9092-93, 9104-10, paras. 16, 37-42.

[1078] *City of Portland v. United States*, 2020 WL 4669906, at 36-37.

[1079] *Implementation of State and Local Governments' Obligation to Approve Certain Wireless Facility Modification Requests Under Section 6409(a) of the Spectrum Act of 2012*, WT Docket No. 19-250, Declaratory Ruling and Notice of Proposed Rulemaking, 35 FCC Rcd 5977, 5979, para. 3 (2020) (*Section 6409 Declaratory Ruling and Notice*), pets. for review pending, *League of California Cities et al. v. FCC et al.*, No. 20-71765 (9th Cir. filed June 22, 2020); *City of Seattle, Washington et al. v. FCC et al.*, No. 20-1300 (D.C. Cir. filed Aug. 7, 2020); *City of Boston, Massachusetts et al. v. FCC et al.*, No. 20-1301 (D.C. Cir. filed Aug. 10, 2020); 47 U.S.C. § 1455(a). In addition, also in June 2020, the Commission released an Emergency Authorizations During COVID-19 Public Notice, which announced an electronic process for Commission licensees to apply for expedited section 106 review or for emergency authorization to resume standard review for qualifying critical infrastructure projects during this crisis. *Section 106 Emergency Authorizations During COVID-19*, Public Notice, 35 FCC Rcd 6517 (WTB 2020).

[1080] *See Section 6409 Declaratory Ruling and Notice*, 35 FCC Rcd at 5977-79, paras. 1-2.

[1081] *Id.* at 5979, 5982-6000, paras. 4, 11-44.

[1082] *Id.* at 6000-03, paras. 45-50.

[1083] *Id.* at 5979-80, 6003-04, paras. 5, 51-56.

that further streamlined the section 6409(a) approval process for state and local governments' review of wireless communication collocations and tower modifications that involve limited ground excavation or deployment of transmission equipment.[1084] The Report and Order revised the definition of "substantial change" to provide that the modification of an existing tower outside the public rights-of-way that entails ground excavation or deployment of transmission equipment up to 30 feet in any direction outside the boundaries of a site will be eligible for streamlined processing under section 6409(a).[1085] The Report and Order also revised the definition of a "site" in a manner that will ensure that the site boundaries from which limited expansion is measured appropriately reflect prior state or local government review and approval.[1086]

369. On July 10 2020, the Commission, the Advisory Council on Historic Preservation (ACHP), and the National Conference of State Historic Preservation Officers executed the *Second Amendment* to the *Nationwide Programmatic Agreement for the Collocation of Wireless Antennas* (Collocation NPA).[1087] The amendment facilitates the collocation of wireless facilities on existing towers by eliminating review under section 106 of the National Historic Preservation Act[1088] for certain collocations that involve a limited expansion beyond the boundaries of a tower site.[1089]

370. In addition, in April 2019, the Commission sought comment on modernizing and updating the over-the-air reception (OTARD) regulatory framework to better account for technological developments.[1090]

B. The Fixed Communications Marketplace

1. Enhancing Competition, Removing Barriers to Investment, and Encouraging Deployment

371. *Updating Wireline Regulation to Enhance Competition and Reduce Inefficiencies*. In a series of three orders adopted in 2019 in response to a USTelecom petition, the Commission forbore from a significant number of regulations that are no longer appropriate in the current marketplace.[1091] Through

[1084] *Implementation of State and Local Governments' Obligations to Approve Certain Wireless Facility Modification Requests Under 6409(a) of the Spectrum Act of 2012*, WT Docket No. 19-250, Report and Order, FCC 20-153 (Nov. 3, 2020) (*Section 6409 Report and Order*).

[1085] *Section 6409 Report and Order*, at 5, 10, paras. 9, 17; 47 CFR § 1.6100(b)(7) ("A modification substantially changes the physical dimensions of an eligible support structure if it meets any of the following criteria: . . . (iv) It entails any excavation or deployment outside the current site . . . .").

[1086] *Section 6409 Report and Order*, at 13-14, paras. 25-28; 47 CFR § 1.6100(b)(6) (defining "site").

[1087] *See Wireless Telecommunications Bureau Announces Execution of Second Amendment to the Nationwide Programmatic Agreement for the Collocation of Wireless Antennas*, Public Notice, 35 FCC Rcd 7150 (WTB 2020); 47 CFR Part 1, Appx. B.

[1088] 54 U.S.C. § 300101 *et seq*.

[1089] *Wireless Telecommunications Bureau Announces Execution of Second Amendment to the Nationwide Programmatic Agreement for the Collocation of Wireless Antennas*, Public Notice, 35 FCC Rcd 7150 (WTB 2020).

[1090] *Updating the Commission's Rule for Over-the-Air Reception Devices*, WT Docket No. 19-71, Notice of Proposed Rulemaking, 34 FCC Rcd 2695, 2695, para. 1 (2019) (*OTARD Notice*).

[1091] *Petition of USTelecom for Forbearance Pursuant to 47 U.S.C. § 160(c) to Accelerate Investment in Broadband and Next-Generation Networks*, WC Docket No. 18-141, Memorandum Opinion and Order, 34 FCC Rcd 2590 (2019) (*Section 271/272 Forbearance Order*); *Petition of USTelecom for Forbearance Pursuant to 47 U.S.C. § 160 (c) to Accelerate Investment in Broadband and Next-Generation Networks*, WC Docket No. 18-141 et al., Report and Order on Remand and Memorandum Opinion and Order, 34 FCC Rcd 5767 (2019) (*BDS Remand Order*/*UNE Transport Forbearance Order*); *Petition of USTelecom for Forbearance Pursuant to 47 U.S.C. § 160 (c) to Accelerate Investment in Broadband and Next-Generation Networks*, WC Docket No. 18-141, Memorandum Opinion and Order, 34 FCC Rcd 6503 (2019) (*UNE Analog Loop and Avoided-Cost Resale Forbearance Order*), *aff'd, Comptel et al. v. FCC*, No. 19-1164 (D.C. Cir. Nov. 3, 2020).

these orders, the Commission relieved carriers of outdated obligations applying only to incumbent local exchange carriers (LECs), such as provisioning service metric reporting, long distance affiliate, and superfluous pole attachment requirements, as well as outdated or unnecessary obligations to provide unbundled network elements to competitors and to offer service for resale at a wholesale discount.[1092] On October 28, 2020, the Commission extended this reform to additional UNEs and to a wider variety of incumbent LECs.[1093]

372. Further, the Commission addressed market-distorting perverse incentives created by the Commission's intercarrier compensation regulatory regime. In September 2019, the Commission revised its rules addressing arbitrage schemes involving fees that long distance companies pay local and intermediate carriers for calls placed by customers of the long distance providers.[1094] In furtherance of these schemes, some of the companies that collect such charges generated large volumes of inbound traffic that allowed them to collect fees that far exceeded the cost of completing the calls.[1095] And on October 7, 2020, the Commission adopted an order addressing similar types of arbitrage schemes relating to calls routed to toll-free numbers.[1096] By revising its rules to reduce these arbitrage opportunities, the Commission has better aligned carriers' incentives with cost, which will lead to more efficient network design and prevent local and long-distance customers (including toll-free customers) from bearing the cost of wasteful schemes.[1097]

373. The Commission also initiated a proceeding to consider whether ex ante regulation and tariffing of end-user charges local carriers assess for access to long distance calling remains in the public interest due to significant marketplace and regulatory changes over the past two-plus decades. On March 31, 2020, the Commission adopted a Notice of Proposed Rulemaking proposing to deregulate and detariff these charges, and to prohibit providers from separately listing these charges on their customers' bills.[1098] These proposals are designed to ensure that the total price that appears on customers' bills is closer to the voice service providers' advertised prices.[1099]

374. *Removing Barriers to and Encouraging Wireline Investment*. In July 2019, the Commission adopted a *Notice of Proposed Rulemaking and Declaratory Ruling* to improve broadband deployment and competition in the nation's MTEs.[1100] Nearly 30% of the U.S. population lives in

[1092] *Id.* In the *UNE Analog Loop and Avoided-Cost Resale Forbearance Order*, the Commission's forbearance relief applied only to incumbent LECs subject to price cap regulation. *UNE Analog Loop and Avoided-Cost Resale Forbearance Order*, 34 FCC Rcd at 6504, para. 2.

[1093] *See generally Modernizing Unbundling Order*. In addition to relief regarding UNE obligations, the Commission extended previously-granted forbearance from the obligation to offer service for resale at a wholesale discount to non-price cap LECs.

[1094] *Updating the Intercarrier Compensation Regime to Eliminate Access Arbitrage*, WC Docket No. 18-155, Report and Order and Modification of Section 214 Authorizations, 34 FCC Rcd 9035 (2019), *pets. for review pending sub nom. Great Lakes Commc'ns Corp. et al. v. FCC*, No. 19-1233 (D.C. Cir.) (consolidated with No. 19-1244) (*Access Arbitrage Order*).

[1095] *Id.* at 9035-36, paras. 1-2.

[1096] *8YY Access Charge Reform*, WC Docket No. 18-156, Report and Order, FCC 20-143 (rel. Oct. 9, 2020) (*8YY Access Charge Reform Order*).

[1097] *Access Arbitrage Order*, 34 FCC Rcd at 9035-37, paras. 1-4; *8YY Access Charge Reform Order*, FCC 20-143, para. 4.

[1098] *Eliminating Ex Ante Pricing Regulation and Tariffing of Telephone Access Charges*, WC Docket No. 20-71, Notice of Proposed Rulemaking, 35 FCC Rcd 3165 (2020).

[1099] *Id.* at 3165-65, paras. 1-4.

[1100] *Improving Competitive Access to Multiple Tenant Environments, Petition for Preemption of Article 52 of the San Francisco Police Code Filed by the Multiple Family Broadband Council*, GN Docket No. 17-142, MB Docket No. (continued….)

condominiums or apartments, and millions more work in office buildings.[1101] The Commission clarified that it welcomes state and local experimentation to increase access to MTEs, so long as those actions are consistent with federal law and policy.[1102] Further, the Commission preempted part of an outlier San Francisco ordinance to the extent it required the sharing of in-use wiring in MTEs, finding that requiring sharing of in-use wiring deters broadband deployment, undercuts the Commission's rules regarding control of cable wiring in residential MTEs, and threatens the Commission's framework to protect the technical integrity of cable systems for the benefit of viewers.[1103] To address further unique challenges associated with broadband deployment in MTEs, the Commission sought comment on the effect that revenue sharing agreements between building owners and broadband providers, exclusivity agreements regarding rooftop facilities, and exclusive wiring arrangements have on broadband competition and deployment.[1104]

375. The Commission has also taken further actions to reduce barriers to deployment of advanced communications capability relating to access to poles. On July 29, 2020, the Wireline Competition Bureau clarified that the imposition of a "blanket ban" by a utility on attachments to any portion of a utility pole is inconsistent with the federal requirement that a "denial of access . . . be specific" to a particular request.[1105] The Bureau also clarified that, while utilities and attachers have the flexibility to negotiate terms in their pole attachment agreements that differ from the requirements in the Commission's rules, a utility cannot use its significant negotiating leverage to require an attacher to give up rights to which the attacher is entitled under the rules without the attacher obtaining a corresponding benefit.[1106]

376. In November 2020, the Wireline Competition Bureau preempted legal requirements imposed by several cities in Missouri to the extent they permit "duplicative rights-of-way fees based solely on passive ownership of facilities used to provide telecommunications services."[1107] Under section 253(d), the Commission is required by Congress to preempt any requirements that effectively prohibit an entity from providing telecommunication services.[1108] In the *Bluebird Declaratory Ruling*, the Bureau found that the cities' legal requirements could increase Bluebird's right-of-way costs by 100%, and that the record showed that such a cost increase would "effectively prohibit Bluebird from providing its services in violation of section 253(a)."[1109]

377. *Restoring Internet Freedom.* In the *Restoring Internet Freedom Order*, the Commission ended heavy-handed, utility-style Title II regulation of the Internet and returned broadband Internet access service to its long-standing classification as an information service under Title I, the light-touch

17-91, Notice of Proposed Rulemaking and Declaratory Ruling, 34 FCC Rcd 5702 (2019), *appeal pending in City & County of San Francisco v. FCC et al.*, Docket No. 19-71832 (9th Cir.).

[1101] *Id*. at 5703, para. 1.

[1102] *Id*. at 5724, paras. 40-41.

[1103] *Id*. at 5724-45.

[1104] *Id*. at 5710-20, paras. 14-31.

[1105] *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Declaratory Ruling, 35 FCC Rcd 7936, 7936-37, 7938-43, paras. 3, 6-13 (WCB 2020) (*CTIA Pole Attachment Declaratory Ruling*); 47 CFR § 1.1403(b).

[1106] *CTIA Pole Attachment Declaratory Ruling*, 35 FCC Rcd at 7944-47, paras. 14-18.

[1107] *Missouri Network Alliance, LLC d/b/a Bluebird Network and Uniti Leasing MW LLC*; *Petition for Preemption and Declaratory Ruling*, WC Docket No. 20-46, Declaratory Ruling, DA 20-1331, at 1, para. 1 (WCB Nov. 9, 2020) (*Bluebird Declaratory Ruling*).

[1108] 47 U.S.C. § 253(a), (d).

[1109] *Bluebird Declaratory Ruling* at 2, para. 2.

framework under which the Internet developed and flourished.[1110] On October 1, 2019, in *Mozilla Corp. v. FCC*, the D.C. Circuit upheld the vast majority of the *Restoring Internet Freedom Order*, remanding three discrete issues for further consideration—namely, the effect of that *Order* on: (1) public safety; (2) the regulation of pole attachments; and (3) universal service support for low-income consumers through the Lifeline program.[1111] On October 27, 2020, the Commission adopted an order addressing the court's limited remand.

378. In the *Restoring Internet Freedom Remand Order*, the Commission considered the three issues remanded by the court and found no reason to depart from its earlier conclusions.[1112] First, the Commission found that neither its decision to return broadband Internet access service to its long-standing classification as an information service, nor its subsequent decision to eliminate the conduct-based open Internet rules, is likely to adversely impact public safety.[1113] To the contrary, the Commission concluded that the regulatory certainty of the *Restoring Internet Freedom Order* has promoted an environment that encourages robust investment in broadband networks and facilities that can be used for many purposes, including public safety purposes.[1114] Second, the Commission concluded that the overall benefits of classifying broadband Internet access service as an information service outweigh the limited potential negative effects resulting from the loss of section 224 rights, and, by extension, the Commission's pole attachment rules, for broadband-only ISPs.[1115] The Commission considered the drawbacks to be limited in part because the vast majority of ISPs also provide either cable or telecommunications services over their networks, and therefore remain able to take advantage of the rights guaranteed by section 224 notwithstanding the reclassification of broadband Internet access service as an information service.[1116] Finally, the Commission concluded it has legal authority under section 254(e) of the Act to provide Lifeline support to Eligible Telecommunications Carriers that provide broadband service over broadband-capable networks that support voice service.[1117] The *Restoring Internet Freedom Remand Order* provided valuable certainty to policies that have fueled broadband deployment and are closing the digital divide.[1118]

379. *Unbundled Network Elements*. Incumbent LECs filed a petition in May 2018 seeking forbearance from obligations to share their networks and retail telecommunications services on an avoided-cost wholesale basis with competitors.[1119] These unbundling and resale obligations were established in the Telecommunications Act of 1996 to encourage competition within the local telecommunications marketplace.[1120] Where competition has flourished, Congress "encouraged the

[1110] *See generally Restoring Internet Freedom Order*.

[1111] *Restoring Internet Freedom*; *Bridging the Digital Divide for Low-Income Consumers*; *Lifeline and Link Up Reform and Modernization*, WC Docket Nos. 17-108, 17-287 & 11-42, Order, 35 FCC Rcd 12328, 12329, para. 2 (2020) (*Restoring Internet Freedom Remand Order*); *see Mozilla Corp. v. FCC*, 940 F.3d 1 (D.C. Cir. 2019) (*Mozilla*); *see also Restoring Internet Freedom Order*, 33 FCC Rcd 311.

[1112] *Restoring Internet Freedom Remand Order*, 35 FCC Rcd at 12329, para. 2.

[1113] *Id.* at 12348-68, paras. 37-66.

[1114] *Id.* at 12336, para. 20.

[1115] *Id.* at 12370-77, paras. 71-81; 47 U.S.C. § 224; 47 CFR Part 1, Subpart J.

[1116] *Restoring Internet Freedom Remand Order* at 12371-72, para. 73.

[1117] *Id.* at 12378, para. 82; 47 U.S.C. § 254(e).

[1118] *2018 Broadband Deployment Report*, 33 FCC Rcd at 1661-62, 1707, paras. 4-5, 92.

[1119] Petition of USTelecom for Forbearance Pursuant to 47 U.S.C. § 160(c) to Accelerate Investment in Broadband and Next-Generation Networks, WC Docket No. 18-141 (filed May 4, 2018).

[1120] The Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (codified at 47 U.S.C. § 151 et seq.).

Commission to use forbearance and other means to encourage deployment of advanced telecommunications capability and remove barriers to infrastructure deployment."[1121]

380. In response to the May 2018 petition, the Commission granted price cap incumbent LECs unbundling relief for DS1 and DS3 interoffice transport[1122] and for analog loops used solely to provide legacy telephone service, specifically Time Division Multiplexing service provided over narrowband copper wires[1123] as well as resale obligations typically used to provide the same legacy service. The Commission later sought comment on broader reforms.[1124] In October 2020, the Commission adopted an Order eliminating unbundling requirements and resale obligations in areas where they stifle technology transitions but preserving them in areas where they are still needed to promote competition.[1125]

381. The *2020 UNE Order* eliminated unbundling requirements for: enterprise DS1 and DS3 loops in areas with sufficient competition; DS0 loops and sub-loops in densely populated areas; voice-grade narrowband loops, multiunit premise subloops, and network interface devices nationwide; and dark fiber transport within one-half mile of competitive fiber networks.[1126] Each element has an appropriate transition period to avoid harming consumers and stranding investment. In addition, the Order forbore from the avoided-cost resale obligation where it continues to exist.[1127]

382. *Broadband Deployment Advisory Committee*. The Chairman re-chartered the *Broadband Deployment Advisory Committee* (BDAC), a federal advisory committee, for a second two-year term effective March 1, 2019.[1128] The BDAC works to craft recommendations for the Commission on ways to accelerate the deployment of broadband by reducing and removing regulatory barriers to infrastructure investment and strengthening existing broadband networks in communities across the country. It serves as a forum for interested stakeholders to exchange ideas and develop recommendations to the Commission on broadband deployment, which in turn enhances the Commission's ability to carry out its statutory responsibility to encourage the deployment of broadband to all Americans.[1129]

383. The re-chartered BDAC is organized into three working groups, each with a distinct purpose. The Disaster Response and Recovery Working Group was originally charged with recommending measures to improve resiliency of broadband infrastructure before a disaster occurs, and strategies that can be used during and after the response to a disaster to minimize broadband network downtime.[1130] On March 27, 2020, the Disaster Response and Recovery Working Group presented a

[1121] *Modernizing Unbundling Order* at 12429-30, para. 12.

[1122] *Petition of USTelecom for Forbearance Pursuant to 47 U.S.C. § 160(c) to Accelerate Investment in Broadband and Next-Generation Networks et al.*, WC Docket No. 18-141 et al., Report and Order on Remand and Memorandum Opinion and Order, 34 FCC Rcd 5767 (2019).

[1123] *Petition of USTelecom for Forbearance Pursuant to 47 U.S.C. § 160(c) to Accelerate Investment in Broadband and Next-Generation Networks*, WC Docket No. 18-141, Memorandum Opinion and Order, 34 FCC Rcd 6503 (2019).

[1124] *Modernizing Unbundling and Resale Requirements in an Era of Next-Generation Networks and Services*, WC Docket No. 19-308, Notice of Proposed Rulemaking, 34 FCC Rcd 11290 (2019).

[1125] *Modernizing Unbundling Order*, at 12426, para. 3.

[1126] *Id.*

[1127] *Id.* at 12497-98, para. 145.

[1128] *FCC Announces the Re-Charter of the Broadband Deployment Advisory Committee and Solicits Nominations for Membership*, GN Docket No. 17-83, Public Notice, 33 FCC Rcd 11747 (2018).

[1129] *FCC Announces Membership and First Meeting of the Re-Chartered Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, 34 FCC Rcd 3251, 3251, (2019) (*2019 Re-Chartered BDAC PN*).

[1130] *Id*.

report and recommendations in response to its charges, which the BDAC approved.[1131] It has since been charged, on April 16, 2020, with assisting the BDAC in documenting the strategies and solutions that stakeholders are developing and implementing in real time to address the deployment-related challenges presented by the COVID-19 pandemic.[1132] The Broadband Infrastructure Deployment Job Skills and Training Opportunities Working Group is charged with making recommendations on ways to make job skills training more widely available and to improve development opportunities for the broadband infrastructure deployment workforce.[1133] The Increasing Broadband Investment in Low-Income Communities Working Group is tasked with identifying new ways to encourage the deployment of high-speed broadband infrastructure and services to low-income communities.[1134]

384. The BDAC has worked diligently to fulfill the charges given to it by the Commission. Since the Commission released the *2018 Report*, the re-chartered BDAC has met six times, during which the BDAC members have discussed their charges and the progress the working groups have made toward developing final reports for consideration and approval by the full BDAC.[1135] At its October 29, 2020 meeting, the BDAC considered and voted on reports and recommendations from its three working groups: Increasing Broadband Investment in Low-Income Communities (Low-Income), Broadband Infrastructure Deployment Job Skills and Training Opportunities (Job Skills), and Disaster Response and Recovery (Disaster Response). The Job Skills working group and Disaster Response working group reports were considered and approved by the full BDAC, while the Low-Income working group report was considered but not voted on or approved, pending further revisions.[1136]

[1131] Broadband Deployment Advisory Cmte., Disaster Response & Recovery Working Grp., Report and Recommendations (Mar. 27, 2020), https://www.fcc.gov/sites/default/files/bdac-disaster-response-recovery-approved-rec-03272020.pdf.

[1132] *FCC Chairman Pai Announces New Charges and Solicits Additional Nominations for the Disaster Response and Recovery Working Group of the Broadband Deployment Advisory Committee to Address Challenges Presented By COVID-19*, GN Docket No. 17-83, Public Notice, 35 FCC Rcd 3553 (2020).

[1133] *2019 Re-Chartered BDAC PN* at 3251.

[1134] *Id.* Announcements concerning the membership of these working groups can be found on the Commission's BDAC page: https://www.fcc.gov/broadband-deployment-advisory-committee. *See FCC Announces Membership of the Broadband Deployment Advisory Committee's Disaster Response and Recovery Working Group*, GN Docket No. 17-83, Public Notice, 33 FCC Rcd 11006 (2018); *FCC Announces the Membership of Two Broadband Deployment Advisory Committee Working Groups*, GN Docket No. 17-83, Public Notice, 34 FCC Rcd 5226 (2019); *FCC Announces Additional Membership of Broadband Deployment Advisory Committee Disaster Response and Recovery Working Group*, GN Docket No. 17-83, Public Notice, 35 FCC Rcd 5669 (2020).

[1135] *2019 Re-Chartered BDAC PN*, 34 FCC Rcd 3251 (June 13, 2019 meeting); *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, 34 FCC Rcd 7714 (2019) (September 19, 2019 meeting); *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, 34 FCC Rcd 9557 (2019) (December 3, 2019 meeting); *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, 35 FCC Rcd 1959 (2020) (March 27, 2020 meeting); *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, 35 FCC Rcd 6442 (2020) (July 29, 2020 meeting); *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, 35 FCC Rcd 10657 (Sept. 29, 2020) (Oct. 29-30, 2020 meeting). Video from each of the BDAC meetings and links to related materials can be found on the Commission's BDAC page: https://www.fcc.gov/broadband-deployment-advisory-committee.

[1136] The October BDAC meeting was held by conference call and was available live to the public over the Internet. Materials from the meeting can be found on the Commission's website: https://www.fcc.gov/news-events/events/2020/10/bdac-meeting-october-2020.

385. *Precision Agriculture Connectivity Task Force*. Consistent with the Agriculture Improvement Act of 2018,[1137] Chairman Pai chartered the Task Force for Reviewing the Connectivity and Technology Needs of Precision Agriculture in the United States under the Federal Advisory Committee Act for a two-year term to make policy recommendations on how to accelerate broadband deployment on agricultural lands.[1138] The Precision Agriculture Task Force is examining policy, regulatory, and technical solutions to encourage the adoption of broadband on farms and ranches and to promote the advancement of precision agriculture in the United States.[1139]

386. In November 2019, Chairman Pai, in consultation with the Secretary of Agriculture, appointed fifteen members of the Task Force including agricultural producers representing diverse geographic regions and farm sizes, equipment manufacturers, and industry representatives, as well as Tribal, state, and local government representatives.[1140] The Precision Agriculture Task Force has met four times in 2020.[1141] Four working groups continue to assist the Task Force in carrying out its work: (1) Mapping and Analyzing Connectivity on Agricultural Lands; (2) Examining Current and Future Connectivity Demand for Precision Agriculture; (3) Encouraging Adoption of Precision Agriculture and Availability of High-Quality Jobs on Connected Farms; and (4) Accelerating Broadband Deployment on Unserved Agricultural Lands.[1142] At its October 28, 2020 meeting, the Task Force considered and voted on reports from its Mapping and Analyzing Connectivity on Agricultural Lands and Examining Current and Future Connectivity Demand for Precision Agriculture working groups, which were approved by the full Task Force. The Task Force also considered and approved an initial report from the Encouraging Adoption of Precision Agriculture and Availability of High-Quality Jobs on Connected Farms working group.[1143]

[1137] Agriculture Improvement Act of 2018, Pub. L. No. 115-334, 132 Stat. 4490, § 12511(b)(2) (2018 Farm Bill). The Precision Agriculture Connectivity Task Force will perform duties and submit reports consistent with section 12511 of the 2018 Farm Bill and in consultation with the Department of Agriculture in successive terms until the Task Force ends on January 1, 2025.

[1138] *FCC Announces the Establishment of the Task Force for Reviewing Connectivity and Technology Needs of Precision Agriculture in the United States and Seeks Nominations for Membership*, Public Notice, 34 FCC Rcd 5057 (2019) (*Precision Agriculture Task Force Public Notice*); Task Force for Reviewing Connectivity & Tech. Needs of Precision Agric. in the U.S., *Charter* (Dec. 4, 2019), https://www.fcc.gov/sites/default/files/precision-ag-task-force-charter-12042019.pdf.

[1139] *Precision Agriculture Task Force Public Notice*, 34 FCC Rcd at 5057.

[1140] *FCC Announces the Membership of and First Meeting of the Task Force for Reviewing the Connectivity and Technology Needs of Precision Agriculture in the United States*, GN Docket No. 19-329, Public Notice, 34 FCC Rcd 10493 (2019) (*Precision Agriculture Task Force Membership Public Notice*).

[1141] *Id.* (setting Dec. 9, 2019 as the date of its first meeting); *FCC Announces the Second Meeting of the Task Force for Reviewing the Connectivity and Technology Needs of Precision Agriculture in the United States on March 25, 2020*, GN Docket No. 19-329, Public Notice, 35 FCC Rcd 2038 (2020); *FCC Announces the Third Meeting of the Task Force for Reviewing the Connectivity and Technology Needs of Precision Agriculture in the United States on March 25, 2020*, GN Docket No. 19-329, Public Notice, 35 FCC Rcd 6327 (2020); *FCC Announces the Fourth Meeting of the Task Force for Reviewing the Connectivity and Technology Needs of Precision Agriculture in the United States on October 28, 2020*, GN Docket No. 19-329, Public Notice, 35 FCC Rcd 10419 (2020).

[1142] *Precision Agriculture Task Force Membership Public Notice*, 34 FCC Rcd at 10493; *FCC Announces the Membership of the Working Groups of the Task Force for Reviewing the Connectivity and Technology Needs of Precision Agriculture in the United States*, GN Docket No. 19-329, Public Notice, 5 FCC Rcd 2053 (2020).

[1143] The October Task Force meeting was held electronically and was open to the public via livestream. Materials from the meeting can be found on the Commission's website: https://www.fcc.gov/news-events/events/2020/10/precision-ag-connectivity-task-force-meeting-october-2020.

2. Universal Service Support

387. Universal service also plays an essential role in deploying broadband networks, particularly in rural, insular, and hard-to-serve areas. The Commission's Universal Service Fund provides funding to increase the availability of telecommunication services and broadband Internet access services for low-income households, rural health care providers, schools and libraries, and consumers in high-cost areas.[1144] As part of its oversight responsibilities, the Commission routinely considers ways to maximize the effect of available Universal Service Fund funding to support broadband deployment.[1145]

388. *High-Cost Support Reform.* By both expanding the use of auctions and improving current programs, the Commission has continued its efforts to reform the manner in which universal service high-cost support is distributed to deploy broadband to rural areas. The Commission has successfully conducted the Connect America Fund Phase II auction to award funding to service providers that commit to offer voice and broadband services to fixed locations in unserved high-cost areas. In 2018, the Phase II auction awarded more than $1.488 billion over 10 years to 103 winning bidders to serve more than 713,000 rural homes and businesses.[1146] The Commission began authorizing Phase II Auction funding in May 2019,[1147] authorizing a total of 16 waves of support through November 12, 2020, a process that continues.[1148] As of November 12, 2020, the Commission has authorized a total of nearly $1.5 billion in Phase II auction funding, which is expanding connectivity to nearly 703,000 homes and small businesses nationwide.[1149] Funding rounds will continue until the authorization process is complete.

389. In January 2020, the Commission established the Rural Digital Opportunity Fund, which will provide up to $20.4 billion in two phases to expand broadband in unserved rural areas, representing the Commission's biggest single step to date toward closing the rural digital divide.[1150] Phase I of the Rural Digital Opportunity Fund will allocate up to $16 billion in funding over the next decade, targeting areas that current data show are wholly unserved by 25/3 Mbps broadband and voice, where Commission

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[1144] 47 U.S.C. § 254.

[1145] *Connect America Fund*; *ETC Annual Reports and Certifications*; *Establishing Just and Reasonable Rates for Local Exchange Carriers*; *Developing a Unified Intercarrier Compensation Regime*; WC Docket Nos. 10-90, 14-58, and 07-135, CC Docket No. 01-92; Report and Order, Third Order on Reconsideration, and Notice of Proposed Rulemaking, 33 FCC Rcd 2990, 2992, para. 4 (2018) (taking several steps to increase broadband deployment in rural areas through the High Cost program, including maximizing available funding for broadband networks); *Promoting Telehealth in Rural America*, WC Docket No. 17-310, Report and Order, 33 FCC Rcd 6574, 6575, para. 3 (2018) (*Telehealth Report and Order*) (increasing the funding cap for the Rural Healthcare program to $571 million to prevent pro-rata funding reductions that could have disproportionately affected rural health care providers, especially those in Alaska).

[1146] *Connect America Fund Phase II Auction Scheduled for July 24, 2018 Notice and Filing Requirements and Other Procedures for Auction 903*, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, 33 FCC Rcd 1428 (2018); *220 Applicants Qualified to Bid in the Connect America Fund Phase II Auction (Auction 903)*; *Bidding to Begin on July 24, 2018*, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, 33 FCC Rcd 6171 (2018) (announcing the qualified bidders for the auction and confirming timing); *Connect America Fund Phase II Auction (Auction 903) Closes*; *Winning Bidders Announced*, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, 33 FCC Rcd 8257 (2018).

[1147] Press Release, FCC, FCC Authorizes First Wave of Funding for Rural Broadband from Connect America Fund Auction (May 14, 2019), https://docs.fcc.gov/public/attachments/DOC-363069A1.pdf.

[1148] Press Release, FCC, FCC Authorizes Over $5.2 Million for Broadband Deployment To Rural Areas in Mississippi (Sept. 2, 2020), https://docs.fcc.gov/public/attachments/DOC-366631A1.pdf; *Connect America Fund Phase II Auction Support for 6 Winning Bids Ready to Be Authorized*, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice (WCB Nov. 12, 2020) (16th wave).

[1149] *Id*.

[1150] *Rural Digital Opportunity Fund*; *Connect America Fund*, WC Docket Nos. 19-126 and 10-90, Report and Order, 35 FCC Rcd 686, 687, at para. 2 (2020) (*Rural Digital Opportunity Fund Order*).

staff estimate as many as 10.25 million unserved Americans live and work.[1151] On October 13, 2020, the Commission announced that 386 applicants were qualified to bid.[1152] The Phase I auction began on October 29, 2020, using a multi-round, reverse auction that favors bids offering faster services with lower latency and encourages intermodal competition to ensure that the greatest possible number of Americans will be connected to the best possible networks, all at a competitive cost.[1153] Phase II of the Rural Digital Opportunity Fund will incorporate the granular, precise broadband availability maps being developed in the Commission's *Digital Opportunity Data Collection* proceeding to allocate at least $4.4 billion to target unserved locations within partially served areas, as well as any areas not won in Phase I.[1154] The Commission also took steps in the *Rural Digital Opportunity Fund Order* to directly target broadband deployment in census blocks on rural Tribal lands. Specifically, the Commission adopted rules effectively increasing the auction reserve price for census blocks on Tribal lands, which makes more support available compared to most non-Tribal census blocks eligible for the auction, and makes additional locations on Tribal lands eligible for the auction.[1155]

390. In September 2019, the Commission approved nearly $950 million in Stage 2 funding for the Uniendo a Puerto Rico and Connect USVI Funds to improve, expand, and harden communications networks in Puerto Rico and the U.S. Virgin Islands that were damaged and destroyed during the 2017 hurricane season.[1156] To that end, the Commission allocated more than $500 million over 10 years for fixed broadband support in Puerto Rico,[1157] and more than $180 million over 10 years in support for fixed networks in the U.S. Virgin Islands.[1158] The Commission is awarding support for fixed broadband through a competitive process, in which service providers bid to serve every location in each covered area with storm-hardened networks at up to gigabit speeds.[1159]

391. On November 2 and November 16, 2020, the Commission announced the results of the competitive bidding process for the Uniendo a Puerto Rico Stage 2 fixed support and the Connect USVI Stage 2 fixed support.[1160] As a result, all of the more than 1.2 million eligible locations in Puerto Rico will get access to at least 100/10 Mbps broadband, and nearly a third will gain access to gigabit speeds.[1161]

[1151] *Id.* at 689-90, para. 8.

[1152] *386 Applicants Qualified to Bid in the Rural Digital Opportunity Fund Phase I Auction (Auction 904)*; *Bidding to Begin on October 29, 2020*, AU Docket No. 20-34, WC Docket Nos. 19-126 and 10-90, Public Notice, 35 FCC Rcd 11356, 11356, para. 1 (OEA & WCB Oct. 13, 2020), https://docs.fcc.gov/public/attachments/DA-20-1187A1.pdf.

[1153] *Rural Digital Opportunity Fund Order*, 35 FCC Rcd at 688, 694-95, paras. 5, 17-18; Press Release, FCC, FCC Announces Kickoff of Groundbreaking $16 Billion Rural Digital Opportunity Fund Phase I Auction (Oct. 29, 2020), https://docs.fcc.gov/public/attachments/DOC-367851A1.pdf.

[1154] *Rural Digital Opportunity Fund Order*, 35 FCC Rcd at 688, 690, paras. 5, 9.

[1155] *Id*. at 694, para. 16.

[1156] *The Uniendo a Puerto Rico Fund and the Connect USVI Fund*; *Connect America Fund*; *ETC Annual Reports and Certifications*, WC Docket Nos. 18-143 et al., Report and Order and Order on Reconsideration, 34 FCC Rcd 9109, 9110, para. 3 (2019) (*2019 Uniendo a Puerto Rico and Connect USVI Funds Order*).

[1157] *Id.* at 9146, para. 67.

[1158] *Id*. at 9163, para. 102.

[1159] *Id.* at 9114-43, paras. 11-66.

[1160] *Wireline Competition Bureau Announces Winning Applicants for Uniendo a Puerto Rico Fund Stage 2 Competitive Process*, WC Docket Nos. 18-143 and 10-90, Public Notice, DA 20-1299 (WCB Nov. 2, 2020) (*Uniendo a Puerto Rico Fund Stage 2 Winning Applicant Public Notice*); *Wireline Competition Bureau Announces Winning Applicants for the Connect USVI Fund Stage 2 Competitive Process*, WC Docket Nos. 18-143 and 10-90, Public Notice, DA 20-1351 (WCB Nov. 16, 2020) (*Connect USVI Fund Stage 2 Winning Applicant Public Notice*).

[1161] *Uniendo a Puerto Rico Fund Stage 2 Winning Applicant Public Notice* at 1, para. 1.

In the U.S. Virgin Islands, broadband at gigabit speeds will be available to all of the more than 46,000 eligible locations.[1162] Further, as part of its efforts to promote robust voice and broadband in the territories, the Commission authorized $258.8 million to expand, improve, and harden mobile broadband networks in Puerto Rico and U.S. Virgin Islands—including the first universal service funding targeted specifically for 5G deployment.[1163]

392. In October 2019, the Commission approved performance testing procedures for all carriers receiving high-cost support to deploy fixed broadband networks to unserved Americans living in rural areas.[1164] These procedures relate to an existing requirement that carriers conduct quarterly speed and latency tests between specified numbers of active subscribers' homes and the Internet and the *Order* made targeted modifications to the testing procedures.[1165] These procedures will help to ensure that rural Americans have access to the same high-quality networks as Americans in urban areas, while also ensuring that carriers remain accountable to consumers, taxpayers, and the Commission, and are delivering the network performance they have committed to provide.

393. The Commission also continued its efforts to reform its Universal Service Fund high-cost programs for rate-of-return carriers. On December 12, 2018, the Commission adopted revised model offers for rate-of-return carriers receiving model-based support; new model offers for rate-of-return carriers currently receiving legacy support; a new budget for carriers remaining on legacy support based on uncapped 2018 claims (that will be increased by inflation annually); and other measures to mitigate the regulatory burden on providers and encourage the efficient use of universal service support.[1166] In August 2019, the Commission authorized over $4.9 billion in support for rate-of-return carriers for maintaining, improving, and expanding broadband in rural areas over the next decade.[1167] This support will ensure broadband access for approximately 455,000 homes and businesses served by 171 carriers in 40 states and territories, including more than 44,000 locations on Tribal lands.[1168]

394. On April 12, 2019, the Commission eliminated the "rate floor" rule that, for several years, served as a de facto federal government mandate that increased rates paid by rural Americans.[1169] The 2011 rule was aimed at limiting the universal service support that rural providers whose rates were below a set minimum rate received. This policy was intended to prevent artificial subsidization of rates below the national urban average, and was scheduled to potentially increase nearly 50% for some

[1162] *Connect USVI Fund Stage 2 Winning Applicant Public Notice* at 1, para. 1.

[1163] *Wireline Competition Bureau Authorizes Stage 2 Mobile Support for Certain Providers Participating in the Uniendo a Puerto Rico Fund and the Connect USVI Fund*, WC Docket Nos.. 18-143 and 10-90, Public Notice, 35 FCC Rcd 6321 (WCB 2020); *Wireline Competition Bureau Authorizes Stage 2 Mobile Support for Viya in the U.S. Virgin Islands*, WC Docket Nos. 18-143 and 10-90, Public Notice, 35 FCC Rcd 11555 (WCB 2020).

[1164] *See* News Release, FCC, FCC Takes Steps to Enforce Quality Standards for Rural Broadband Networks (Oct. 25, 2019), https://docs.fcc.gov/public/attachments/DOC-360424A1.pdf; *Connect America Fund*, WC Docket No. 10-90, Order on Reconsideration, 34 FCC Rcd 10109 (2019) (*CAF Performance Standards Order on Reconsideration*).

[1165] *CAF Performance Standards Order on Reconsideration*, 34 FCC Rcd at 10112-16, paras. 12-19, 10124-26, paras. 18-19, 10139-49, paras. 39-49, 10156-94, paras. 130-44.

[1166] *Connect America Fund, et al.*, WC Docket Nos. 10-90 et al., Report and Order, Further Notice of Proposed Rulemaking, and Order on Reconsideration, 33 FCC Rcd 11893 (2018).

[1167] *See Wireline Competition Bureau Authorizes 171 Rate-of-Return Companies to Receive $491 Million Annually in Alternative Connect America Cost Model II Support to Expand Rural Broadband*, WC Docket No. 10-90, Public Notice, 34 FCC Rcd 7271 (WCB 2019).

[1168] Press Release, FCC, FCC Authorizes Support for Broadband in Over 44,000 Tribal Homes and Businesses Nationwide (Aug. 22, 2019), https://docs.fcc.gov/public/attachments/DOC-359226A1.pdf.

[1169] *Connect America Fund*, WC Docket No. 10-90, Report and Order, 34 FCC Rcd 2621 (2019).

consumers on July 1, 2020.[1170] Instead, the Commission concluded that, particularly in light of changes to Universal Service Fund high-cost support programs, the rule no longer served a purpose and instead, had the perverse effect of making rates less affordable, and thus, should be eliminated.[1171]

395. *Tribal Lands.* In May 2019, the Consumer and Governmental Affairs Bureau, Wireless Telecommunications Bureau, and Wireline Competition Bureau submitted a report to Congress providing an analysis of broadband deployment on Tribal lands.[1172] The *Tribal Lands Broadband Access Deployment Report* found that, while deployment to Tribal lands has increased in recent years, Tribal lands experience lower rates of both fixed and mobile broadband deployment as compared to non-Tribal areas of the United States, particularly in rural areas.[1173] The *Tribal Lands Broadband Access Deployment Report* also describes in detail the Commission's efforts to leverage its available programs to increase the availability of broadband on Tribal lands, including universal service program reforms, expanded direct consultation with Tribes, and making available additional, valuable spectrum resources.[1174] In Tribal areas served by rate-of-return carriers, the Commission made model-based support available and increased support for Tribal locations; companies that elected model support will provide at least 25/3 Mbps service to more than 37,000 locations on Tribal lands.[1175] Previously, to address the higher costs that legacy rate-of-return carriers typically face in serving Tribal lands, the Commission increased the amount of operating costs that the high-cost program will offset for carriers that predominantly serve tribal lands.[1176] For unserved Tribal lands in price cap service areas, the Commission took steps in the *Rural Digital Opportunity Fund Order* to directly target broadband deployment in census blocks on rural Tribal lands. Specifically, the Commission adopted a policy that has the effect of increasing the auction reserve price for serving such census blocks compared to the typical census blocks eligible for the auction, which we expect will encourage deployment on Tribal lands.[1177]

396. *Lifeline*. In October 2019, in conjunction with reversing a legally insupportable interpretation of the traditional state and federal roles in designating ETCs and eliminating the Lifeline Broadband Provider Eligible Telecommunications Carrier category, the Commission sought comment on a new Lifeline program goal of increasing broadband adoption among low-income customers and the data that the Commission might collect and analyze to assess that potential goal.[1178] In addition, the Commission clarified the obligations of participating carriers and took targeted steps to improve compliance by Lifeline ETCs to reduce waste, fraud, and abuse in the program, so as to maximize the

[1170] *Id.* at 2621, paras. 1-2.

[1171] *Id.* at 2624-26, paras. 10-14.

[1172] FCC, CGB, WTB, and WCB, *Report on Broadband Deployment in Indian Country, Pursuant to the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018* (2019), https://docs.fcc.gov/public/attachments/DOC-357269A1.pdf (*Tribal Lands Broadband Access Deployment Report*).

[1173] *Id*. at 1.

[1174] *Id.* at 9-18.

[1175] *Wireline Competition Bureau Authorizes 171 Rate-of-Return Companies to Receive $491 Million Annually in Alternative Connect America Cost Model II Support To Expand Rural*, Public Notice, WC Docket No. 10-90, 34 FCC Rcd 7271 (WCB 2019).

[1176] *Connect America Fund*, 33 FCC Rcd 3602, 3603-04, WC Docket No. 19-90, Report and Order, para. 5 (2018)

[1177] *Rural Digital Opportunity Fund Order*, 35 FCC Rcd at 694, para. 16.

[1178] *Bridging the Digital Divide for Low-Income Consumers, Lifeline and Link Up Reform and Modernization*, *Telecommunications Carriers Eligible for Universal Service Support*, WC Docket Nos. 17-287, 11-42, and 09-197, Fourth Report and Order, Order on Reconsideration, Memorandum Opinion and Order, Notice of Proposed Rulemaking, and Notice of Inquiry, 34 FCC Rcd 10886, 10898-914, paras. 27-66, 10945-47, paras. 136-42 (*2019 Lifeline Reform Order*).

extent that funding can be best used to close the digital divide for low-income Americans.[1179] And on November 16, 2020, the Wireline Competition Bureau revised the formula used to annually update the Lifeline program's mobile broadband minimum service standard to ensure predictable, reasonable results from the updating mechanism, enabling the program to better serve subscribers with robust mobile broadband service offerings.[1180]

397. *Rural Health Care Reforms*. As the demand for telemedicine has increased, the Commission's Rural Health Care Program has witnessed a dramatic increase in health care provider participation, which in turn put extreme demands on limited Program funding. In the August 2019 *Rural Health Care Reform Order*,[1181] the Commission simplified the method of determining support in the Rural Health Care Telecommunications Program; targeted funding to rural areas in the most need of health care services funding by prioritizing support based on rurality and whether the area is medically underserved when demand exceeds available funding; increased the effectiveness of competitive bidding; and streamlined program administration.[1182] And on October 19, 2020, the Wireline Competition Bureau released an Order waiving the budget cap for certain upfront and multi-year payments in the Rural Health Care Program's Healthcare Connect Fund in order to use already available money to fully fund all eligible services requested in Funding Year 2020.[1183] As a result, more than $800 million is available in the current funding year to fund the connectivity needs of rural health care providers, more than double the available funding when the Commission first increased the budget cap in 2018.

398. *Connected Care Pilot Program*. On March 31, 2020, the Commission adopted a Report and Order establishing a three-year, up to $100 million Connected Care Pilot Program to help defray the cost of bringing telehealth services directly to patients, with a primary emphasis on low-income patients and veterans.[1184] Eligible health care providers selected to participate in the Pilot Program will receive an 85% discount on qualifying broadband connectivity for broadband-enabled telehealth services that connect patients directly to their health care providers, as well as other information services used to

[1179] *Id*. at 10914-10945, paras. 67-133. The Commission sought comment on further reforms. *Id.* at 10947-953, para. 143-64. In addition to these efforts, the Commission has also launched the Lifeline National Eligibility Verifier (National Verifier) in all states and territories. USAC, National Verifier (last visited Oct. 27, 2020), https://www.usac.org/lifeline/eligibility/national-verifier/. With the launch of the National Verifier, Lifeline applicants and subscribers can apply for or recertify their eligibility for the Lifeline program through an objective third-party, instead of relying on Lifeline providers to determine who is eligible for the benefit. USAC, Lifeline National Verifier Plan, WC Docket Nos. 11-42, 17-287, 09-197, and 10-90, at 17-20 (Jul. 31, 2020). The National Verifier leverages nationwide automated eligibility checks to confirm applicants' qualification for Lifeline via their participation in Medicaid or Federal Public Housing Assistance, in addition to 21-state database connections to automatically verify applicants' participation in the Supplemental Nutrition Assistance Program or Supplemental Security Income, or applicants' income-based eligibility. *Id.* at 6, 17-20. The launch of the National Verifier will improve program integrity in the Lifeline application process and provide applicants with a uniform application experience. *See generally id*.

[1180] *Lifeline and Link Up Reform and Modernization, Telecommunications Carriers Eligible for Universal Service Support, Connect America Fund*; WC Docket Nos. 11-42, 09-197, 10-90, Order, DA 20-1358 (WCB Nov. 16, 2020). This will increase the Lifeline program's mobile broadband minimum service standard to 4.5 GB per month beginning December 2020, instead of the increase to 11.75 GB that would otherwise go into effect, to ensure that Lifeline subscribers have sufficient broadband capacity while keeping Lifeline services affordable. *Id.* at para. 20.

[1181] *Promoting Telehealth in Rural America*, WC Docket No. 17-310, Report and Order, 34 FCC Rcd 7335 (2019) (*Rural Health Care Reform Order*).

[1182] *Id*. at 7340-430, paras. 9-202.

[1183] *Rural Health Care Support Mechanism*, WC Docket No. 02-60, Order, 35 FCC Rcd 11696 (WCB 2020).

[1184] *Promoting Telehealth for Low-Income Consumers*; *COVID-19 Telehealth Program*, WC Docket Nos. 18-213 and 20-89, Report and Order, 35 FCC Rcd 3366, 3368-69, para. 5 (WCB 2020) (*Promoting Telehealth for Low-Income Consumers Order*).

provide connected care services and certain network equipment.[1185] Data gathered through the Pilot Program will be used to analyze how universal service funds can support health care providers and patient use of connected care services and the possible benefits that support of broadband service for connected care may bring.[1186] On September 3, 2020, the Wireline Competition Bureau released a Public Notice providing guidance to assist prospective applicants in preparing to apply for the Pilot Program, including information about eligible funding, eligible health care providers, requesting an eligibility determination before filing an FCC Form 460, and information required on applications.[1187] The application filing window for the Pilot Program is open from November 5 to December 7, 2020.[1188]

399. *Rural Telehealth Initiative.* In August 2020, the Commission, the U.S. Department of Health and Human Services, and the U.S. Department of Agriculture signed a Memorandum of Understanding to work together on the Rural Telehealth Initiative, a joint effort to collaborate and share information to address health disparities, resolve service provider challenges, and promote broadband services and technology to rural areas in America.[1189] The agencies have started a cross-cutting, multi-Department Rural Task Force to look across the relevant Administration programs and provide a path forward for health care in rural America, recognizing particular needs in technology, infrastructure, and regulatory flexibility to provide health care tailored to these communities' needs.[1190] This Task Force will regularly meet to consider future recommendations or guidelines for this effort and exchange agency expertise, scientific and technical information, data, and publications.

400. *E-Rate*. The Commission's E-Rate program is a vital source of support for connectivity to, and within, schools and libraries. In December 2019, the Commission released a *Report and Order* making permanent the "category two budget" approach the Commission adopted in 2014 for funding internal connections following a five-year test period.[1191] The category two budget approach consists of five-year budgets that provide a set amount of funding to support these internal connections, which are primarily used for Wi-Fi, a technology that has enabled schools and libraries to transition from computer labs to one-to-one digital learning.[1192] Based on the Commission's experience during the five-year test period,[1193] the Commission concluded that the category two budget approach has provided broader, more equitable, and more predictable funding for schools and libraries than under the prior rules.[1194] Informed by this experience, the Commission also took important steps to simplify and streamline the category two budget approach to allow applicants to make more effective use of category two funding, reduce

[1185] *Id*. at 3384-85, 3397, paras. 38, 55.

[1186] *Id*. at 3368-69, para. 5.

[1187] *Wireline Competition Bureau Provides Additional Information Concerning the Connected Care Pilot Program*, WC Docket No. 18-213, Public Notice, 35 FCC Rcd 9408 (WCB 2020).

[1188] *Wireline Competition Bureau Announces Connected Care Pilot Program Application Filing Window Opening*, WC Docket No. 18-213, Public Notice, DA 20-1315 (WCB Nov. 5, 2020).

[1189] *Memorandum of Understanding for Planning a Rural Telehealth Initiative among the U.S. Department of Health and Human Services and U.S. Department of Agriculture and the Federal Communications Commission* (effective Aug. 31, 2020), https://www.hhs.gov/sites/default/files/rural-telehealth-mou-hhs-usda-fcc.pdf (*Rural Telehealth Initiative MOU*).

[1190] *Id.* at 3.

[1191] *Modernizing the E-Rate Program for Schools and Libraries*, WC Docket No. 13-184, Report and Order, 34 FCC Rcd 11219 (2019) (*Category Two Report and Order*).

[1192] *Id.* at 11219, para. 1.

[1193] *See Modernizing the E-Rate Program for Schools and Libraries*, WC Docket No. 13-184, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 8870, 8898-922, section IV.B. (2014); *Modernizing the E-Rate Program for Schools and Libraries*; *Connect America Fund*, WC Docket Nos. 13-184, 10-90, Second Report and Order and Order on Reconsideration, 29 FCC Rcd 15538, 15571-78, section III.A. (2014).

[1194] *Category Two Report and Order*, 34 FCC Rcd at 11220, para. 2.

administrative burdens, and ensure more equitable, consistent distribution of support for small, rural schools and libraries within the existing E-Rate program budget for category two services.[1195]

401. To further promote the deployment of high-speed networks to unserved and underserved schools and libraries, in January 2020, the Commission adopted a *Report and Order* permanently eliminating the requirement that E-Rate applicants amortize over three years upfront, non-recurring category one charges of $500,000 or more, including charges for special construction projects–a requirement the Commission had suspended in 2014.[1196] In eliminating the requirement, the Commission noted that suspension of the amortization requirement had created a more certain path for reimbursement, which made applicants and service providers more willing to invest in new broadband infrastructure, resulting in lower costs to both applicants and universal service funding.[1197]

402. *Promoting Broadband Access for Veterans*. In May 2019, the Wireline Competition Bureau submitted a report to Congress examining the current state of broadband access and adoption by veterans, and providing recommendations on how to promote veterans' access to broadband, so that they may fully participate in the digital economy.[1198] In the *Veterans Broadband Access Report*, the Bureau found that, while many veterans have access to both fixed and mobile broadband options, a significant number still lack access to fixed broadband, mobile broadband, or both.[1199] Additionally, the Bureau found that households with veterans subscribe to mobile broadband services at lower rates than households without veterans, and that barriers to broadband adoption for veterans may include lack of deployment where they live, price, and digital illiteracy or perceived irrelevance.[1200]

403. *Improving Broadband Deployment Data*. The Commission continues its efforts to make progress establishing the *Digital Opportunity Data Collection*, a new data collection for collecting fixed broadband data to better pinpoint where broadband is available to consumers and where service is lacking, as well as in implementing the Broadband DATA Act.[1201] In the August 2020 *Digital Opportunity Data Collection Order and Second Further Notice*, the Commission took the next step in developing the new broadband coverage maps by adopting specific coverage reporting and disclosure requirements for fixed and mobile broadband providers, filing and certification requirements, measures for determining the accuracy of broadband availability data (including audits and collecting crowdsourced data), standards for collecting and incorporating verified data for use in the coverage maps from governmental entities and certain third parties, and establishing the Broadband Serviceable Location

[1195] *Id*.

[1196] *E-Rate Program Amortization Requirement, Modernizing the E-Rate Program for Schools and Libraries*, WC Docket Nos. 19-2, 13-184, Report and Order, 35 FCC Rcd 672, 672-73, para. 2 (2020) (*E-Rate Amortization Elimination Order*); *see also E-Rate Program Amortization Requirement, Modernizing the E-Rate Program for Schools and Libraries*, WC Docket Nos. 19-2, 13-184, Notice of Proposed Rulemaking and Order, 34 FCC Rcd 785 (2019). The components of special construction costs eligible for E-Rate discounts include costs for design and engineering, project management, digging trenches, and laying fiber. *See Modernizing the E-Rate Program for Schools and Libraries*, WC Docket No. 13-184, Order, 31 FCC Rcd 9767, 9775 (2016); *Schools and Libraries Universal Service Support Mechanism, A National Broadband Plan for Our Future*, CC Docket No. 02-6, GN Docket No. 09-51, Order, 25 FCC Rcd 18762, 18773 n.54 (2010).

[1197] *E-Rate Amortization Elimination Order*, 35 FCC Rcd at 674-75, paras. 8-9.

[1198] FCC, WCB, Report on Promoting Broadband Internet Access Service for Veterans, Pursuant to the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (WCB 2019), https://docs.fcc.gov/public/attachments/DOC-357270A1.pdf (*Veterans Broadband Access Report*).

[1199] *Id.* at 5-11.

[1200] *Id*. at 10, 12-13.

[1201] *See generally Digital Opportunity Data Collection Second Order and Third Further Notice*; *Digital Opportunity Data Collection Order and Second Further Notice*.

Fabric.[1202] The Commission also sought comment on several narrow issues relating to implementing the challenge and verification processes for coverage data, implementing the Broadband Serviceable Location Fabric, and certain other specific requirements of the Broadband DATA Act outside the scope of the *Digital Opportunity Data Collection Order*.

3. Satellite

404. On August 1, 2019, the Commission adopted rules to facilitate the deployment of small satellites.[1203] The Commission made available an optional, alternative streamlined licensing procedure for qualifying small satellite applicants, with an easier application process, a lower application fee, and a generally shorter timeline for review than previously available. With the "part 25 streamlined small satellite process," the Commission limited the regulatory burdens borne by small satellite applicants while promoting orbital debris mitigation and efficient use of spectrum.

405. On September 26, 2019, the Commission's DBS rules were updated for the first time in over a decade.[1204] The Commission lifted the "freeze" on new DBS applications imposed in 2005, adopted a first-come, first-served processing procedure for DBS applications and aligned DBS rules with streamlined requirements recently adopted for GSO FSS satellite networks.[1205]

406. On April 24, 2020, the Commission comprehensively updated the Commission's rules regarding orbital debris mitigation.[1206] The updated regulations were designed to ensure that the Commission's actions concerning radio communications, including licensing U.S. spacecraft and granting access to the U.S. market for non-U.S. spacecraft, mitigate the growth of orbital debris, while at the same time not creating undue regulatory obstacles to new satellite ventures.

407. On May 13, 2020, the Commission adopted rules expanding the scope of operations available with Earth Stations in Motion (ESIMs).[1207] The Commission extended licensing rules for ESIMs that operate with GSO FSS space stations to additional frequency bands available for blanket licensing of earth stations at fixed locations. The Commission also adopted rules enabling the licensing of ESIMs with NGSO FSS space stations based on the regulatory framework adopted for ESIM communications with GSO FSS networks.

408. On November 18, 2020, the Commission further streamlined its rules governing satellite services by more closely aligning the licensing processes for space stations and earth stations.[1208] The Commission created an optional, unified license framework to authorize the blanket-licensed earth stations and space stations in a satellite system under a single license.[1209] The Commission also

[1202] *Digital Opportunity Data Collection Order and Second Further Notice*, 35 FCC Rcd at 7664-96, paras. 9-86.

[1203] *Streamlining Licensing Procedures for Small Satellites*, IB Docket 18-86, Report and Order, 34 FCC Rcd 13077, 10378, para. 2 (2019) (*Small Satellites Report and Order*).

[1204] Amendment of the Commission's Policies and Rules for Processing Applications in the Direct Broadcast Satellite Service, Report and Order, 34 FCC Rcd 9014, 9014, para. 1 (2019).

[1205] *See id.* at 9016-17, 9018, 9021, 9024, paras. 8, 14, 20, 30.

[1206] *Orbital Debris Report and Order and FNPRM*, 35 FCC Rcd at 4157, para. 1.

[1207] *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*; *Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, IB Docket Nos. 17-95 and 18-315, Second Report and Order, Report and Order, and Further Notice of Proposed Rulemaking, 35 FCC Rcd 5137, 5139, para. 5 (2020) (*ESIMs Report and Order and FNPRM*).

[1208] *Further Streamlining Part 25 Rules Governing Satellite Services*, IB Docket No. 18-314, Report and Order, FCC 20-159 (Nov. 19, 2020).

[1209] *Id.* at 6-13, paras. 15-36.

harmonized the build-out requirements for earth stations and space stations and eliminated unnecessary reporting rules to reduce regulatory burdens and provide additional operational flexibility.[1210]

C. The Video and Audio Communications Marketplace

409. Over the past two years, the Commission has taken significant steps to enhance competition and encourage deployment of communications services in the video and audio markets. First, the Commission has an ongoing review to modernize the regulations that apply to media outlets and eliminate those that are outdated. To date, this *Modernization of Media Regulation Initiative* has resulted in over 25 orders, several of which are summarized below. Second, the Commission also adopted rules to allow broadcast television stations to voluntarily transition to the next-generation broadcast standard, ATSC 3.0. Third, to address issues on remand from the U.S. Court of Appeals for the Sixth Circuit, the Commission adopted rules to reduce local franchising barriers to cable television and broadband deployment. Fourth, the Commission found that a LEC-affiliated video programmer meets the statutory test for effective competition to a cable operator, and exempted that cable operator from rate regulation. Fifth, the Commission has continued to adopt rules to revitalize AM broadcasting. And finally, the Commission adopted rules to streamline and improve the FM translator interference complaint and resolution process.

410. *Modifying or Eliminating Unnecessary Regulations.* In 2017, the Commission began an effort to modernize its regulations affecting media outlets by eliminating or modifying a number of obsolete, burdensome, or outmoded rules, thereby lowering barriers to entry and enhancing competition.[1211] The Commission's work to "modernize [its] regulations and reduce unnecessary requirements that no longer serve the public interest"[1212] has continued since the *2018 Communications Marketplace Report*.

411. The Commission took a number of steps to modernize regulations applicable to broadcast licensees. For example, the Commission eliminated rules requiring broadcasters to post and maintain broadcast licenses and related information in specific locations, such as the station transmitter site or control point.[1213] The Commission also eliminated the requirement that broadcast television and radio stations file FCC Form 397 - Broadcast EEO Mid-Term Report.[1214] In addition, the Commission revised its broadcast local public notice rules "to simplify broadcasters' local public notice obligations in a manner that reduces costs and burdens, while facilitating robust public participation in the broadcast licensing process."[1215] Further, by a March 2019 Report and Order, the Commission adopted streamlined procedures for reauthorizing television station satellite status when the license of a television satellite station is assigned or transferred,[1216] and in July 2019, the Commission modernized its children's

[1210] *Id.* at 13-22, paras. 37-65.

[1211] *Commission Launches Modernization of Media Regulation Initiative*, MB Docket No. 17-105, Public Notice, 32 FCC Rcd 4406 (2017).

[1212] *Modernization of Media Regulation Initiative; Revisions to Cable Television Rate Regulations et al.*, MB Docket Nos. 17-105, 02-144, Further Notice of Proposed Rulemaking and Report and Order, 33 FCC Rcd 10549, 10550, para. 1 (2018) (*Cable Rate Regulations Further Notice*).

[1213] *Amendment of Parts 1, 5, 73, and 74 of the Commission's Rules Regarding Posting of Station Licenses and Related Information et al.*, MB Docket No. 18-21, Report and Order, 33 FCC Rcd 11876 (2018).

[1214] *Elimination of Obligation to File Broadcast Mid-Term Report (Form 397) Under Section 73.2080(f)(2) et al.*, MB Docket No. 18-23, Report and Order, 34 FCC Rcd 668 (2019). The Commission held that it could rely on information already available in the online public file to carry out the statutorily required review of broadcast stations' employment practices at the mid-point of their license terms. *Id.* at 670-71, para. 6.

[1215] *Amendment of Section 73.3580 of the Commission's Rules Regarding Public Notice of the Filing of Applications et al.*, MB Docket No. 17-264, Second Report and Order, 35 FCC Rcd 5094, 5094-95, para. 1 (2020).

[1216] *Streamlined Reauthorization Procedures for Assigned or Transferred Television Satellite Stations et al.*, MB Docket No. 18-63, Report and Order, 34 FCC Rcd 1539 (2019).

television programming rules, granting broadcasters additional scheduling flexibility, allowing broadcasters to offer more diverse and innovative educational programming, and relieving unnecessary burdens.[1217] The Commission also eliminated its radio duplication rule, which restricted the duplication of programming on commonly owned broadcast radio stations operating in the same service (AM or FM) and geographic area.[1218]

412. The Commission's modernization efforts also focused on outdated or unnecessary rules related to cable operators and other MVPDs. For example, the Commission eliminated rules requiring cable operators make available at various locations a listing of the cable television channels that each cable system delivers to its subscribers.[1219] The Commission also adopted several updates and improvements to its leased access rules,[1220] including modifying the leased access rate formula to reflect changes that have occurred in the last 20 years, while alleviating burdens on cable operators.[1221] In addition, the Commission modernized its rules to allow required notices between MVPDs and broadcasters to be delivered electronically,[1222] as well as eliminated the requirement that cable operators maintain certain records regarding ownership and carriage of video programming services.[1223] The Commission also amended its rules requiring cable operators to provide notice to subscribers regarding service or rate changes in order to make consumer notices more meaningful and accurate, reduce consumer confusion, and better ensure that subscribers receive the information they need to make informed choices about their service options.[1224]

413. *Next Generation Television Standard.* In November 2017, the Commission adopted an Order authorizing television stations to use the new Advanced Television Systems Committee (ATSC) 3.0 broadcast transmission standard and set forth operational requirements, MVPD carriage rights, public interest obligations, and technical standards.[1225] In June 2020, the Commission released (1) a Second Report and Order and Order on Reconsideration providing guidance for ATSC 3.0 television broadcasters seeking a waiver of the Commission's local simulcasting rules and clarifying that a Next Gen TV station's "significantly viewed" status does not change when it moves its ATSC 1.0 simulcast channel to a temporary host facility,[1226] and (2) a Declaratory Ruling clarifying that the Commission's broadcast ownership rules do not apply to the lease of broadcast spectrum to provide ancillary and supplementary

[1217] *Children's Television Programming Rules et al.*, MB Docket No. 18-202, Report and Order and Further Notice of Proposed Rulemaking, 34 FCC Rcd 5822 (2019).

[1218] *Amendment of Section 73.3556 of the Commission's Rules Regarding Duplication of Programming on Commonly Owned Radio Stations et al.*, MB Docket No. 19-310, Report and Order, 35 FCC Rcd 8383 (2020).

[1219] *Channel Lineup Requirements – Sections 76.1705 and 76.1700(a)(4) et al.*, MB Docket No. 18-92, Report and Order, 34 FCC Rcd 2636, 2636 para. 1 (2019). The Commission concluded that the requirements were unnecessary because channel lineups are readily available to consumers through a variety of other means. *See generally id.*

[1220] *Leased Commercial Access et al.*, MB Docket No. 07-42, Report and Order and Second Further Notice of Proposed Rulemaking, 34 FCC Rcd 4934 (2019).

[1221] *Leased Commercial Access et al.*, MB Docket No. 07-42, Second Report and Order, 35 FCC Rcd 7589 (2020).

[1222] *Electronic Delivery of Notices to Broadcast Television Stations et al.*, MB Docket No. 19-165, Report and Order, 35 FCC Rcd 857 (2020).

[1223] *Amendment of Commission Rule Requiring Records of Cable Operator Interests in Video Programming et al.*, MB Docket No. 20-35, Report and Order, 35 FCC Rcd 11172 (2020).

[1224] *Cable Service Change Notifications et al.*, MB Docket No. 19-347, Report and Order, 35 FCC Rcd 11052 (2020).

[1225] *Authorizing Permissive Use of the "Next Generation" Broadcast Television Standard*, GN Docket No. 16-142, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 9930 (2017) (*Next Gen TV Order*).

[1226] *Authorizing Permissive Use of the "Next Generation" Broadcast Television Standard*, GN Docket No. 16-142, Second Report and Order and Order on Reconsideration, 35 FCC Rcd 6793, 6794, 6797-6807, 6810-11, paras. 1, 9-28, 34-37 (2020).

services.[1227] In addition, as discussed further in section VI.C. below, the Commission is continuing to consider changes to its rules related to digital broadcast television to facilitate the provision of next generation television services.

414. *Local Franchising Issues*. On August 2, 2019, the Commission released a Third Report and Order addressing how local franchising authorities (LFAs) may regulate incumbent cable operators and cable television services, with specific focus on issues remanded from the United States Court of Appeals for the Sixth Circuit.[1228] The Order held that: (1) cable-related, "in-kind" contributions required by a cable franchise agreement are franchise fees subject to the statutory five-percent cap in section 622 of the Act; (2) LFAs may not regulate the provision of most non-cable services, including broadband Internet access service, offered over a cable system by an incumbent cable operator; (3) the Act preempts any state or local regulation of a cable operator's non-cable services that would impose obligations on franchised cable operators beyond what Title VI of the Act allows; and (4) Commission requirements that concern LFA regulation of cable operators should apply to both state-level franchising actions and state regulations that impose requirements on local franchising.[1229]

415. *LEC-Affiliated OVD Effective Competition.* An October 2019 Commission decision found for the first time that a cable system could be subject to effective competition from an LEC-affiliated OVD.[1230] The Communications Act allows LFAs to regulate MVPD rates for the basic cable service tier and equipment only if the cable systems at issue are not subject to "effective competition."[1231] Under the statute's "LEC Test," a cable system is subject to effective competition in any franchise area where:

> a local exchange carrier or its affiliate (or any [MVPD] using the facilities of such carrier or its affiliate) offers video programming services directly to subscribers by any means (other than direct-to-home satellite services) in the franchise area of an unaffiliated cable operator which is providing cable service in that franchise area, but only if the video programming services so offered in that area are comparable to the video programming services provided by the unaffiliated cable operator in that area.[1232]

416. In an October 2019 Memorandum Opinion and Order, the Commission found that under the LEC Test, Charter cable systems in Kauai, Hawaii, and certain franchise areas in Massachusetts were subject to effective competition from the AT&T TV Now OVD service, and therefore not subject to LFA rate regulation.[1233]

417. *AM Revitalization.* The Commission's ongoing AM Revitalization initiative aims to "help AM broadcasters better serve the public, thereby advancing the Commission's fundamental goals of

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[1227] *Promoting Broadcast Internet Innovation Through ATSC 3.0*, MB Docket No. 20-145, Declaratory Ruling and Notice of Proposed Rulemaking, 35 FCC Rcd 5916, 5917, 5922-25, paras. 2, 13-17 (2020) (*Broadcast Internet Declaratory Ruling and Notice of Proposed Rulemaking)*.

[1228] *Implementation of Section 621(a)(1) of the Cable Communications Policy Act of 1984 as Amended by the Cable Television Consumer Protection and Competition Act of 1992*, MB Docket No. 05-311, Third Report and Order, 34 FCC Rcd 6844 (2019) (*Section 621(a)(1) Third R&O*), *appeal pending in City of Eugene, Oregon v. FCC*, No. 19-4161 (6th Cir.). *See also Montgomery County, Md. v. FCC*, 863 F.3d 485 (6th Cir. 2017).

[1229] *Section 621(a)(1) Third R&O*, 34 FCC Rcd at 6844-45, para. 1.

[1230] *Petition for Determination of Effective Competition in 32 Massachusetts Communities and Kauai, HI (HI0011)*, MB Docket No. 18-283, Memorandum Opinion and Order, 34 FCC Rcd 10229 (2019), *appeal pending in Massachusetts Department of Telecommunications and Cable v. FCC*, No. 19-2282 (1st Cir.) (*Charter Effective Competition Order)*.

[1231] *Id.* at 10229-30, para. 1

[1232] *Id.*; 47 U.S.C. § 543(l)(1)(D); *see also* 47 CFR § 76.905(b)(4) (implementing the statutory LEC Test).

[1233] *See generally Charter Effective Competition Order*.

localism, competition, and diversity in broadcast media."[1234] In furtherance of this effort, the Commission adopted a Report and Order on October 28, 2020 authorizing AM stations to adopt all-digital broadcasting voluntarily.[1235] That Order provides AM broadcasters with flexibility to adopt the best mode of all-digital operation to meet the needs of a station's listeners and to enhance the station's ability to remain competitive.[1236] The Order finds that broadcasting entirely in digital would allow AM broadcasters to improve signal quality, signal coverage, power usage, and spectrum efficiency; offer additional services that FM broadcasters currently offer (e.g., song and artist identification); and expand their programming options to include music formats.[1237] These improvements in AM quality and services should allow AM broadcasters to better compete with FM broadcasting and non-broadcast sources of audio programming. In addition, the Commission opened two FM translator filing windows—Auctions 99 and 100—resulting in the issuance of approximately 1,700 FM translator construction permits to AM licensees.[1238] These translator facilities provide important operational flexibility for AM broadcasters to simulcast their signal on the FM band, thereby allowing them to compete more effectively with higher audio quality services.[1239]

418. *FM Translator Interference.* In May 2019, the Commission adopted a Report and Order that streamlines and improves the FM translator interference complaint and resolution process.[1240] The streamlined rules are designed to enhance the ability of FM broadcasters to compete in the audio marketplace by limiting or avoiding protracted and contentious interference disputes, providing translator licensees additional investment certainty and flexibility to remediate interference, and allowing for earlier and expedited resolution of interference complaints.[1241]

D. Efforts To Ensure and Improve Connectivity During the COVID-19 Pandemic

419. During the COVID-19 pandemic, fixed and mobile connectivity is more important than ever. Americans rely on broadband services to work remotely, access telehealth, and stay connected with loved ones. As a result, demand for broadband services has increased.[1242] CTIA, for example, reports that among the top wireless providers, for non-holiday Mondays from March 23, 2020 through July 27, 2020, the upper bound of the increase in weekly voice network use relative to the average pre-pandemic Monday was between 6.7% and 24.3%.[1243] Similarly, the upper bound of the increase in data use on

[1234] *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Notice of Proposed Rulemaking, 28 FCC Rcd 15221, 15222, para. 1 (2013).

[1235] *All-Digital AM Broadcasting*, MB Docket No. 19-311, Report and Order, FCC 20-154 (Oct. 28, 2020).

[1236] *See generally id.*

[1237] *Id.* at 2-3, 6-9, paras. 3, 8-13.

[1238] This figure is based on analysis of CDBS data by Commission staff. *See also* Paul McLane, *AM Translator CPs Get Some Deadline Relief*, Radio World (Sept. 10, 2020), https://www.radioworld.com/news-and-business/headlines/am-translator-cps-get-some-deadline-relief.

[1239] *See, e.g.*, *Amendment of Service and Eligibility Rules for FM Broadcast Translator Stations*, MB Docket No. 07-172, Report and Order, 24 FCC Rcd 9642 (2009).

[1240] *Amendment of Part 74 of the Commission's Rules Regarding FM Translator Interference*, MB Docket No. 18-119, Report and Order, 34 FCC Rcd 3457 (2019) (*FM Translator Interference R&O*); Press Release, FCC, FCC Improves Translator Interference Complaint and Resolution Process (May 9, 2019), https://docs.fcc.gov/public/attachments/DOC-357374A1.pdf.

[1241] *FM Translator Interference R&O*, 34 FCC Rcd at 3457-58, para. 1.

[1242] CTIA, *The Wireless Industry Responds to COVID-19*, https://www.ctia.org/covid-19 (last visited Oct. 27, 2020) (*CTIA COVID-19 Website*).

[1243] Specifically, the figures are based on the highest reported percentage increase in voice minutes among the top four providers for each Monday from March 23, 2020 through July 27, 2020, as compared to the average of Mondays from February 24, 2020 to March 16, 2020. *CTIA COVID-19 Website*.

wireless networks was between 6.7% and 28.4% relative to pre-pandemic levels over the same time period.[1244]

420. Similarly, due to the pandemic, an estimated 124,000 U.S. K-12 schools closed at the end of March 2020, which impacted over 55 million students.[1245] The number of school closures continued to evolve during the 2020-2021 school-year. The Bureau of Labor Statistics (BLS) estimates that in May 2020 approximately 35% of workers (or 55.4 million of the 158.2 million labor force) teleworked specifically because of the pandemic.[1246] Multiple sources have reported how the pandemic has impacted traffic on America's networks, with the estimates of an increase ranging between 20% and 40%.[1247]

421. As students began distance learning and adults began teleworking more consistently, internet connection, bandwidth capability, and network capacity have become essential. The Commission has taken many actions to ensure that Americans remain connected throughout the pandemic, many of which are outlined in Chairman Pai's Keep Americans Connected Initiative.[1248]

422. *Keep Americans Connected Initiative*. Chairman Pai announced the Keep Americans Connected Initiative on March 13, 2020.[1249] To ensure that Americans did not lose their broadband or telephone connectivity as a result of the exceptional circumstances brought about by the pandemic, Chairman Pai specifically asked broadband and telephone service providers and trade associations to take the Keep Americans Connected Pledge.[1250] More than 800 companies and associations signed the pledge, committing to: (1) not terminate service to any residential or small business customers because of their inability to pay their bills due to the disruptions caused by the coronavirus pandemic; (2) waive any late fees that any residential or small business customers incur because of their economic circumstances related to the coronavirus pandemic; and (3) open its Wi-Fi hotspots to any American who needs them.[1251] Chairman Pai also urged companies with low-income broadband programs to expand and improve them, and those without them to adopt such programs. In addition, Chairman Pai called on broadband providers to relax their data usage limits in appropriate circumstances and take steps to promote remote learning and telehealth.[1252]

423. This pledge, intended to provide Americans relief in the early days of the COVID-19 pandemic, expired on June 30, 2020, to allow companies, especially smaller communications companies,

[1244] Similar to the voice figures, the numbers represent the highest reported percentage increase in data usage reported among the top four providers relative to the average data use on Mondays from February 24, 2020 to March 16, 2020. *CTIA COVID-19 Website*.

[1245] Education Week, *Map: Coronavirus and School Closures in 2019-2020*(May 15, 2020), https://www.edweek.org/ew/section/multimedia/map-coronavirus-and-school-closures.html.

[1246] Bureau of Labor Statistics, *Supplemental Data Measuring the Effects of Coronavirus (COVID-19) Pandemic on the Labor Market*, https://www.bls.gov/cps/effects-of-the-coronavirus-covid-19-pandemic.htm (last visited Oct. 27, 2020).

[1247] Doug Brake, *Lessons from the Pandemic: Broadband Policy After Covid-19*, Information Technology & Innovation Foundation (July 13, 2020), https://itif.org/publications/2020/07/13/lessons-pandemic-broadband-policy-after-covid-19.

[1248] FCC, *Keep Americans Connected*, https://www.fcc.gov/keep-americans-connected (last visited Oct. 27, 2020) (*Keep Americans Connected Website*).

[1249] Press Release, FCC, Chairman Pai Launches the Keep Americans Connected Pledge (Mar. 13, 2020); https://docs.fcc.gov/public/attachments/DOC-363033A1.pdf (*Keep Americans Connected Pledge Launch Announcement*).

[1250] *Id.*

[1251] *Id.*; *Keep Americans Connected Website*.

[1252] *Keep Americans Connected Pledge Launch Announcement* at 2.

to continue to fund their operations.[1253] In preparation for this expiration, Chairman Pai called on broadband and telecommunications service providers to take steps to help ensure that American consumers and small businesses remain connected after June 30, 2020, specifically urging companies to develop payment plans and deferred payment arrangements.[1254]

424. To help wireless service providers meet increased consumer demand for broadband during the coronavirus pandemic, the Commission issued more than 200 grants of special temporary authority to use additional spectrum to wireless service providers.[1255] Further, many providers have implemented policies that go beyond the Keep Americans Connected Pledge and address the challenges that Americans face during the COVID-19 pandemic.[1256] In a few noteworthy cases, mobile wireless service providers have increased hotspot data allotments, added new low cost plans, and provided free wireless data to students for educational purposes.[1257]

425. Many fixed broadband service providers have created specific COVID-19 policies aimed at keeping consumers connected.[1258] Comcast, for example, committed to not disconnect services to individuals, waived late fees, maintained free Wi-Fi hotspots, paused data caps, and offered two months free service for new customers in their internet essentials program.[1259] AT&T removed data overage charges to home internet services, upgraded some 10 Mbps packages to 25 Mbps, and added households that participate in the National School Lunch Program and Head Start to the AT&T Access program.[1260] Verizon announced it would waive activation fees for new lines and would forego data caps due to the pandemic, and launched a new internet package aimed specifically at lower-income consumers and offered two months free to Lifeline subscribers.[1261] Frontier committed to providing service without data

[1253] *See* Press Release, FCC, Chairman Pai Extends Keep Americans Connected Pledge Through End of June Due to Ongoing COVID-19 Pandemic (Apr. 30, 2020), https://docs.fcc.gov/public/attachments/DOC-364090A1.pdf; Press Release, FCC, FCC Chairman Pai Urges Congress to Help Consumers Stay Connected Following End of Keep Americans Connected Pledge on June 30 (June 19, 2020), https://docs.fcc.gov/public/attachments/DOC-365040A1.pdf (June 19 Keep America Connected Press Release).

[1254] June 19 Keep America Connected Press Release at 1.

[1255] *See, e.g.*, Application of Alyrica Networks, Inc., ULS File No. 0009032423 (granted Apr. 24, 2020); Application of Zirkel Wireless, LLC, ULS File No. 0009031132 (granted May 6, 2020); Application of WireFree Communications, Inc., ULS File No. 0009264146 (granted Nov. 4, 2020).

[1256] FCC, *Companies Have Gone Above and Beyond the Call to Keep Americans Connected During Pandemic*, https://www.fcc.gov/companies-have-gone-above-and-beyond-call-keep-americans-connected-during-pandemic (last visited Oct. 27, 2020) *(FCC Carrier Response Website*).

[1257] *FCC Carrier Response Website.*

[1258] Many of these firms have created COVID-19 policies aimed at improving their networks, helping first responders and communities, aiding educational needs, supporting employees, and helping their business clients. However, this paragraph only discusses the companies' efforts to help consumers of residential fixed services.

[1259] Press Release, Comcast, *Comcast Extends Comprehensive COVID-19 Response Polices to June 30* (Apr. 27, 2020), https://corporate.comcast.com/press/releases/comcast-extends-comprehensive-covid-19-response-policies-to-june-30; *see also* Letter from Gregory Coutros, Associate Corporate Counsel, Regulatory Affairs, Hughes Network Systems, LLC, to Marlene H. Dortch, Secretary, FCC, WC Docket No. 20-269 at 2 (filed Nov. 3, 2020) (stating that "Hughes has supported students in Tatums, OK, a small rural town where previously only two homes had broadband internet access, by providing [satellite] broadband services through a community hub to ensure that students in the town would be able to continue their education remotely without disruptions during the pandemic").

[1260] Press Release, AT&T, *COVID-19: Our Response*, (Aug. 26, 2020), https://about.att.com/pages/COVID-19.html#consumers.

[1261] Press Release, Verizon, *Covid Response Customers*, https://www.verizon.com/about/news/covid-response-customers (last visited Oct. 27, 2020).

caps throughout the pandemic.[1262] Charter offered free internet packages for students for up to 60 days.[1263] CenturyLink committed to not charge late fees and not disconnect residential customers through June 30, 2020, removed data caps until August 1, 2020, and offered new payment plans for a subset of its customer base.[1264] In addition, many other fixed broadband service providers have also taken measures to protect consumers during the pandemic.[1265]

426. *COVID-19 Telehealth Program.* One of the most critical efforts of the Commission's pandemic response has been the COVID-19 Telehealth Program. The Commission established the COVID-19 Telehealth Program, pursuant to the Coronavirus Aid, Relief, and Economic Security (CARES) Act, which was signed into law on March 27, 2020.[1266] Under this standalone initiative, the Commission provided $200 million "to support efforts of health care providers to address coronavirus by providing telecommunications services, information services, and devices necessary to enable the provision of telehealth services" during the pendency of the COVID-19 pandemic.[1267] On April 13, 2020, the Commission began accepting applications and made awards on a rolling basis until the $200 million of funding authorized by Congress was exhausted. On July 8, 2020, the Commission announced the final set of approved applications.[1268] In all, the Commission approved 539 applications, including more than three thousand health care locations across 49 states plus the District of Columbia and Guam.[1269] The applicants that were awarded funding are able to seek reimbursement from the Commission for eligible services and devices.

427. *Regulatory Flexibility for Competitive Eligible Telecommunications Carriers.* On March 31, 2020, the Wireline Competition Bureau waived geographic limitations on where certain carriers, known as competitive ETCs, can spend legacy high-cost universal service support.[1270] Specifically, competitive ETCs, who mostly provide mobile wireless service, receive approximately $382 million each year in legacy but are required to spend that support only in specific geographic service areas.[1271] The Order waived that strict geographic requirement to allow affiliated competitive ETCs to spend the universal service support in any affiliated ETC's designated service area in order to allow them to respond to the pandemic by spending funds where they are needed most to ensure that Americans using these networks can stay connected.[1272]

[1262] Press Release, Karen Quach, Frontier, *COVID-19: What Frontier Is Doing to Support Customers* (Apr. 28, 2020) https://go.frontier.com/media-center/official-covid-19-response/.

[1263] Press Release, Charter Communications, *COVID-19 Update: Charter Continues to Keep Customers Connected* (June 3, 2020), https://corporate.charter.com/newsroom/covid-19-update-charter-continues-to-keep-customers-connected.

[1264] Press Release, CenturyLink, *COVID-19 Support*, https://news.centurylink.com/covid-19-faqs (last visited Oct. 27, 2020).

[1265] *See, e.g.*, Letter from Jonathan Spalter, President and CEO, USTelecom – The Broadband Association to the Hon. Roger Wicker, et al., U.S. Senate (Mar. 13, 2020), https://www.ustelecom.org/wp-content/uploads/2020/03/USTelecom-COVID-19-Network-Letter-to-Congress.pdf.

[1266] Pub. L. No 116-136, 134 Stat. 281.

[1267] *Promoting Telehealth for Low-Income Consumers Order*, 35 FCC Rcd at 3366, para 2.

[1268] Press Release, FCC, FCC Approves Final Set of COVID-19 Telehealth Program Applications (July 8, 2020), https://docs.fcc.gov/public/attachments/DOC-365417A1.pdf.

[1269] Press Release, FCC, *Final List of COVID-19 Telehealth Program Awardees*, https://www.fcc.gov/sites/default/files/covid-19-telehealth-program-recipients.pdf.

[1270] *Connect America Fund*, WC Docket No. 10-90, Order, 35 FCC Rcd 2964.

[1271] *Id.* at para. 2.

[1272] *Id.*

428. *Regulatory Flexibility for Rural Health Care and E-Rate Programs*. Further, the Commission has acted during the COVID-19 pandemic to provide increased regulatory flexibility in the Commission's Rural Health Care and E-Rate Programs. In an effort to help ensure that healthcare providers have the resources they need to promote telehealth solutions, the Commission adopted an Order on March 13, 2020, to fully fund all eligible Rural Health Care Program services for Funding Year 2019 with an additional $42.19 million in funding.[1273] On March 18, 2020 the Wireline Competition Bureau waived the gift rules for both the Rural Health Care and E-Rate Programs, which allowed service providers to offer, and Rural Health Care and E-Rate Program participants to solicit and accept, improved broadband connections or equipment for telehealth or remote learning during the COVID-19 pandemic.[1274] The Bureau later extended this waiver to run through December 31, 2020.[1275] On March 26, 2020, the Bureau provided additional relief to Rural Health Care Program participants by (1) extending the RHC Program application filing window until June 30, 2020; (2) easing competitive bidding requirements for health care providers with expiring evergreen contracts; and (3) providing an extension of procedural deadlines, such as the response time for USAC information requests, the service delivery deadline, the invoice filing deadline, and the deadline for appeals and requests for waiver.[1276] On September 16, 2020, the Wireline Competition Bureau's Telecommunications Access Policy Division waived, under certain conditions, the Rural Health Care Program invoice filing deadline for recipients of funding year 2019 funding commitment letters, extending it to the later of March 15, 2021 or 180 days after the issuance of the funding commitment letter by USAC.[1277] On October 19, 2020, to promote the continued widespread delivery of vital communications-based health care during the pandemic, the Wireline Competition Bureau waived the cap on upfront payments and multi-year commitments for FY 2020 to ensure that all RHC Program requests for support could be funded in full.[1278]

429. On March 13, and April 1, 2020, the Wireline Competition Bureau issued various waivers and extensions of certain E-Rate program rules and deadlines, including an extension of the FCC Form 471 application filing deadline for funding year 2020, and extensions of other program deadlines such as the service implementation deadline for special construction and the deadline to submit appeals and waiver requests, respectively.[1279] In addition, on March 23, 2020, the Bureau issued a reminder to schools and libraries that are closed as a result of the pandemic that they may allow the general public to use their E-Rate-supported Wi-Fi networks while on the school's campus or the library's property.[1280]

[1273] *Rural Health Care Support Mechanism*, WC Docket No. 02-60, Order, 35 FCC Rcd 2659, 2659, para. 3, 2662-63, paras. 8-9 (2020). The Order permits USAC to carry forward additional unused funds from prior years to cover a funding gap between demand and available funding, and waives the cap on multi-year commitments and upfront payments that would have resulted in unnecessary reductions in support for rural health care providers and their patients. *Id.*

[1274] *See Rural Health Care Universal Service Support Mechanism*; *Schools and Libraries Universal Service Support Mechanism*, WC Docket No. 02-60, CC Docket No. 02-6, Order, 35 FCC Rcd 2741 (WCB 2020).

[1275] *See Rural Health Care Universal Service Support Mechanism*; *Schools and Libraries Universal Service Support Mechanism*, WC Docket No. 02-60, CC Docket No. 02-6, Order, 35 FCC Rcd 9416 (WCB 2020).

[1276] *See Rural Health Care Support Mechanism*, WC Docket No. 02-60, Order, 35 FCC Rcd 2922, 2922, para. 1 (WCB 2020).

[1277] *Rural Health Care Support Mechanism*, WC Docket No. 02-60, Order, 35 FCC Rcd 10356 (WCB/TAPD 2020).

[1278] *Rural Health Care Support Mechanism*, WC Docket No. 02-60, Order, 35 FCC Rcd 11696 (WCB 2020).

[1279] *Wireline Competition Bureau Directs USAC to Extend E-Rate Application Filing Window for Funding Year 2020 Due to Potential Coronavirus Disruptions*, CC Docket No. 02-6, Public Notice, 35 FCC Rcd 2089 (2020) (extending the deadline from March 25, 2020 to April 29, 2020); *Schools and Libraries Universal Service Support Mechanism*, CC Docket No. 02-6, Order, 35 FCC Rcd 2978 (WCB 2020).

[1280] *Wireline Competition Bureau Confirms that Community Use of E-Rate-Supported Wi-Fi Networks Is Permitted During School and Library Closures Due to COVID-19 Pandemic*, WC Docket Nos. 02-6, 13-184, Public Notice, 35 FCC Rcd 2879 (WCB 2020).

And on September 16, 2020, the Bureau announced the opening of a second funding year 2020 FCC Form 471 application filing window to allow schools to request additional E-Rate funding to address increased on-campus bandwidth needs resulting from the pandemic.[1281]

430. *Regulatory Flexibility for Lifeline Program*. Beginning on March 17, 2020, the Wireline Competition Bureau temporarily waived the Lifeline program's annual recertification and reverification requirements to protect Lifeline program participants potentially affected by the COVID-19 pandemic.[1282] In addition, on March 30, 2020, the Bureau also waived the non-usage rules and general de-enrollment rules to prevent Lifeline subscribers from being involuntary de-enrolled during the pandemic[1283] and, on April 29, 2020, eased documentation requirements for subscribers demonstrating eligibility based on income to facilitate the application process for individuals who lost their employment during the pandemic.[1284] Finally, on June 1, 2020, the Bureau streamlined the enrollment process for subscribers residing on rural Tribal lands by enabling carriers to begin providing service to those subscribers prior to the submission of all required documentation.[1285] In August 2020, these waivers were initially extended through November 30, 2020[1286] and, in November 2020, they were subsequently extended through February 28, 2021.[1287]

431. On November 16, 2020, the Bureau also waived the program rules updating the minimum service standard for mobile broadband, resulting in a standard of 4.5 GB/month for the next year.[1288] Without this waiver, the standard would have increased to 11.75 GB/month on December 1, 2020.[1289] The Bureau found that preventing an almost fourfold increase in the standard while allowing a moderate increase appropriately balances the program's goals of accessibility and affordability, particularly given consumers' increased reliance on broadband during the COVID-19 pandemic.[1290]

432. In addition to these waivers, since the beginning of the pandemic the Commission has partnered with the Department of Health and Human Services (including the Administration for Children and Families, the Administration for Community Living, the Agency for Healthcare Research and Quality, the Health Resources and Services Administration, the Indian Health Service, the Office of the Assistant Secretary for Planning and Evaluation, and the Substance Abuse and Mental Health Services Administration), the Department of Veterans Affairs (including the Veterans Health Administration's Homeless Programs Office and Office of Connected Care), the Department of Housing and Urban Development (including the Office of Field Policy and Management, the Office of Housing, and the Office of Public and Indian Housing), the Department of Agriculture, the Bureau of Indian Affairs, the Social Security Administration, the Federal Emergency Management Agency, the National Telecommunications and Information Administration, the National Institute for Children's Health Quality, and the National Association of Regulatory Utility Commissioners to promote Lifeline

[1281] *Schools and Libraries Universal Service Support Mechanism*, CC Docket No. 02-6, Order, 35 FCC Rcd 10347 (WCB 2020). The window opened on September 21, 2020 and closed on October 16, 2020. *See* USAC, Special Edition News Brief, *FY2020 Second Application Filing Window Opens September 21, 2020* (Sept. 21, 2020), https://apps.usac.org/sl/tools/news-briefs/preview.aspx?id=972.

[1282] *Lifeline and Link Up Reform and Modernization*, Order, 35 FCC Rcd 2729 (WCB 2020).

[1283] *Lifeline and Link Up Reform and Modernization*, Order, 35 FCC Rcd 2950 (WCB 2020).

[1284] *Lifeline and Link Up Reform and Modernization*, Order, 35 FCC Rcd 4482 (WCB 2020).

[1285] *Lifeline and Link Up Reform and Modernization*, Order, 35 FCC Rcd 5510 (WCB 2020).

[1286] *Lifeline and Link Up Reform and Modernization*, Order, 35 FCC Rcd 8791 (WCB 2020).

[1287] *Lifeline and Link Up Reform and Modernization*, Order, DA 20-1357 (WCB Nov. 16, 2020).

[1288] *Lifeline and Link Up Reform and Modernization*, Order, DA 20-1358 (WCB Nov. 16, 2020).

[1289] *Id.* at para. 7.

[1290] *Id.* at paras. 2, 12.

awareness during the pandemic to ensure that consumers who are newly eligible for the program have the information and resources they need to apply.

VI. COMMISSION AGENDA TO FURTHER ENCOURAGE INVESTMENT, INNOVATION, DEPLOYMENT, AND COMPETITION

433. RAY BAUM'S Act of 2018 also requires the Commission to describe the agenda of the Commission for the next 2-year period for addressing challenges and opportunities in the communications marketplace.[1291]

A. The Mobile Wireless Communications Marketplace

434. *Spectrum*. Incumbent service providers need additional spectrum to increase their coverage or capacity, while new entrants need access to spectrum to enter a geographic area. In addition, average data usage per connection has been substantially increasing in recent years, and this growth is expected to continue, in turn increasing service providers' need for additional spectrum. Forward thinking spectrum policy is critical for next generation wireless networks. To spur greater investment in the mobile wireless industry, the Commission will continue to make available a significant amount of additional spectrum across a range of low-, mid-, and high-band frequencies to ensure a competitive mobile wireless services marketplace.

435. Mid-band spectrum is essential for 5G buildout due to its desirable coverage, capacity, and propagation characteristics.[1292] The Commission's auction of flexible-use service licenses in the 3.7-3.98 GHz band for next-generation wireless services (Auction 107 or "C-band auction") is expected to begin on December 8, 2020.[1293] The auction will offer 5,684 new flexible-use overlay licenses for spectrum in the C-band.[1294] Repurposing of the spectrum is moving forward on an accelerated timeline. Incumbent space station operators have committed to make available the lower 120 megahertz of the band in 46 Partial Economic Areas (PEAs) by December 5, 2021, and the lower 120 megahertz in the remaining PEAs, plus an additional 180 megahertz nationwide, by December 5, 2023.[1295] This is another important step towards releasing critical mid-band spectrum into the market and furthering the deployment of 5G and other advanced spectrum-based services across the country.[1296]

436. In September 2020, the Commission adopted an order and notice to establish service rules for the 3.45-3.55 GHz band to enable the Commission to make the spectrum available as quickly as possible.[1297] With this band, as well as the spectrum made available in the C-band and the 3.5 GHz band, the Commission will continue to progress towards making a 530-megahertz swath of mid-band spectrum available for 5G from 3.45 to 3.98 GHz. The White House stated that this auction of 100 megahertz of mid-band spectrum could be held in December 2021 with the spectrum in use by 2022.[1298] Further,

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[1291] *See* RAY BAUM'S Act of 2018.

[1292] *3.7 GHz Report and Order*, 35 FCC Rcd at 2345, para. 3.

[1293] *C-band Auction Public Notice*, 35 FCC Rcd at 8406, 8409, paras. 1, 2, 9.

[1294] *C-band Auction Public Notice*, 35 FCC Rcd at 8407-08, para. 7.

[1295] *3.7 GHz Report and Order*, 35 FCC Rcd at 2413-14, paras. 168-170; *Wireless Telecommunications Bureau Announces Accelerated Clearing in the 3.7-4.2 GHz Band*, GN Docket No. 18-122, Public Notice, DA 20-578, at 1-2 (June 1, 2020).

[1296] *Auction of Flexible-Use Service Licenses in the 3.7-3.98 GHz Band for Next-Generation Wireless Services, Comment Sought on Competitive Bidding Procedures for Auction 107*, AU Docket No. 20-25, Pubic Notice, 35 FCC Rcd 2601, 2602, para. 1 (2020).

[1297] *3.45-3.55 GHz Order and FNPRM* at 2, paras. 2-4.

[1298] RCR Wireless News, Kelly Hill, *Mid-band Spectrum Infusion: 3.45-3.55 GHz Will Be Opened Up for 5G* (Aug. 11, 2020), https://www.rcrwireless.com/20200811/spectrum/midband-spectrum-infusion-3-45-3-55-ghz-will-be-opened-up-for-5g.

regarding mid-band spectrum, the *2.5 GHz Report and Order* adopted rules to facilitate advanced wireless services in the 2.5 GHz band─including a pre-auction priority window for Tribal Nations to apply to obtain unassigned spectrum on rural Tribal lands that closed in September.[1299]

437. Regarding low-band spectrum, as part of the *900 MHz Report and Order*, the Commission established a transition mechanism based primarily on negotiations between prospective broadband licensees and existing narrowband incumbent licensees.[1300] The Report and Order states that in 2021, the Commission will evaluate the success of the 900 MHz band realignment and explore whether to adopt an additional mechanism to transition the 900 MHz band to broadband.[1301]

438. In June 2020, concerning higher band spectrum, the Commission adopted a notice to seek comment on potential rule changes to facilitate the provision of wireless backhaul for 5G, as well as the deployment of broadband services to aircraft and ships, by taking advantage of the highly directional characteristics of signals in the 71-76 GHz, 81-86 GHz, 92-94 GHz, and 94.1-95 GHz bands.[1302] In addition, the Commission's notices of proposed rulemaking in the *Spectrum Frontiers* proceeding have explored repurposing additional mmW bands for flexible use, including the 26 GHz (25.25-27.5 GHz), 32 GHz (31.8-33.4 GHz), 42 GHz (42-42.5 GHz), and 50 GHz (50.4-52.6 GHz) bands.[1303]

439. *Expanding Wireless Access in Rural Areas*. In October of this year, the Commission adopted a report and order that establishes the 5G Fund for Rural America, replaces Mobility Fund Phase II and retargets high-cost universal service support for mobile services toward deployment of 5G services, using a multi-round reverse auction.[1304] The 5G Fund would help ensure that rural Americans enjoy the same benefits from our increasingly digital economy as their urban counterparts—more than 200 million of whom already have access to 5G mobile broadband—and would include a special focus on deployments that support precision agriculture.[1305]

440. In addition, the Commission established a new task force to advise the Commission on policies aimed at delivering connectivity so that American agriculture producers can use and benefit from precision agriculture.[1306] Formed in June 2019, the Precision Ag Connectivity Task Force has submitted

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[1299] *2.5 GHz Report and Order*, 34 FCC Rcd at 5447, 5463-69, paras. 3, 47-65; Press Release, FCC, FCC Announces Close of First-Ever Rural Tribal Priority Window for Spectrum (Sept. 3, 2020), https://docs.fcc.gov/public/attachments/DOC-366657A1.pdf; *see also* U.S. Senate, Committee on Commerce, Science, and Transportation, "Oversight of the Federal Communications Commission," Statement of Chairman Ajit Pai, Federal Communications Commission, at 4 (June 24, 2020), https://docs.fcc.gov/public/attachments/DOC-365131A1.pdf.

[1300] *900 MHz Report and Order*, 35 FCC Rcd at 5201-06, paras. 38-52.

[1301] *900 MHz Report and Order*, 35 FCC Rcd at 5205, para. 48.

[1302] *Modernizing and Expanding Access to the 70/80/90 GHz Bands*, WT Docket No. 20-133, Notice of Proposed Rulemaking and Order, 35 FCC Rcd 6039 (2020).

[1303] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services et al.*, GN Docket No. 14-177, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, 33 FCC Rcd 5576 (2018).

[1304] *5G Fund Report and Order* at 2-3, paras. 1, 4.

[1305] *5G Fund NPRM and Order*, 35 FCC Rcd at 3996, para. 5, Statement of Chairman Ajit Pai, at 1.

[1306] Press Release, FCC, Chairman Pai Announces New Task Force Focused On Connecting American Farms and Ranches (June 17, 2019), https://docs.fcc.gov/public/attachments/DOC-358005A1.pdf (Chairman Pai Task Force Press Release); *see also FCC Announces the Establishment of the Task Force for Reviewing Connectivity and Technology Needs of Precision Agriculture in the United States and Seeks Nominations for Membership*, GN Docket 19-329, Public Notice, 34 FCC Rcd 5057 (2019) (*Precision Ag Task Force Notice*) (The Commission established the Precision Ag Connectivity Task Force for an initial period of two years, and the Commission will renew the task force every two years until the task force terminates on January 1, 2025.).

reports and will continue to perform all duties consistent with the Agriculture Improvement Act of 2018.[1307] The task force will continue to work with the U.S. Department of Agriculture to develop policy recommendations to promote the rapid, expanded deployment of fixed and mobile broadband Internet access service on agricultural land.[1308]

441. *Infrastructure*. Over the past two years, as described above, the Commission has undertaken a comprehensive review of our wireless infrastructure rules. To meet rapidly increasing demand for wireless services and prepare our national infrastructure for 5G, the Commission will continue to pursue an agenda to reduce regulatory impediments to help facilitate wireless infrastructure investment and deployment. Supporting the deployment of 5G and other next-generation wireless services through smart infrastructure policy is critical. The wireless infrastructure landscape has shifted toward the development of 5G networks and technologies that require dense deployment of smaller antennas across provider networks in locations closer to customers.[1309]

B. The Fixed Communications Marketplace

442. Data demonstrates the success of Commission policies encouraging fixed broadband deployment and competition, with more Americans having coverage available from multiple fixed broadband providers than ever before.[1310] At the same time, the Commission has laid the groundwork for future success through its more recent undertakings, such as the Rural Digital Opportunity Fund auction, that started on October 29, 2020.

443. The Commission's policymaking efforts over the next two years will continue to focus on creating a regulatory environment that reduces barriers to investment and encourages building, maintaining, and upgrading next-generation networks to bring the benefits of broadband to all Americans. These efforts will aim to do so, whenever possible, through unleashing the power of competition through light-touch regulation, such as continued examination of ex ante price regulation and tariffing.

444. The BDAC, Precision Agriculture Task Force, and Digital Opportunity Data Collection will play important roles in the Commission's policymaking process. The two advisory committees, as well as their working groups, will continue to meet regularly and form recommendations for accelerating deployment. And the substantially improved data made available through the Digital Opportunity Data Collection will allow the Commission to better monitor the effectiveness of current policies in advancing the goals of universal service and closing the digital divide, informing current and future proceedings. The Commission will also use this data, as well as currently-available data, to continue to monitor the effects of its deregulatory policies on competition, and will continue to look for further opportunities to spur competition.

445. With respect to satellite, the Commission plans further revisions to its orbital debris mitigation requirements.[1311] In a Further Notice of Proposed Rulemaking, the Commission made proposals and sought comment on additional rule updates related to mitigating orbital debris, including addressing liability issues and economic incentives.[1312].

[1307] *Precision Ag Task Force Notice*, 34 FCC Rcd at 5057-58; Agriculture Improvement Act of 2018, Pub. L. No. 115-334, 132 Stat. 4490, §§ 12511(b)(3)(A), (b)(5).

[1308] Chairman Pai Task Force Press Release at 1.

[1309] *OTARD Notice*, 34 FCC Rcd at 2697, para. 7.

[1310] *See supra* section III.A.

[1311] *Orbital Debris Report and Order and FNPRM*, 35 FCC Rcd at 4226-49, paras. 154-205.

[1312] *See id.* at 4157, para. 1 (describing the *FNPRM* as addressing probability of accidental explosions, collision risk for multi-satellite systems, maneuverability requirements, casualty risk, indemnification, and performance bonds tied to successful spacecraft disposal).

C. The Video and Audio Communications Marketplace

446. Pursuant to its ongoing *Modernization of Media Regulation Initiative*, the Commission, as noted above, has issued over 25 orders designed to reduce burdens on licensees, while simultaneously enhancing competition and service to the public. The Commission will continue its efforts to modernize its regulations by eliminating or modifying obsolete, burdensome, or outmoded rules, including by completing previously initiated rulemakings.[1313]

447. In December 2018, the Commission commenced its quadrennial review of its broadcast ownership rules, asking whether these rules remain necessary in the public interest as the result of competition and whether to retain, modify, or eliminate any of the rules in light of dramatic changes in the media marketplace in recent years.[1314] In addition, judicial review of the Commission's prior quadrennial review of its media ownership rules remains ongoing as the Supreme Court recently granted petitions for writ of certiorari and designated time for oral argument on a date to be determined.[1315] A related rulemaking proceeding examines the national television audience reach cap, which prohibits a single entity from owning television stations that collectively reach more than 39% of the total nationwide audience.[1316]

448. Further, the Commission expects to continue its efforts to promote diversity of ownership in the broadcast industry. To that end, the Advisory Committee on Diversity and Digital Empowerment (Committee), which was re-charted by Chairman Pai in July 2019 for a second two-year term,[1317] seeks to provide advice and recommendations to the Commission regarding how to empower disadvantaged communities and accelerate the entry of small businesses, including those owned by women and minorities, into the media, digital news and information, and audio and video programming industries. Through its working groups,[1318] the Committee intends to host several events, including workshops and symposiums aimed at addressing ways to access the capital necessary to enter and compete in the media and communications industries. The Committee also intends to make recommendations to the Commission regarding issues such as best practices for attracting and retaining diverse applicants in the tech, media, and communications fields; efforts to increase the participation of minorities and women in broadcasting and related industry sectors; and ways to close the digital divide by providing access and services to unserved and underserved communities.

[1313] For example, in October 2018, the Commission issued a Further Notice of Proposed Rulemaking proposing further modifications to update the Commission's cable rate regulation rules, which are more than 25 years old, to better reflect the current video market. *See Cable Rate Regulations Further Notice.*

[1314] *See generally 2018 Quadrennial Regulatory Review – Review of the Commission's Broadcast Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, MB Docket No. 18-349, Notice of Proposed Rulemaking, 33 FCC Rcd 12111 (2018) (*2018 Quadrennial Review NPRM*). Three of the Commission's broadcast ownership rules are under review in this proceeding.

[1315] On September 23, 2019, the United States Court of Appeals for the Third Circuit vacated and remanded several Commission decisions related to the Commission's 2014 Quadrennial Review of its broadcast ownership rules. *Prometheus Radio Project v. FCC*, 939 F.3d 567 (3rd Cir. 2019), *petition for rehearing en banc denied*. The court issued its mandate on November 29, 2019. Letter from Patricia S. Dodszuweit, Clerk, *Prometheus Radio Project v. FCC*, Nos. 17-1107 et al. (3rd Cir. Nov. 29, 2019). On October 2, 2020, the United States Supreme Court granted the United States' and FCC's writ of certiorari seeking review of the Third Circuit's decision. *Association of Broadcasters v. Prometheus Radio Project*, No. 19-1241, 2020 WL 5847133 (U.S. Oct. 2, 2020).

[1316] *Amendment of Section 73.3555(e) of the Commission's Rules, National Television Multiple Ownership Rule*, MB Docket No. 17-138, Notice of Proposed Rulemaking, 32 FCC Rcd 10785 (2017).

[1317] *See FCC Seeks Nominations for Membership on Advisory Committee on Diversity and Digital Empowerment*, Public Notice, 34 FCC Rcd 4791 (2019).

[1318] *See, e.g., FCC Announces Membership and Working Group Chairs for the Advisory Committee on Diversity and Digital Empowerment*, GN Docket No. 17-208, Public Notice, 34 FCC Rcd 9566 (2019).

449. With respect to television broadcast stations, the Commission continues to facilitate the voluntary adoption of a new transmission standard, ATSC 3.0, that is intended to allow broadcasters to provide additional programming and innovative services to consumers, thereby enhancing competition in the video marketplace.[1319] Related issues include potential modifications to the Commission's technical rules to allow ATSC 3.0 licensees to make effective use of distributed transmission system technologies,[1320] eliminating potential regulatory barriers to deployment of ancillary and supplementary services, and considering whether any changes or clarifications are needed to the Commission's rules to support the new ATSC 3.0 technological capability.[1321]

450. Efforts to enhance competition and improve public service in the audio marketplace continue as well. As noted above, to help AM radio stations better compete in the marketplace, the Commission recently authorized AM stations to adopt all-digital broadcasting voluntarily. With regard to the FM radio service, the Commission recently updated the Commission's technical rules for the low power FM service and rules for processing applications for new noncommercial educational FM stations and low power FM stations. These rule changes will afford LPFM stations greater flexibility to serve listeners. In addition, the Commission expects to open filing windows for new full service NCE FM and for LPFM station applications in the near future, which will provide the first new licensing opportunities for noncommercial stations in more than ten years. The Commission also expects to conduct an auction of new, vacant FM allotments,[1322] providing opportunities for new entities to enter the commercial radio marketplace and for existing licensees to augment their broadcast portfolios.

VII. PROCEDURAL MATTERS

451. This Communications Marketplace Report is issued pursuant to section 401 of the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (codified at 47 U.S.C. § 163), section 103(b) of the Broadband Data Improvement Act (codified at 47 U.S.C. § 1303(b), and section 623(k) of the Communications Act of 1934, as amended (codified at 47 U.S.C. § 543(k).

452. **IT IS ORDERED** that this Communications Marketplace Report shall be published on the website of the Federal Communications Commission and that the Office of Legislative Affairs shall submit copies of this Communications Marketplace Report to the Committee on Energy and Commerce of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate.

453. **IT IS FURTHER ORDERED** that the proceeding in GN Docket No. 20-60 is **TERMINATED**.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

[1319] *Next Gen TV Order*, 32 FCC Rcd at 9931-33, para. 2.

[1320] *Rules Governing The Use of Distributed Transmission System Technologies*, MB Docket No. 20-74, Notice of Proposed Rulemaking, 35 FCC Rcd 3330 (2020).

[1321] *Broadcast Internet Declaratory Ruling and Notice of Proposed Rulemaking*, 35 FCC Rcd at 5917-18, 5926-34, paras. 5, 18-37; Press Release, FCC, FCC Issues Declaratory Ruling to Promote Broadcast Internet Services (June 9, 2020), https://docs.fcc.gov/public/attachments/DOC-364823A1.pdf.

[1322] An FM auction planned for Spring 2020 was postponed due to the COVID-19 pandemic. *Auction 106 Postponed*, AU Docket No. 19-290, Public Notice, 35 FCC Rcd 2886 (2020).

APPENDIX A

LIST OF COMMENTERS

Comments

ACA Connects—America's Communications Association (ACA Connects) Comments (filed Apr. 27, 2020) (ACA Connects Comments)
American Independent Media, Inc. (AIM) Comments (filed May 28, 2020) (AIM Comments)
American Economic Liberties Project (AELP); Open Markets Institute (OMI) Comments (filed May 27, 2020) (AELP/OMI Comments)
American Television Alliance (ATVA) Comments (filed Apr. 27, 2020) (ATVA Comments)
Competitive Carriers Association (CCA) Comments (filed Apr. 27, 2020) (CCA Comments)
Consumer Technology Association (CTA) Comments (filed Apr. 27, 2020) (CTA Comments)
CTIA Comments (filed Apr. 27, 2020) (CTIA Comments)
Google Fiber, Inc. (Google Fiber) Comments (filed Apr. 27, 2020) (Google Fiber Comments)
Hughes Network Systems, LLC (Hughes) Comments (filed Apr. 27, 2020) (Hughes Comments)
INCOMPAS Comments (filed Apr. 27, 2020) (INCOMPAS Comments)
Iridium Communications Inc. (Iridium) Comments (filed Apr. 27, 2020) (Iridium Comments)
Media Captioning Services, Inc. (MCS) Comments (filed Mar. 18, 2020) (MCS Comments)
musicFIRST Coalition; Future of Music Coalition (FMC) Comments (filed Apr. 27, 2020) (musicFIRST/FMC Comments)
National Association of Broadcasters (NAB) Comments (filed Apr. 27, 2020) (NAB Comments)
NCTA—The Internet & Television Association Comments (filed Apr. 27, 2020) (NCTA Comments)
NTCA—The Rural Broadband Association Comments (filed Apr. 27, 2020) (NTCA Comments)
Satellite Industry Association (SIA) Comments (filed Apr. 27, 2020) (SIA Comments)
Space Exploration Holdings, LLC (SpaceX) Comments (filed Apr. 27, 2020) (SpaceX Comments)
The Free State Foundation (FSF) Comments (filed Apr. 27, 2020) (FSF Comments)
USTelecom Comments (filed Apr. 27, 2020) (USTelecom Comments)
Wireless Internet Service Providers Association (WISPA) Comments (filed Apr. 27, 2020) (WISPA Comments)

Reply Comments

Advanced Analytical Consulting Group (AACG) Reply Comments (filed May 28, 2020) (AACG Reply Comments)
Common Cause; National Hispanic Media Coalition (NHMC) Reply Comments (filed May 28, 2020) (Common Cause/NHMC Reply Comments)
Hughes Network Systems, LLC (Hughes) Reply Comments (filed May 29, 2020) (Hughes Reply Comments)
musicFIRST Coalition; Future of Music Coalition (FMC) Reply Comments (filed May 28, 2020) (musicFIRST /FMC Reply Comments)
National Association of Broadcasters (NAB) Reply Comments (filed May 28, 2020) (NAB Reply Comments)
NCTA—The Internet & Television Association Reply Comments (filed May 28, 2020) (NCTA Reply Comments)
New America's Open Technology Institute (OTI) Reply Comments (filed May 27, 2020) (OTI Reply Comments)
Next Century Cities (NCC) Reply Comments (filed May 28, 2020) (NCC Reply Comments)
SES Americom, Inc.; O3b Limited (SES) Reply Comments (filed May 28, 2020) (SES and O3b Reply Comments)

Space Exploration Holdings, LLC (SpaceX) Reply Comments (filed May 28, 2020) (SpaceX Reply Comments)

Ex Partes

ABC Television Affiliates Association, CBS Television Network Affiliates Association, FBC Television Affiliates Association, NBC Television Affiliates (Four Network Affiliates Associations) *Ex Parte* (filed June 18, 2020) (Four Network Affiliates Associations *Ex Parte*)
ACA Connects—America's Communications Association *Ex Parte* (filed June 30, 2020) (ACA Connects *Ex Parte*)
Anthem Sports & Entertainment *Ex Parte* (filed Sept. 10, 2020) (Anthem Sports & Entertainment *Ex Parte*)
Consumer Technology Association (CTA) *Ex Parte* (filed Aug. 13, 2020) (CTA Aug. 13, 2020 *Ex Parte*)
Consumer Technology Association (CTA) *Ex Parte* (filed Sept. 4, 2020) (CTA Sept. 4, 2020 *Ex Parte*)
CTIA *Ex Parte* (filed Aug. 6, 2020) (CTIA Aug. 6, 2020 *Ex Parte*)
CTIA *Ex Parte* (filed Aug. 25, 2020) (CTIA Aug. 25, 2020 *Ex Parte*)
Graham Media Group *Ex Parte* (filed July 21, 2020) (Graham Media Group July 21, 2020 *Ex Parte*)
Graham Media Group *Ex Parte* (filed July 30, 2020) (Graham Media Group July 30, 2020 *Ex Parte*)
Graham Media Group *Ex Parte* (filed Aug. 6, 2020) (Graham Media Group Aug. 6, 2020 *Ex Parte*)
Graham Media Group *Ex Parte* (filed Aug. 10, 2020) (Graham Media Group Aug. 10, 2020 *Ex Parte*)
Graham Media Group *Ex Parte* (filed Sept. 10, 2020) (Graham Media Group Sept. 10, 2020 *Ex Parte*)
Hughes Network Systems, LLC (Hughes) *Ex Parte* (filed June 12, 2020) (Hughes *Ex Parte*)
Hearst Television *Ex Parte* (filed July 1, 2020) (Hearst Television July 1, 2020 *Ex Parte*)
Hearst Television *Ex Parte* (filed July 22, 2020) (Hearst Television July 22, 2020 *Ex Parte*)
SIA *Ex Parte* (filed Sept. 9, 2020) (SIA *Ex Parte*)
NCTA *Ex Parte* (filed Nov. 6, 2020) (NCTA Nov. 6 *Ex Parte*)
NCTA *Ex Parte* (filed Nov. 16, 2020) (NCTA Nov. 16 *Ex Parte*)
NCTA *Ex Parte* (filed Nov. 24, 2020) (NCTA Nov. 24 *Ex Parte*)

APPENDIX B

MOBILE WIRELESS COMMUNICATIONS MARKET

APPX. B-1: Estimated Total Mobile Wireless Connections: 2003-2019

APPX. B-2: Change in CPI, 1997-2019

APPX. B-3: Annualized Average Revenue Per Reported Subscriber Unit (ARPU): 1993-2019

APPX. B-4: Ookla Speedtest--Estimated 5G (Beta) Speeds by Service Provider, Nationwide

APPX. B-5: Mobile Wireless Coverage Maps

APPX. B-6: Mobile Wireless Coverage

APPX. B-1
Estimated Total Mobile Wireless Connections: 2003–2019

	NRUF			CTIA
Year	Connections (millions)	Increase from previous year (millions)	Connections Per 100 People	Estimated Connections (millions)
2003	160.6	18.8	54	158.7
2004	184.7	24.1	62	182.1
2005	213.0	28.3	71	207.9
2006	241.8	28.8	80	233.0
2007	263.0	21.2	86	255.4
2008	279.6	16.6	91	270.3
2009	290.7	11.1	94	285.6
2010	301.8	11.1	97	296.3
2011	317.3	15.5	101	316.0
2012	329.2	11.9	105	326.5
2013	339.2	10.0	108	335.7
2014	357.1	17.2	114	355.4
2015	378.2	21.1	121	377.9
2016	398.4	20.2	127	395.9
2017	410.7	12.3	126	400.2
2018	421.7	11.0	128	421.8
2019	430.3	8.6	130	442.5

Source: NRUF 2003–2019; CTIA Year-End 2019 Wireless Industry Indices Report; Census data.

APPX. B-2
Change in CPI, 1997-2019

Year	CPI		Wireless Telephone Services CPI		Telephone Services CPI		Land-line Telephone Services CPI	
	Annual Index Average	Annual Change	Annual Index Average	Annual Change	Annual Index Average	Annual Change	Annual Index Average	Annual Change
1997	100.0		100.0		100.0			
1998	101.6	1.6%	95.1		100.7			
1999	103.8	2.2%	84.9	-10.7%	100.1	-0.6%		
2000	107.3	3.4%	76.0	-10.5%	98.5	-1.6%		
2001	110.3	2.8%	68.1	-10.4%	99.3	0.8%		
2002	112.1	1.6%	67.4	-1.0%	99.7	0.4%		
2003	114.6	2.3%	66.8	-0.9%	98.3	-1.4%		
2004	117.7	2.7%	66.2	-0.9%	95.8	-2.5%		
2005	121.7	3.4%	65.0	-1.8%	94.9	-0.9%		
2006	125.6	3.2%	64.6	-0.6%	95.8	0.9%		
2007	129.2	2.9%	64.4	-0.3%	98.2	2.6%		
2008	134.1	3.8%	64.2	-0.2%	100.5	2.2%		
2009	133.7	-0.4%	64.3	0.0%	102.4	1.9%	100.0	
2010	135.8	1.6%	62.4	-2.9%	102.4	0.0%	101.6	
2011	140.1	3.2%	60.1	-3.6%	101.2	-1.1%	103.3	1.7%
2012	143.0	2.1%	59.7	-0.8%	101.7	0.5%	105.6	2.2%
2013	145.1	1.5%	58.6	-1.8%	101.6	-0.1%	108.1	2.4%
2014	147.5	1.6%	57.4	-2.1%	101.1	-0.4%	111.1	2.7%
2015	147.7	0.1%	55.2	-3.8%	99.3	-1.8%	113.4	2.1%
2016	149.5	1.3%	54.7	-1.0%	98.8	-0.5%	114.5	1.0%
2017	152.7	2.1%	48.8	-10.7%	91.8	-7.2%	116.1	1.4%
2018	156.5	2.4%	47.6	-2.5%	90.4	-1.5%	117.2	1.0%
2019	159.3	1.8%	46.4	-2.53%	89.4	-1.1%	120.8	3.0%
1997 to 2019		**59.3%**		**-53.6%**		**-10.6%**		**20.8%**

Source: Data from Bureau of Labor Statistics. All CPI figures were taken from BLS databases. Bureau of Labor Statistics, http://www.bls.gov. Beginning in January 2010, the CPIs for local telephone service and long-distance telephone service were discontinued and replaced by a new CPI for land-line telephone services.[1]

[1] The index used in this analysis, the CPI for All Urban Consumers (CPI-U), represents about 87% of the total U.S. population. Bureau of Labor Statistics, Consumer Price Index: Frequently Asked Questions, https://www.bls.gov/cpi/questions-and-answers.htm. The CPI category "Telephone Services" has two components: wireless telephone services and landline telephone services. Additional information can be found at Bureau of Labor Statistics, Consumer Price Index: How the Consumer Price Index Measures Price Change for Telephone Services, https://www.bls.gov/cpi/factsheets/telephone-services.htm.

APPX. B-3
Annualized Average Revenue Per Reported Subscriber Unit (ARPU): 1993–2019

Year	Total Annual Service Revenue (thousands)	Percentage Change	Average Reported Subscribers	Average Monthly Revenue per Active Subscriber Unit
1993	$10,895,175		11,861,362	$76.55
1994	$14,229,922	30.6%	18,299,487	$64.80
1995	$19,081,239	34.1%	26,757,320	$59.43
1996	$23,634,971	23.9%	35,554,818	$55.40
1997	$27,485,633	16.3%	46,375,849	$49.39
1998	$33,133,175	20.6%	58,455,471	$47.23
1999	$40,018,489	20.8%	71,885,076	$46.39
2000	$52,466,020	31.1%	90,048,320	$48.55
2001	$65,316,235	24.5%	109,318,848	$49.79
2002	$76,508,187	17.1%	125,002,023	$51.00
2003	$87,624,093	14.5%	141,658,059	$51.55
2004	$102,121,210	16.5%	161,980,026	$52.54
2005	$113,538,221	11.2%	186,801,940	$50.65
2006	$125,456,825	10.5%	213,077,033	$49.07
2007	$138,869,304	10.7%	234,921,960	$49.26
2008	$148,084,170	6.6%	252,539,475	$48.87
2009	$152,551,854	3.0%	265,038,212	$47.97
2010	$159,929,648	4.9%	280,392,201	$47.53
2011	$169,767,314	6.2%	306,840,648	$46.11
2012	$185,013,936	9.0%	314,685,754	$48.99
2013	$189,192,812	2.3%	323,133,932	$48.79
2014	$187,848,477	(0.7%)	335,606,098	$46.64
2015	$191,949,025	2.2%	358,228,494	$44.65
2016	$188,524,256	(1.8%)	378,554,642	$41.50
2017	$179,091,135	(5.0%)	386,013,771	$38.66
2018	$182,779,484	2.1%	402,376,536	$37.85
2019	$187,361,982	2.5%	423,609,827	$36.86

Source: CTIA Year-End 2019 Wireless Industry Indices Report.

APPX. B-4
Ookla Speedtest--Estimated 5G (Beta) Speeds by Service Provider, Nationwide

In this Appendix, we present the nationwide mean and median 5G download and upload speeds based on Ookla data by service provider for calendar year 2019.[2]

Service Provider	2019 Download		2019 Upload		
	Mean Download Speed (Mbps)	Median Download Speed (Mbps)	Mean Upload Speed (Mbps)	Median Upload Speed (Mbps)	Number of Tests (DL/UL)
AT&T	630.66	605.03	22.71	21.92	18,893
Sprint	195.65	174.27	13.25	11.12	129,157
T-Mobile	79.29	52.62	20.53	18.25	35,947
Verizon Wireless	763.74	754.40	31.33	28.94	174,756

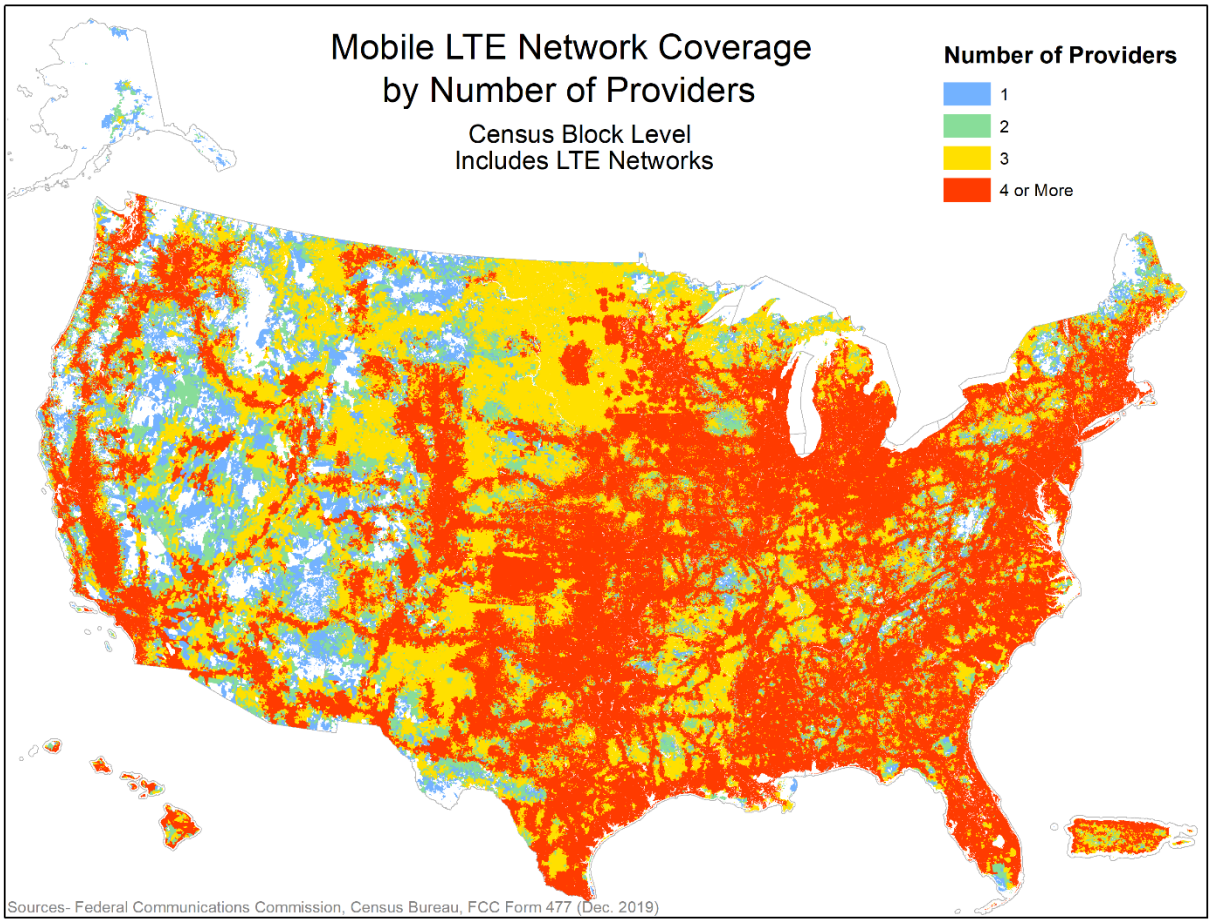
Source: Ookla SPEEDTEST intelligence data, © 2020 Ookla, LLC. All rights reserved. Published with permission of Ookla.

[2] According to Ookla, the 5G (Beta) technology type includes speed tests taken on devices that are capable of classifying results as 5G and that are differentiable from 4G, 3G, and 2G results. This is a subset of all Ookla speed tests taken on devices capable of connecting to a 5G network, which could include tests taken on 2G, 3G, 4G, and 5G technologies. https://www.ookla.com/speedtest-intelligence (last visited Oct. 27, 2020).

APPX. B-5
Mobile Wireless Coverage Maps

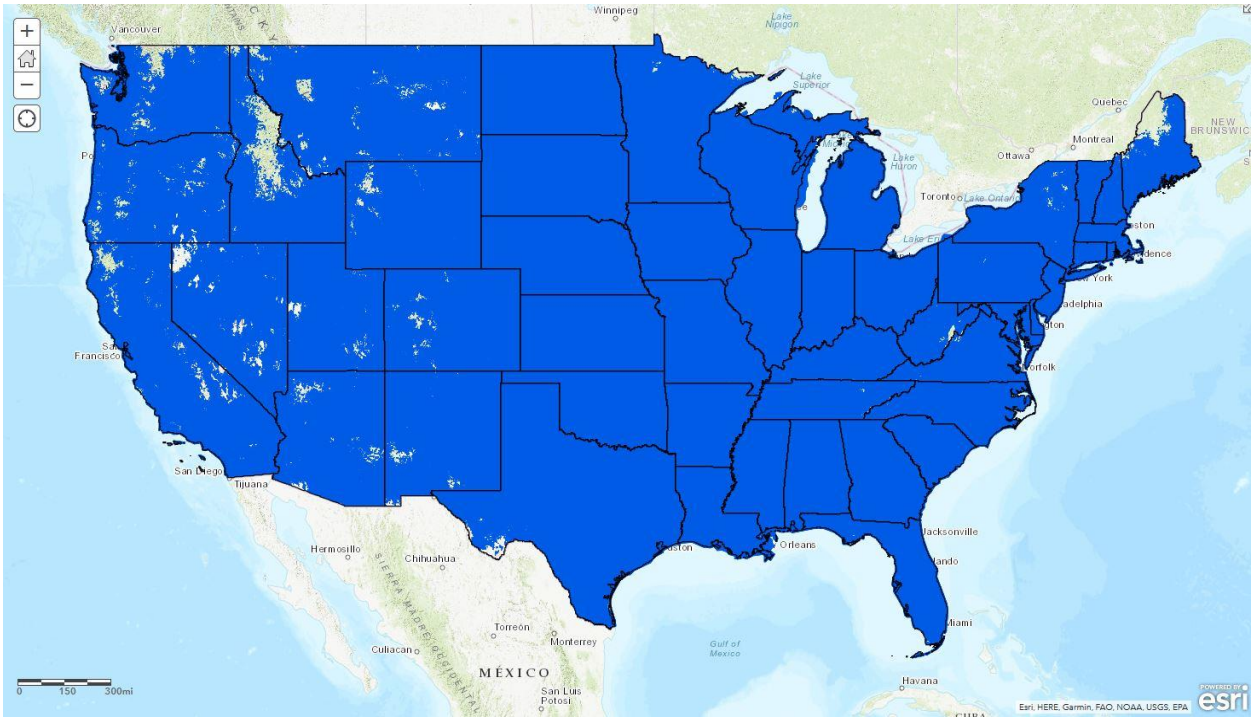
The maps presented below are based on Commission estimates derived from census block analysis of December 2019 FCC Form 477 coverage maps, using the centroid methodology.[3]

4G LTE Coverage Nationwide by Number of Service Providers
FCC Form 477, Centroid Method, December 2019

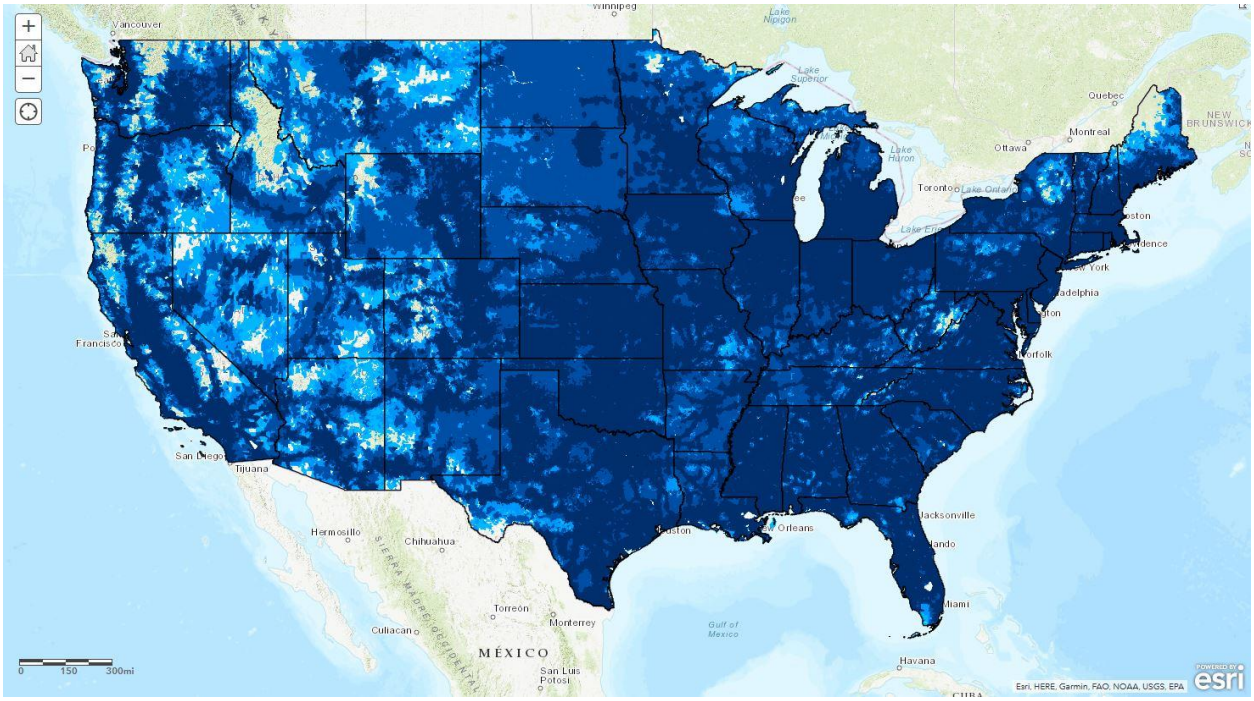


[3] The centroid methodology provides estimates of the percentage of the population located in census blocks with a certain number of service providers and represents network coverage. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block. In addition, the fact that a service provider reports coverage in a particular census block does not mean that it necessarily provides coverage everywhere in the census block. This is likely to be particularly relevant in larger rural census blocks. For both these reasons, the number of service providers in a census block does not necessarily reflect the number of choices available to a particular individual or household.

Nationwide Mobile Wireless Coverage, Year-End 2019 (FCC Form 477)

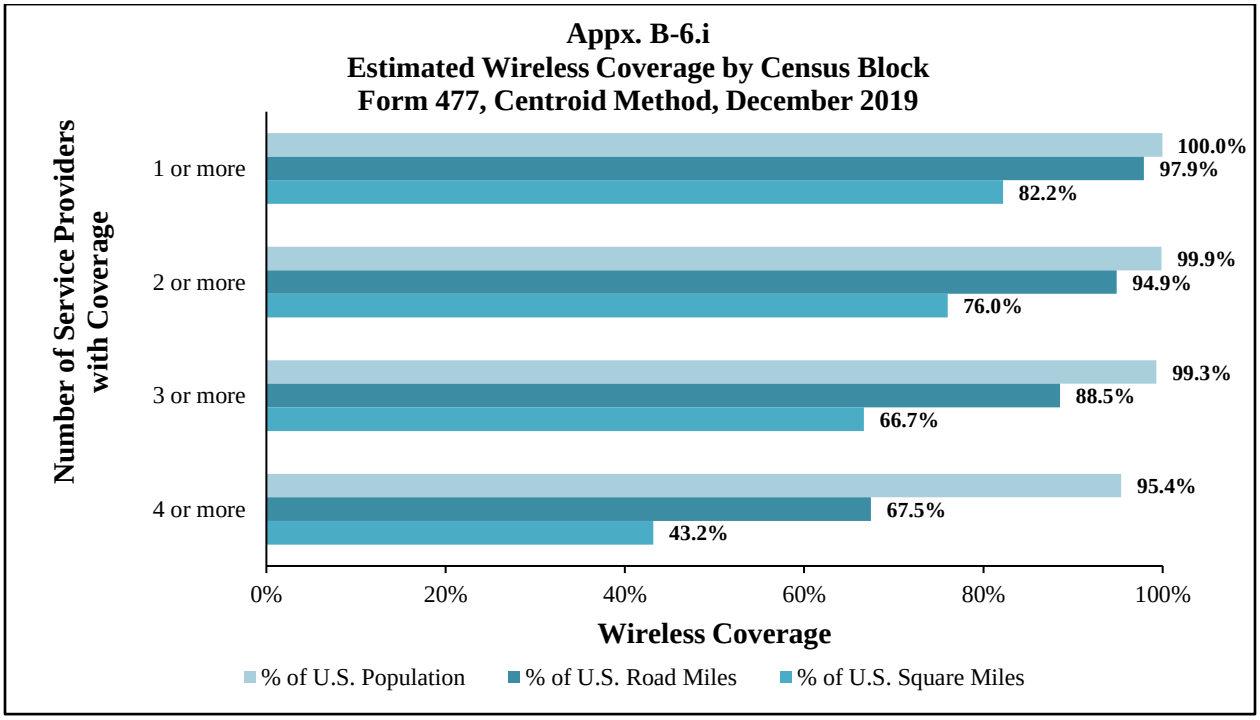


Nationwide 4G LTE Coverage, Year-End 2019 (FCC Form 477)



APPX. B-6
Mobile Wireless Coverage

The figures presented below are based on Commission estimates derived from census block analysis of December 2019 FCC Form 477 coverage maps, using both the centroid and the actual area coverage methodologies. We report those figures based on the centroid analysis first,[4] before moving on to those associated with the actual-area methodology.[5]



Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.[6]

[4] The centroid methodology is applied to U.S. census blocks overlaid on service provider coverage maps. Under this methodology, if the geometric center point, or centroid, of a census block is within the coverage boundary of a coverage map, then we consider that block to be "covered" by that service provider and/or technology. We then aggregate the population, land area, and road miles of the covered census blocks to generate our total coverage estimates. We note that these coverage estimates represent deployment of mobile networks and do not indicate the extent to which service providers affirmatively offer service to residents in the covered areas. While we recognize that this analysis likely overstates the coverage experienced by some consumers, especially in large or irregularly shaped census blocks, we find that it is nonetheless useful because estimated coverage can be compared across network technologies and service providers. For a more detailed discussion of the centroid methodology, *see Twentieth Wireless Competition Report*, 32 FCC Rcd at 9016, para. 71.

[5] For the actual-area methodology, since we do not know the distribution of either the population or road miles at the sub-census block level, as noted above, we must approximate the percentage that is covered by each technology. To do this, we assume that both population and road miles are distributed uniformly across each census block. The fraction of the population or road miles covered in a census block is assumed to be proportional to the fraction of the actual area covered. We then sum the estimated covered population (road miles) across blocks to estimate the total covered population (road miles) within the United States.

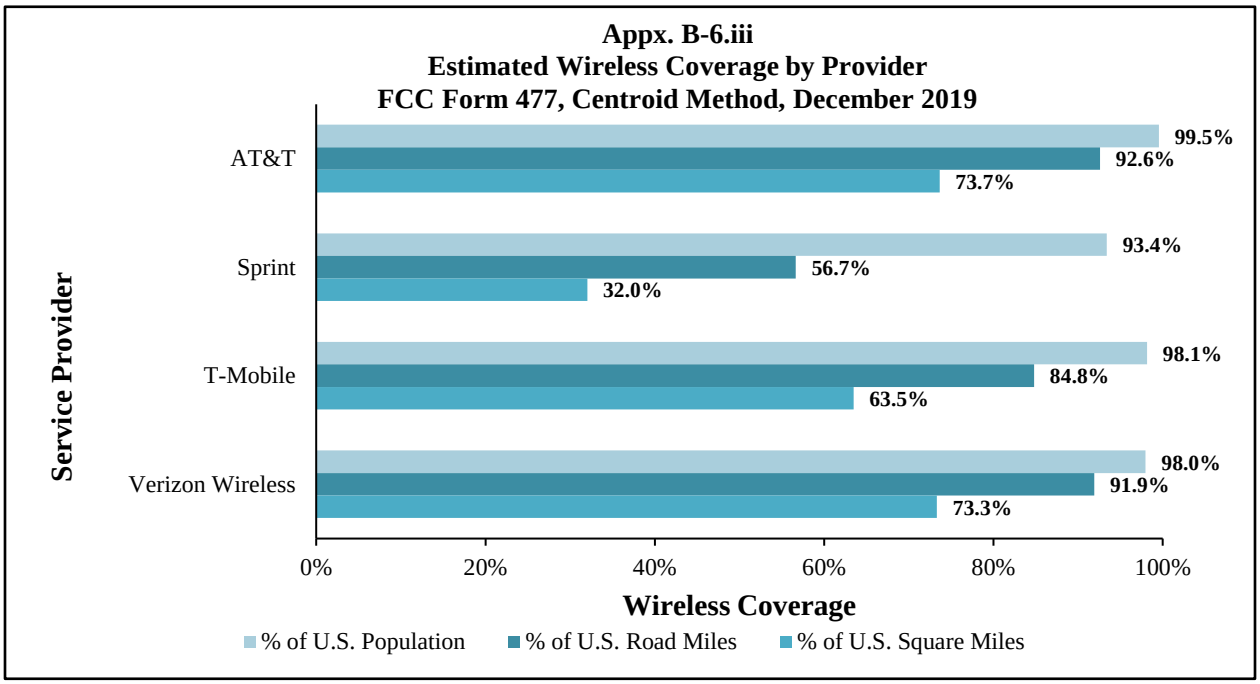
[6] Note that the number of service providers in a census block represents network coverage only. Network coverage does not necessarily reflect the number of service providers that actively offer service to individuals located in a given area. This applies to all figures presented in this Appendix.

Appx. B-6.ii
***Estimated* Overall Wireless Coverage by Census Block[7]**
FCC Form 477, Centroid Method, December 2019

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total US POPs	Square Miles Contained in Those Blocks	% of Total US Square Miles	Road Miles Contained in Those Blocks	% of Total US Road Miles
US Total	*10,609,302*	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
1 or more	10,529,121	312,369,004	100.0%	2,918,043	82.2%	6,675,170	97.9%
2 or more	10,406,552	312,030,932	99.9%	2,698,676	76.0%	6,467,505	94.9%
3 or more	10,099,092	310,304,912	99.3%	2,367,334	66.7%	6,036,201	88.5%
4 or more	8,749,015	298,036,807	95.4%	1,533,506	43.2%	4,598,912	67.5%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.iii
Estimated Wireless Coverage by Provider
FCC Form 477, Centroid Method, December 2019



Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

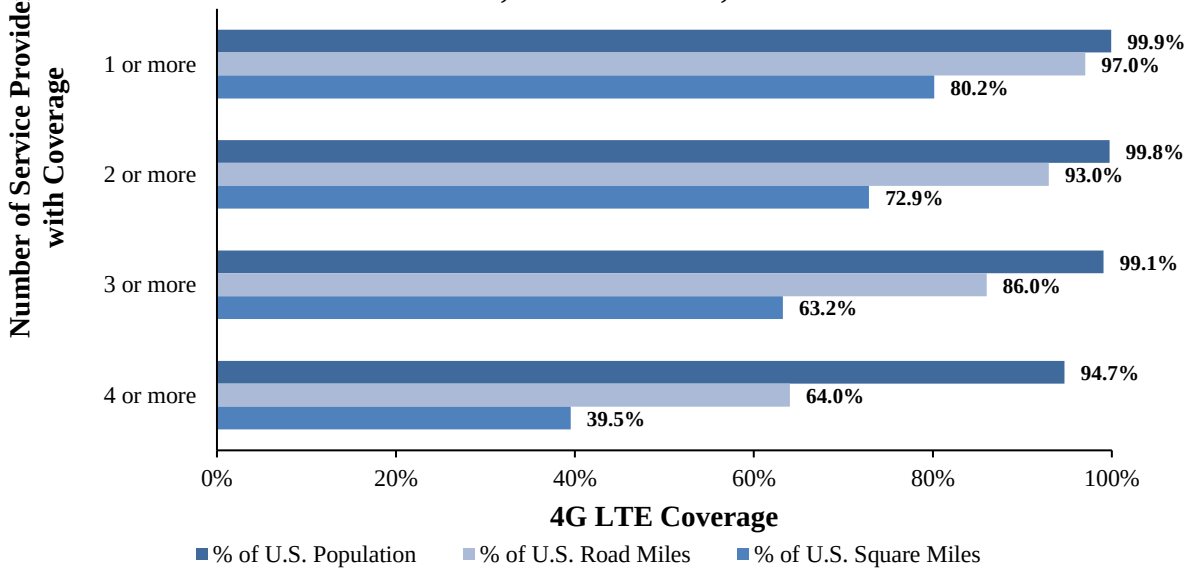
[7] As explained in section II.A.6, we include the continental United States, Hawaii, Alaska and Puerto Rico, and exclude all water-only blocks in our analysis.

Appx. B-6.iv
***Estimated* Overall Wireless Coverage in the U.S. by Provider**
FCC Form 477, Centroid Method, December 2019

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total US POPs	Square Miles Contained in Those Blocks	% of Total US Square Miles	Road Miles Contained in Those Blocks	% of Total US Road Miles
US Total	*10,609,302*	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
AT&T	10,261,956	311,059,564	99.5%	2,615,372	73.7%	6,312,875	92.6%
Sprint	8,007,634	291,864,441	93.4%	1,137,319	32.0%	3,862,827	56.7%
T-Mobile	9,776,392	306,663,166	98.1%	2,253,935	63.5%	5,782,106	84.8%
Verizon	10,122,552	306,154,384	98.0%	2,604,023	73.3%	6,265,830	91.9%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.v
Estimated 4G LTE Coverage by Census Block
FCC Form 477, Centroid Method, December 2019



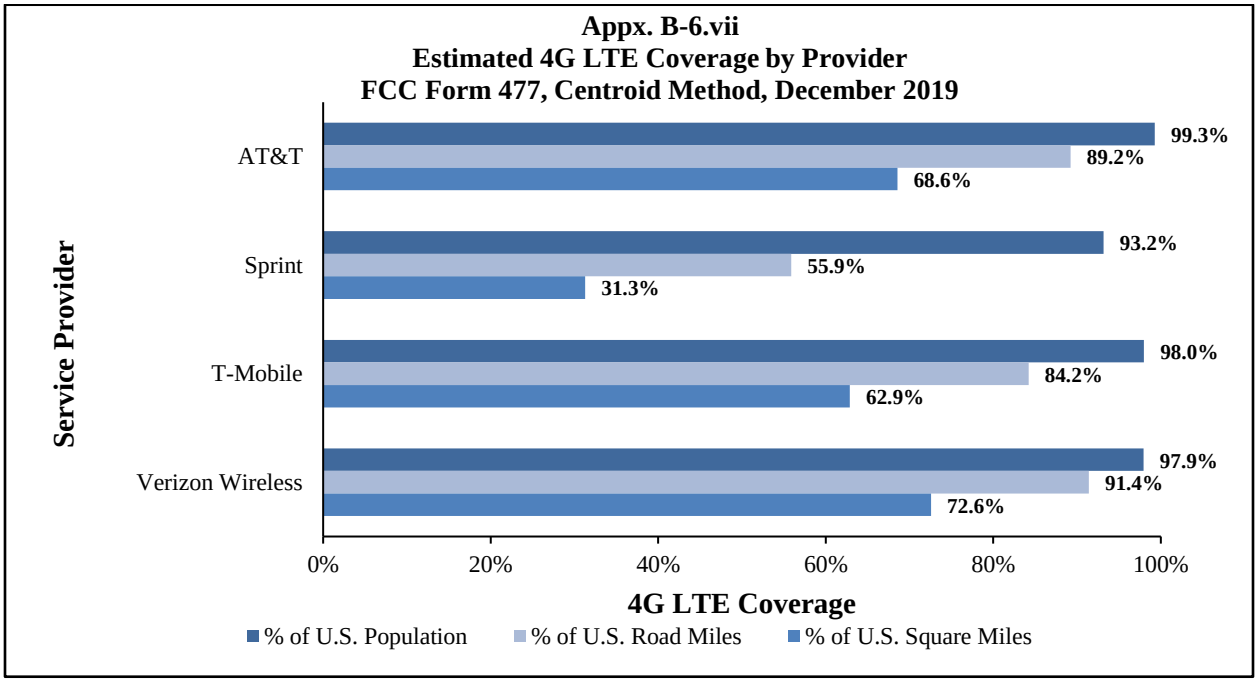
Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.vi
***Estimated* 4G LTE Coverage by Census Block**
FCC Form 477, Centroid Method, December 2019

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total US POPs	Square Miles Contained in Those Blocks	% of Total US Square Miles	Road Miles Contained in Those Blocks	% of Total US Road Miles
US Total	*10,609,302*	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
1 or more	10,489,423	312,247,963	99.9%	2,846,035	80.2%	6,615,903	97.0%
2 or more	10,319,281	311,723,273	99.8%	2,587,539	72.9%	6,338,345	93.0%
3 or more	9,967,520	309,623,288	99.1%	2,245,475	63.2%	5,863,500	86.0%
4 or more	8,526,346	295,978,637	94.7%	1,403,912	39.5%	4,365,263	64.0%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.vii
Estimated 4G LTE Coverage by Provider
FCC Form 477, Centroid Method, December 2019



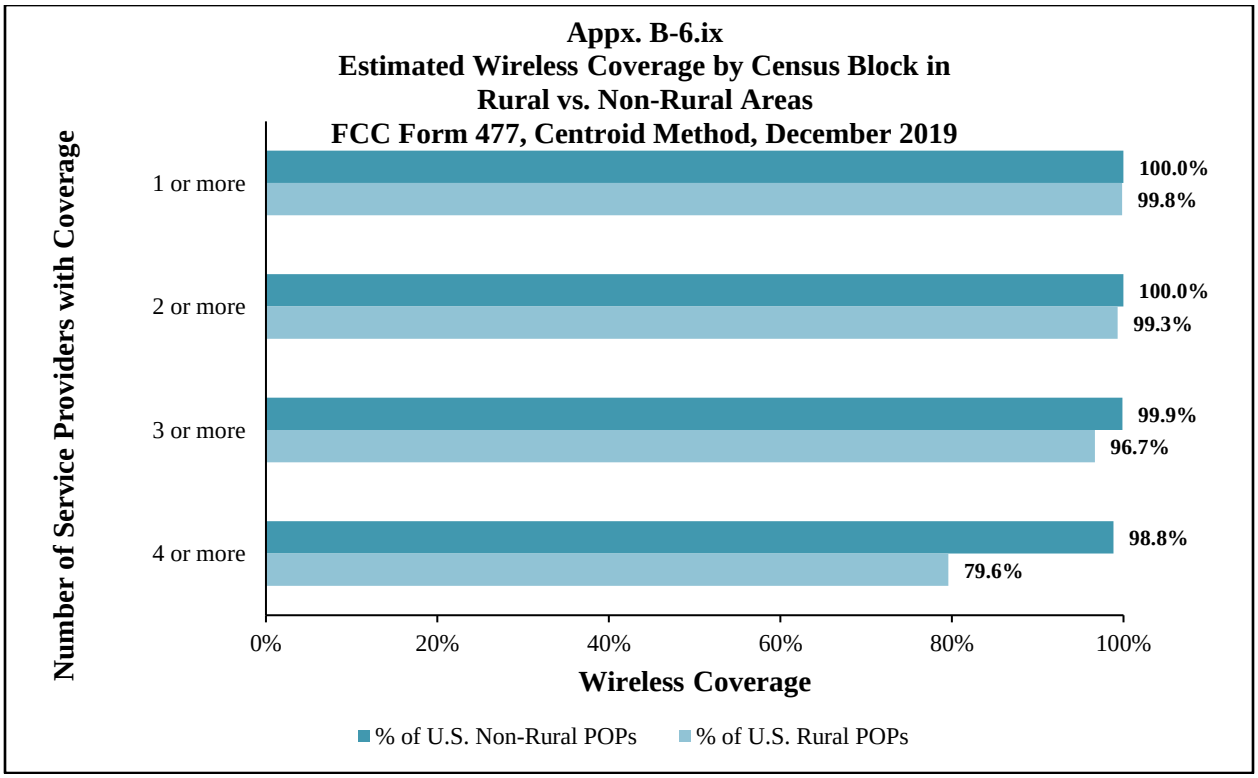
Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.viii
***Estimated* 4G LTE Coverage in the U.S. by Provider**
FCC Form 477, Centroid Method, December 2019

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total US POPs	Square Miles Contained in Those Blocks	% of Total US Square Miles	Road Miles Contained in Those Blocks	% of Total US Road Miles
US Total	*10,609,302*	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
AT&T	10,092,189	310,263,022	99.3%	2,434,274	68.6%	6,083,783	89.2%
Sprint	7,946,870	291,107,844	93.2%	1,111,158	31.3%	3,809,932	55.9%
T-Mobile	9,730,951	306,208,201	98.0%	2,233,005	62.9%	5,741,068	84.2%
Verizon	10,101,126	306,042,769	97.9%	2,576,315	72.6%	6,231,215	91.4%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.ix
Estimated Wireless Coverage by Census Block in Rural vs. Non-Rural Areas
FCC Form 477, Centroid Method, December 2019



Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.x

***Estimated* Wireless Coverage in Rural Areas by Census Block**

FCC Form 477, Centroid Method, December 2019

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Rural US POPs	Square Miles Contained in Those Blocks	% of Total Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Rural US Rural Road Miles
US Total	*4,937,330*	*56,094,554*	*100.0%*	*2,987,281*	*100.0%*	*4,518,876*	*100.0%*
1 or more	4,861,580	56,002,253	99.8%	2,359,842	79.0%	4,381,939	97.0%
2 or more	4,748,292	55,717,253	99.3%	2,153,231	72.1%	4,186,254	92.6%
3 or more	4,468,473	54,221,123	96.7%	1,843,644	61.7%	3,785,159	83.8%
4 or more	3,277,109	44,639,872	79.6%	1,073,430	35.9%	2,474,106	54.8%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xi

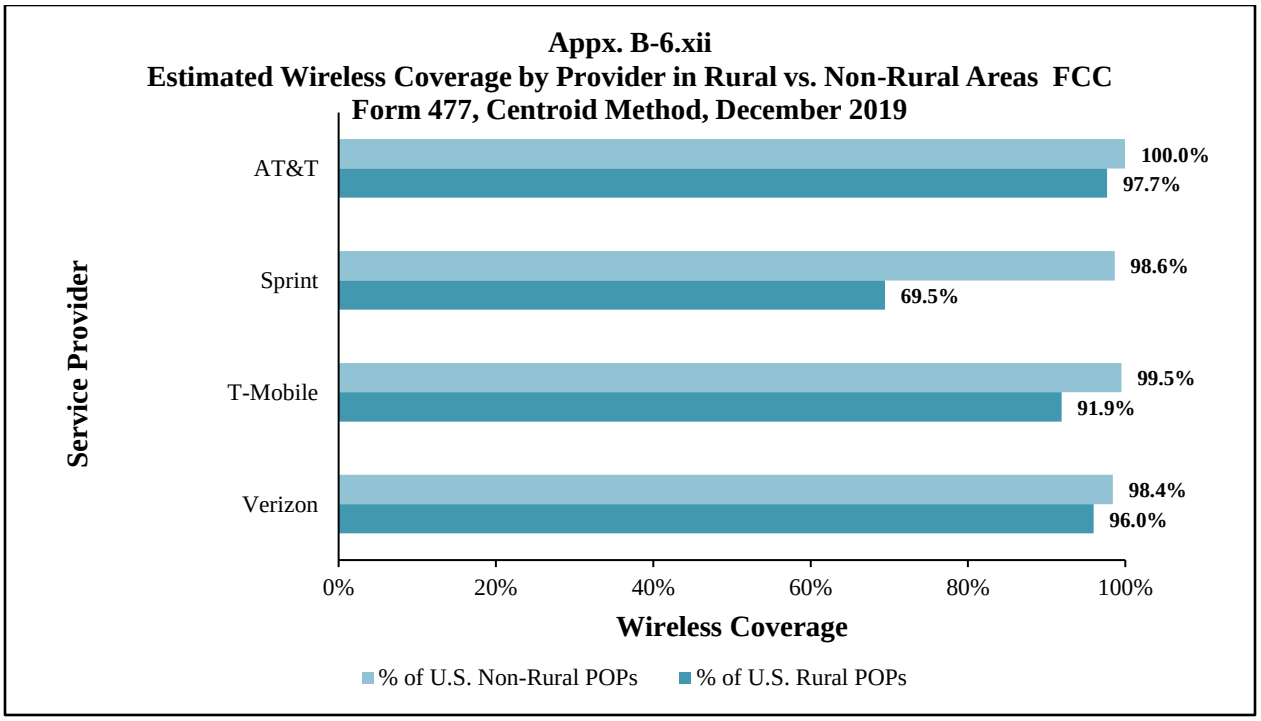
***Estimated* Wireless Coverage in Non-Rural Areas by Census Block**

FCC Form 477, Centroid Method, December 2019

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Non-Rural US POPs	Square Miles Contained in Those Blocks	% of Total Non-Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
US Total	*5,671,972*	*256,376,773*	*100.0%*	*563,570*	*100.0%*	*2,298,858*	*100.0%*
1 or more	5,667,541	256,366,751	100.0%	558,201	99.0%	2,293,230	99.8%
2 or more	5,658,260	256,313,679	100.0%	545,445	96.8%	2,281,251	99.2%
3 or more	5,630,619	256,083,789	99.9%	523,690	92.9%	2,251,042	97.9%
4 or more	5,471,906	253,396,935	98.8%	460,076	81.6%	2,124,805	92.4%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xii
Estimated Wireless Coverage by Provider in Rural vs. Non-Rural Areas FCC Form 477, Centroid Method, December 2019



Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xiii
***Estimated* Rural Wireless Coverage in the U.S. by Provider**
FCC Form 477, Centroid Method, December 2019

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total Rural US POPs	Road Miles Contained in Those Blocks	% of Total US Rural Road Miles
US Total	*4,937,330*	*56,094,554*	*100.0%*	*4,518,876*	*100.0%*
AT&T	4,606,610	54,797,178	97.7%	4,032,772	89.2%
Sprint	2,556,660	38,960,453	69.5%	1,756,584	38.9%
T-Mobile	4,186,297	51,548,586	91.9%	3,557,823	78.7%
Verizon	4,554,849	53,826,825	96.0%	4,020,660	89.0%

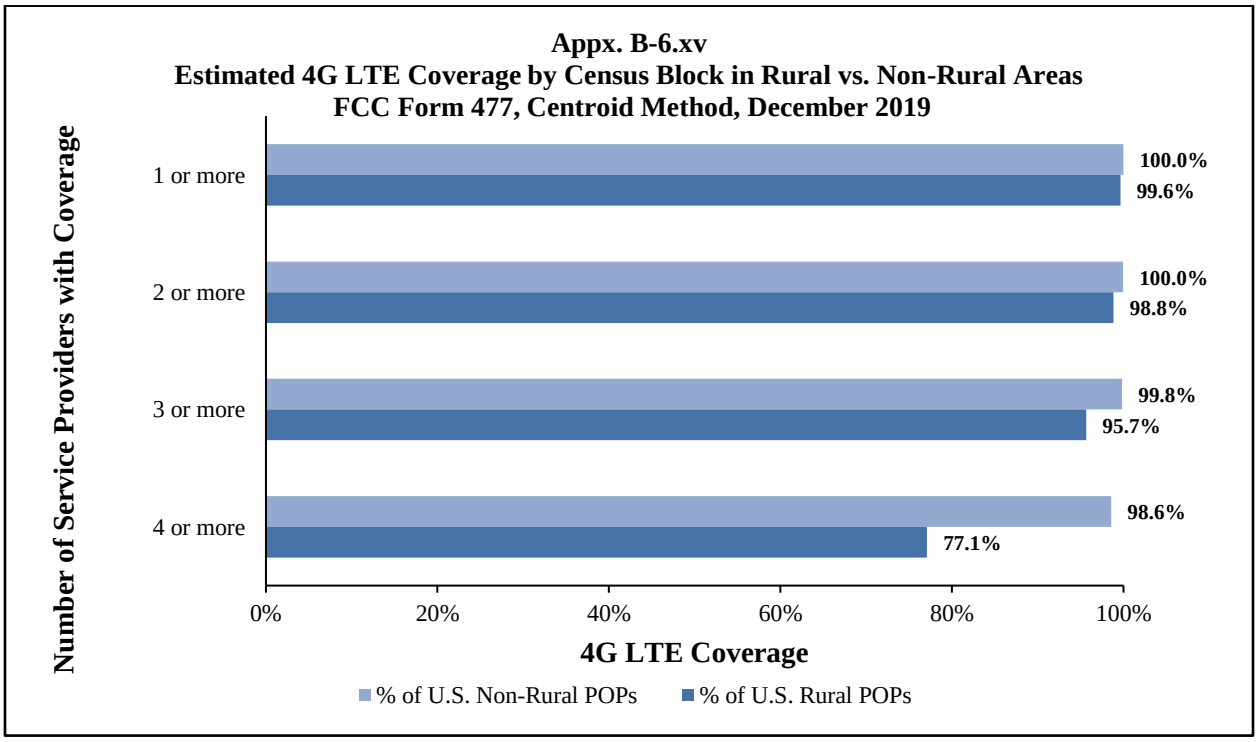
Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xiv
***Estimated* Non-Rural Wireless Coverage in the U.S. by Provider**
FCC Form 477, Centroid Method, December 2019

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total Non-Rural US POPs	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
US Total	*5,671,972*	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
AT&T	5,655,346	256,262,386	100.0%	2,280,102	99.2%
Sprint	5,450,974	252,903,988	98.6%	2,106,243	91.6%
T-Mobile	5,590,095	255,114,580	99.5%	2,224,283	96.8%
Verizon	5,567,703	252,327,559	98.4%	2,245,171	97.7%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xv
Estimated 4G LTE Coverage by Census Block in Rural vs. Non-Rural Areas
FCC Form 477, Centroid Method, December 2019



Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xvi
***Estimated* 4G LTE Coverage in *Rural* Areas by Census Block**
FCC Form 477, Centroid Method, December 2019

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Rural US POPs	Square Miles Contained in Those Blocks	% of Total Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Rural US Road Miles
US Total	*4,937,330*	*56,094,554*	*100.0%*	*2,987,281*	*100.0%*	*4,518,876*	*100.0%*
1 or more	4,824,317	55,891,480	99.6%	2,291,809	76.7%	4,326,538	95.7%
2 or more	4,667,313	55,446,581	98.8%	2,047,964	68.6%	4,064,516	89.9%
3 or more	4,349,679	53,659,415	95.7%	1,730,916	57.9%	3,625,851	80.2%
4 or more	3,084,791	43,245,020	77.1%	953,359	31.9%	2,263,330	50.1%

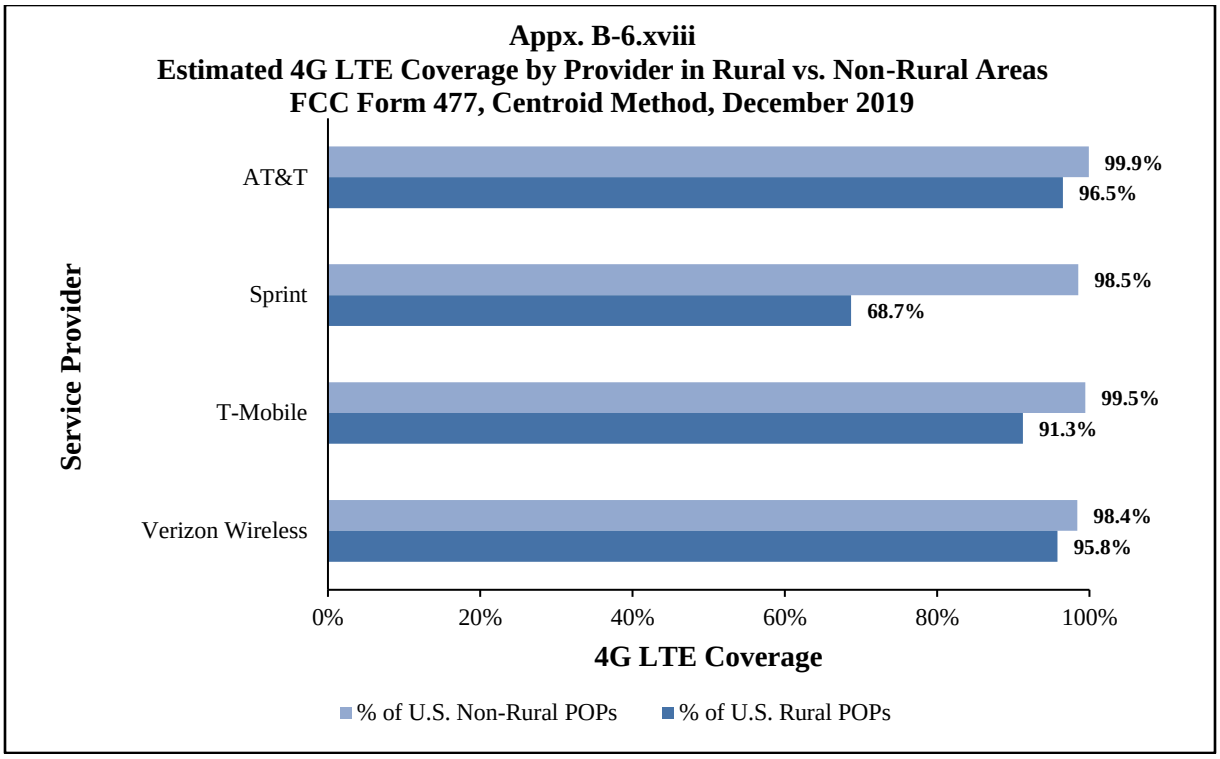
Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xvii
***Estimated* 4G LTE Coverage in *Non*-R*ural* Areas by Census Block**
FCC Form 477, Centroid Method, December 2019

Number of Providers with Coverage in a Block	Number of Blocks	POPs Contained in Those Blocks	% of Total Non-Rural US POPs	Square Miles Contained in Those Blocks	% of Total Non-Rural US Square Miles	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
US Total	*5,671,972*	*256,376,773*	*100.0%*	*563,570*	*100.0%*	*2,298,858*	*100.0%*
1 or more	5,665,106	256,356,483	100.0%	554,226	98.3%	2,289,364	99.6%
2 or more	5,651,968	256,276,692	100.0%	539,576	95.7%	2,273,829	98.9%
3 or more	5,617,841	255,963,873	99.8%	514,558	91.3%	2,237,649	97.3%
4 or more	5,441,555	252,733,617	98.6%	450,554	79.9%	2,101,933	91.4%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xviii
Estimated 4G LTE Coverage by Provider in Rural vs. Non-Rural Areas
FCC Form 477, Centroid Method, December 2019



Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xix
***Estimated* Rural 4G LTE Coverage in the U.S. by Provider**
FCC Form 477, Centroid Method, December 2019

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total Rural US POPs	Road Miles Contained in Those Blocks	% of Total US Rural Road Miles
US Total	*4,937,330*	*56,094,554*	*100.0%*	*4,518,876*	*100.0%*
AT&T	4,455,922	54,144,634	96.5%	3,825,019	84.6%
Sprint	2,512,957	38,544,276	68.7%	1,715,503	38.0%
T-Mobile	4,146,157	51,190,034	91.3%	3,521,517	77.9%
Verizon	4,536,520	53,744,742	95.8%	3,989,676	88.3%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xx
***Estimated* Non-Rural 4G LTE Coverage in the U.S. by Provider**
FCC Form 477, Centroid Method, December 2019

Provider	Number of Blocks	POPS Contained in Those Blocks	% of Total Non-Rural US POPs	Road Miles Contained in Those Blocks	% of Total Non-Rural US Road Miles
US Total	*5,671,972*	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
AT&T	5,636,267	256,118,388	99.9%	2,258,764	98.3%
Sprint	5,433,913	252,563,568	98.5%	2,094,428	91.1%
T-Mobile	5,584,794	255,018,167	99.5%	2,219,551	96.6%
Verizon	5,564,606	252,298,027	98.4%	2,241,539	97.5%

Source: Based on centroid analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xxi
***Estimated* Wireless Coverage in the U.S. by Provider**
FCC Form 477, Actual Area Method, December 2019

Provider	Covered POPs	% of Total US POPs	Covered Square Miles	% of Total US Square Miles	Covered Road Miles	% of Total US Road Miles
US Total	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
AT&T	310,968,586	99.5%	2,602,777	73.3%	6,294,494	92.3%
Sprint	291,642,976	93.3%	1,134,078	31.9%	3,848,705	56.5%
T-Mobile	306,569,022	98.1%	2,253,061	63.5%	5,774,522	84.7%
Verizon	306,016,690	97.9%	2,574,431	72.5%	6,236,618	91.5%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.[8]

Appx. B-6.xxii
***Estimated* 4G LTE Coverage by Census Block**
FCC Form 477, Actual Area Coverage Method, December 2019

Number of Providers with Coverage in a Block	Covered POPs	% of Total US POPs	Covered Square Miles	% of Total US Square Miles	Covered Road Miles	% of Total US Road Miles
US Total	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
1 or more	312,226,003	99.9%	2,838,030	79.9%	6,601,782	96.8%
2 or more	311,620,475	99.7%	2,576,767	72.6%	6,318,525	92.7%
3 or more	309,442,466	99.0%	2,233,488	62.9%	5,840,654	85.7%
4 or more	295,713,142	94.6%	1,397,873	39.4%	4,347,972	63.8%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.

[8] Unlike the centroid methodology where each block is either covered or not, the actual area coverage methodology acknowledges that many blocks are only partially covered. Because it is unclear which census blocks should be considered covered or not, we do not report the number of blocks covered in these results. This applies to all figures using the actual-area methodology.

Appx. B-6.xxiii
***Estimated* 4G LTE Coverage in the U.S. by Provider**
FCC Form 477, Actual Area Method, December 2019

Provider	Covered POPs	% of Total US POPs	Covered Square Miles	% of Total US Square Miles	Covered Road Miles	% of Total US Road Miles
US Total	*312,471,327*	*100.0%*	*3,550,852*	*100.0%*	*6,817,734*	*100.0%*
AT&T	310,114,264	99.2%	2,424,155	68.3%	6,061,401	88.9%
Sprint	290,874,954	93.1%	1,108,271	31.2%	3,796,429	55.7%
T-Mobile	306,127,791	98.0%	2,233,057	62.9%	5,734,884	84.1%
Verizon	305,899,986	97.9%	2,549,618	71.8%	6,203,717	91.0%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xxiv
***Estimated* Rural Wireless Coverage in the U.S. by Provider**
FCC Form 477, Actual Area Coverage, December 2019

Provider	Covered POPs	% of Total Rural US POPs	Covered Road Miles	% of Total US Rural Road Miles
US Total	*56,094,554*	*100.0%*	*4,518,876*	*100.0%*
AT&T	54,752,286	97.6%	4,016,251	88.9%
Sprint	38,848,130	69.3%	1,747,397	38.7%
T-Mobile	51,502,289	91.8%	3,550,095	78.6%
Verizon	53,755,113	95.8%	3,993,709	88.4%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xxv
***Estimated* Non-Rural Wireless Coverage in the U.S. by Provider**
FCC Form 477, Actual Area Coverage, December 2019

Provider	Covered POPs	% of Total Non-Rural US POPs	Covered Road Miles	% of Total Non-Rural US Road Miles
US Total	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
AT&T	256,216,299	99.9%	2,278,243	99.1%
Sprint	252,794,847	98.6%	2,101,308	91.4%
T-Mobile	252,261,577	99.5%	2,224,428	96.8%
Verizon	251,981,080	98.4%	2,242,909	97.6%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xxvi

***Estimated* 4G LTE Coverage in *Rural* Areas by Census Block**
FCC Form 477, Actual Area Coverage Method, December 2019

Number of Providers with Coverage in a Block	Covered POPs	% of Total Rural US POPs	Covered Road Miles	% of Total Rural US Road Miles
US Total	*56,094,552*	*100.0%*	*4,518,876*	*100.0%*
1 or more	55,871,661	99.6%	4,312,777	95.4%
2 or more	55,388,238	98.7%	4,045,489	89.5%
3 or more	53,549,953	95.5%	3,604,736	79.8%
4 or more	43,125,141	76.9%	2,250,927	49.8%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xxvii
***Estimated* 4G LTE Coverage in *Non-Rural* Areas by Census Block**
FCC Form 477, Actual Area Coverage Method, December 2019

Number of Providers with Coverage in a Block	Covered POPs	% of Total Non-Rural US POPs	Covered Road Miles	% of Total Non-Rural US Road Miles
US Total	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
1 or more	256,354,342	100.0%	2,289,005	99.6%
2 or more	256,232,238	99.9%	2,273,036	98.9%
3 or more	255,892,513	99.8%	2,235,917	97.3%
4 or more	252,588,001	98.5%	2,097,045	91.2%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xxviii
***Estimated* Rural 4G LTE Coverage in the U.S. by Provider**
FCC Form 477, Actual Area Coverage, December 2019

Provider	Covered POPs	% of Total Rural US POPs	Covered Road Miles	% of Total US Rural Road Miles
US Total	*56,094,554*	*100.0%*	*4,518,876*	*100.0%*
AT&T	54,752,286	96.4%	3,804,727	84.2%
Sprint	38,848,130	68.5%	1,706,975	37.8%
T-Mobile	51,502,289	91.2%	3,514,885	77.8%
Verizon	53,755,113	95.7%	3,964,023	87.7%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.

Appx. B-6.xxix
***Estimated* Non-Rural 4G LTE Coverage in the U.S. by Provider**
FCC Form 477, Actual Area Coverage, December 2019

Provider	Covered POPs	% of Total Non-Rural US POPs	Covered Road Miles	% of Total Non-Rural US Road Miles
US Total	*256,376,773*	*100.0%*	*2,298,858*	*100.0%*
AT&T	256,054,609	99.9%	2,256,674	98.2%
Sprint	252,435,857	98.5%	2,089,454	90.9%
T-Mobile	254,973,804	99.5%	2,219,999	96.6%
Verizon	252,228,271	98.4%	2,239,694	97.4%

Source: Based on actual area analysis of December 2019 FCC Form 477 and 2010 Census data.

APPENDIX C

FIXED COMMUNICATIONS MARKET

APPX. C-1: Adoption Rate for Fixed Terrestrial Services in the United States and U.S. Territories (Dec. 31, 2019)

APPX. C-2: Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 10/1 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

APPX. C-3: Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 25/3 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

APPX. C-4: Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 50/5 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

APPX. C-5: Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 100/10 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

APPX. C-6: Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 250/25 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

APPX. C-7: Population (millions) by Provider Options for Fixed Terrestrial Services, Segmented by Type of Urban Area (Dec. 31, 2019)

APPX. C-1
Adoption Rate for Fixed Terrestrial Services in the United States and U.S. Territories
(Dec. 31, 2019)[1]

	10/1 Mbps	25/3 Mbps	50/5 Mbps	100/10 Mbps	250/25 Mbps
United States	76.6%	68.9%	64.2%	50.4%	9.0%
Alabama	62.8%	56.4%	50.9%	45.7%	5.4%
Alaska	70.4%	54.9%	55.8%	*	*
American Samoa	*	*	*	*	NA
Arizona	77.6%	72.2%	57.5%	50.5%	15.2%
Arkansas	55.3%	48.9%	40.3%	32.6%	12.9%
California	83.2%	74.1%	70.1%	51.3%	6.5%
Colorado	79.1%	73.2%	68.0%	36.1%	7.7%
Connecticut	83.6%	71.0%	67.1%	48.4%	8.2%
Delaware	92.7%	90.0%	89.2%	53.1%	14.8%
District of Columbia	87.9%	83.0%	81.8%	54.0%	*
Florida	91.1%	80.7%	75.9%	63.2%	6.0%
Georgia	76.6%	65.6%	60.1%	50.5%	10.0%
Guam	*	*	*	*	*
Hawaii	*	*	*	*	*
Idaho	59.6%	48.8%	37.0%	29.6%	5.5%
Illinois	74.0%	60.4%	57.8%	46.1%	3.4%
Indiana	68.3%	56.5%	52.5%	43.6%	4.9%
Iowa	61.3%	54.1%	47.6%	31.0%	4.9%
Kansas	69.6%	58.6%	51.6%	46.1%	14.7%
Kentucky	65.6%	58.3%	51.4%	44.6%	5.9%
Louisiana	64.0%	57.6%	49.5%	43.9%	12.7%
Maine	76.8%	62.6%	56.7%	53.0%	0.5%
Maryland	89.0%	84.0%	83.4%	51.5%	*
Massachusetts	89.2%	86.7%	85.2%	53.0%	10.7%
Michigan	72.4%	62.7%	58.1%	49.2%	2.3%
Minnesota	71.0%	64.5%	59.1%	37.1%	5.3%
Mississippi	50.4%	39.7%	32.7%	26.4%	5.1%
Missouri	65.1%	57.1%	55.5%	50.0%	9.7%

[1] NA: Service is not available in this area; * Data not included to maintain confidentiality.

	10/1 Mbps	25/3 Mbps	50/5 Mbps	100/10 Mbps	250/25 Mbps
Montana	65.6%	60.1%	57.3%	*	5.3%
N. Mariana Isl.	*	*	*	*	NA
Nebraska	71.7%	62.2%	53.6%	52.1%	14.9%
Nevada	84.3%	75.3%	62.8%	60.2%	15.7%
New Hampshire	89.4%	83.4%	81.4%	45.8%	7.1%
New Jersey	89.6%	87.2%	85.6%	64.3%	20.2%
New Mexico	55.7%	50.1%	45.5%	22.4%	3.0%
New York	81.9%	77.3%	74.3%	68.2%	13.5%
North Carolina	76.2%	71.4%	66.1%	60.2%	7.3%
North Dakota	79.0%	73.6%	67.0%	60.4%	6.9%
Ohio	73.9%	63.0%	53.0%	48.7%	5.6%
Oklahoma	62.0%	53.3%	47.9%	42.3%	16.2%
Oregon	75.4%	70.2%	65.3%	37.8%	5.2%
Pennsylvania	77.3%	72.7%	68.8%	43.5%	9.7%
Puerto Rico	29.5%	16.6%	12.9%	*	0.4%
Rhode Island	89.0%	86.4%	78.4%	72.1%	*
South Carolina	77.8%	69.3%	62.8%	58.0%	6.8%
South Dakota	74.4%	70.4%	61.6%	56.9%	4.6%
Tennessee	70.5%	61.5%	58.3%	50.4%	11.4%
Texas	75.7%	67.0%	62.1%	50.5%	12.5%
U.S. Virgin Isl.	*	*	*	*	*
Utah	78.5%	70.0%	66.1%	34.3%	10.1%
Vermont	75.3%	64.2%	62.3%	34.0%	7.5%
Virginia	78.4%	75.0%	72.5%	53.4%	18.8%
Washington	79.2%	74.1%	71.0%	37.8%	5.6%
West Virginia	51.7%	49.4%	48.5%	33.5%	12.7%
Wisconsin	73.3%	64.4%	59.0%	55.4%	2.7%
Wyoming	67.4%	63.1%	53.5%	49.6%	0.5%

APPX. C-2
Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 10/1 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

	Pop. Eval.	Zero	One	Two	At Least Three
United States	331.777	2.2%	14.0%	46.2%	37.6%
Alabama	4.902	5.4%	28.3%	42.6%	23.6%
Alaska	0.731	7.2%	19.6%	43.4%	29.9%
American Samoa	0.048	0.0%	100.0%	0.0%	0.0%
Arizona	7.279	2.4%	5.5%	9.0%	83.0%
Arkansas	3.018	7.3%	28.9%	44.0%	19.8%
California	39.512	1.0%	8.4%	41.3%	49.3%
Colorado	5.758	1.6%	5.8%	13.5%	79.0%
Connecticut	3.565	0.4%	3.1%	88.5%	8.1%
Delaware	0.974	1.9%	18.3%	68.9%	10.8%
District of Columbia	0.706	1.5%	1.8%	9.6%	87.1%
Florida	21.477	2.6%	13.9%	56.4%	27.1%
Georgia	10.614	3.1%	19.2%	60.2%	17.5%
Guam	0.168	0.0%	97.2%	2.8%	0.0%
Hawaii	1.416	1.9%	18.8%	76.8%	2.5%
Idaho	1.787	2.2%	8.0%	16.6%	73.3%
Illinois	12.672	1.0%	7.9%	46.8%	44.3%
Indiana	6.732	1.2%	7.1%	20.2%	71.5%
Iowa	3.155	1.9%	15.4%	35.3%	47.4%
Kansas	2.913	1.0%	8.3%	24.2%	66.5%
Kentucky	4.468	0.9%	16.4%	55.1%	27.7%
Louisiana	4.649	3.8%	27.8%	39.6%	28.8%
Maine	1.344	1.3%	16.6%	58.6%	23.4%
Maryland	6.046	2.1%	13.0%	63.0%	21.9%
Massachusetts	6.892	1.7%	21.0%	54.2%	23.2%
Michigan	9.986	1.4%	13.8%	37.7%	47.2%
Minnesota	5.639	0.8%	8.6%	22.3%	68.3%
Mississippi	2.975	8.8%	33.5%	35.1%	22.6%
Missouri	6.136	2.8%	12.0%	20.8%	64.4%
Montana	1.069	6.4%	33.9%	37.4%	22.3%
Nebraska	1.934	0.7%	4.2%	16.9%	78.2%
Nevada	3.080	2.0%	7.3%	17.9%	72.9%
New Hampshire	1.360	1.3%	11.8%	81.3%	5.7%
New Jersey	8.882	1.3%	18.7%	76.4%	3.6%

	Pop. Eval.	Zero	One	Two	At Least Three
New Mexico	2.096	4.3%	12.1%	15.5%	68.1%
New York	19.454	1.0%	10.8%	58.4%	29.9%
North Carolina	10.488	2.1%	20.9%	63.3%	13.7%
North Dakota	0.762	2.7%	45.0%	33.0%	19.3%
Northern Mariana Isl.	0.051	3.0%	95.5%	1.5%	0.0%
Ohio	11.689	0.7%	14.6%	47.8%	36.9%
Oklahoma	3.954	8.1%	30.2%	40.8%	20.8%
Oregon	4.218	2.6%	9.9%	36.9%	50.7%
Pennsylvania	12.802	2.2%	17.4%	67.8%	12.6%
Puerto Rico	3.194	0.0%	1.5%	4.8%	93.7%
Rhode Island	1.059	1.4%	7.1%	89.9%	1.6%
South Carolina	5.149	4.2%	31.2%	51.1%	13.4%
South Dakota	0.885	1.7%	24.6%	25.4%	48.3%
Tennessee	6.829	2.8%	19.0%	58.2%	20.0%
Texas	28.977	2.2%	11.3%	41.9%	44.6%
U.S. Virgin Isl.	0.106	0.0%	0.0%	98.5%	1.5%
Utah	3.206	3.3%	6.5%	15.7%	74.5%
Vermont	0.624	1.7%	16.5%	62.6%	19.2%
Virginia	8.541	4.4%	18.2%	60.5%	16.8%
Washington	7.614	1.7%	9.9%	41.7%	46.7%
West Virginia	1.792	5.5%	20.7%	51.3%	22.5%
Wisconsin	5.822	2.3%	18.3%	58.6%	20.7%
Wyoming	0.579	4.2%	11.7%	19.4%	64.7%

APPX. C-3
Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 25/3 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

	Pop. Eval.	Zero	One	Two	At Least Three
United States	331.777	4.4%	21.9%	44.8%	29.0%
Alabama	4.902	12.4%	30.0%	44.0%	13.6%
Alaska	0.731	14.8%	22.1%	44.9%	18.2%
American Samoa	0.048	0.0%	100.0%	0.0%	0.0%
Arizona	7.279	5.2%	12.4%	18.2%	64.2%
Arkansas	3.018	19.0%	34.2%	34.0%	12.8%
California	39.512	1.5%	13.8%	41.4%	43.3%
Colorado	5.758	2.8%	9.8%	17.0%	70.5%
Connecticut	3.565	0.8%	21.4%	71.3%	6.5%
Delaware	0.974	2.2%	33.1%	62.8%	1.9%
District of Columbia	0.706	2.0%	4.4%	14.7%	78.8%
Florida	21.477	3.7%	18.1%	54.6%	23.6%
Georgia	10.614	6.2%	20.4%	57.5%	15.9%
Guam	0.168	33.0%	65.4%	1.6%	0.0%
Hawaii	1.416	2.1%	42.8%	53.4%	1.7%
Idaho	1.787	4.7%	14.0%	20.6%	60.7%
Illinois	12.672	2.0%	11.4%	50.1%	36.4%
Indiana	6.732	3.9%	15.4%	33.0%	47.7%
Iowa	3.155	4.0%	25.7%	38.8%	31.4%
Kansas	2.913	4.3%	24.3%	30.0%	41.4%
Kentucky	4.468	5.7%	31.1%	49.9%	13.2%
Louisiana	4.649	11.6%	34.4%	39.8%	14.3%
Maine	1.344	3.5%	49.8%	39.1%	7.6%
Maryland	6.046	2.5%	23.7%	59.7%	14.0%
Massachusetts	6.892	2.0%	42.0%	35.2%	20.7%
Michigan	9.986	4.2%	21.8%	35.8%	38.2%
Minnesota	5.639	2.5%	13.8%	27.3%	56.5%
Mississippi	2.975	19.7%	30.9%	30.9%	18.4%
Missouri	6.136	6.9%	20.8%	31.6%	40.7%
Montana	1.069	13.3%	46.4%	31.6%	8.7%
Nebraska	1.934	3.7%	12.2%	25.8%	58.3%
Nevada	3.080	2.9%	10.9%	31.9%	54.3%
New Hampshire	1.360	3.2%	42.5%	52.4%	1.9%
New Jersey	8.882	1.5%	30.0%	65.4%	3.2%

	Pop. Eval.	Zero	One	Two	At Least Three
New Mexico	2.096	12.9%	20.0%	23.2%	44.0%
New York	19.454	1.3%	20.4%	54.7%	23.6%
North Carolina	10.488	4.5%	32.5%	53.4%	9.6%
North Dakota	0.762	3.2%	52.9%	32.9%	11.0%
Northern Mariana Isl.	0.051	3.0%	95.5%	1.5%	0.0%
Ohio	11.689	2.8%	26.7%	47.1%	23.4%
Oklahoma	3.954	12.2%	32.1%	37.9%	17.8%
Oregon	4.218	5.1%	17.7%	53.8%	23.4%
Pennsylvania	12.802	4.1%	35.1%	56.1%	4.7%
Puerto Rico	3.194	0.1%	1.6%	10.1%	88.2%
Rhode Island	1.059	1.4%	10.5%	87.6%	0.5%
South Carolina	5.149	8.7%	34.0%	47.5%	9.8%
South Dakota	0.885	5.0%	31.6%	28.6%	34.7%
Tennessee	6.829	6.3%	24.0%	53.8%	15.9%
Texas	28.977	4.2%	15.8%	42.1%	37.9%
U.S. Virgin Isl.	0.106	0.0%	0.0%	100.0%	0.0%
Utah	3.206	4.3%	8.7%	19.4%	67.6%
Vermont	0.624	6.9%	38.8%	45.3%	9.1%
Virginia	8.541	5.8%	29.1%	55.2%	9.9%
Washington	7.614	3.7%	22.0%	49.4%	24.9%
West Virginia	1.792	17.8%	45.2%	28.7%	8.4%
Wisconsin	5.822	6.8%	26.2%	54.8%	12.2%
Wyoming	0.579	7.3%	12.7%	27.9%	52.2%

APPX C-4
Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 50/5 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

	Pop. Eval.	Zero	One	Two	At Least Three
United States	331.777	6.2%	27.0%	45.3%	21.4%
Alabama	4.902	13.9%	32.7%	41.4%	12.0%
Alaska	0.731	19.7%	62.8%	16.6%	0.9%
American Samoa	0.048	0.0%	100.0%	0.0%	0.0%
Arizona	7.279	6.2%	14.8%	18.5%	60.5%
Arkansas	3.018	22.6%	38.7%	32.9%	5.7%
California	39.512	3.6%	18.8%	47.1%	30.4%
Colorado	5.758	4.0%	14.4%	19.6%	62.0%
Connecticut	3.565	0.9%	29.8%	63.6%	5.8%
Delaware	0.974	2.4%	33.8%	62.5%	1.3%
District of Columbia	0.706	2.0%	4.4%	14.7%	78.8%
Florida	21.477	4.0%	19.1%	54.5%	22.5%
Georgia	10.614	7.2%	21.7%	56.0%	15.1%
Guam	0.168	98.1%	1.9%	0.0%	0.0%
Hawaii	1.416	2.4%	43.8%	52.8%	1.1%
Idaho	1.787	16.4%	33.0%	37.7%	12.9%
Illinois	12.672	4.5%	20.9%	50.8%	23.8%
Indiana	6.732	7.3%	20.8%	35.9%	35.9%
Iowa	3.155	7.7%	38.5%	41.8%	12.0%
Kansas	2.913	11.8%	34.4%	34.7%	19.1%
Kentucky	4.468	8.0%	36.0%	48.2%	7.8%
Louisiana	4.649	12.9%	37.9%	36.5%	12.8%
Maine	1.344	4.2%	63.0%	31.1%	1.6%
Maryland	6.046	3.5%	33.0%	55.5%	8.0%
Massachusetts	6.892	2.1%	42.2%	35.0%	20.7%
Michigan	9.986	6.3%	27.1%	37.9%	28.7%
Minnesota	5.639	2.9%	16.1%	28.9%	52.1%
Mississippi	2.975	21.4%	32.1%	30.2%	16.3%
Missouri	6.136	14.0%	29.5%	43.8%	12.7%
Montana	1.069	23.9%	57.9%	15.9%	2.3%
Nebraska	1.934	8.5%	30.4%	35.7%	25.4%
Nevada	3.080	3.3%	11.6%	33.8%	51.3%
New Hampshire	1.360	3.7%	49.7%	45.3%	1.4%
New Jersey	8.882	1.5%	30.0%	65.3%	3.2%

	Pop. Eval.	Zero	One	Two	At Least Three
New Mexico	2.096	15.3%	20.8%	21.2%	42.7%
New York	19.454	1.4%	25.5%	52.1%	21.0%
North Carolina	10.488	5.2%	36.7%	51.9%	6.3%
North Dakota	0.762	3.4%	54.2%	31.5%	10.9%
Northern Mariana Isl.	0.051	98.5%	1.5%	0.0%	0.0%
Ohio	11.689	4.0%	35.8%	45.2%	15.0%
Oklahoma	3.954	22.0%	36.6%	38.9%	2.4%
Oregon	4.218	7.2%	25.8%	52.2%	14.8%
Pennsylvania	12.802	4.5%	39.3%	52.0%	4.2%
Puerto Rico	3.194	0.2%	4.9%	14.9%	80.1%
Rhode Island	1.059	1.4%	10.5%	87.6%	0.5%
South Carolina	5.149	9.8%	35.4%	45.5%	9.3%
South Dakota	0.885	9.3%	42.4%	36.8%	11.5%
Tennessee	6.829	8.4%	27.2%	53.4%	11.0%
Texas	28.977	6.6%	21.5%	43.8%	28.1%
U.S. Virgin Isl.	0.106	0.0%	0.2%	99.8%	0.0%
Utah	3.206	5.6%	18.2%	32.5%	43.7%
Vermont	0.624	8.5%	47.7%	38.4%	5.4%
Virginia	8.541	8.3%	38.0%	50.5%	3.1%
Washington	7.614	5.0%	27.2%	51.9%	15.8%
West Virginia	1.792	21.6%	57.5%	18.9%	2.0%
Wisconsin	5.822	9.8%	35.0%	53.0%	2.2%
Wyoming	0.579	8.6%	18.9%	28.4%	44.1%

APPX. C-5
Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 100/10 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

	Pop. Eval.	Zero	One	Two	At Least Three
United States	331.777	8.3%	35.8%	42.6%	13.4%
Alabama	4.902	17.8%	39.4%	32.8%	10.0%
Alaska	0.731	20.6%	67.3%	11.3%	0.8%
American Samoa	0.048	0.0%	100.0%	0.0%	0.0%
Arizona	7.279	8.4%	19.2%	31.3%	41.2%
Arkansas	3.018	27.4%	43.5%	25.0%	4.1%
California	39.512	4.4%	27.6%	44.9%	23.1%
Colorado	5.758	7.5%	21.1%	26.4%	45.0%
Connecticut	3.565	1.2%	82.0%	15.6%	1.1%
Delaware	0.974	3.8%	40.9%	54.4%	0.8%
District of Columbia	0.706	2.0%	4.5%	14.9%	78.6%
Florida	21.477	5.4%	33.8%	53.8%	7.0%
Georgia	10.614	8.5%	28.3%	50.2%	13.0%
Guam	0.168	99.8%	0.2%	0.0%	0.0%
Hawaii	1.416	2.4%	44.0%	52.8%	0.8%
Idaho	1.787	22.5%	44.8%	30.4%	2.2%
Illinois	12.672	6.4%	37.2%	44.5%	11.8%
Indiana	6.732	12.3%	37.9%	40.5%	9.3%
Iowa	3.155	11.2%	45.6%	35.6%	7.7%
Kansas	2.913	15.7%	39.7%	29.6%	15.0%
Kentucky	4.468	9.5%	42.2%	41.9%	6.4%
Louisiana	4.649	15.6%	45.0%	33.9%	5.5%
Maine	1.344	9.8%	80.6%	9.3%	0.3%
Maryland	6.046	3.8%	34.5%	58.2%	3.4%
Massachusetts	6.892	2.8%	41.9%	37.6%	17.7%
Michigan	9.986	7.8%	36.3%	34.8%	21.1%
Minnesota	5.639	6.1%	34.4%	45.7%	13.7%
Mississippi	2.975	29.9%	40.7%	23.0%	6.4%
Missouri	6.136	17.7%	36.4%	38.2%	7.7%
Montana	1.069	29.4%	61.9%	7.3%	1.4%
Nebraska	1.934	11.3%	35.4%	35.4%	17.8%
Nevada	3.080	4.3%	16.2%	51.9%	27.6%
New Hampshire	1.360	5.0%	61.1%	33.5%	0.3%
New Jersey	8.882	1.5%	30.7%	64.7%	3.1%

	Pop. Eval.	Zero	One	Two	At Least Three
New Mexico	2.096	22.1%	41.4%	33.1%	3.4%
New York	19.454	1.6%	27.3%	50.5%	20.6%
North Carolina	10.488	6.4%	46.1%	42.6%	4.8%
North Dakota	0.762	7.2%	56.4%	30.6%	5.9%
Northern Mariana Isl.	0.051	99.9%	0.1%	0.0%	0.0%
Ohio	11.689	5.7%	47.1%	37.1%	10.0%
Oklahoma	3.954	24.6%	44.2%	30.0%	1.2%
Oregon	4.218	9.9%	33.5%	54.6%	2.0%
Pennsylvania	12.802	5.1%	42.6%	48.9%	3.4%
Puerto Rico	3.194	0.7%	9.6%	28.7%	61.0%
Rhode Island	1.059	1.4%	10.5%	87.6%	0.5%
South Carolina	5.149	14.5%	41.0%	37.1%	7.4%
South Dakota	0.885	15.2%	43.3%	36.8%	4.6%
Tennessee	6.829	9.7%	35.5%	46.4%	8.5%
Texas	28.977	10.6%	32.0%	42.3%	15.1%
U.S. Virgin Isl.	0.106	0.2%	99.8%	0.0%	0.0%
Utah	3.206	7.6%	28.4%	31.2%	32.8%
Vermont	0.624	13.9%	62.3%	22.3%	1.6%
Virginia	8.541	9.6%	38.8%	48.9%	2.7%
Washington	7.614	7.1%	36.4%	48.3%	8.1%
West Virginia	1.792	25.7%	65.2%	8.9%	0.2%
Wisconsin	5.822	13.6%	50.9%	35.2%	0.3%
Wyoming	0.579	19.4%	36.1%	27.2%	17.4%

APPX. C-6
Percentage of Population (millions) With Zero, One, Two, or At Least Three Provider Options for 250/25 Mbps Fixed Terrestrial Services (Dec. 31, 2019)

	Pop. Eval.	Zero	One	Two	At Least Three
United States	331.777	12.9%	52.0%	31.2%	4.0%
Alabama	4.902	24.7%	46.1%	21.4%	7.8%
Alaska	0.731	22.2%	70.4%	7.4%	0.0%
American Samoa	0.048	100.0%	0.0%	0.0%	0.0%
Arizona	7.279	10.4%	22.0%	59.3%	8.3%
Arkansas	3.018	47.1%	38.2%	13.0%	1.7%
California	39.512	7.3%	71.5%	19.3%	1.9%
Colorado	5.758	16.3%	60.9%	22.2%	0.6%
Connecticut	3.565	6.1%	86.5%	7.4%	0.0%
Delaware	0.974	3.9%	41.1%	54.3%	0.8%
District of Columbia	0.706	2.2%	16.2%	81.5%	0.1%
Florida	21.477	8.2%	63.2%	26.2%	2.5%
Georgia	10.614	15.5%	39.2%	37.9%	7.5%
Guam	0.168	99.9%	0.1%	0.0%	0.0%
Hawaii	1.416	2.5%	44.2%	53.3%	0.0%
Idaho	1.787	26.5%	61.6%	11.5%	0.4%
Illinois	12.672	7.9%	64.7%	25.4%	1.9%
Indiana	6.732	15.0%	53.2%	25.8%	6.0%
Iowa	3.155	17.3%	58.7%	20.5%	3.5%
Kansas	2.913	24.9%	43.6%	22.3%	9.2%
Kentucky	4.468	17.3%	46.8%	32.2%	3.6%
Louisiana	4.649	20.4%	56.3%	20.9%	2.5%
Maine	1.344	11.2%	84.7%	4.1%	0.1%
Maryland	6.046	6.5%	32.3%	61.0%	0.2%
Massachusetts	6.892	3.0%	49.8%	46.3%	0.8%
Michigan	9.986	12.2%	50.6%	29.1%	8.1%
Minnesota	5.639	12.6%	51.9%	26.1%	9.5%
Mississippi	2.975	41.4%	41.1%	14.3%	3.2%
Missouri	6.136	24.3%	45.9%	27.2%	2.6%
Montana	1.069	34.1%	63.7%	2.1%	0.0%
Nebraska	1.934	19.4%	47.7%	27.7%	5.3%
Nevada	3.080	5.7%	22.5%	57.4%	14.4%
New Hampshire	1.360	5.8%	66.0%	28.0%	0.3%
New Jersey	8.882	2.8%	31.8%	64.2%	1.3%

	Pop. Eval.	Zero	One	Two	At Least Three
New Mexico	2.096	35.8%	58.8%	5.4%	0.0%
New York	19.454	2.1%	30.4%	54.7%	12.7%
North Carolina	10.488	9.1%	56.2%	31.5%	3.1%
North Dakota	0.762	37.8%	58.7%	3.0%	0.4%
Northern Mariana Isl.	0.051	100.0%	0.0%	0.0%	0.0%
Ohio	11.689	11.8%	55.3%	29.5%	3.4%
Oklahoma	3.954	36.5%	45.8%	17.2%	0.5%
Oregon	4.218	17.9%	58.3%	23.5%	0.3%
Pennsylvania	12.802	7.0%	47.0%	45.7%	0.4%
Puerto Rico	3.194	13.4%	68.8%	15.8%	1.9%
Rhode Island	1.059	1.4%	10.5%	87.6%	0.5%
South Carolina	5.149	23.6%	49.3%	23.6%	3.6%
South Dakota	0.885	48.0%	45.9%	4.8%	1.3%
Tennessee	6.829	13.8%	45.0%	36.3%	4.8%
Texas	28.977	16.1%	47.9%	29.9%	6.1%
U.S. Virgin Isl.	0.106	0.2%	99.8%	0.0%	0.0%
Utah	3.206	16.6%	48.4%	19.0%	16.0%
Vermont	0.624	16.5%	65.4%	17.7%	0.4%
Virginia	8.541	15.1%	35.9%	48.0%	1.0%
Washington	7.614	12.0%	69.3%	18.2%	0.5%
West Virginia	1.792	40.5%	53.6%	5.8%	0.1%
Wisconsin	5.822	16.2%	67.8%	16.0%	0.1%
Wyoming	0.579	30.4%	52.1%	17.0%	0.5%

APPX. C-7
Population (millions) by Provider Options for Fixed Terrestrial Services, Segmented by Type of Urban Area (Dec. 31, 2019)

	10/1 Mbps		25/3 Mbps		50/5 Mbps		100/10 Mbps		250/25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
All Urban Areas										
Zero	2.292	0.9%	3.260	1.2%	4.333	1.6%	5.884	2.2%	13.697	5.1%
One	26.663	10.0%	46.533	17.5%	60.564	22.7%	87.663	32.9%	142.993	53.7%
Two	129.069	48.4%	129.346	48.5%	134.840	50.6%	130.260	48.9%	97.330	36.5%
At Least Three	108.431	40.7%	87.317	32.8%	66.718	25.0%	42.647	16.0%	12.436	4.7%
Urban Clusters										
Zero	0.342	1.2%	0.881	3.0%	1.539	5.2%	2.247	7.6%	6.022	20.3%
One	5.544	18.6%	11.211	37.7%	15.239	51.3%	18.704	62.9%	19.116	64.3%
Two	11.572	38.9%	10.942	36.8%	9.770	32.9%	7.386	24.8%	4.177	14.0%
At Least Three	12.273	41.3%	6.698	22.5%	3.184	10.7%	1.395	4.7%	0.418	1.4%
Urbanized Areas										
Zero	1.950	0.8%	2.379	1.0%	2.793	1.2%	3.637	1.5%	7.675	3.2%
One	21.118	8.9%	35.322	14.9%	45.325	19.1%	68.959	29.1%	123.877	52.3%
Two	117.497	49.6%	118.403	50.0%	125.070	52.8%	122.875	51.9%	93.153	39.4%
At Least Three	96.158	40.6%	80.619	34.1%	63.534	26.8%	41.253	17.4%	12.018	5.1%

STATEMENT OF
COMMISSIONER BRENDAN CARR
APPROVING IN PART AND CONCURRING IN PART

Re: *Communications Marketplace Report*, GN Docket No. 20-60.

The 2020 Communications Marketplace Report contains more good news for American consumers. Prices for high-speed Internet services are down, competition for Internet services is up, and with providers building new broadband infrastructure at an accelerated pace the digital divide continues to close. In short, the policies we've put in place over the past few years are working.

The Report also confirms that providers from previously distinct industries are continuing to converge and compete like never before. A new generation of low-earth orbit satellites are competing to offer high-speed home Internet services. Wireless providers are increasingly offering fixed high-speed services in competition with cable. Cable is competing to build fixed and mobile platforms that offer next-gen Internet and video services. And broadcasters are starting to leverage the potential of ATSC 3.0 and Broadcast Internet technologies to deliver 25 Mbps services directly to consumers.

This is not like any competition we've seen before. And it's also why I concur in part in today's Report. I would go even further than the Report does in recognizing the converged market for connectivity that now exists. The Commission's decades-old approach of viewing different technologies—including mobile, fixed, satellite, and broadcast offerings—as competing in distinct and separate markets no longer matches the way that Americans consume these services. As I've emphasized before, the FCC's market definitions often look backwards to where the sector has been, rather than where it is going.[1]
This approach makes the FCC's job of assessing the state of competition more difficult and fails to reflect the way that consumers are using high-speed connections today and, certainly, tomorrow.

Therefore, as we prepare these Reports and analyze competition in our rulemaking and adjudicatory proceedings, I believe we should do so even more mindful of the converged market for connectivity in which providers now compete.

[1] Keynote Remarks of FCC Commissioner Brendan Carr at the Phoenix Center's 19th Annual U.S. Telecoms Symposium: Keeping Pace with Dynamic Industries (Dec. 3, 2019), https://go.usa.gov/xAkTD.

STATEMENT OF
COMMISSIONER JESSICA ROSENWORCEL,
CONCURRING

Re: *Communications Marketplace Report*, GN Docket No. 20-60

Today the Federal Communications Commission issues its second-ever communications marketplace report. In this report, we offer data about the state of competition in the mobile wireless market, the satellite market, and the video market. There is a lot of change underway, as the ways we watch and the networks we depend on to connect are evolving. So we look at the characteristics of each of these different industry segments, the state of deployment of communications capabilities, and the barriers to entry. We also provide data about broadband, including an examination of how the United States fares vis-à-vis other countries.

This report is important because it can inform the work of this agency as well as other federal and state authorities, and Congress. For consumers, today's report offers what may be one of the most comprehensive sources of public data about the state of the services they receive, including the latest iterations of the Measuring Broadband America reports.

But while this overall report is full of facts and figures, it also falls short. Following our inaugural production of this report two years ago, I suggested we should use this proceeding to identify the transformational changes that are taking place across these services from both the provider and user perspective. This discussion could also include how these changes may create opportunities for market entry or conversely, further increase barriers to entry. I think now, during a global pandemic when so much of modern life has migrated online and depends on communications, this kind of analysis would be especially useful. I regret that today's report does not correct course and offer this analysis.

Moreover, I believe that the roadmap set forth in this report does not adequately reflect the magnitude of the work ahead for this agency. Earlier this week, a new appropriations law directed the FCC to establish an Emergency Broadband Benefit program. This effort is designed to expand access to high-speed service and address the persistent challenges with affordability that prevent us from making broader progress addressing the digital divide. These issues of adoption merit serious discussion but regrettably are barely present in this report. In addition, this law tasks the agency with expanded support for telehealth and provides the funding needed to replace network equipment that presents a security risk. These new legislative tasks along with those in existing statutes are a reminder that we have serious work to do to ensure that safe and reliable services reach 100% of our population—in rural areas, urban areas, and everything in-between.

STATEMENT OF
COMMISSIONER GEOFFREY STARKS
APPROVING IN PART AND DISSENTING IN PART

Re: *Communications Marketplace Report et al.*, GN Docket No. 20-60

Much of this Report is uncontroversial and useful. I thank the Commission staff who assembled this wide-ranging look at the communications marketplace. The wealth of factual information presented here is a testament to both their hard work and the enormous scope of issues facing the Commission today.

I cannot, however, fully approve this Report. Many of the decisions the Report touts as promoting competition and closing the digital divide have done no such thing. Here's one important example: The Report's discussion of the *2019 Lifeline Reform Order* leaves that decision's harmful impacts—increasing red tape, reducing provider participation, and making it less likely that low-income Americans will receive robust broadband internet access through the program—out of the discussion entirely. Another missed opportunity is in the Report's general description of regulatory barriers to entry into broadcasting without any specific discussion of the historically persistent barriers to entry, including access to capital, for people of color and women.

Moreover, the Report's agenda for the next two years fails to set the right vision, particularly with respect to the fixed communications marketplace. There is not one word in that section about promoting affordability or making sure that low-income communities share in the benefits of broadband. At the end of this difficult year, we should not need more evidence that internet inequality stands between tens of millions of Americans and equitable access to opportunity. I therefore dissent in part.