

FCC FACT SHEET*

Communications Marketplace Report

Report; GN Docket No. 18-231

Background: Title IV of RAY BAUM'S Act of 2018 directs the Commission to publish in the last quarter of every even-numbered year a comprehensive evaluation of the state of the communications marketplace in the United States. With this first Communications Marketplace Report, the Commission fulfills that statutory requirement to consolidate several previously separate reports into a single report addressing the state of the broader communications market in the United States.

What the Report Would Do:

- Promote transparency by consolidating a number of the Commission's reports, which historically had been issued as separate documents assessing different aspects of the communications marketplace.
- Provide a holistic overview of competition in mobile wireless communications, fixed broadband communications, audio, video, and satellite communications markets.
- Assess the state of deployment of communications capabilities.
- Assess barriers to competitive entry, including market entry barriers for entrepreneurs and other small businesses.
- Compile a list of geographic areas that are not served by any provider of advanced telecommunications capabilities.
- Describe the Commission's actions to address challenges and opportunities in the communications marketplace during the previous two years.
- Discuss the Commission's agenda for continuing to address those challenges and opportunities over the next two years.

* This document is being released as part of a "permit-but-disclose" proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in GN Docket No. 18-231, which may be accessed via the Electronic Comment Filing System (<https://www.fcc.gov/ecfs/>). Before filing, participants should familiarize themselves with the Commission's *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. See 47 CFR § 1.1200 *et seq.*

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

Table listing matters and docket numbers: In the Matter of Communications Marketplace Report, GN Docket No. 18-231; The State of Mobile Wireless Competition, WT Docket No. 18-203; Status of Competition in the Market for the Delivery of Video Programming, MB Docket No. 17-214; Status of Competition in the Marketplace for Delivery of Audio Programming, MB Docket No. 18-227; Satellite Communications Services for the Communications Marketplace Report, IB Docket No. 18-251.

REPORT*

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By the Commission:

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* This document has been circulated for tentative consideration by the Commission at its December 2018 open meeting. The issues and data referenced in this document, as well as the Commission's ultimate resolution of those issues remain under consideration and subject to change. The data relied upon in the report may be updated as appropriate. This document does not constitute any official action by the Commission. However, the Chairman has determined that, in the interest of promoting the public's ability to understand the nature and scope of issues under consideration, the public interest would be served by making this document publicly available. The FCC's ex parte rules apply and presentations are subject to "permit-but-disclose" ex parte rules. See, e.g., 47 C.F.R. §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission's ex parte rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. See 47 CFR §§ 1.1200(a), 1.1203.

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I. INTRODUCTION

1. With this first Communications Marketplace Report, the Commission fulfills the requirement set forth in RAY BAUM'S Act of 2018¹ to streamline its numerous and varied public reports into a single document providing a comprehensive evaluation of the state of communications in the United States. This Report consolidates the Commission's historical, statutorily required reports, all of which had been issued in separate documents and at different times, and which assessed different aspects of the diverse communications technologies the Commission oversees. For the first time, the Report places essential information about all of these technologies in one place.

2. Title IV of RAY BAUM'S Act of 2018 directs the Commission to publish in the last quarter of every even-numbered year "a report on the state of the communications marketplace."² Each biennial report must assess 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; and must describe the actions taken by the Commission in the previous two years to address challenges and opportunities in the communications marketplace, and the Commission's agenda for continuing to address those challenges and opportunities over the next two years. The Commission must also compile a list of geographic areas that are not served by any provider of advanced telecommunications capability.

3. In addition to establishing the Communications Marketplace Report requirement, RAY BAUM'S Act of 2018 also expressly repealed and modified the Commission's requirement to produce many other reports. The Media Bureau, Wireless Telecommunications Bureau, and Wireline Competition Bureau separately sought public comment to assist the Commission in fulfilling its reporting duties under the RAY BAUM'S Act of 2018.³ In total, RAY BAUM'S Act of 2018 eliminated or materially modified 10 separate regularly recurring Commission reports to Congress and in their place consolidated the most data required by those reports into this single comprehensive report.⁴ The Commission's regulatory reach encompasses a number of different modes of communications. The replacement of multiple separate reports on distinct schedules with a single consolidated Communications Marketplace Report provides greater transparency to the public, enables a more holistic examination of the state the communications market across technologies, and simplifies for interested parties the ability to research, consider and evaluate our assessments.

II. ASSESSMENT OF COMPETITION AND DEPLOYMENT

4. This section of the Communications Marketplace Report addresses the requirement that the Commission assess the state of competition in the communications marketplace, including a discussion of barriers to competitive entry, including market entry barriers for entrepreneurs and other small businesses. We first discuss the state of competition in the mobile wireless market, including market characteristics, spectrum and pricing levels and trends. We then discuss competition in the audio market, such as terrestrial and satellite radio, and in the video market, including broadcast, multichannel

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

² 47 U.S.C. § 163(a).

³ See *Media Bureau Seeks Comment on the Status of Competition in the Marketplace for Delivery of Audio Programming*, Public Notice, MB Docket No. 18-227, DA 18-761 (rel. July 23, 2018), *Wireless Telecommunications Bureau Seeks Comment on The State of Mobile Wireless Competition*, WT Docket No. 18-203, Public Notice, DA-18-663, (WTB 2018) (*Mobile Wireless Competition PN*), *Wireline Competition Bureau Seeks Comment on The State of Fixed Broadband Competition*, GN Docket No. 18-231, Public Notice, DA 18-784 (WCB July 27, 2018).

⁴ See RAY BAUM's Act, section 402. The Act also eliminates other, non-regularly recurring Commission reporting obligations to Congress. See *id.*, section 402(i)(1)-(5).

and online video services. We next address the state of competition in the fixed broadband market, including investment trends and market barriers, as well as a discussion of the voice services market. The Report next addresses the state of competition in the satellite market including industry providers and recent changes in the market. We also assess in this section the state of deployment of communications capabilities as required by RAY BAUM'S Act. 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.⁵ In addition, we include throughout this section data presentations related to the various markets and discussions of intermodal competition, also as required by RAY BAUM'S Act of 2018.

A. The Mobile Wireless Market

5. 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.⁶ In this section, we present and review available 2017 data for all mobile wireless services, including voice, messaging, and broadband, and also present certain pricing information as of early 2018.⁷

1. Characteristics of the Mobile Wireless Industry

a. Service Providers⁸

6. *Facilities-Based Service Providers.* As of year-end 2017, there were four facilities-based mobile wireless service providers in the United States that are typically described as "nationwide": AT&T, Sprint, T-Mobile, and Verizon Wireless. Although none of these four nationwide service providers has a network that is truly ubiquitous, all four service providers have networks that cover at least 90% of the population with Long Term Evolution (LTE).⁹ Therefore, this *Report* will refer to these four service providers as "nationwide service providers." Collectively, these four service providers

⁵ 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.*

⁶ The *Communications Marketplace Report* includes information in this section on the mobile wireless marketplace that previously was submitted to Congress as a separate *Mobile Wireless Competition Report* under Section 332(c)(1)(C) of the Communications Act of 1934, as amended (Communications Act). 47 U.S.C. § 332(c)(1)(C). Section 332(c)(1)(C) was amended by striking the first and second sentences, which read: "The Commission shall review competitive market conditions with respect to commercial mobile services and shall include in its annual report an analysis of those conditions. Such analysis shall include an identification of the number of competitors in various commercial mobile services, an analysis of whether or not there is effective competition, an analysis of whether any of such competitors have a dominant share of the market for such services, and a statement of whether additional providers or classes of providers in those services would be likely to enhance competition." *Id.*

⁷ Our analysis in this section is data-centric; it combines discussions with substantial use of figures in accessible data formats. For additional information not included in this section, see the dedicated web appendix where we include, for example, various maps of coverage, and additional figures depicting LTE coverage based on the centroid methodology. FCC, Web Appendices 1-7, at XX. Citations to Comments in this section refer to filings submitted in response to the Mobile Wireless Competition PN. *See generally* Mobile Wireless Competition PN.

⁸ We note that mobile satellite service providers offer satellite-based communications to mobile devices, and generally are targeted at users who require communications and asset tracking in remote areas, in disaster response situations, or other places where terrestrial mobile wireless network access may be limited. In addition, narrowband data service providers offer services including two-way messaging, as well as machine-to-machine (M2M) and other telemetry communications, and are consumed primarily by businesses, government users, and other institutions. *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. 17-126, Twentieth Report, 32 FCC Rcd 8968, 8977, paras. 17-18 (2017) (*Twentieth Report*).

⁹ *See infra* Section II.A.8.

account for over 400 million connections.¹⁰ U.S. Cellular, currently the fifth 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 23 states.¹¹ As of December 31, 2017, U.S. Cellular accounted for approximately five million connections.¹² C Spire, the sixth largest service provider in the U.S., provides service in the Southeastern United States to nearly one million subscribers.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 service providers increase choice for consumers and help to promote deployment in rural areas.¹⁵

7. *Mobile Virtual Network Operator (MVNOs)*. MVNOs do not own any network facilities, but instead purchase mobile wireless services wholesale from facilities-based service providers and resell these services to consumers.¹⁶ In 2017, TracFone Wireless (TracFone), an America Movil subsidiary, was the largest MVNO, with approximately 23 million subscribers.¹⁷ In 2015, Google launched “Project Fi,” an MVNO in partnership with T-Mobile and Sprint whereby Google Fi subscribers switch between Wi-Fi networks and these two service providers’ LTE networks.¹⁸ In 2016, both Comcast,¹⁹ and Charter

¹⁰ See *infra* Figure II.A-1.

¹¹ United States Cellular Corp., 2017 SEC Form 10-K, at 1 (filed Feb. 26, 2018), <https://www.sec.gov/Archives/edgar/data/821130/000082113018000008/usm10k.htm>. U.S. Cellular is a majority-owned (83%) subsidiary of Telephone and Data Systems, Inc. *Id.*

¹² *Id.* According to U.S. Cellular, its LTE network reached 99% of its customers. U.S. Cellular, U.S. Cellular Announces 2015 Statewide Investment in Iowa, <https://www.uscellular.com/about/press-room/2016/USCELLULAR-ANNOUNCES-2015-STATEWIDE-INVESTMENT-IN-IOWA.html> (last visited Nov. 19, 2018).

¹³ C Spire, About C Spire, https://www.cspire.com/company_info/about/news_detail.jsp?entryId=29600003 (last visited Nov. 19, 2018).

¹⁴ Examples of regional facilities-based service providers include Appalachian Wireless, Bluegrass Cellular, Carolina West Wireless, Cellcom, Choice Wireless, GCI, Nex-Tech Wireless, and Sagebrush Cellular.

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 *Twentieth Report*, 32 FCC Rcd 8976, at 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.” *Sixteenth Report*, 28 FCC Rcd at 3739, para. 32.

¹⁷ TracFone, TracFone Home, <http://www.tracfone.com/> (last visited Nov. 19, 2018); Prepaid Phone News, Fourth Quarter, 2017 Prepaid Mobile Subscriber Numbers by Operator (Feb. 19, 2018), <https://www.prepaidphonenews.com/2018/02/fourth-quarter-2017-prepaid-mobile.html>.

¹⁸ 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 WiFi service is also provided by two other MVNOs - FreedomPop (<https://www.freedompop.com/>) and Republic Wireless (<https://republicwireless.com/faqs/>).

¹⁹ FierceWireless, Comcast to Launch Wireless Service in 2017 with Verizon MVNO, 15M Wi-Fi Hotspots (Sept. 20, 2016), <http://www.fiercewireless.com/wireless/comcast-to-launch-wireless-service-2017-verizon-mvno-15m-wi-fi-hotspots>.

Communications,²⁰ the nation's two largest cable providers, activated MVNO options they held with Verizon Wireless. Comcast launched its wireless service in the spring of 2017 as Xfinity Mobile and had approximately 380,000 subscribers at year-end 2017.²¹ Charter began offering its service in the summer of 2018.²²

b. Connections/Subscribers

8. To estimate the number of mobile wireless subscribers/connections,²³ this *Report* uses Numbering Resource Utilization Forecast (NRUF) data, which tracks the quantity of phone numbers that have been assigned to mobile wireless devices,²⁴ CTIA data, and UBS data. As shown in Figure A-1 below,²⁵ the number of mobile wireless connections, based on NRUF,²⁶ grew by approximately 3% from year-end 2016 to year-end 2017 to approximately 411 million, while CTIA estimates of mobile wireless connections grew to approximately 400 million, an increase of approximately 1%. Figure A-2 presents data on total connections by service segment based on UBS data. It shows that, in 2017, the postpaid segment accounted for more than 60% of all connections, while the prepaid segment accounted for less than 20% of all connections, and wholesale connections and connected devices accounted for the remainder.²⁷

9. Figure 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 for 2017.²⁸ In addition, when measuring market share in terms of revenue, in 2017, Verizon Wireless's market share was 35.5%, compared to 32.4% for AT&T, 17% for T-Mobile, and 12.8% for

²⁰ 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>.

²¹ FireceWireless, Comcast's Xfinity Mobile MVNO Grows to 380,000 Customer Lines in Less than 1 Year (Jan. 24, 2018) <https://www.fiercewireless.com/wireless/comcast-s-xfinity-mobile-mvno-grows-to-380-000-customer-lines-less-than-1-year>.

²² Charter Communications NewsRoom, Introducing Spectrum Mobile (June 30, 2018) <https://newsroom.charter.com/news-views/introducing-spectrum-mobile/>.

²³ 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: "'Subscribers' is used as a term of art, and reflects the number of revenue-generating units, equally describable as 'wireless connections' – the equivalent of wireline 'lines.' The terms 'subscriber' and 'subscribership' do not denote unique individual subscribers." CTIA Wireless Industry Indices Year-End 2017, at 16.

²⁴ NRUF provides a measure of the number of mobile wireless connections or connected devices that have assigned telephone numbers. As the number of mobile wireless devices that lack telephone numbers increases, the NRUF data will become less accurate.

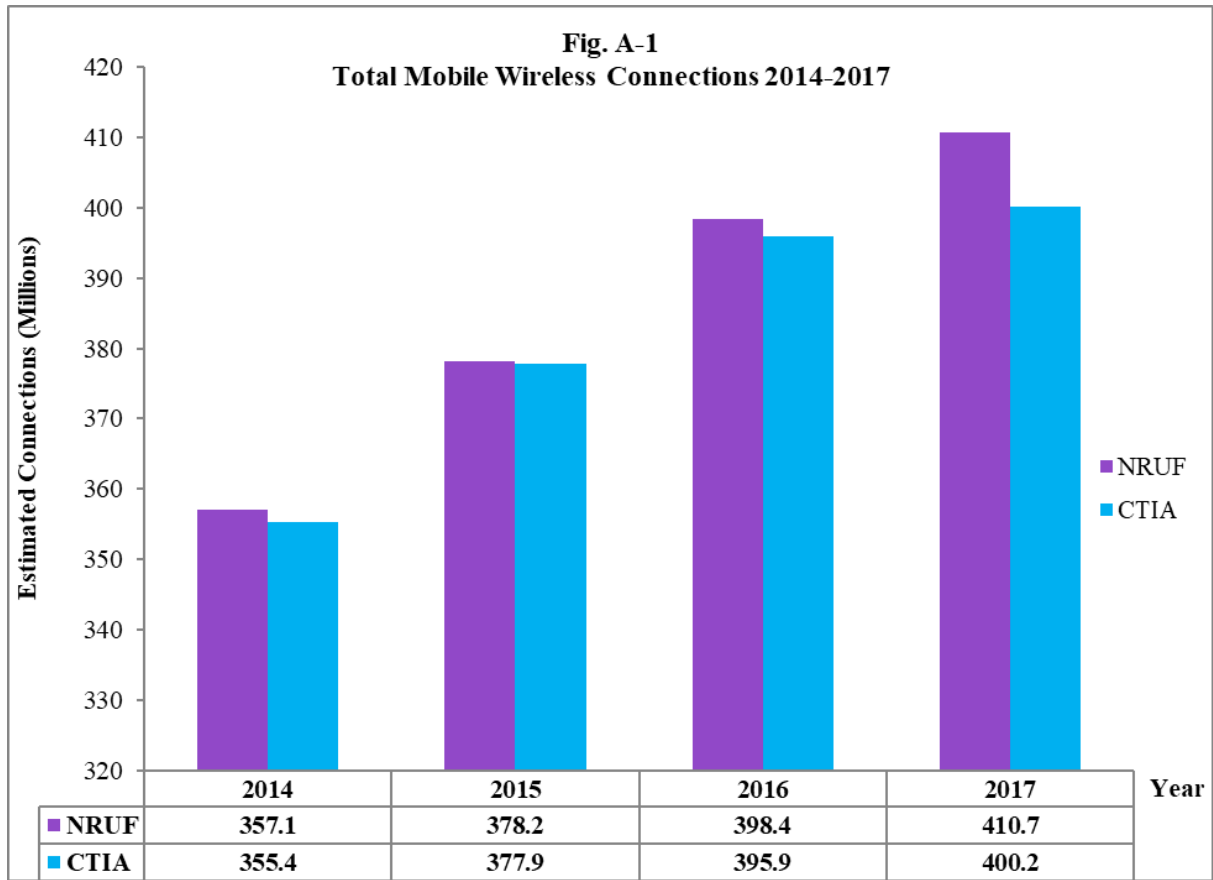
²⁵ For details of total mobile wireless connections over time, see Web Appendix I: Total Mobile Wireless Connections at XX.

²⁶ We have estimated penetration rates (the number of mobile wireless connections per 100 people), using NRUF for the 172 Economic Areas (EAs) in the United States. Our estimates suggest that 2017 regional penetration rates range from 99.9% in La Crosse, WI-MN to 186% in Davenport-Moline, IA-IL. Note that NRUF-based penetration rates can exceed 100% because NRUF identifies the number of connected devices that have associated telephone numbers, and a single subscriber may have multiple connected devices. See Web Appendix II: Penetration Rates by EA.

²⁷ Connected devices are primarily mobile, non-voice devices, including (but not limited to) Internet access devices (e.g., wireless modem cards and mobile Wi-Fi hotspots), tablets, e-readers, smart watches, and telematics systems.

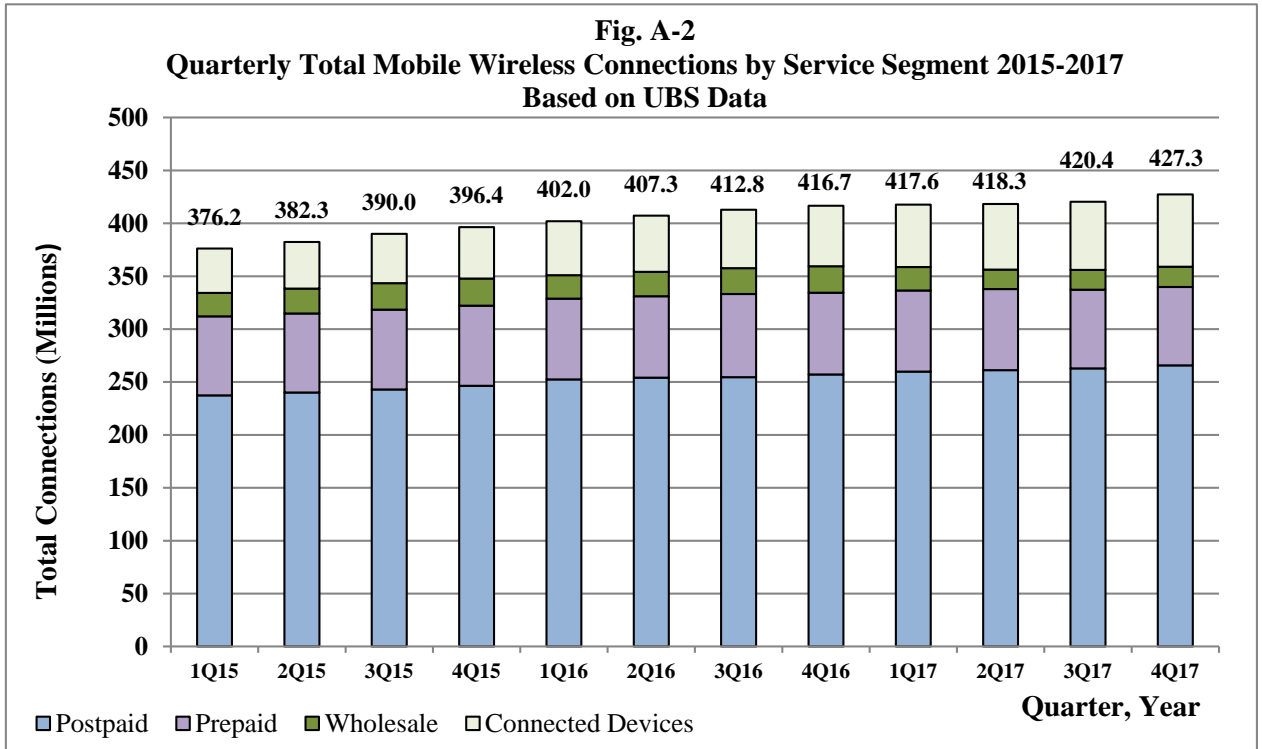
²⁸ The size of a company, typically measured by service revenues or subscribers, relative to the total size of the industry determines its market share. See *The MIT Dictionary of Modern Economics*, 268 (4th ed. 1992).

Sprint.²⁹



Source: NRUF, CTIA Wireless Industry Indices Year-End 2017.

²⁹ Based on UBS data, Verizon Wireless’s service revenues were \$63.1 billion, compared to \$57.7 billion for AT&T, \$30.2 billion, for T-Mobile, and \$22.7 billion for Sprint. For previous years, *see Twentieth Report*, 32 FCC Rcd at 8987-88, para. 32 and Table II.C.1. In 2017, total wireless service revenues were approximately \$179 billion, a year-over-year decrease of \$9.4 billion (or approximately 5%). CTIA Wireless Industry Indices Year-End 2017, at 58.



Source: UBS Investment Research. UBS US Wireless 411, Version 51, Figure 17; UBS US Wireless 411, Version 59, Figure 42; UBS Wireless 411, Feb. 2017, Figure 25; UBS Data 2017.

Fig. A-3
Estimated Total Connections for Publicly Traded Facilities–Based Mobile
Wireless Service Providers (in thousands): 2014–2017

Service Providers	EOY 2014	EOY 2015	EOY 2016	EOY 2017	EOY 2017 (% Market Share)
Verizon Wireless	134,612	140,924	145,859	151,978	35.1
AT&T	120,620	128,679	134,875	146,847	33.9
T-Mobile	55,018	63,282	71,455	74,040	17.1
Sprint	55,929	58,578	59,515	54,683	12.6
U.S. Cellular	4,760	4,876	5,079	5,063	1.2
Top 5 Service Providers Total	370,939	396,339	416,783	432,611	

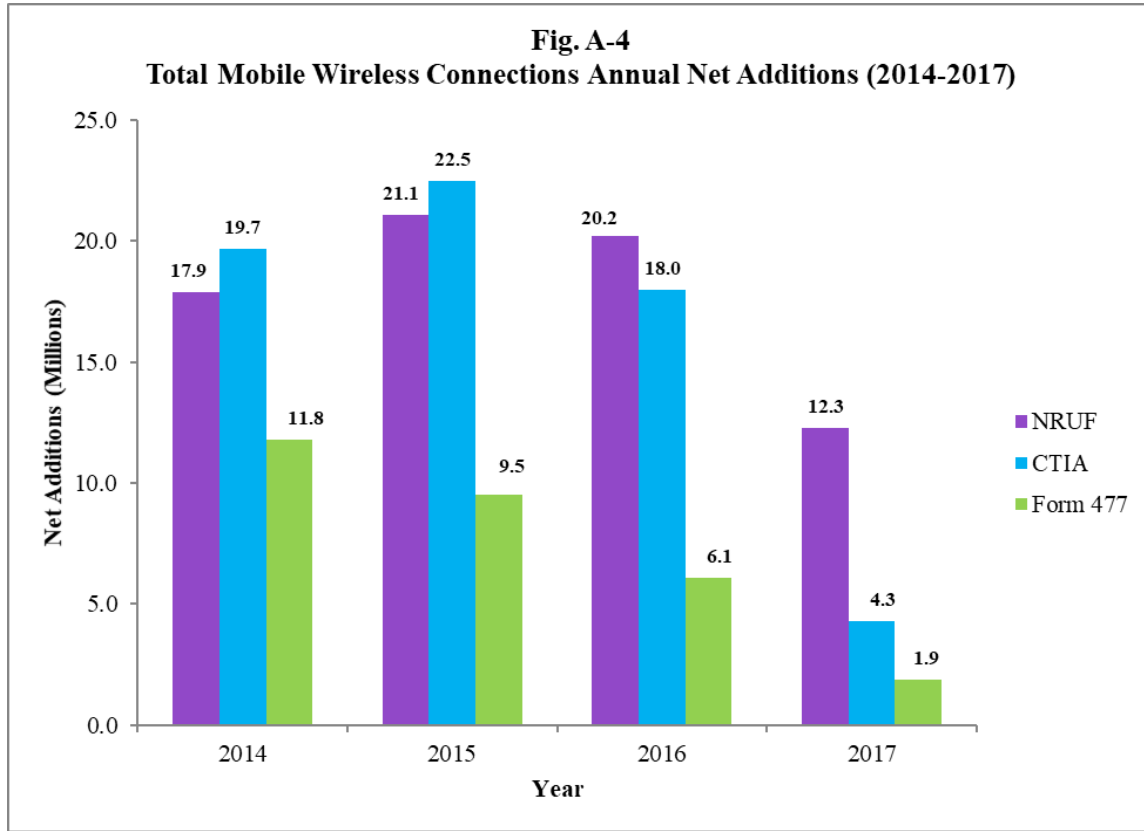
Source: UBS US Wireless 411, Version 51, Table 21; Version 59, Figure 53; UBS Wireless 411, Feb. 2017, Figure 33; and UBS Data 2017. Total estimated connections figure includes data only for the service providers reported in this table.

10. Estimates of the number of net additions in 2017 vary. As shown in Figure A-4, for 2017, there were approximately 12 million net additions based on NRUF data, compared with 4 million based on CTIA data. Preliminary mobile voice subscriber data as reported by service providers on Form 477 show that for 2017, net subscriber additions totaled approximately 2 million.³⁰ Figure A-5 below

³⁰ Based on Form 477, the preliminary total number of mobile voice telephone subscriptions at year-end 2017 was 338.2 million, as compared to 340.1 million at year-end 2016. We again note that the year-end Form 477 data are

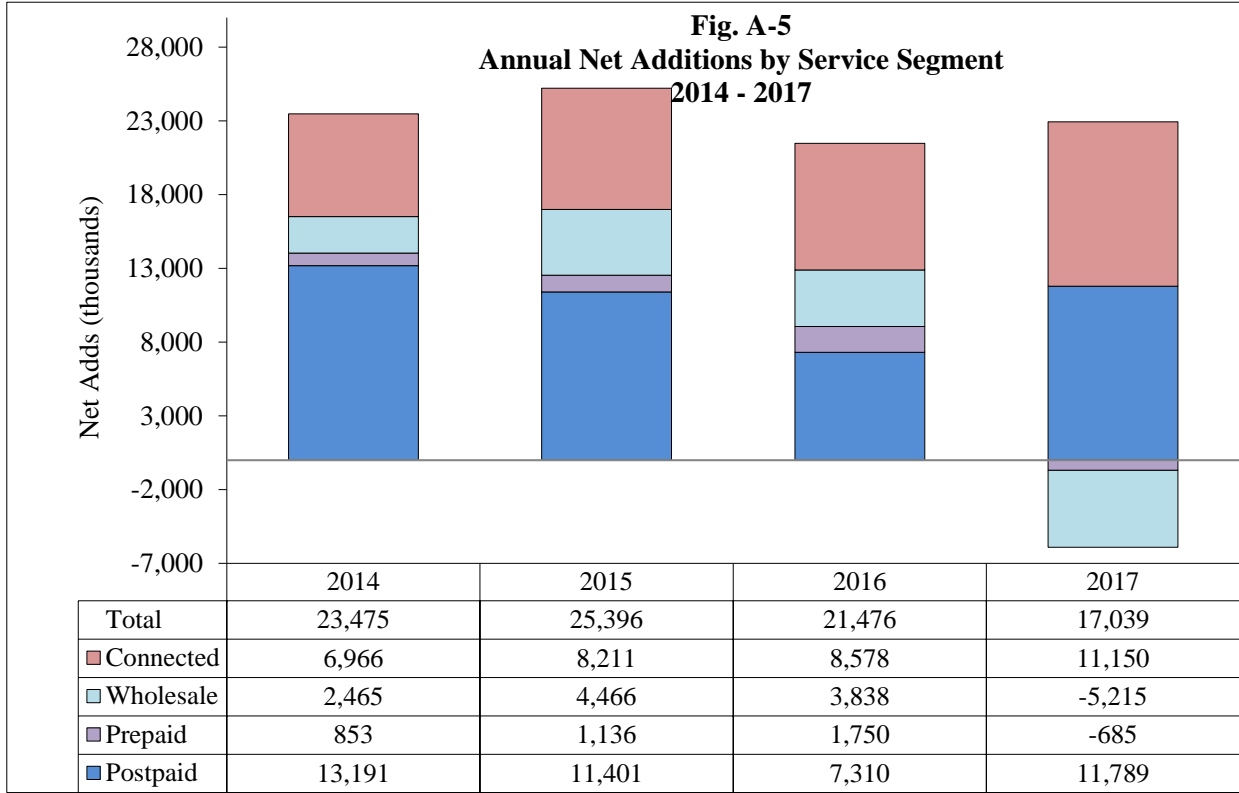
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shows that postpaid net additions increased in 2017, and that the net number of connected device additions was consistently higher than prepaid additions, from 2014 through 2017. Figure A-6, based on UBS data, shows net subscriber additions by the four nationwide service providers from 2014 through 2017.

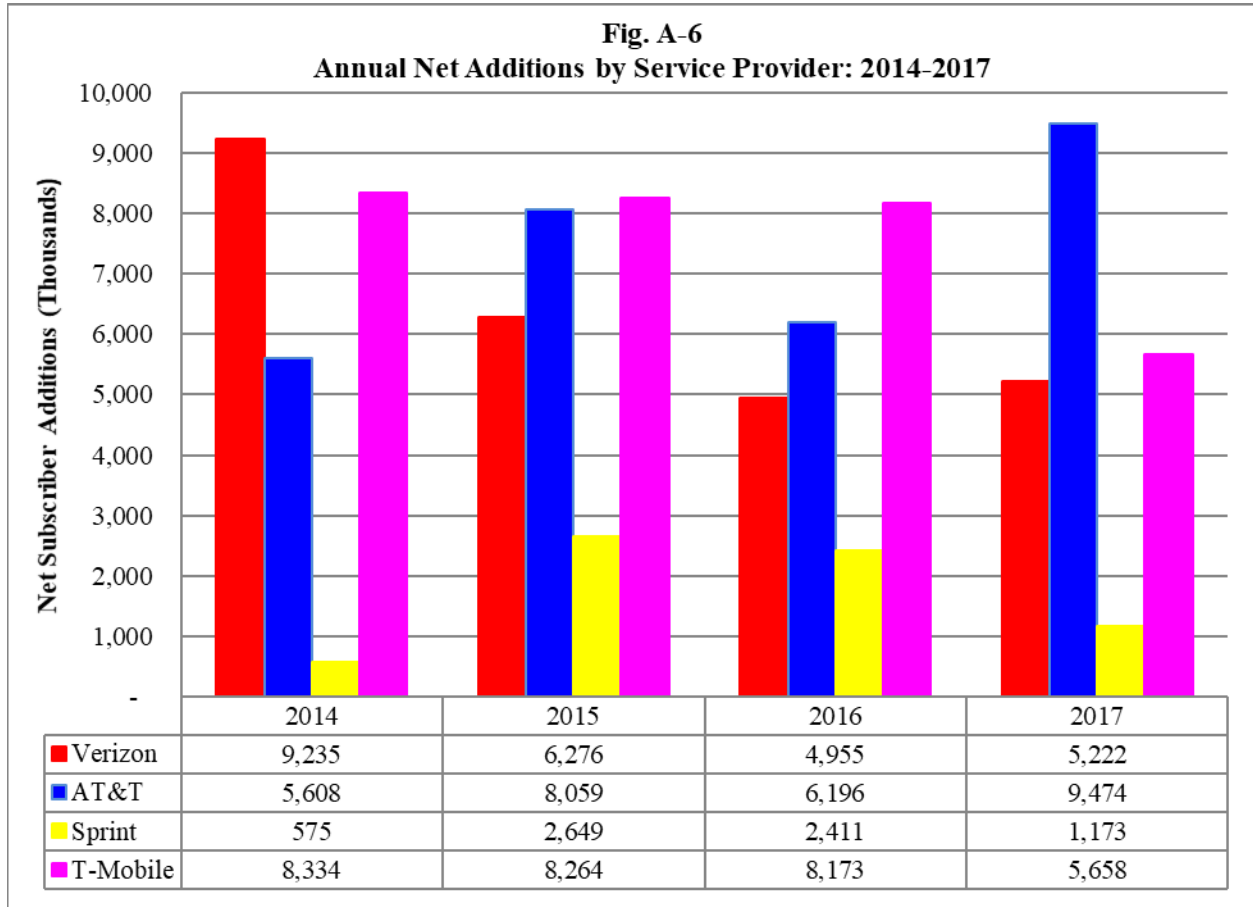


Source: NRUF, CTIA Wireless Industry Indices Year-End 2017, Form 477.

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 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, 2016 (Feb. 2018). <https://www.fcc.gov/voice-telephone-services-report>. These data do not include non-voice devices.



Source: UBS Investment Research. UBS US Wireless 411, V. 59, Figure 42; UBS US Wireless 411, Feb. 2017, Figure 25; and UBS Data 2017.



Source: UBS Investment Research. UBS US Wireless 411, Version 51, Figure 14; UBS US Wireless 411, Version 59, Figure 62; UBS Wireless 411 Feb. 2017, Figure 35; and UBS Data 2017.

c. Churn

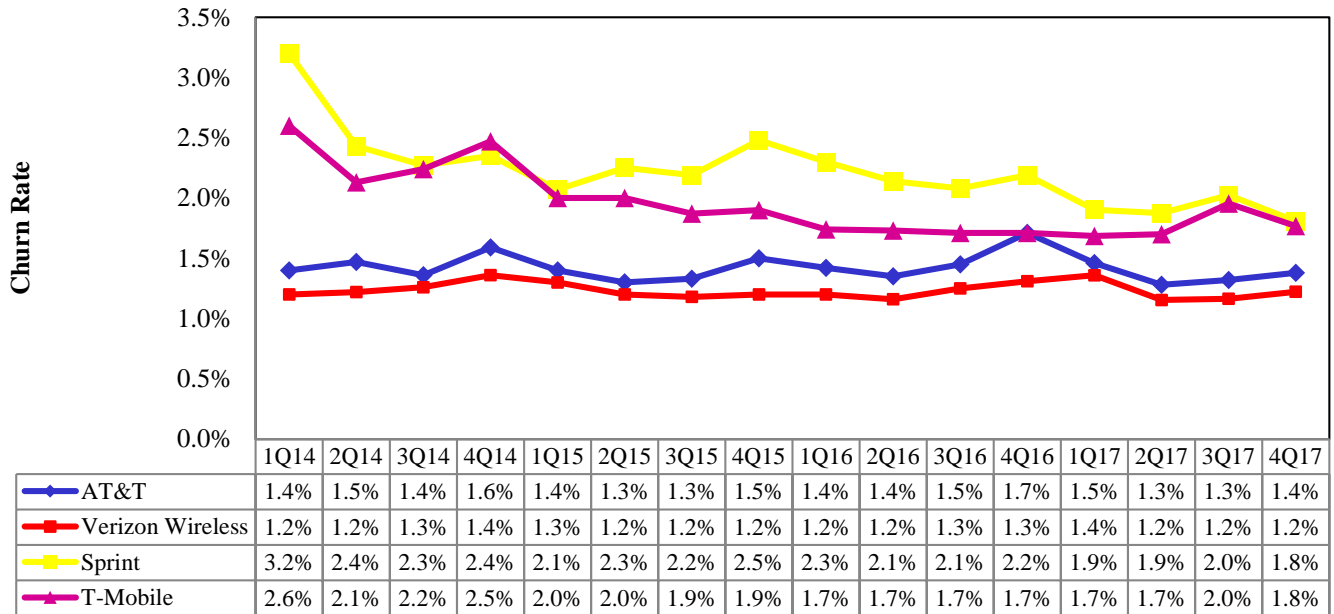
11. Churn measures the percentage of connections that are disconnected from mobile wireless service during a given time period.³¹ A service provider's churn rate depends on many factors, such as the distribution of its customers between postpaid and prepaid service plans, customer satisfaction with their service provider, and switching costs.³² High levels of industry churn can indicate that consumers are not only willing but are also able to switch easily between service providers. For 2017, CTIA reported an annual industry-wide churn rate of 15.9%, and a monthly rate of 1.3%.³³ Figure A-7 shows the churn rates for the four nationwide providers by quarter.

³¹ Churn is calculated by dividing the aggregate number of wireless subscriber connections who canceled service during a time period by the total number of wireless subscriber 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.

³² *Twentieth Report*, 32 FCC Rcd at 8984, para. 26; *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, 3865, para. 260 (2013) (*Sixteenth Report*).

³³ CTIA Wireless Industry Indices Year-End 2017, at 35. For prepaid services, CTIA reported an annual industry-wide churn rate of 48.3% and a monthly churn rate of 4%. *Id.* at Appendix C, 12.

Fig. A-7
Quarterly Churn Rate for Nationwide Mobile Wireless Providers
1st Quarter 2014- 4th Quarter 2017



Source: UBS Investment Research. UBS US Wireless 411, Version 49, Table 16. UBS US Wireless 411, Version 51, Figure 28. UBS US Wireless 411, Version 59, Figure 60; UBS US Wireless 411 Feb. 2017, Figure 35; and UBS Data 2017.

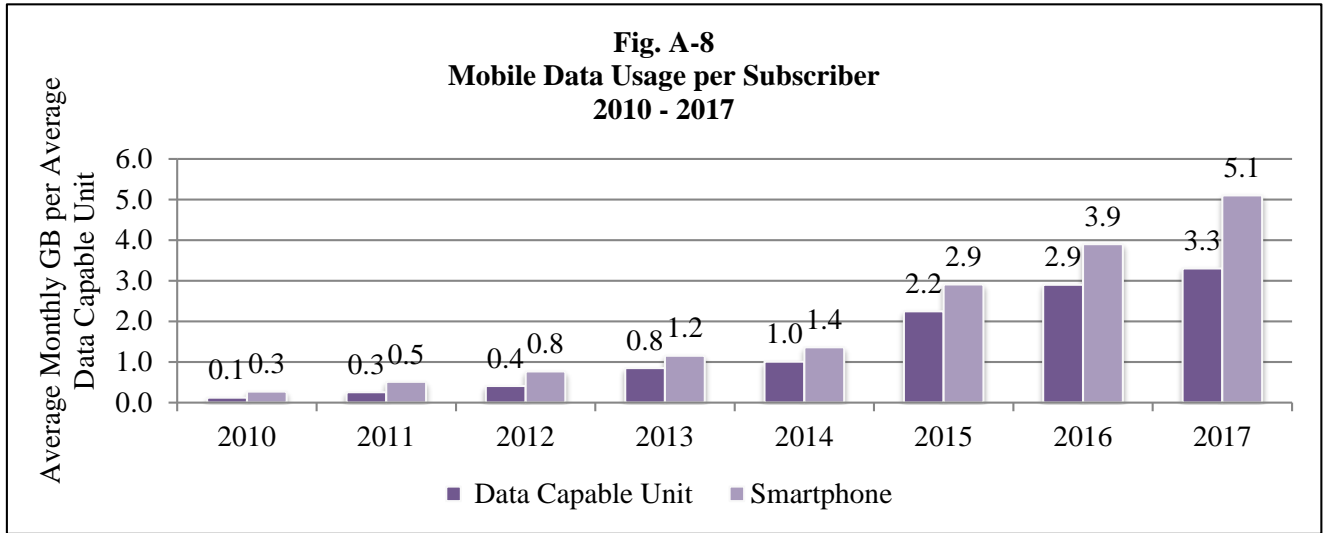
d. Data Usage

12. As shown in Figure A-8, monthly data usage per smartphone subscriber rose to an average of 5.1 GB per subscriber per month, an increase of approximately 31% from year-end 2016 to year-end 2017.³⁴ Figure A-9 shows that there was a corresponding drop in total annual minutes of voice use (MOUs) of approximately 21%,³⁵ and in total messaging traffic of approximately 9%.³⁶

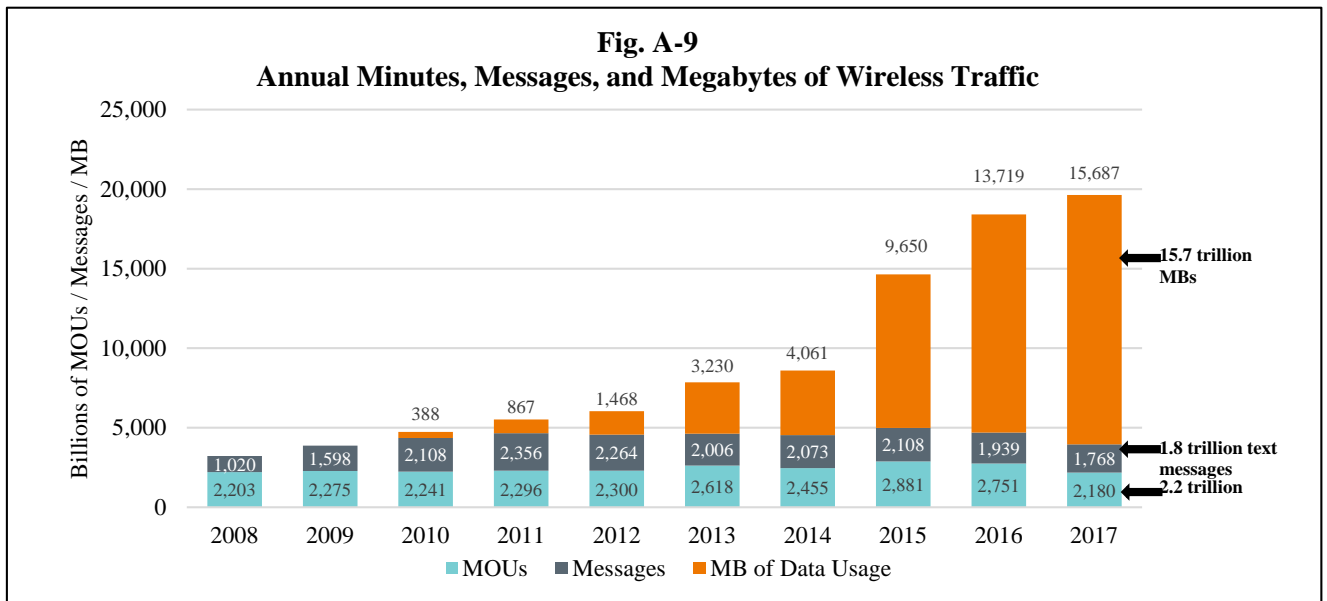
³⁴ *Id.* at 64, Chart 27.

³⁵ *Id.* at 60.

³⁶ *Id.* at 67. 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. *Id.* at 13.



Source: CTIA Wireless Industry Indices Year-End 2017, at 64, Chart 27.



Source: CTIA Wireless Industry Indices Year-End 2017, at 68, Chart 31.

13. According to a Pew survey, by the end of 2017, smartphone and tablet ownership were 77% and 53%, respectively, up from 51% and 31%, in 2012.³⁷ As of January 2018, Pew reported that one in five American adults are “smartphone-only” Internet users—they own a smartphone, but do not have traditional fixed home broadband service.³⁸ According to preliminary data from the Centers for Disease Control and Prevention (CDC), from December 2014 to December 2017, the percentage of U.S. households that were identified as wireless-only (no landline telephone service) increased from approximately 45% to approximately 54%.³⁹

³⁷ Pew Research Center, Mobile Fact Sheet (Feb. 5, 2018), <http://www.pewinternet.org/fact-sheet/mobile/>.

³⁸ *Id.*

³⁹ CDC, NCHS, Stephen J. Blumberg and Julian V. Luke, Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, July-December 2017, National Center for Health Statistics (June 2018), <https://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201806.pdf>.

2. Pricing Levels and Trends

14. The following discussion focuses on pricing developments and changes during the period covered by this *Report*.⁴⁰ We note first that mobile service providers offer nationwide pricing plans throughout their service areas, with little disparity in monthly recurring charges between rural and non-rural markets.⁴¹ The majority of mobile wireless subscribers in the United States are billed monthly, after service has been provided (postpaid service), while others pay for services in advance of receiving them (prepaid service).⁴²

a. Postpaid Service

15. In 2017, service providers continued the trend of offering unlimited data plans,⁴³ with major providers adding tiers to their unlimited data plans.⁴⁴ Providers also continued not to count certain types of data towards deprioritization and data limits (T-Mobile's "Binge On" program, for example).⁴⁵ Not only did service providers compete in pricing, they also competed to offer the best combination of features with their unlimited plans.⁴⁶ Verizon Wireless, for example, introduced two new unlimited plans in August 2017, Go Unlimited and Beyond Unlimited.⁴⁷ In February 2018, U.S. Cellular offered four lines with unlimited data for \$35 each.⁴⁸ Verizon Wireless added a new data plan called Above Unlimited

⁴⁰ This renders 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. *Connect America Fund*, Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663, 17694, 17708-09, paras. 85, 113, & 114 (2011).

⁴¹ *Twentieth Report*, 32 FCC Rcd at 9002, para. 48; *Sixteenth Report*, 28 FCC Rcd at 3797, para. 137.

⁴² 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. *Twentieth Report*, 32 FCC Rcd at 9005-06, para. 56.

⁴³ While a majority of unlimited plans are offered to postpaid subscribers, some providers now also offer unlimited to their prepaid subscribers.

⁴⁴ 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., Sprint, Sprint Unlimited Data, Talk and Text Cell Phone Plans, https://www.sprint.com/landings/unlimited-cell-phone-plans/?id16=unlimited%20Freedom%20%7CALL&question_box=unlimited%20Freedom%20%7CALL (last visited Nov. 19, 2018); Verizon Wireless, Above Unlimited FAQs, <https://www.verizonwireless.com/support/above-unlimited-faqs/> (last visited Nov. 19, 2018). 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, Mobile Share Flex Plans, <https://www.att.com/shop/wireless/data-plans.html> (last visited Nov. 19, 2018); AT&T, Rollover Data, <https://www.att.com/shop/wireless/rollover-data.html> (last visited Nov. 19, 2018).

⁴⁵ *Twentieth Report*, 32 FCC Rcd at 9004, para. 52.

⁴⁶ AT&T Comments at 8.

⁴⁷ Verizon Wireless, Verizon Unlimited (Aug. 22, 2017), <https://www.verizon.com/about/news/verizon-unlimited>. The Go Unlimited plan offers DVD-quality streaming and hotspot speeds of 600 Kbps for \$75 (1 line) per month, while Beyond Unlimited includes HD-quality streaming and mobile hotspot with up to 15 GB for \$85 (1 line) per month. The terms of service of Verizon Wireless's Unlimited Plans indicate that data may be temporarily slower during any time of congestion with the GO Unlimited plan, and may decrease in times of congestion, after 22 GB of data has been used with Beyond Unlimited. See, e.g., Verizon Wireless, Go Unlimited FAQs, <https://www.verizonwireless.com/support/go-unlimited-faqs/> (last visited Nov. 19, 2018); Verizon Wireless, Beyond Unlimited FAQs, <https://www.verizonwireless.com/support/beyond-unlimited-faqs/> (last visited Nov. 19, 2018).

⁴⁸ U.S. Cellular, U.S. Cellular Offering Four Lines With Unlimited Data For \$35 Each (Feb. 12, 2018), <https://www.uscellular.com/about/press-room/2018/USCELLULAR-OFFERING-FOUR-LINES-WITH-UNLIMITED-DATA-FOR-35-DOLLARS-EACH.html>.

in June 2018, that allows customers to mix and match different unlimited plans, and it includes 75 GB of LTE data, along with HD video streaming for \$95 (1 line) per month.⁴⁹ Later that month, AT&T launched two new top-tier unlimited data offerings, Unlimited & More for \$70 for a single line, and Unlimited & More Premium for \$80 for a single line (the latter includes its new WatchTV streaming video service).⁵⁰ In July 2018, Sprint introduced two new unlimited plans: its top-tier plan, Unlimited Plus, offers 1080p video streaming, 15 GB of personal hotspot data, subscriptions to Hulu and Tidal for \$70 per month for one line of service, while Unlimited Basic streams video at 480p resolution, includes 500 MB of personal hotspot service, and subscriptions to Hulu for \$60 per month for one line of service.⁵¹ In contrast, T-Mobile introduced a less expensive unlimited plan in August 2018, Essentials, which starts at \$60 for the first line and includes unlimited talk, text and smartphone data.⁵²

b. Prepaid Service

16. The four nationwide service providers also offer prepaid service under their own prepaid brands, in addition to selling mobile wireless service wholesale to MVNOs, which then resell service on the nationwide networks under a variety of prepaid brands. Verizon Wireless has the smallest share of prepaid subscribers among the nationwide service providers, with only one prepaid brand, Verizon Wireless Prepaid. To varying degrees, the other three nationwide service providers pursue a multi-brand prepaid strategy.⁵³ TracFone, the largest MVNO reseller, also has multiple prepaid brands, including Straight Talk, telcel, and SafeLink, which target different market and demographic segments such as premium, Hispanic, or low-income subscribers.⁵⁴

17. As postpaid offerings have shifted away from term contracts and equipment subsidies, 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, unlimited prepaid plans were first introduced in February 2017 by Sprint's Boost Mobile, and in October 2017, Boost Mobile offered a family plan of five lines with unlimited data for \$100 a month to consumers who switched service.⁵⁵ AT&T's Cricket offered new customers twelve months of unlimited data access, calls, texts and media messages in their Unlimited 2 Plan for \$40 a month in February 2018.⁵⁶ In April 2018, T-Mobile's

⁴⁹ Verizon Wireless, Mix and match your unlimited plans (Jun. 14, 2018), <https://www.verizon.com/about/news/mix-and-match-your-unlimited-plans>.

⁵⁰ AT&T, AT&T Debuts "WatchTV" With 2 New Unlimited Wireless (Jun. 21, 2018), http://about.att.com/newsroom/watchtv_app_with_unlimited_wireless.html.

⁵¹ Sprint, Sprint's Industry-Leading Unlimited Plans Just Got Even Better! New Unlimited Plans Include Features Customers Love for the Best Price (Jul. 12, 2018), <https://newsroom.sprint.com/sprints-industry-leading-unlimited-plans-just-got-even-better-new-unlimited-plans-include-features-customers-love-for-best-price.htm>.

⁵² T-Mobile, Introducing T-Mobile Essentials: Smartphone Freedom on a Great Network at the Right Price (Aug. 6, 2018), <https://www.t-mobile.com/news/introducing-t-mobile-essentials>.

⁵³ Sprint prepaid brands include Boost Mobile, Virgin Mobile, and Assurance Wireless (under the Assurance Wireless brand, Virgin Mobile provides service to Lifeline eligible subscribers and subscribers who have lost their Lifeline eligibility and retain Assurance Wireless retail service); AT&T prepaid brands include AT&T Prepaid and Cricket; and T-Mobile prepaid brands include MetroPCS.

⁵⁴ TracFone Wireless Inc., Brands, <http://www.tracfonewirelessinc.com/en/brands/> (last visited Nov. 19, 2018).

⁵⁵ Boost Mobile, Boost Mobile Offers Unsurpassed Value in Family Plans – Five Lines with Unlimited Gigs for \$100 a Month and Free Phones (Oct. 25, 2017), <http://newsroom.sprint.com/boost-mobile-offers-unsurpassed-value-in-family-plans-five-lines-with-unlimited-gigs-for-100-month-and-free-phones.htm>.

⁵⁶ Cricket, Cricket Helps Make Your Tax Refund Go Further with Unlimited Data for Just \$40/Month <http://cricketwireless.mediaroom.com/cricket-helps-make-your-tax-refund-go-further-with-unlimited-data-for-just-40-month> (last visited Nov. 19, 2018).

MetroPCS offered new customers two months of unlimited data for free.⁵⁷ 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. For example, Cricket reduces data download speeds to a maximum of 128 Kbps after the customer's high-speed data allowance is used.⁵⁸

c. Price Indicators for Mobile Wireless Services

18. It is difficult to directly compare prices because providers offer a variety of plans, frequently under multipart pricing schemes, which also vary in non-price terms and features, such as the consequences of reaching usage limits.⁵⁹ Figures A-10 and A-11 present monthly postpaid prices for the four nationwide service providers' standard and premium unlimited plans, including discounts for auto-pay, which are now common.⁶⁰ Figure A-12 shows the current monthly prices for major prepaid service providers. Premium plans tend to have higher thresholds of data usage before deprioritization, more 4G LTE hotspot data, increased streaming video quality, and increased international allowances compared with standard plans offered by the same provider. Unlimited service is also the primary offering of prepaid plans, though postpaid users frequently are given priority over prepaid users on a given network during times of peak congestion.⁶¹ Further, the heaviest postpaid users may also experience deprioritized speeds during periods of peak network congestion after they have exceeded certain monthly data thresholds.⁶²

⁵⁷ T-Mobile, Switch to MetroPCS Today and get TWO Months Unlimited Data Free (Apr. 12, 2018), <https://www.t-mobile.com/news/metropcs-two-months-free>.

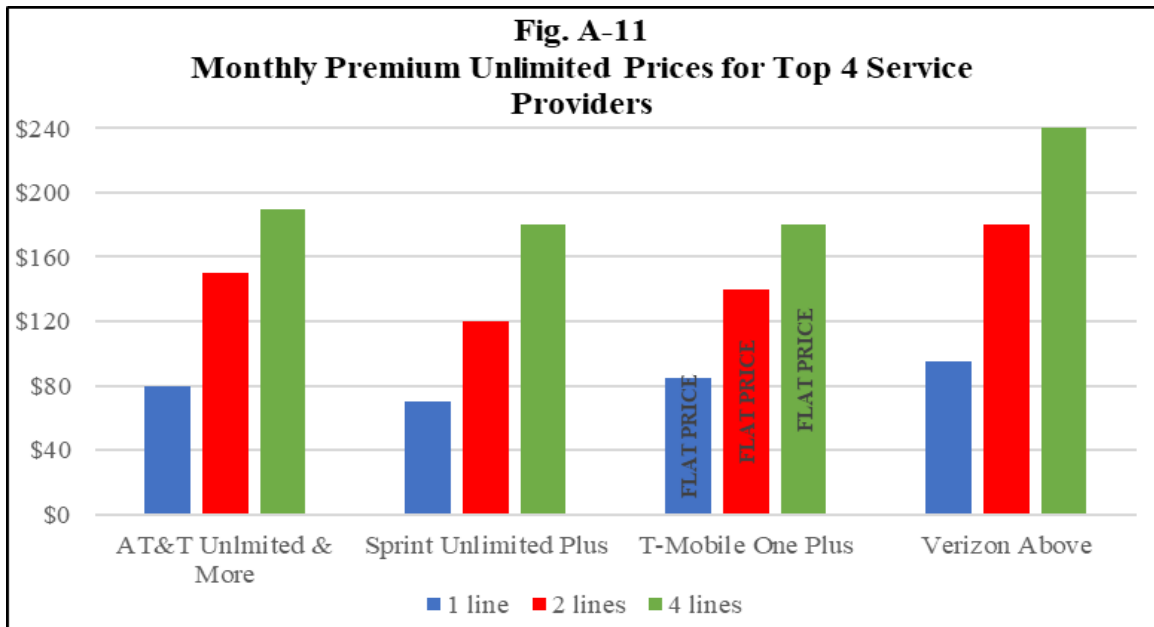
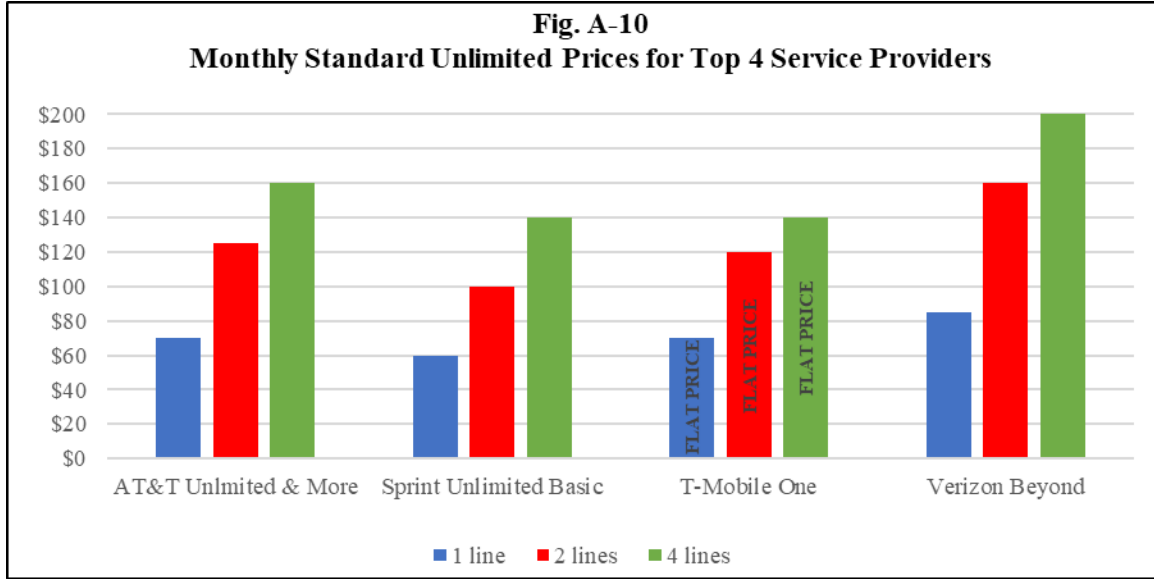
⁵⁸ Cricket Wireless, Mobile Broadband Information, <https://www.cricketwireless.com/legal-info/mobile-broadband-information.html> (last visited Nov. 19, 2018).

⁵⁹ 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 and any average price comparison implicitly assumes uniform subscribership of all plans. *See, e.g., Twentieth Report*, 32 FCC Rcd at 9006, para. 57; *Sixteenth Report*, 28 FCC Rcd at 3797, para. 137. According to analysis by Recon Analytics, the cost per MB has fallen significantly over the past decade, from \$1.37 per MB in 2007 to less than half a cent per MB in 2016. FierceWireless, Industry Voices—Entner: Consumer 'Surplus' in Wireless Rises \$192B in 2 Years (Aug. 14, 2017), <http://www.fiercewireless.com/wireless/industry-voices-entner-consumer-surplus-wireless-rises-192b-2-years>.

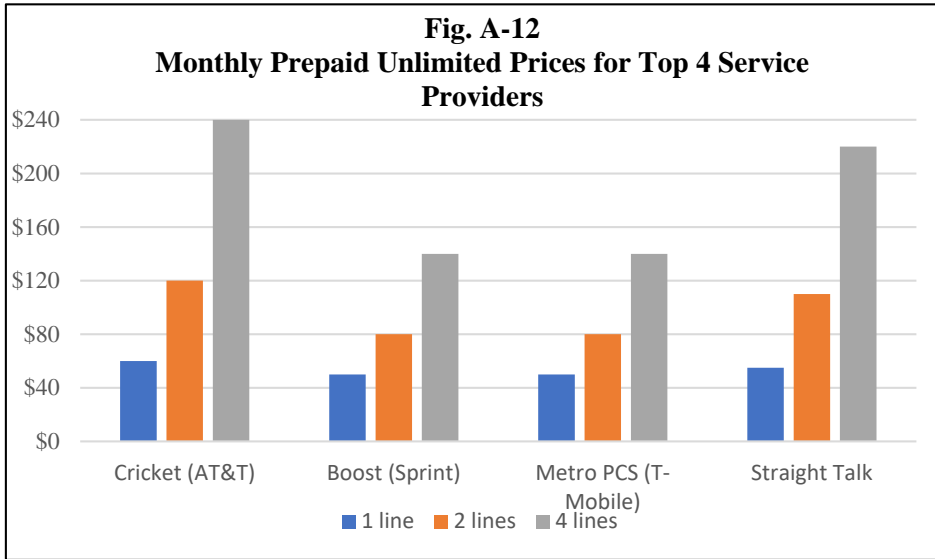
⁶⁰ In addition, T-Mobile incorporates taxes and fees into its advertised prices for its T-Mobile One plan. As these fees vary by locality, there is no way to fully account for the differences in pricing in Figures A-10 and A-11.

⁶¹ 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* <https://www.metropcs.com/terms-conditions/terms-conditions-service.html>.

⁶² As noted above, the average consumer uses about 5 GB of data per month, and after a certain level of data consumption (between 20 and 50 GB depending on the provider), data may be deprioritized. *See* Section II.A.1.d.



Note: The prices for unlimited data plans in Figures A-10 and A-11 were taken from service providers’ websites on September 1, 2018. Prices include any per line charges indicated by the service provider. 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. Prices and the specifics of the plans are subject to change.



Note: The prices were taken from service providers’ websites on September 1, 2018. Prices include any per line charges indicated by the service provider. Prices and the specifics of the plans are subject to change.

19. *CPI.* The Consumer Price Index (CPI) is a measure of the average change over time in the prices paid by consumers for a fixed market basket of consumer goods and services. As documented in previous *Reports*, two different pricing indicators—the Wireless Telephone Services CPI,⁶³ and the per-minute price of voice service—show that mobile wireless prices have declined significantly since the mid-1990s.⁶⁴ According to CPI data, the price (in constant dollars) of mobile wireless services has continued to decline: from 2016 to 2017, the annual Wireless Telephone Services CPI decreased by 11% while the overall CPI increased by 2%, and the broader Telephone Services CPI fell by 7%.⁶⁵ Further, from 2013 through 2017, the annual Wireless Telephone Services CPI decreased by approximately 17% and the Telephone Services CPI decreased by approximately 10%, while the overall CPI increased by approximately 5%.

20. *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 complex rate structures, such as mobile wireless service.⁶⁶ As shown in Figure A-13 below, which is based on

⁶³ All CPI figures were taken from BLS databases: Bureau of Labor Statistics, <http://www.bls.gov> (last visited Nov. 19, 2018). 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> (last visited Nov. 19, 2018). 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> (last visited Nov. 19, 2018).

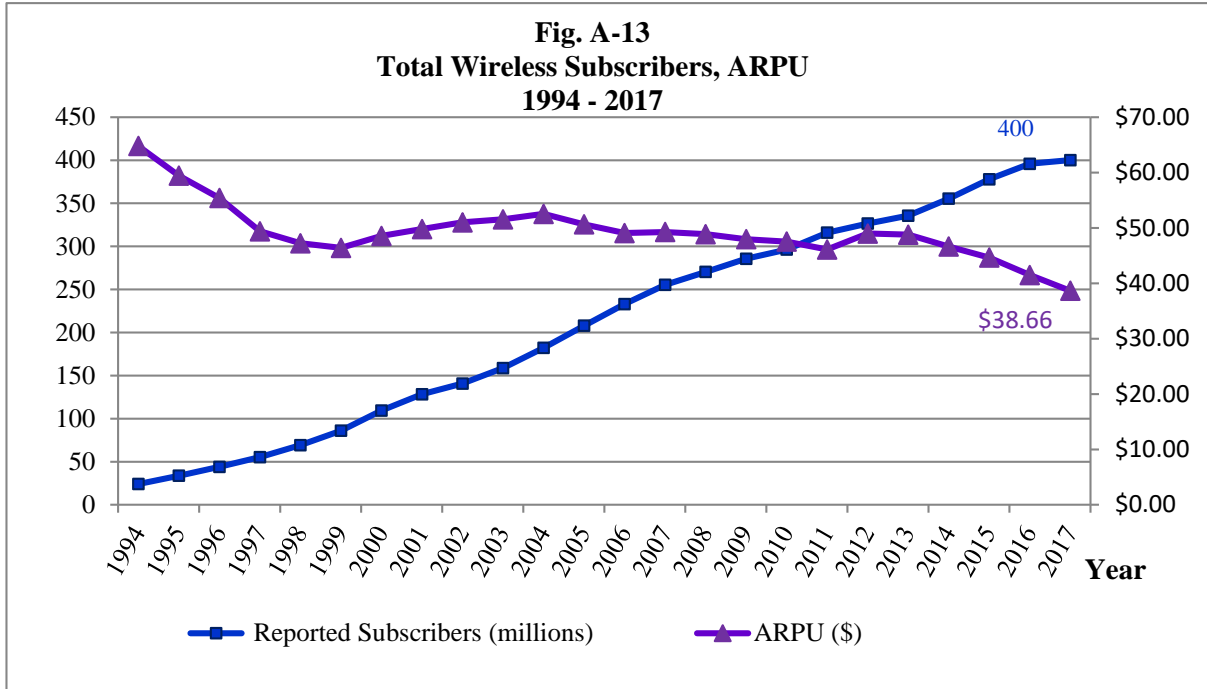
⁶⁴ See, e.g., *Twentieth Report*, 32 FCC Rcd at 9008, para. 58; *Sixteenth Report*, 28 FCC Rcd at 3875, 3877, para. 265, Table 38.

⁶⁵ For changes in the CPI over time, see Web Appendix III: CPI at XX.

⁶⁶ *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 Report*); Patrick McCloughan and Sean Lyons, *Accounting for ARPU: New evidence from international panel data*,

(continued....)

CTIA data, industry ARPU fell sharply during 2017 from \$41.50 to \$38.66, a decline of approximately 7%.⁶⁷ Recent changes by service providers, such as the removal of overage charges, the move toward unlimited data plans, and Equipment Installment Plans (EIPs) have all contributed to the reported decline in ARPU. Figure A-13 also shows subscribers/connections and ARPU for more than 20 years.⁶⁸



Source: Based on CTIA Wireless Industry Indices Year-End 2017.

21. *Average Revenue Per Unit by Service Provider.* Based on UBS estimates, as seen in Figure A-14, from the fourth quarter of 2014 to the fourth quarter of 2017, ARPU declined for all service providers, with the exception of T-Mobile: AT&T’s ARPU declined by approximately 19.5; Sprint’s ARPU declined by approximately 20%; Verizon Wireless’s ARPU declined by approximately 23%; while T-Mobile’s ARPU was virtually constant. Industry ARPU declined by approximately 18% over this time period.

(Continued from previous page) _____
 Telecommunications Policy 30, 521-32 (2006); Eun-A Park, Krishna Jayakar, *Competition between Standards and the Prices of Mobile Telecommunication Services: Analysis of Panel Data*, TPRC 2015 (Aug. 15, 2015).

⁶⁷ 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 Wireless Industry Indices Year-End 2017, at 8.

⁶⁸ For additional details on ARPUs from 1993 to 2017, see Web Appendix IV: ARPU at XX.

Fig. A-14

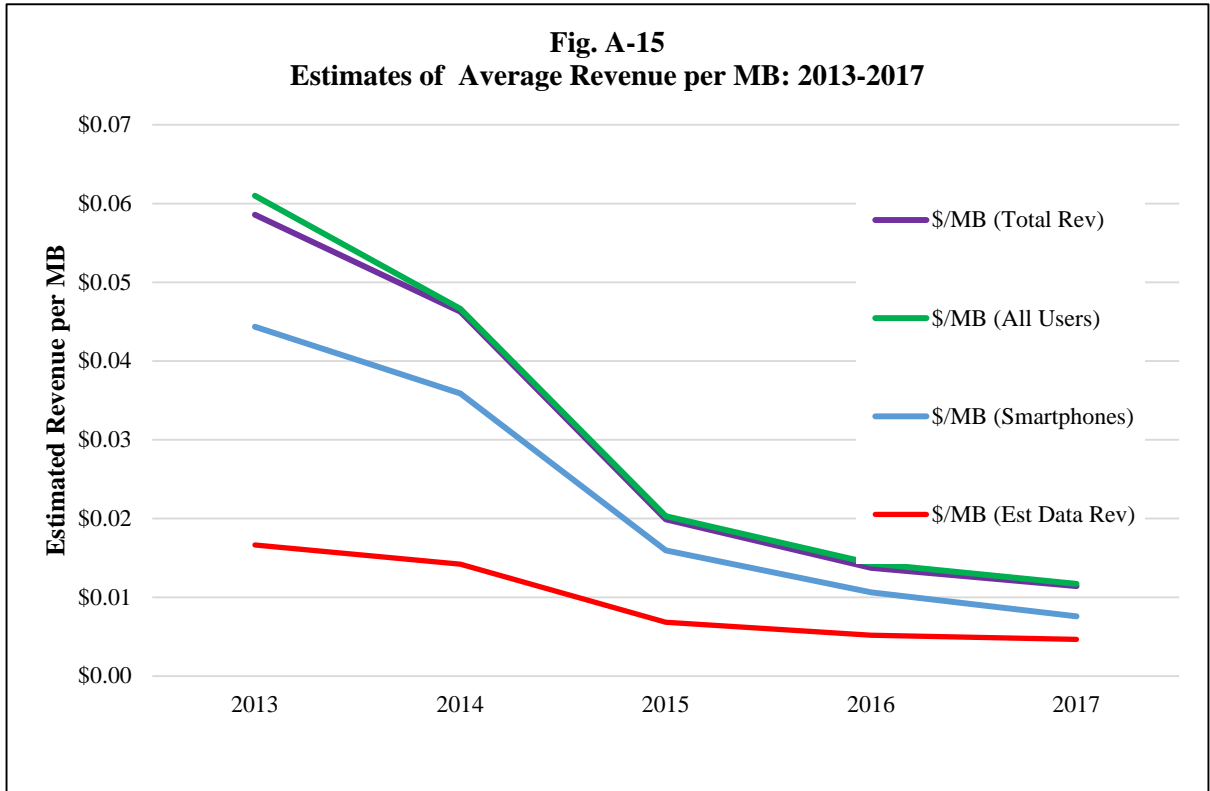
**ARPU Estimates of Publicly Traded Facilities-Based Mobile Wireless Service Providers
4th Quarter 2014–4th Quarter 2017**

Nationwide Providers	4Q14	4Q15	4Q16	4Q17
AT&T	\$42.04	\$38.78	\$36.58	\$34.13
Sprint	\$40.44	\$35.54	\$32.03	\$32.49
T-Mobile	\$35.56	\$34.53	\$33.80	\$35.62
Verizon Wireless	\$45.52	\$40.99	\$37.52	\$35.27
U.S. Cellular	\$53.58	\$49.32	\$49.03	\$46.89
Industry ARPU	\$42.27	\$38.54	\$35.93	\$34.73

Source: UBS Data 2017.

22. *Estimated Average Revenue per MB.* 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 a true price per megabyte (MB) data used. However, by making certain assumptions,⁶⁹ we can calculate various industry-wide estimates of the average revenues per MB. Figure A-15 below shows four different estimates of the average revenue per MB, based on data from CTIA and the U.S. Census Bureau. All four estimates indicate that average revenue per MB has been declining. Specifically, as of year-end 2017, these estimates show a decrease of approximately 10% to approximately 29% compared to 2016, and a decrease of approximately 72% to approximately 83% compared to 2013.

⁶⁹ For a full discussion of the methodology used to derive \$/MB, see *Twentieth Report*, 32 FCC Rcd at 9010, para. 61 & n.202.



Source: Based on data from the CTIA Wireless Industry Indices Year-End 2017 and the U.S. Census.

3. Non-Price Competition

a. Investment

23. Over the past 8 years, mobile wireless service providers in the United States have invested, based on CTIA data,⁷⁰ more than \$229.5 billion in their networks,⁷¹ which has resulted in higher data speeds, expanded network coverage, and increased network densification.⁷² Based on UBS data, wireless service providers made capital investments of \$28.5 billion in 2017, an increase of approximately 2.3% from the \$27.9 billion invested in 2016. As shown in Figure A-16, absolute capital expenditures by AT&T and Verizon Wireless consistently have exceeded those by T-Mobile and Sprint. In 2016-17, AT&T, T-Mobile, and Verizon Wireless each had CAPEX of approximately 16.3% to 17.4% of service revenue.⁷³ CAPEX by Sprint, on the other hand, fell considerably in this time period, from approximately 17% of service revenue in 2015, to 7.5% in 2016, before increasing to 11% in 2017.⁷⁴ The mobile

⁷⁰ 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 Wireless Industry Indices Year-End 2017, at 47.

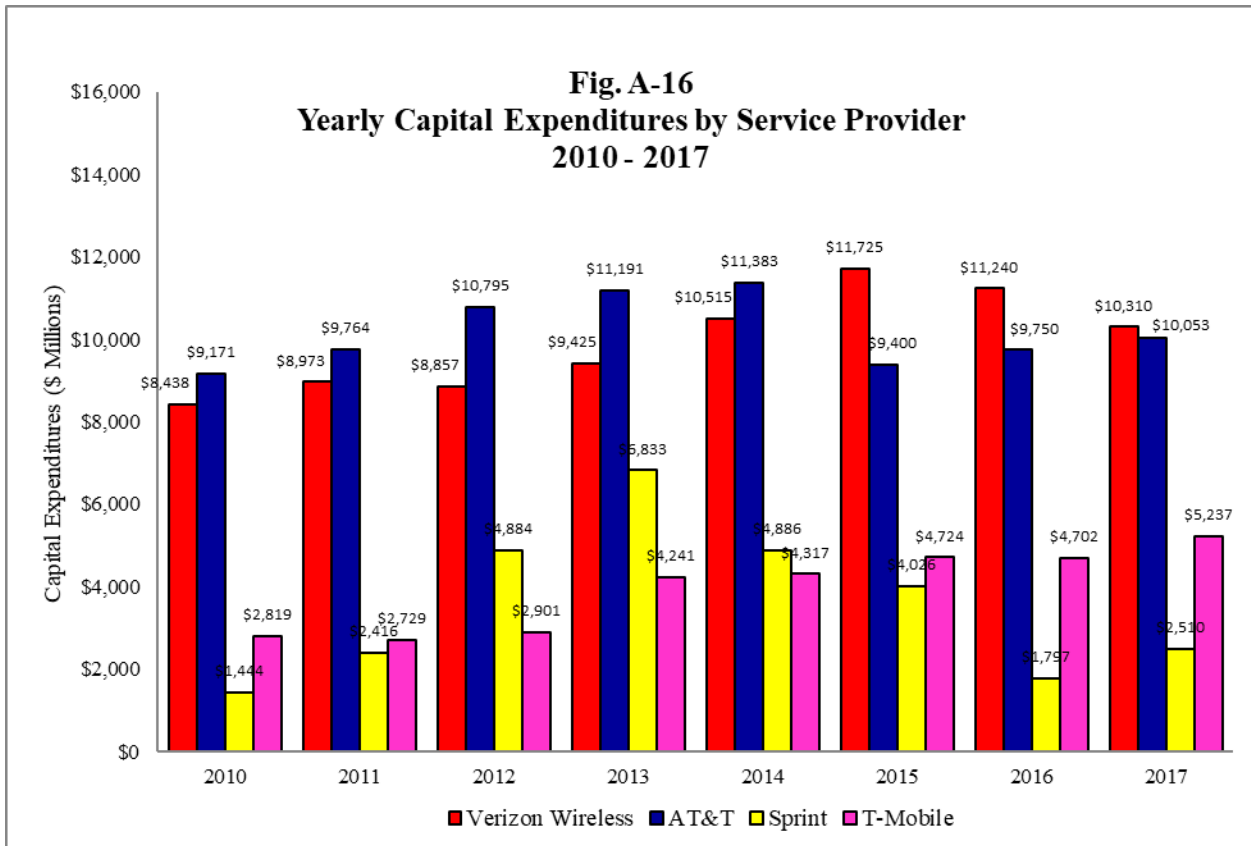
⁷¹ CTIA Wireless Industry Indices Year-End 2017, at 47.

⁷² The *Sixteenth Report* noted that 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 consistent with the cyclical nature of technological adoption in the mobile wireless service industry. *Sixteenth Report*, 28 FCC Rcd at 3842, para. 215.

⁷³ UBS Data, Sept. 2018.

⁷⁴ *Id.*

wireless industry is currently in the process of preparing for the introduction of 5G services, and equipment vendors such as Ericsson reported that its “networks segment saw a 2% increase year-over-year with North American (U.S.) operators’ investments in 5G driving that growth.”⁷⁵



Source: UBS US Wireless 411, Version 55, Figure 54; UBS US Wireless 411, Version 57, Figure 60; UBS US Wireless 411, Version 59, Figure 72; Wireless 411, February 2017, Figure 38; UBS Data 2017.

b. Mobile Wireless Devices, Services, and Advertising

24. Mobile wireless service providers compete by offering consumers a large variety of mobile wireless devices and differentiated services at a variety of prices.⁷⁶ In addition, they compete for customers by advertising and marketing, with marketing campaigns focusing on the quality, coverage, and reliability of their mobile broadband networks.⁷⁷ They also have promoted the advantages of their particular service plans, including unlimited plans and the prices of their plans relative to those of their rivals.⁷⁸ Some providers marketed mobile wireless service plan bundles with content offerings or device offerings: for example, Verizon Wireless advertised its unlimited plan alongside an offering for Google’s Pixel 2 phone, while Sprint and AT&T both advertised their plans alongside offerings for Apple’s iPhone.⁷⁹ AT&T advertised free HBO with its unlimited data plans, and T-Mobile advertised a free

⁷⁵ RCR Wireless, Ericsson focused on 5G in the US, its biggest market (Aug. 10, 2018), <https://www.rcrwireless.com/20180810/5g/ericsson-focused-on-5g-in-the-us-its-biggest-market>.

⁷⁶ *Twentieth Report*, 32 FCC Rcd at 9011, para. 62.

⁷⁷ See *id.* at 9013, para. 66; FierceWireless, The Top 5 Wireless Ads: Verizon spends \$30M on Pixel 2 spots in November (Dec. 12, 2017), <https://www.fiercewireless.com/wireless/top-5-wireless-ads-verizon-spends-30m-pixel-2-spots>.

⁷⁸ *Id.*

⁷⁹ *Id.*

subscription to Netflix.⁸⁰ In 2017, Verizon Wireless spent more than \$2.6 billion on advertising, down slightly from \$2.7 billion in 2016; AT&T spent \$3.8 billion, similar to its 2016 spending; T-Mobile spent \$1.8 billion, up slightly from \$1.7 billion in 2016; and Sprint spent \$1.3 billion, up slightly from \$1.1 billion in 2016.⁸¹

c. Speed of Service

25. 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.⁸² 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.⁸³ Because these and other factors cause variations in mobile network performance, various methodologies are used 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 while 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.⁸⁴ This *Report* presents speed data using the Ookla Net Index data (crowdsourced), OpenSignal data (crowdsourced), and RootMetrics (structured sample).⁸⁵

26. Figures A-17 and A-18 present the nationwide mean and median LTE download and upload speeds based on Ookla data by service provider for the second half of 2016 through the second half of 2017.⁸⁶ Figure A-19 presents the increase over time for mean and median LTE download speeds

⁸⁰ *Id.*

⁸¹ Verizon, 2017 Annual Report (Form 10-K) at note 14 (Feb. 23, 2018); Verizon, 2016 Annual Report (Form 10-K) at note 14 (Feb. 21, 2017); AT&T Inc., 2017 Annual Report (Form 10-K) at note 19 (Feb. 20, 2018); AT&T Inc., 2016 Annual Report (Form 10-K) at note 18 (Feb. 17, 2017); T-Mobile 2017 Annual Report (Form 10-K) at 68 (Feb. 20, 2018); T-Mobile 2016 Annual Report (Form 10-K) at 60 (Feb. 14, 2017); Sprint, 2017 Annual Report (Form 10-K) at F-17 (May 24, 2018); Sprint, 2016 Annual Report (Form 10-K) at F-16 (May 26, 2017).

⁸² See generally *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 17-199, 33 FCC Rcd 1660, 1673, para. 32 & n.92 (2018) (2018 *Broadband Deployment Report*). In addition, in the section on broadband deployment, we assess the extent to which Americans are covered by mobile LTE (based on 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).

⁸³ For a detailed discussion of the various factors, see *Twentieth Report*, 32 FCC Rcd at 9033, para. 87; *Sixteenth Report*, 28 FCC Rcd at 3895, para. 293.

⁸⁴ For a detailed discussion of crowdsourcing and structured sample data, see *Twentieth Report*, 32 FCC Rcd at 9033-34, para. 88.

⁸⁵ The results based on the CalSPEED drive-test data gathered by the California Public Utility Commission (CPUC) (structured sample) can be found in the Web Appendix V: Mobile Wireless Speeds at XX. In addition, while speed metrics based on the FCC Speed Test (available for both Android phones and the iPhone) were reported in the *Seventeenth Report* through the *Nineteenth Report*, we did not report these metrics in the *Twentieth Report* and do not report them in this *Report* due to certain anomalies found in the underlying data. An in-depth discussion of the Measuring Broadband America Program's FCC Speed Test is available in the *Seventeenth Report*. *Seventeenth Report*, 29 FCC Rcd at 15467, Appendix VI., paras. 7-9; see also FCC, Measuring Mobile Broadband Performance, <http://www.fcc.gov/measuring-broadband-america/mobile> (last visited Nov. 19, 2018).

⁸⁶ Ookla gathers crowdsourced mobile speed data through the use of its Speedtest mobile app. Speedtest, Ookla Speedtest Mobile Apps, <http://www.speedtest.net/mobile/> (last visited Nov. 19, 2018). An in-depth discussion of the Ookla speed test is available in the *Seventeenth Report*. *Seventeenth Report*, 29 FCC Rcd at 15465-66, Appendix VI., paras. 1-6. The upload and download speeds were calculated by Ookla and provided to the Commission for use in this *Report*. Note that in recent years, Ookla has updated their data cleaning and aggregation rules, and thus the reported data may differ slightly from previous *Reports*.

for all providers, from the first half of 2016 through the first half of 2018. Based on Ookla data, Figure A-19 indicates that the median LTE download speed increased from 12.8 Mbps to 19.5 Mbps, an increase of approximately 52%, over this time period.

Fig. A-17

Ookla Speed Test--Estimated LTE Download Speeds by Service Provider, Nationwide

Service Provider	2H2016			1H2017			2H2017		
	Mean Down load Speed (Mbps)	Median Down load Speed (Mbps)	Number of Tests ('000s)	Mean Down load Speed (Mbps)	Median Down load Speed (Mbps)	Number of Tests ('000s)	Mean Down load Speed (Mbps)	Median Down load Speed (Mbps)	Number of Tests ('000s)
AT&T	22.74	16.23	2,519	23.63	16.12	2,664	23.66	15.55	2,834
Sprint	15.51	9.20	2,269	18.11	9.81	2,407	21.78	11.11	2,123
T-Mobile	23.61	16.72	3,744	26.20	18.32	3,769	30.48	21.12	3,498
Verizon Wireless	23.51	17.12	3,044	23.82	16.32	4,362	25.93	16.78	4,269

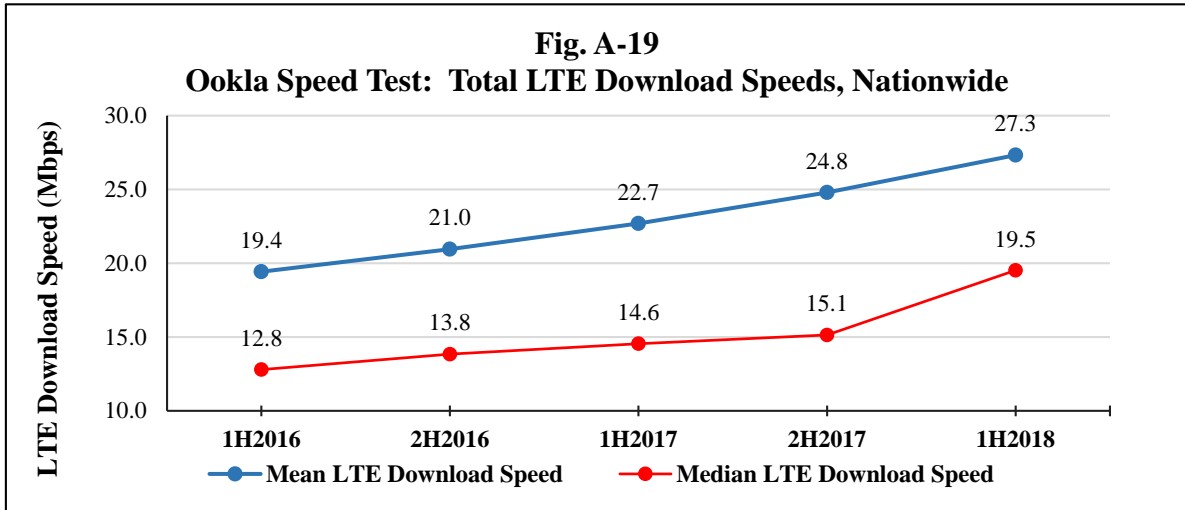
Source: Ookla SPEEDTEST intelligence data, © 2018 Ookla, LLC. All rights reserved. Published with permission of Ookla.

Fig. A-18

Ookla Speed Test - Estimated LTE Upload Speeds by Service Provider, Nationwide

Service Provider	2H2016			1H2017			2H2017		
	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	7.42	5.23	2,519	7.46	5.13	2,664	7.53	4.91	2,834
Sprint	4.73	3.48	2,269	4.83	3.51	2,407	3.82	2.69	2,123
T-Mobile	11.98	9.37	3,744	12.07	9.45	3,769	11.99	9.36	3,498
Verizon Wireless	8.28	4.93s	3,044	8.69	5.24	4,362	9.11	5.56	4,269

Source: Ookla SPEEDTEST intelligence data, © 2018 Ookla, LLC. All rights reserved. Published with permission of Ookla.



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27. Nationwide average LTE download speeds for the second half of 2016 through the second half of 2017 from OpenSignal are presented in Figure A-20 below.⁸⁷

Fig. A-20
OpenSignal –Estimated LTE Download Speeds, Nationwide

Service Provider	2H2016	1H2017	2H2017
	Av. Download Speed (Mbps)	Av. Download Speed (Mbps)	Av. Download Speed (Mbps)
AT&T	13.86	12.92	13.27
Sprint	8.99	9.76	12.02
T-Mobile	16.65	17.45	19.42
Verizon Wireless	16.89	14.91	17.77
Total	13.95	14.99	16.31

Source: OpenSignal, 2018, © OpenSignal

28. We present in Figure A-21 the mobile wireless indices within the United States for the second half of 2016 through the second half of 2017 from RootMetrics.⁸⁸

⁸⁷ OpenSignal gathers crowdsourced mobile speed data through the use of its mobile app. OpenSignal, State of Mobile Networks: USA, <https://opensignal.com/reports/2017/02/usa/state-of-the-mobile-network>; (last visited Nov. 19, 2018). In addition to user-initiated tests, OpenSignal also collects network speed measurements at a high frequency per user, <https://opensignal.com/methodology> (last visited Nov. 6, 2018). OpenSignal does not provide summary statistics for LTE upload speeds before the first half of 2018, thus only LTE download speeds are included.

⁸⁸ RootMetrics, Methodology, <http://rootmetrics.com/en-US/methodology> (last visited Nov. 19, 2018). RootMetrics performs drive tests and stationary tests in specific locations, using the leading Android-based smartphone 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, Appendix VI., paras 10-11.

Fig. A-21
RootMetrics National Speed Index Data, 2nd Half 2016--2st Half 2017

Service Provider	2nd Half 2016			1st Half 2017			2nd Half 2017		
	Speed Index	Data Index	Text Index	Speed Index	Data Index	Text Index	Speed Index	Data Index	Text Index
AT&T	89.6	94.4	95.3	91.4	95.5	95.6	92.3	95.7	96.0
Sprint	72.3	82.5	95.0	78.2	86.6	95.2	77.8	87.7	95.2
T-Mobile	87.1	90.6	89.1	90.5	93.2	89.5	90.9	93.1	91.5
Verizon Wireless	93.3	96.5	96.5	92.9	96.5	96.5	93.2	96.5	96.8

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

4. Entry Conditions and Market Concentration

29. *Entry Conditions.* To evaluate the competitiveness of any market, one must consider multiple factors, including prices and trends in prices, non-price rivalry, investment, innovation, and any barriers to entry.⁸⁹ Entry conditions are important in helping to understand the degree to which incumbent firms may or may not possess market power, the ability to maintain prices above competitive levels. High barriers to entry reduce the number of competitors in a market and reduce the threat to incumbents of new entry.⁹⁰ Entry occurs in the context of underlying regulatory and market conditions that directly influence the total number of firms that can successfully compete. In the mobile wireless marketplace, there are both regulatory and non-regulatory barriers to entry. Regulatory barriers to entry arise from government-imposed regulations, rules, and restrictions that may impose additional costs for entrants or that may directly prohibit or limit entry. For the most part, they are related to the inputs necessary to offer mobile wireless services. Examples of regulatory barriers include spectrum policy, which affects the spectrum capacity available for mobile wireless services and regulations regarding tower and antenna siting, which affect whether and how quickly mobile wireless network can be deployed or expanded. Non-regulatory or market conditions that may determine the number of providers that can operate in the market, or may deter entry, include efficiencies of size and scale, permanent asymmetries across service providers' costs, difficulties in acquiring access to sites for network infrastructure, and capital cost requirements, such as those costs incurred in acquiring spectrum or deploying a nationwide network.

30. *Market Concentration (NRUF Data).* High market concentration levels in any market may raise some concern that a market is not competitive, although we note that this is not necessarily the case.⁹¹ To measure mobile wireless concentration, the Commission employs the Herfindahl-Hirschman

⁸⁹ *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); *AT&T-Leap Order*, 29 FCC Rcd at 2756-57, para. 49; *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).

⁹⁰ 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*, W. W. Norton and Company, 2014, at 433-34; Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* (4th ed.), Addison, Wesley, Longman, Inc., 2005, at 61, 76. See also George S. Ford, et al., *Competition After Unbundling: Entry, Industry Structure, and Convergence*, Federal Communications Law Journal, 2007, 59: 2, at 344.

⁹¹ 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* (4th ed.), West Publishing, at 117 (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, ed. Mark Armstrong and Robert Porter, Elsevier (2007); John Sutton, *Sunk Costs and Market Structure*, MIT Press

(continued....)

Index (HHI), widely used in competition analysis to measure market concentration. HHI is calculated by summing the squared market shares of all firms in the given market.⁹² 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.⁹³ As of year-end 2014, the weighted average HHI (weighted by population across the 172 EAs in the United States) for mobile wireless services was 3,138. As of year-end 2017, the weighted average HHI for mobile wireless services was 3,106.⁹⁴ Figure A-22 shows the relationship between the HHI by EA and EA population densities. This chart indicates that HHI values tend to decline as the population density increases. The most concentrated EAs tend to be more rural, while major metropolitan areas lie in the least concentrated EAs. This likely reflects greater demand and greater cost efficiencies (per-user mobile wireless network deployment costs tend to decrease with increases in the population density) in more densely-populated areas.⁹⁵

(Continued from previous page) _____

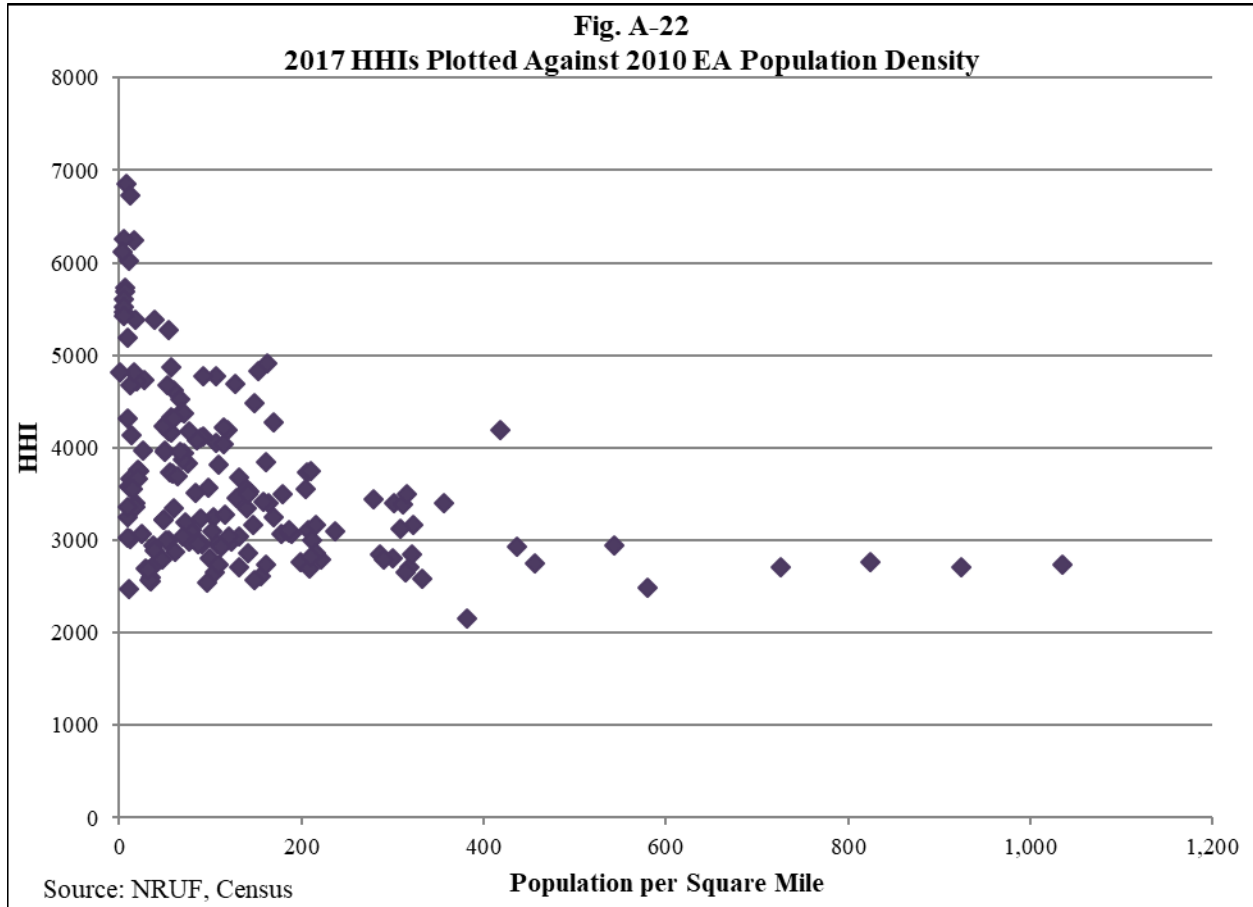
(1991); Joseph Farrell and Carl Shapiro, Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition, *The B.E. Journal of Theoretical Economics*, Vol.10, Issue 1, Article 9; Gregory J. Werden and Luke M. Froeb, Unilateral Competitive Effects of Horizontal Mergers in *Handbook of Antitrust Economics*, ed. Paolo Buccirossi, MIT Press (2008).

⁹² 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., *Applications of AT&T Inc., Leap Wireless International, Inc., Cricket License Co., LLC and Leap Licenseco, Inc. for Consent To Transfer Control and Assign Licenses and Authorizations*, Memorandum Opinion and Order, 29 FCC Rcd 2735, 2735, para. 27 (WTB, IB 2014) (*AT&T-Leap Order*).

⁹³ NRUF subscriber 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* 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.

⁹⁴ 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>.

⁹⁵ 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*, MIT Press (1991); Luis Cabral, *Introduction to Industrial Organization*, MIT Press, Chapter 14 (2000); Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* (4th ed.), Addison, Wesley, Longman, Inc., at 41 (2005); George S. Ford, et al., *Competition After Unbundling: Entry, Industry Structure, and Convergence*, *Federal Communications Law Journal*, 59:2, at 332, 337 (2007).



5. Mobile Wireless Spectrum

31. Spectrum is a critical input in the provision of mobile wireless services.⁹⁶ It can affect whether, when, and where existing service providers and potential entrants will be able to expand capacity or deploy networks.⁹⁷ 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. Spectrum bands vary in breadth and in their propagation characteristics, and these variations have implications for how spectrum is deployed.⁹⁸ The effective supply of spectrum capacity that is available for mobile wireless service depends on several aspects of spectrum policy, including allocation and

⁹⁶ 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 copper may lack sufficient capacity for current data demands.

⁹⁷ *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6134, para. 2.

⁹⁸ 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. *Twentieth Report*, 32 FCC Rcd at 8992, para. 36 & n.112; *Sixteenth Report*, 28 FCC Rcd at 3789, para. 119.

licensing policies, as well as interference and technical rules.⁹⁹ 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.¹⁰⁰ Therefore, spectrum policies affect the ability of incumbents and potential entrants to access spectrum and to build out or expand capacity. The Commission's actions to make more spectrum available are discussed in Section III.

32. Subject to the Commission's approval, licensees may transfer licenses, in whole or in part (through partitioning and/or disaggregation), on the secondary market.¹⁰¹ In reviewing proposed transfers of control of spectrum, the Commission uses an initial spectrum screen¹⁰² to help identify, for case-by-case review, local markets where changes in spectrum holdings resulting from the transaction may be of particular concern.¹⁰³ In the past decade, in the context of its review of secondary market transactions, 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.¹⁰⁴ The current suitable and available spectrum included in the spectrum screen is shown in Figure A-23:

⁹⁹ *Sixteenth Report*, 28 FCC Rcd at 3765, para.75.

¹⁰⁰ Rappaport, T. S., *Wireless Communications: Principles and Practice* (2nd ed.), Prentice Hall, 2002, at 58.

¹⁰¹ 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.

¹⁰² The Commission includes spectrum that it finds is suitable and available for the provision of mobile wireless services. See, e.g., *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6169, para. 71; See, e.g., *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, 3638-39, para. 17 (WTB, IB 2016) (*Sprint-Shentel-NTELOS Order*).

¹⁰³ See, e.g., *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6221-22, para. 225; see also *AT&T-Leap Order*, 29 FCC Rcd at 2752-53, paras. 39, 41. In the case of transfer of business units, the Commission's initial 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., *Sprint-Shentel-NTELOS Order*, 31 FCC Rcd at 3639, para. 17 & n.50; *AT&T-Leap Order*, 29 FCC Rcd at 2753, para. 41 & n.140. In addition, the Commission determined in the *Mobile Spectrum Holdings Report and Order* 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. See, e.g., *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6240, paras. 282-88.

¹⁰⁴ *Incentive Auction Closing and Channel Reassignment*, Public Notice, 32 FCC Rcd 2786 (WTB 2017); *Sprint-Shentel-NTELOS Order*, 31 FCC Rcd at 3637-38, paras. 15-16; *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. A-23

Spectrum Included in the Spectrum Screen¹⁰⁵

<i>Spectrum Band</i>	<i>Megahertz (Amount)</i>
600 MHz	70
700 MHz ¹⁰⁶	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	89
<i>Total Amount of Spectrum</i>	<i>715.5</i>

6. Service Providers' Spectrum Holdings

33. Figures A-24 and A-25 below present spectrum holdings by service provider. As of August 2018, the four nationwide service providers, AT&T, Sprint, T-Mobile, and Verizon Wireless together held approximately 80% of all the spectrum included in the spectrum screen, measured on a MHz-POPs basis. Figure A-26 shows the population-weighted average megahertz spectrum holdings of licensees by frequency band.¹⁰⁷

¹⁰⁵ We note that while 15 megahertz of AWS-3 spectrum is available on a nationwide basis (1695-1710 GHz), we will evaluate the availability of the remaining 50 megahertz of AWS-3 spectrum (1755-1780 GHz and 2155-2180 GHz) on a market-by-market basis. Further, while 112.5 megahertz of EBS spectrum is available, we discount this spectrum such that 89 megahertz is included in the screen for review of proposed transactions. *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 6177-79, 6184-6187, paras. 100-102, 118-25.

¹⁰⁶ This does not include the 20 megahertz of 700 MHz spectrum allocated to public safety.

¹⁰⁷ 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. A-24

**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.	89 meg.**
AT&T	3.8%	41.9%	44.6%	0.0%	29.1%	0.0%	16.2%	33.5%	0.0%	100.0%	0.0%	0.0%
Sprint	0.0%	0.4%	0.0%	96.5%	29.0%	0.0%	0.0%	0.0%	0.0%	0.0%	93.1%	95.7%
T-Mobile	45.3%	14.2%	0.1%	0.0%	22.3%	0.0%	41.1%	5.5%	0.0%	0.0%	0.0%	0.0%
VZW	0.0%	31.0%	47.6%	0.0%	16.6%	0.0%	39.7%	18.9%	0.0%	0.0%	0.0%	0.0%
USCC	2.6%	3.5%	4.0%	0.0%	1.1%	0.0%	0.8%	2.6%	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	22.0%	2.3%	3.7%	3.5%	2.0%	0.0%	2.2%	4.9%	0.0%	0.0%	6.9%	4.3%

* Staff estimates as of Aug. 2018. Abbreviations for spectrum bands: Cell. (Cellular), SMR (Specialized Mobile Radio Service), PCS (Personal Communications Service), BRS (Broadband Radio Service), and EBS (Educational Broadband Service).

** In accordance with the spectrum screen in proposed secondary market transactions, only 89 megahertz of EBS spectrum is included.

Fig. A-25

Population-Weighted Average Megahertz Holdings by Licensee, by Frequency Band*

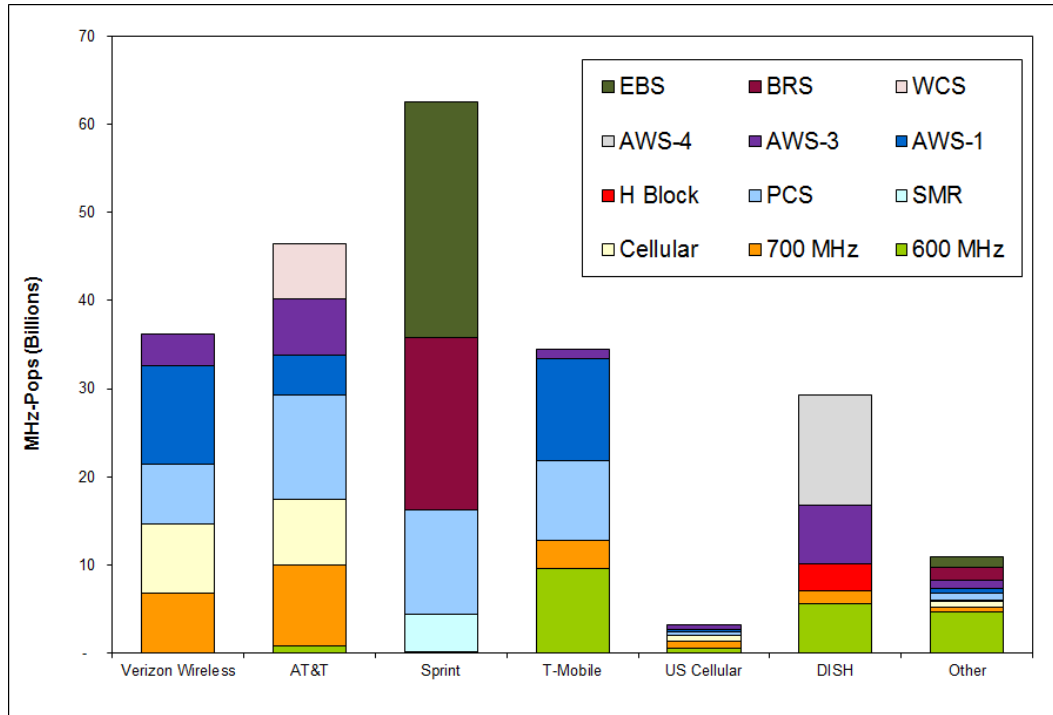
	600 MHz	700 MHz	Cell.	SMR	PCS	H Block	AWS-1	AWS-3	AWS-4	WCS	BRS	EBS
Spectrum Counted	70 meg.	70 meg.	50 meg.	14 meg.	130 meg.	10 meg.	90 meg.	65 meg.	40 meg.	20 meg.	67.5 meg.	89 meg.**
AT&T	2.6	29.4	23.6	0.0	37.9	0.0	14.6	20.3	0.0	20.0	0.0	0.0
Sprint	0.0	0.3	0.0	13.8	37.7	0.0	0.0	0.0	0.0	0.0	62.9	85.2
T-Mobile	30.8	10.0	0.0	0.0	29.0	0.0	37.0	3.3	0.0	0.0	0.0	0.0
VZW	0.0	21.7	25.2	0.0	21.6	0.0	35.7	11.5	0.0	0.0	0.0	0.0
USCC	1.8	2.5	2.1	0.0	1.4	0.0	0.7	1.6	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	14.9	1.6	2.0	0.5	2.6	0.0	2.0	3.0	0.0	0.0	4.6	3.8

* Staff estimates as of Aug. 2018.

** In accordance with the spectrum screen in proposed secondary market transactions, only 89 megahertz of EBS spectrum is included.

Fig. A-26:

Spectrum Holdings by Band Weighted by Population



Note: Staff estimates as of Aug. 2018.

7. Wireless Infrastructure

34. Wireless infrastructure facilities constitute another major input in the provision of mobile wireless services.¹⁰⁸ In addition to towers and other tall structures, such as lattice towers, guyed towers, monopoles, rooftops, water towers, and steeples, wireless infrastructure also includes distributed antenna systems (DAS) and small cells.¹⁰⁹ In order to expand or to improve coverage in existing service areas, and to accommodate newer technologies, mobile service providers historically have deployed additional cell sites. According to CTIA, cell sites in commercial use have mostly increased in the last five years, from 304,360 at year-end 2013, to 298,005 in 2014, 307,626 in 2015, 308,334 in 2016, and 323,448 at year-end 2017.¹¹⁰

¹⁰⁸ 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 public switched telephone network, 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, and independent backhaul operators. *Twentieth Report*, 32 FCC Rcd at 8997-98, para. 42 & n.135; *Sixteenth Report*, 28 FCC Rcd at 3912, para. 336.

¹⁰⁹ For a full description of DAS and small cells, see *Twentieth Report*, 32 FCC Rcd at 8997, para 42, n.133 & n.134.

¹¹⁰ CTIA Wireless Industry Indices Year-End 2017, at 54. Because multiple cell sites can be collocated in the same “tower” site, the reported cell sites should not be equated with “towers.” The reported cell sites include repeaters and other cell-extending devices (e.g., femtocells or distributed antenna systems). *Id.* at 53. Based on UBS Data 2017, the number of AT&T’s cell sites increased from 67,000 at the end of 2016 to 70,300 at the end of 2017, Verizon Wireless’s increased from 58,300 to 61,800, T-Mobile’s increased from 59,417 to 61,457, and Sprint’s stayed at 50,000. Note that the decrease in the total number of commercial cell sites in 2014 from 2013 is likely due to “a combination of consolidation and the retirement of older generation of technologies.” CTIA Wireless Industry

(continued....)

35. Mobile service providers increasingly have started to deploy small cells and DAS sites to fill local coverage gaps, to densify networks and increase local capacity, or to prepare for deploying their 5G network.¹¹¹ Estimates for small cell deployment by the end of 2018 range from 80,000 to 400,000.¹¹² Rather than building their own DAS deployments, some service providers share neutral host systems owned by third-party operators.¹¹³ Today, there are more than 120 tower and DAS operators in the United States,¹¹⁴ and a majority of towers are now owned or operated by independent tower companies rather than by mobile wireless service providers. In most cases, tower operators and property owners lease antenna, rooftop and other site space to multiple wireless service providers.¹¹⁵

36. The three largest publicly-traded neutral host providers are Crown Castle, American Tower, and SBA Communications. These three companies alone invested nearly \$2.5 billion dollars in 2017, an increase of nearly 25% over 2016.¹¹⁶ As of December 2017, according to one estimate, these three infrastructure providers owned or operated approximately 95,000 towers (not including DAS and small cells).¹¹⁷ At the end of December 2017, they had 1.7 to 2.2 tenants per tower site and had significant capacity available for additional antennas or tenants.¹¹⁸ Figure A-27 shows that, as of April 2018, there were three or more tower operators in 83% of counties nationwide, and four or more tower operators in 61% of counties.¹¹⁹

(Continued from previous page) _____
Indices Report Year-End 2014, at p. 101-102.

¹¹¹ *Twentieth Report*, 32 FCC Rcd at 8998, para. 43.

¹¹² CTIA Comments at 51 (80,000 small cells); Wireless Infrastructure Association (WIA) Comments at 7 (125,000 small cells). *See also* RCR Wireless, North American Enterprises to Deploy 400,000 Small Cells This Year (Apr. 5, 2018), <https://www.rcrwireless.com/20180405/network-infrastructure/north-american-enterprises-deploy-400000-small-cells-tag23>.

¹¹³ American Tower Corporation 2017 Annual Report, at 6; *see also* Clearsky Technologies, ClearSky to Launch First American “Small Cell as a Service” Carrier Customer, <http://www.csky.com/launches-first-scaas-carrier-customer/> (last visited Nov. 19, 2018).

¹¹⁴ Wireless Estimator, Top 100 Tower Companies in the U.S., <http://wirelessestimator.com/top-100-us-tower-companies-list/> (last visited Nov. 19, 2018).

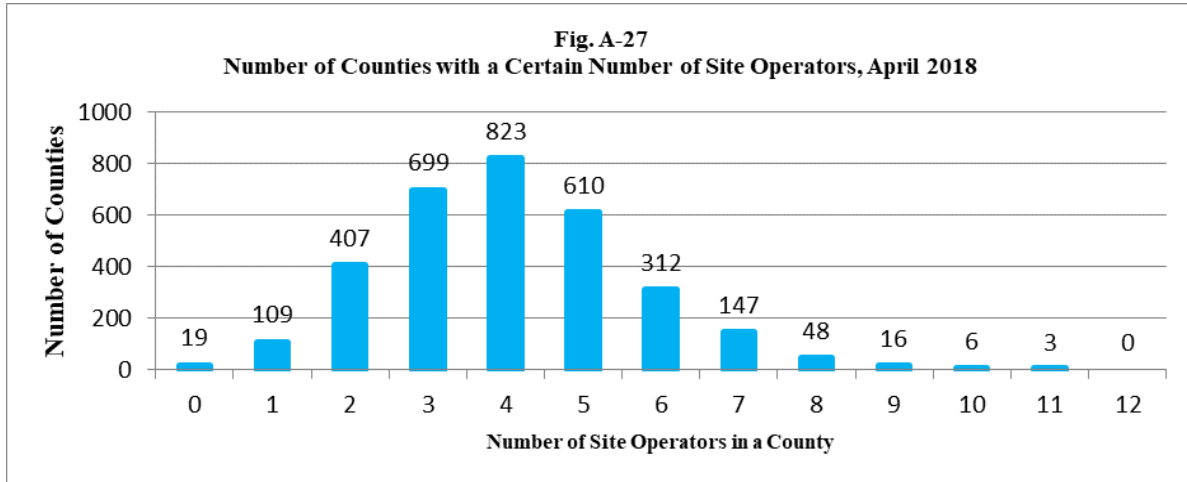
¹¹⁵ *See, e.g.*, American Tower 2017 Annual Report, Part 1 at 3; *see also* Crown Castle 2017 Annual Report, Part 1, at 20; FierceWireless, Crown Castle executive sees small cells moving to multitenant scenarios, smaller markets, <https://www.fiercewireless.com/wireless/crown-castle-exec-sees-small-cells-moving-to-multi-tenant-scenarios-smaller-markets>; Verizon Wireless, <http://www.verizonwireless.com/b2c/realestate/> (last visited Oct 17, 2018).

¹¹⁶ WIA Comments at 2.

¹¹⁷ Wireless Estimator, Top 100 Tower Companies in the U.S. (Crown Castle at 40,039, American Tower at 39,989, SBA at 14,873, and as of May 2018, not including rooftop sites, DAS and small cells), http://www.wirelessestimator.com/t_content.cfm?pagename=US-Cell-Tower-Companies-Complete-List (last visited Nov. 19, 2018).

¹¹⁸ American Tower 2017 Annual Report, Part I, at 4 (1.9 tenants per tower), Crown Castle 2017 Annual Report, Part 1, at 18 (2.2 tenants per tower), and SBA 2017 Annual Report, Item 1, at 3 (1.7 tenants per tower).

¹¹⁹ Tower site information was downloaded from 49 tower providers’ websites in April 2018. 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 Nov. 19, 2018).



Source: 49 tower companies' data on standalone towers, rooftops, DAS, and small cells (April 2018).

8. Network Coverage

37. We measure network coverage based on Form 477 data,¹²⁰ and we use the actual area methodology, which analyzes the data on a sub-census-block level, and calculates the percentage of each census block covered by each technology.¹²¹ Unlike the centroid methodology where a particular census block is either covered or not, the actual area methodology estimates the area of the census block covered by each service provider by technology.¹²² Because we currently do not know the distribution of the population at the sub-census-block level, however, 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.¹²³

¹²⁰ For a detailed description of the Form 477 data collection, see *Twentieth Report*, 32 FCC Rcd at 9015, para. 69.

¹²¹ 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 Report*, 32 FCC Rcd at 9016-17, para. 71. In practice, actual area and centroid methodologies yield similar results at the national level. *Twentieth Report*, 32 FCC Rcd at 9017-18, para. 72. We present coverage maps based on the centroid methodology in Web Appendix VI: Mobile Wireless Coverage Maps at XX. In addition, we report our results based on the centroid and actual area methodologies in Web Appendix VII: Mobile Wireless Coverage at XX.

¹²² This sub-census-block analysis can tell us 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., LTE), but we do not currently know how this interplays with other technologies (e.g., with 2G or 3G technologies). Therefore, we can calculate the areas served and not served by all wireless technologies (LTE, non-LTE 4G, 3G, and 2G technologies) only at the national level.

¹²³ In order to fully exploit 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 at this time for the current *Report*, however.

38. As the Commission has stated, having accurate and reliable mobile broadband deployment data is critical to policymakers as well as to consumers.¹²⁴ We observe that, while the current Form 477 deployment data is an improvement over the deployment data previously available on a national scale, questions have arisen in various contexts regarding the bases for certain filings.¹²⁵ For example, in the context of the Mobility Fund Phase II (MF-II) proceeding, the Commission determined that a separate, one-time data collection was necessary to ensure that all Form 477 filers were using a consistent standard when reporting their deployment of 5 Mbps 4G LTE services.¹²⁶ In addition, the Commission has initiated a rulemaking to consider improvements in the Form 477 data collection process.¹²⁷

39. In this Section, we first present our estimates of mobile wireless coverage by individual service provider using any technology. Second, we present our LTE coverage estimates for the percentage of the U.S. population, land area, and road miles, by number of service providers, before turning to LTE coverage by individual service providers. Finally, we present our estimates of coverage in rural and non-rural areas, first by number of service providers, and then by individual service providers. Unless otherwise noted, we rely on Form 477 data as of December 2017 for our analysis of network coverage.

a. Overall Coverage by Individual Service Provider

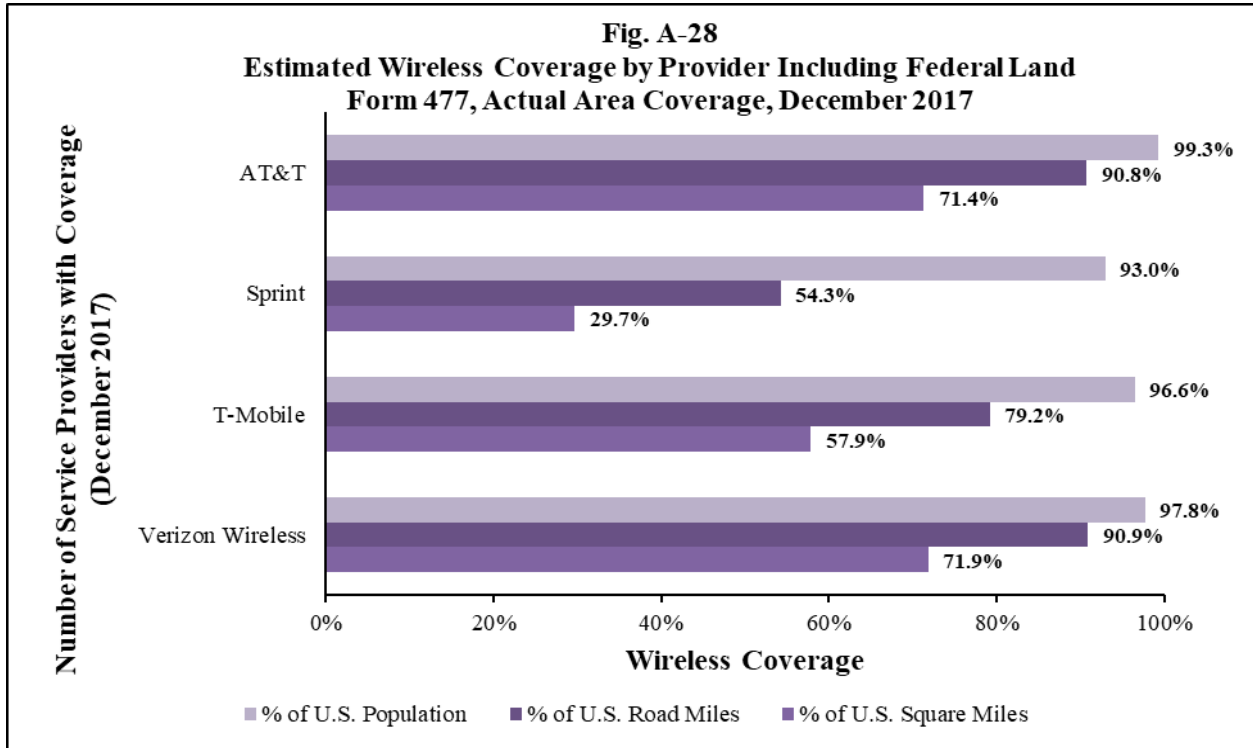
40. Figure A-28 presents estimates of mobile wireless coverage by individual mobile wireless service provider using any technology. Figure A-28 indicates that AT&T covered census blocks containing approximately 99% of the population, while the comparable approximate percentages are 98% for Verizon Wireless, 97% for T-Mobile, and 93% for Sprint. Verizon Wireless and AT&T each covered over 70% of the land area, while T-Mobile and Sprint each covered less than 60% of the land area. In terms of road miles, AT&T and Verizon Wireless covered approximately 91%, T-Mobile covered approximately 79%, and Sprint covered approximately 54%.

¹²⁴ *Modernizing the FCC Form 477 Data Program*, Further Notice of Proposed Rulemaking, 32 FCC Rcd 6329, 6331-32, para. 8 (2017) (*Modernizing the FCC Form 477 Data Program*).

¹²⁵ *Modernizing the FCC Form 477 Data Program*, 32 FCC Rcd at 6332-33, para. 10.

¹²⁶ *Connect America Fund, Universal Service Reform—Mobility Fund*, Order on Reconsideration and Second Report and Order, 32 FCC Rcd 6282, 6286, 6287, 6298, paras. 7, 10, 34 (2017) (reconsidering the Commission's decision to use the Form 477 data given the various challenges with respect to the accuracy of the Form 477 deployment data, and determining that there would be a new one-time data collection).

¹²⁷ *See generally Modernizing the FCC Form 477 Data Program*, 32 FCC Rcd 6329.

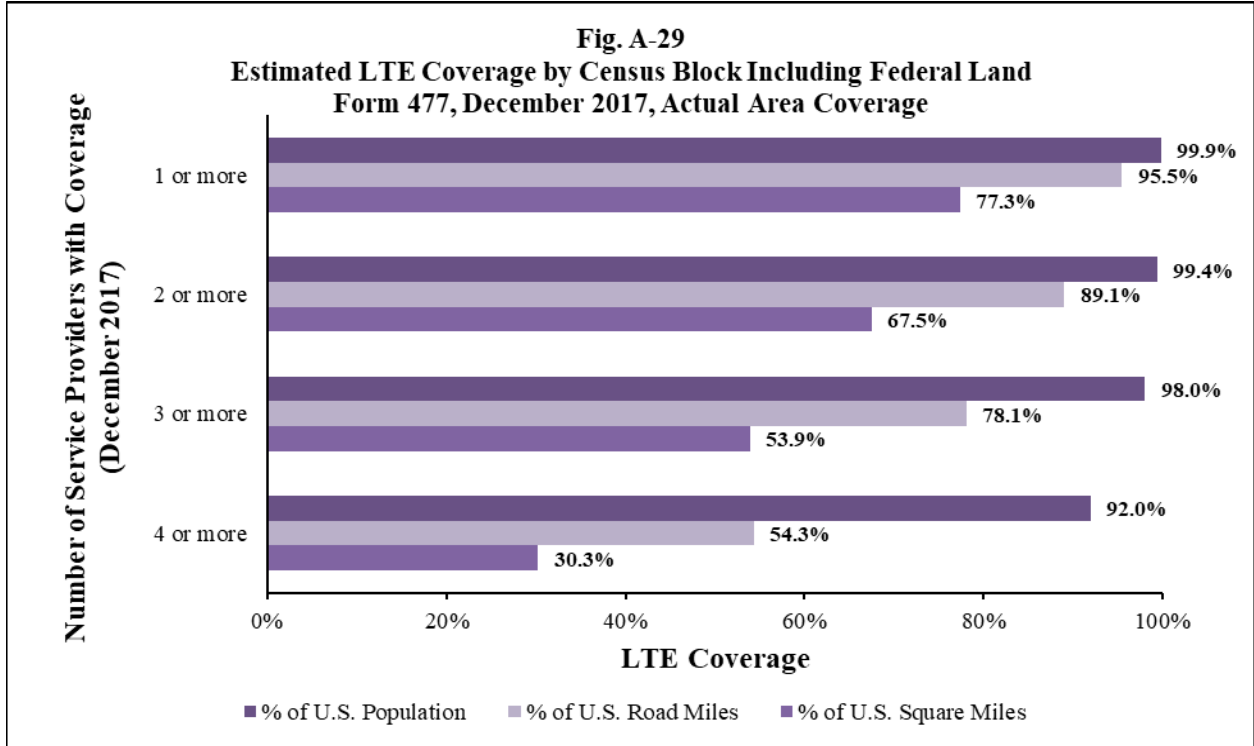


Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block.

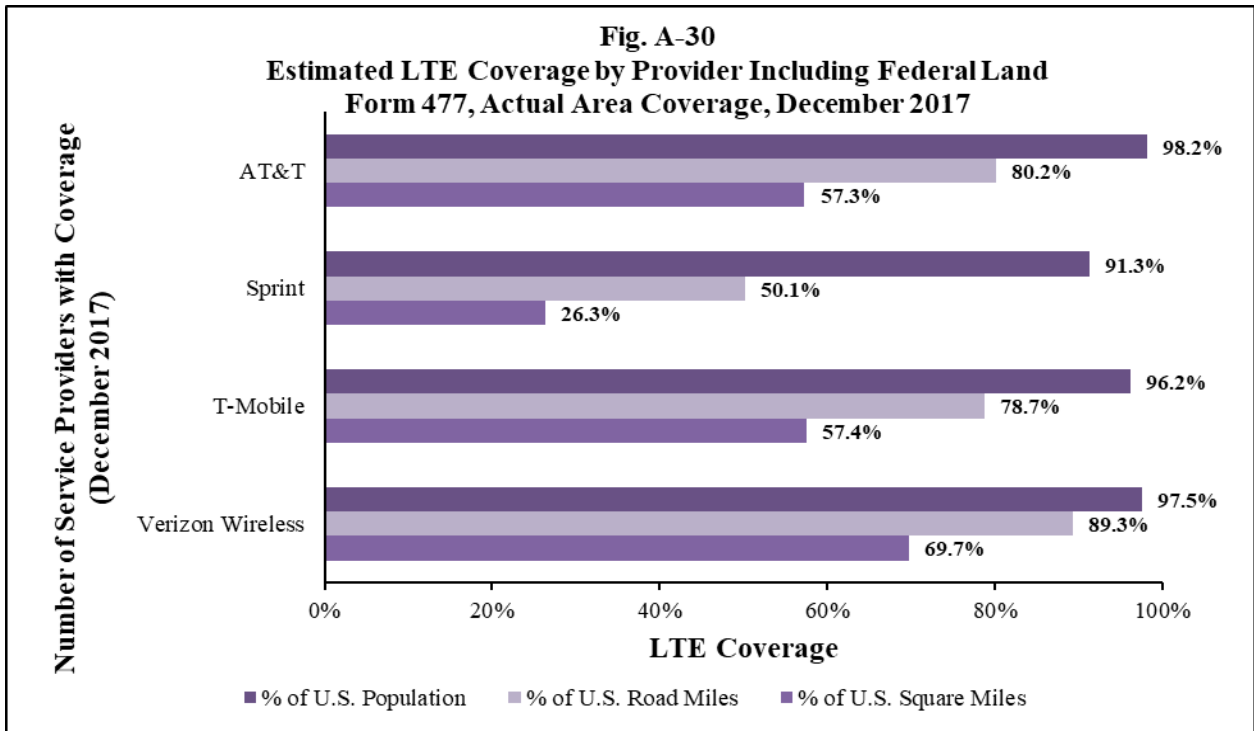
b. LTE Mobile Broadband Coverage

41. Figure A-29 presents LTE mobile broadband coverage by number of service providers. It shows that approximately 92% of the U.S. population lived in census blocks with LTE coverage by at least four service providers. These census blocks only accounted for approximately 54% of road miles and approximately 30% of the total land area of the United States, however.

42. Figure A-30 presents estimates of LTE mobile broadband coverage by individual mobile wireless service provider. It shows that Verizon Wireless and AT&T each provided LTE coverage to census blocks containing approximately 98% of the population, T-Mobile provided LTE coverage to approximately 96% of the population, while Sprint provided LTE coverage to approximately 91% of the population. In terms of road miles and land area, Verizon Wireless covered approximately 89% of road miles and 70% of the land area, AT&T covered approximately 80% of road miles and 57% of the land area, T-Mobile covered approximately 79% of road miles and 57% of the land area, and Sprint covered approximately 50% of road miles and 26% of the land area with LTE.



Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. 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.

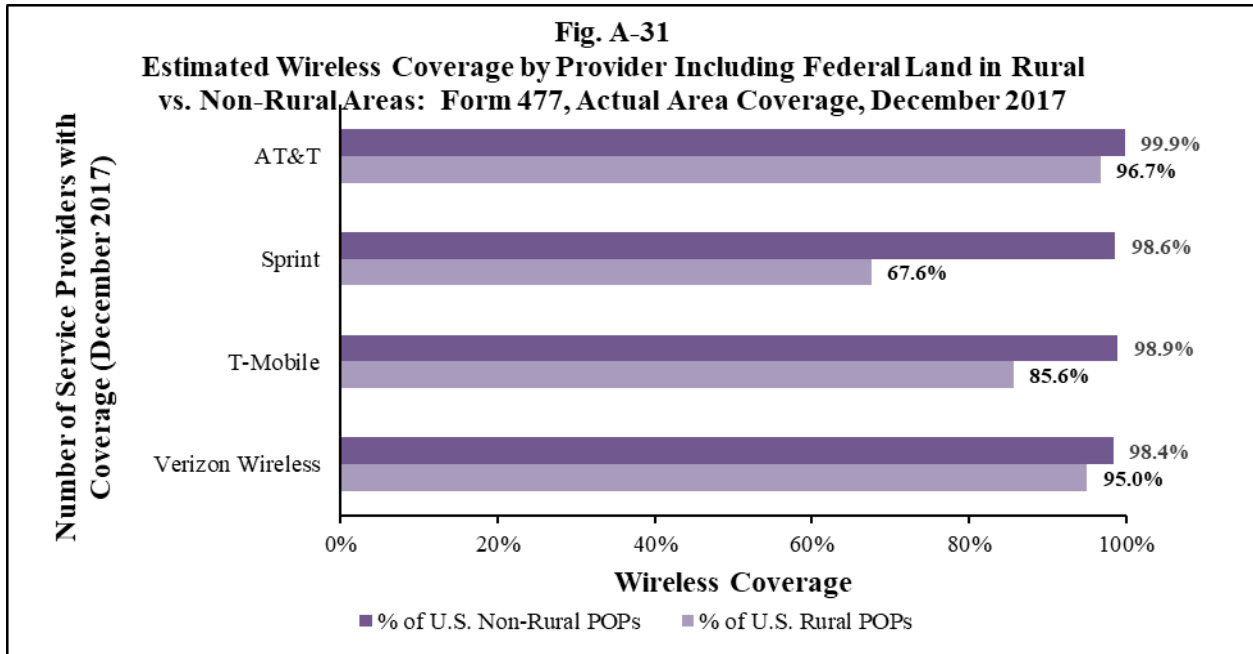


Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. That a particular service provider has indicated that it has network coverage in a particular census block does not necessarily mean that it offers service to residents in that census block.

c. Rural/Non-Rural Comparisons

43. Although the Communications Act does not include a statutory definition of what constitutes a rural area, the Commission, for purposes of its analysis for the *Mobile Wireless Competition Report*, has defined a rural area as one with a population density of 100 people per square mile or less.¹²⁸ 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 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.

44. Figure A-31 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 all four nationwide service providers covered at least 97% of the non-rural population with mobile wireless service. Rural wireless coverage by service provider was more limited: AT&T covered approximately 97%, Verizon Wireless covered approximately 95%, T-Mobile covered approximately 86%, and Sprint covered approximately 68% of the rural population with wireless service.



Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. 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.

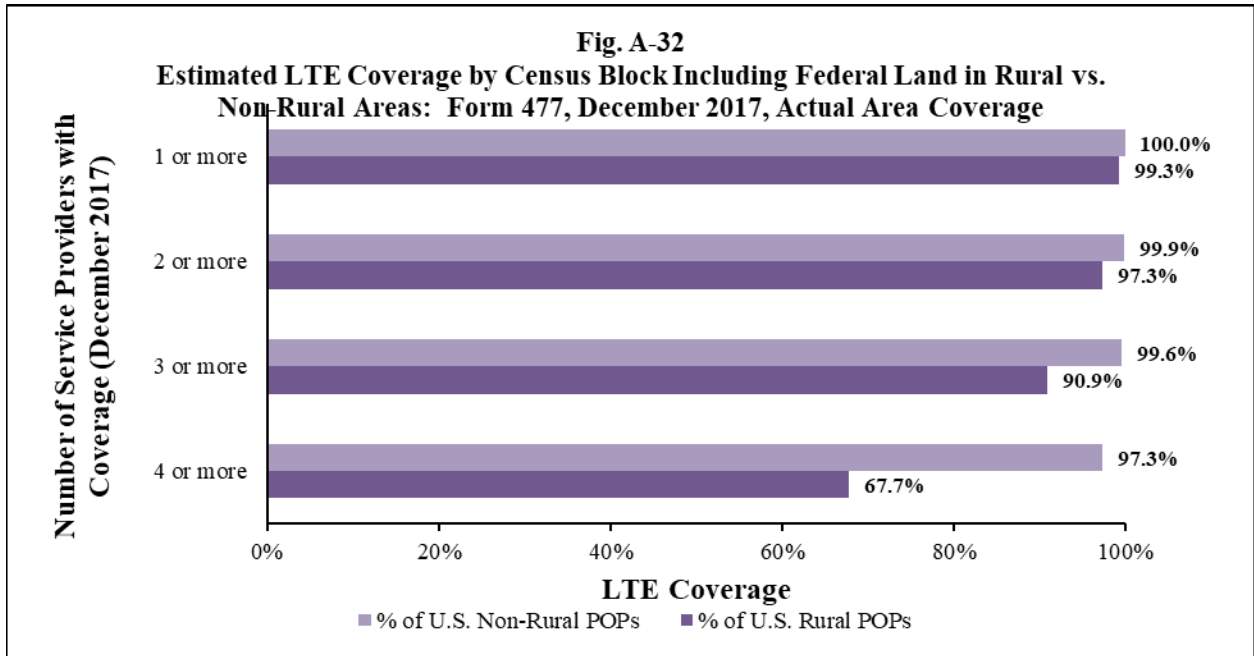
d. Rural and Non-Rural LTE Coverage by Number of Service Providers

45. Figure A-32 presents 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 LTE service providers, while approximately 91% of the rural population had

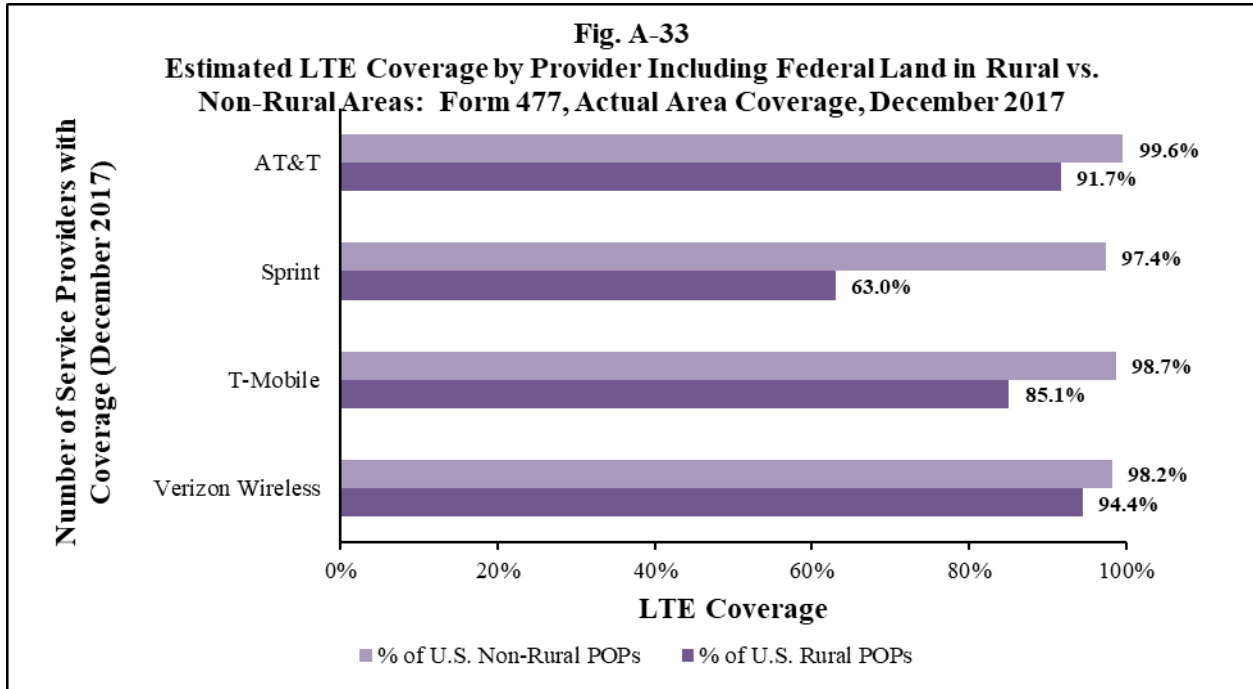
¹²⁸ *Twentieth Report*, 32 FCC Rcd at 8977, paras. 17-18; *Facilitating the Provision of Spectrum-Based Services to Rural Areas and Promoting Opportunities for Rural Telephone Companies To Provide Spectrum-Based Services*, Report and Order and Further Notice of Proposed Rule Making, 19 FCC Rcd 19078, 19086-88, paras. 10-12 (2004) (*2004 Report and Order*).

the same network coverage. Approximately 97% of the non-rural American population had LTE coverage from four or more service providers, while only approximately 68% of the rural population was covered by at least four LTE service providers.

46. Figure A-33 presents 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 covers at least 97% of the non-rural population with LTE. Regarding LTE coverage in rural areas, Verizon Wireless covered approximately 94%, AT&T covered approximately 92%, T-Mobile covered approximately 85%, and Sprint covered approximately 63% of the rural population with LTE.



Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. 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.



Source: Based on actual area coverage analysis of December 2017 Form 477 and 2010 Census data. 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.

B. The Video Market

47. This chapter examines participation and competition in today's video programming marketplace.¹²⁹ 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, whereas other providers, like online video providers, are much more recent additions to the marketplace. Below we examine the current state of the marketplace and provide data regarding competition among and between the different types of providers.

48. The major participants in the marketplace for the delivery of video programming can be divided into three categories:

- **Television Broadcasters:** These entities broadcast video content over the air, and consumers can receive this content via a television set connected to an antenna. Participants in this category include local television stations affiliated with broadcast networks (e.g., ABC, CBS, FOX, and NBC), independent commercial television stations, and noncommercial

¹²⁹ In this section, we rely on a variety of publicly available sources of industry information and data including: Securities and Exchange Commission filings; data from trade association and government entities; data from securities analysts and other research companies and consultants (e.g., S&P Global, Nielsen Media Research); company news releases and websites; newspaper and periodical articles; scholarly publications; vendor product releases; white papers; and various public Commission filings, decisions, reports, and data. We make use of both individual company data and industry-wide data. In addition, the Media Bureau released a Public Notice soliciting comment for the Commission's Nineteenth Report on the Status of Competition in the Market for the Delivery of Video Programming. *Media Bureau Seeks Comment on the Status of Competition in the Market for the Delivery of Video Programming*, Public Notice, 32 FCC Rcd 6654 (2017) (*19th VCR PN*). While Congress has since eliminated the statutory obligation that the Commission produce an annual Video Competition Report, we considered comments and reply comments submitted in response to the *19th VCR PN* when preparing this report. Citations to Comments and Reply Comments in this section refer to filings submitted in response to the *19th VCR PN*.

educational television stations. Television stations offer a set schedule of programs through the day, as well as live sporting events, news coverage, and other real-time broadcasts of events.

- **Multichannel video programming distributors (MVPDs):** These providers use wireline or satellite technologies to deliver video programming to consumers. MVPD packages typically include linear channels – both cable channels and retransmitted broadcast channels – and video on demand (VOD) content.¹³⁰ Traditional cable providers (e.g., Comcast, Charter, and smaller cable operators), telephone company providers (e.g., Verizon Fios), and direct broadcast satellite (DBS) providers (e.g., DISH Network and DIRECTV) are all MVPDs.
- **Online video distributors (OVDs):** These participants use the Internet to deliver video content to consumers.¹³¹ In addition to providing linear video channels and VOD content, OVDs often rent and sell video content to their customers. OVDs include large companies like Netflix, Hulu, Amazon, and DISH Sling TV, as well as numerous other providers, some of which focus on small or niche audiences.

49. We begin our discussion of the video programming marketplace by considering these three categories of providers--MVPDs, OVDs, and broadcast television stations--separately. We discuss below in turn the significant participants in each category, the business models and competitive strategies they employ, relevant performance metrics, and recent marketplace entry and exit. In discussing MVPDs, we will also report on the Commission's most current data on the prices charged by cable operators to consumers, as well as the most current data regarding the retransmission fees paid by cable systems to broadcast stations. We then address intermodal competition--that is, competition between participants in different categories--by looking at the similarities and differences between the video services offered by members of each group, consumer response and behavior, and subscribership trends. Finally, we discuss selected marketplace factors that are relevant to competition in the video marketplace.

1. MVPDs

50. An MVPD is an entity that sells packages of cable and broadcast channels to consumers. MVPDs include traditional cable providers (e.g., Comcast, Charter), DBS providers (e.g., DISH Network, DIRECTV), and telco providers (e.g., AT&T U-verse, Verizon Fios). MVPDs typically offer both linear cable and broadcast channels, as well as video-on-demand programs. Because households typically subscribe to only one MVPD, video competition between MVPDs generally can be viewed as "winner-take-all"--an MVPD either wins the household or loses out to a rival MVPD.

51. *Availability to Consumers.* Cable MVPDs generally exist in non-overlapping franchise areas and, as a result, do not compete directly with one another for the same subscriber, so most consumers have access to only one cable MVPD. Where cable overbuilders exist (for example, RCN or Wide Open West) consumers have access to more than one cable MVPD. Ordinarily, there is not more than one such overbuilder in a particular geographic area.¹³² Telephone company MVPDs rarely compete

¹³⁰ 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.

¹³¹ 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." See *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Eighteenth Report, 32 FCC Rcd 568, 570 n. 4 (MB 2017) (*18th Report*).

¹³² The available data do not permit us to calculate how many homes have access to two cable MVPDs. However, S&P Global estimates that cable overbuilders have more than 1 million video subscribers nationwide. S&P Global, *Cable TV Investor* at 7 (Feb. 28, 2017).

with one another for the same subscribers; however, they almost always overbuild areas already served by at least one cable company. DIRECTV and DISH Network have national footprints and almost all consumers nationwide have access to both DBS MVPDs. Until recently, DBS MVPDs competed with one another and with every cable and telephone company MVPD. This changed with the merger of AT&T and DIRECTV in July 2015, which eliminated competition between AT&T U-verse and DIRECTV. Although most consumers have access to three competing MVPDs (two DBS MVPDs and a cable MVPD),¹³³ some consumers also have access to a competing telephone company MVPD, for a total of four MVPDs. We estimated that 17.9% of housing units had access to four MVPDs in 2015.¹³⁴ The number may be declining as buildout of wireline MVPD networks by telephone companies has slowed in recent years,¹³⁵ but we lack reliable data.

52. *Subscribership.* At the end of 2017, seven MVPDs each had over one million video subscribers. These include four cable companies (Comcast, Charter, Cox, and Altice), DISH Network (a DBS MVPD), Verizon Fios (a telephone company MVPD), and AT&T (a combined telephone company MVPD and DBS MVPD).¹³⁶ Twelve cable MVPDs and four telephone company MVPDs each had over 100,000 and fewer than one million video subscribers.¹³⁷ In addition, many small cable and telephone company MVPDs serve significantly smaller numbers of customers.

53. MVPDs as a group have been losing subscribers since 2013.¹³⁸ Figure B-1 provides data for MVPD video subscribers for 2016 and 2017. Collectively, MVPDs lost about 3.6 million video subscribers over the period. Cable MVPDs lost 986,000 subscribers; DBS MVPDs lost 1,693,000 subscribers; and telephone company MVPDs lost 903,000 subscribers.

¹³³ We assume that cable MVPDs are available to approximately 99% of housing units and DBS is available to all housing units although we recognize that in reality physical features (e.g., tall buildings, terrain, and trees) prevent some housing units from receiving DBS signals. See *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Sixteenth Report, 30 FCC Rcd 3253, 3264-65 and Table 1 (MB 2015) (*16th Report*).

¹³⁴ *18th Report*, 32 FCC Rcd at 577, para. 21.

¹³⁵ See *infra* para. 68.

¹³⁶ S&P Global, Top Cable MSOs (last visited June 15, 2018).

¹³⁷ *Id.* The twelve cable MVPDs were Mediacom, Wide Open West, Cable One, RCN, Atlantic Broadband, Midcontinent Communications, Armstrong Utilities, Service Electric Cable TV, Blue Ridge Cable Technologies, WaveDivision Holdings, GCI Liberty, and Buckeye Broadband. The four telephone company MVPDs were CenturyLink, Consolidated Communications, Cincinnati Bell, and Frontier Communications. *Id.*

¹³⁸ S&P Global, U.S. Multichannel Industry Benchmarks (last visited Sept. 28, 2018).

Fig. B-1

MVPD Video Subscribers (in thousands)¹³⁹

	2016	2017	Net Change
Cable	52,845	51,859	-986
Comcast	22,508	22,357	-151
Charter	17,236	16,997	-239
Cox	3,932	3,852	-80
Altice	3,709	3,582	-127
Other Cable	5,459	5,071	-388
DBS	33,181	31,488	-1,693
DIRECTV	21,012	20,458	-554
DISH Network	12,170	11,030	-1,140
Telephone Company	11,529	10,626	-903
Verizon Fios	4,694	4,619	-75
AT&T U-verse	4,281	3,658	-623
Frontier	1,145	961	-184
Other Telephone	1,409	1,388	-21
MVPD Total	97,556	93,973	-3,583

54. Figure B-2 shows the relative shares of MVPD subscribers for cable, DBS, and telephone companies. While the total number of MVPD subscribers declined from 99.7 million in 2015, to 97.6 in 2016, to 94.0 million in 2017, cable's relative share increased, the share for telephone companies decreased, and the share for DBS changed little.¹⁴⁰

Fig. B-2

Percentage of MVPD Subscribers¹⁴¹

Year	Cable	DBS	Telephone
2015	53.5	33.2	13.1
2016	54.1	34.0	11.8
2017	55.2	33.5	11.3

55. *Video Revenue.* Video revenues for the largest MVPDs are shown in Figure B-3. According to S&P Global, video revenue from cable, DBS, and telephone company MVPDs peaked in 2016 at \$117.7 billion, fell to \$116.1 billion in 2017, and is projected to fall to \$113.2 billion in 2018.¹⁴²

¹³⁹ S&P Global, Cable TV Investor at 4 (Mar. 27, 2018). See also Leichtman Research Group, LRG Research Notes at 3-4 & 6 (1Q 2018), <http://www.leichtmanresearch.com/research.html#notes>.

¹⁴⁰ S&P Global, U.S. Multichannel Industry Benchmarks (last visited June 15, 2018).

¹⁴¹ See *id.* Throughout this section, percentages provided may not sum to exactly 100 due to rounding.

¹⁴² Tony Lenoir, *Multichannel Trends: 10-year video revenue outlook anticipates continued drift away from 2016 peak*, S&P Global (Sept. 27, 2018).

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 ad revenue of \$4.2 billion in 2016 and \$3.9 billion in 2017.¹⁴³

Fig. B-3

MVPD Video Revenue (in millions)¹⁴⁴

	2016	2017	Percentage Change
AT&T	\$36,460	\$36,728	0.7%
Comcast	\$22,357	\$23,129	3.5%
Charter	\$16,390	\$16,641	1.5%
DISH Network	\$15,212	\$14,391	-5.4%

a. Business Models and Competitive Strategies

56. MVPDs often seek to differentiate themselves from one another to gain an advantage over competitors. For example, they may differentiate based on equipment technology, pricing, discounts for new subscribers, responses to increased programming costs, bundles, differing sizes of video packages, TV Everywhere¹⁴⁵ rights, integration of OVD services with MVPD packages, Wi-Fi hotspots,¹⁴⁶ and digital technology.¹⁴⁷ MVPDs also have different strategies for owning their own content and for offering alternative OVD services for consumers who do not subscribe to an MVPD's traditional video services. We discuss some of the most relevant of these issues further below.

57. *Channel Packages.* Today, the major MVPDs offer hundreds of linear channels, and there is often substantial overlap in the channels offered by competing MVPDs. Providers rarely offer exclusive channels,¹⁴⁸ and all of the large MVPDs traditionally have offered consumers access to all the major broadcast and cable networks, as well as a similar selection of premium channels. As a result, from the perspective of linear programming, most consumers view MVPDs as good substitutes because they can replace one MVPD with another, without losing popular channels, provided the household has access to a competing MVPD.

¹⁴³ *Id.*

¹⁴⁴ AT&T, 2017 Annual Report at 20; Comcast, SEC Form 10-K for the year ended December 31, 2017 at 39 (Comcast 2017 10-K); Charter, SEC Form 10-K for the year ended December 31, 2017 at 4 and 35; DISH Network, SEC Form 10-K for the year ended December 31, 2017 at 62 (DISH Network 2017 10-K).

¹⁴⁵ *See infra* para. 63.

¹⁴⁶ Some MVPDs have built Wi-Fi Networks that enable subscribers to access content on mobile devices outside their homes. A consortium called Cable Wi-Fi, comprised of Cox, Altice, Charter, and Comcast, has built over 500,000 hotspots typically located in high-traffic areas like businesses, hotels, restaurants and malls. *See, e.g.,* Spectrum, *Cable WiFi Internet access is brought to consumers through a collaboration among U.S. Internet service providers*, <https://www.spectrum.com/content/spectrum/residential/microsites/cablewifi/cablewifi.html> (last visited Nov. 15, 2018). Cable Wi-Fi allows Internet subscribers of these companies to access the hotspots of other consortium members. *Id.*

¹⁴⁷ Wireline MVPDs continue to free up bandwidth in their systems by transitioning analog channels to digital. According to S&P Global, Comcast, Cox, and Mediacom were all-digital in 2016. S&P Global, *Cable TV Investor* at 4-5 (Feb. 28, 2017). Charter expects to finish transitioning systems it acquired from Time Warner Cable and BrightHouse in 2019. *Id.*

¹⁴⁸ The NFL Sunday Ticket, offered exclusively by DIRECTV, is perhaps the most well-known exception to this observation.

58. *VOD Programming.* MVPDs often distinguish themselves by offering varying amounts of VOD content, which gives subscribers access to a vast library of television shows and movies. This library of programming available “on demand” offers subscribers another way to consume video programming besides the linear channels. The average number of VOD movies and TV episodes offered by major MVPDs reached 77,570 selections per month at the end of 2017,¹⁴⁹ but there was wide variance among providers. For example, Verizon Fios offered 160,000 VOD titles per month, Cox 100,000, DISH Network 47,000, Charter 35,000, and DIRECTV 30,000.¹⁵⁰

59. *Packages and Pricing.* To attract and retain customers, MVPDs offer a variety of channel packages at different prices. Although the channel packages offered by one company are never exactly the same as the channel packages offered by another company, competitive forces pressure MVPDs to offer comparable channel packages at similar prices.¹⁵¹ Traditional MVPD channel packages include a large number of channels and cover a wide variety of genres and interests. For example, Comcast offers three packages with channel counts ranging from about 140 to more than 260, priced from \$59.99 to \$84.99 per month.¹⁵² Similarly, DISH Network offers packages with channel counts ranging from 190 to more than 290, priced from \$59.99 to \$89.99 per month.¹⁵³

60. In response to competition from OVDs, slow growth in household incomes, and increasing programming costs, some MVPDs have begun offering smaller video packages (sometimes called “skinny” channel packages), which typically include a limited selection of channels, often focusing on specific subscriber interests, such as sports, children’s entertainment, or movies.¹⁵⁴ Examples of such video packages include Verizon Fios’s Custom TV-Action & Entertainment with 62 channels and Custom TV-Sports & News with 57 channels.¹⁵⁵ Packages start at \$64.99 per month.¹⁵⁶ Similarly, DIRECTV’s Select All Included package provides more than 150 channels for \$40.00 per month.¹⁵⁷

61. *Prices for New and Existing Subscribers.* The prices discussed above are generally applicable to new subscribers. Typically, the prices prominently displayed to consumers on MVPD websites, in mailings, or in television advertisements are for new subscribers, and are often for a limited time (e.g., six months, one year, or two years), with the subscription rate increasing thereafter.

¹⁴⁹ S&P Global, Cable TV Investor at 3-4 (Feb. 23, 2018).

¹⁵⁰ *Id.*

¹⁵¹ Many factors potentially affect the value of a video package including the specific networks and movie channels included in the package, the advanced services included in the package (e.g., HD, DVR, VOD, and TV Everywhere), rental of set-top boxes, and fees for local stations and regional sports. Similarly, MVPD video services differ by equipment, number of connected TVs, length of contract, and additional fees. *See e.g.*, Brendan Hesse, *DISH Network Versus DIRECTV*, Digital Trends (May 12, 2017), <https://www.digitaltrends.com/home-theater/dish-network-versus-directv/>. *See also*, Trevor Wheelwright, *Verizon Fios vs Comcast XFINITY*, Reviews.org (June 16, 2017), <http://www.reviews.org/comparisons/verizon-fios-vs-comcast-xfinity/>.

¹⁵² Comcast, *XFINITY Deals*, <https://www.xfinity.com/learn/offers?lob=tv.internet> (last visited June 27, 2018).

¹⁵³ DISH Network, *Satellite TV Packages*, <https://www.dish.com/programming/packages/> (last visited June 27, 2018).

¹⁵⁴ S&P Global, Cable TV Investor at 1 (July 31, 2015); S&P Global, Cable TV Investor at 3 (July 29, 2015). *See also* Joe Flint, *Why Does the Cable-TV Bundle Exist Anyway?*, Wall St. J. (June 8, 2015), <http://www.wsj.com/articles/why-does-the-cable-tv-bundle-exist-anyway-1433807825>.

¹⁵⁵ Verizon, *Fios Custom TV | Verizon Official Site*, <https://fios.verizon.com/fios-custom-tv-package.html> (last visited Sept. 24, 2018).

¹⁵⁶ Verizon, *Fios TV Plans, Custom | Verizon Official Site*, <https://www.verizon.com/home/fiostv/> (last visited Sept. 24, 2018).

¹⁵⁷ DIRECTTV, *DIRECTTV Packages – Build Your Own*, <https://www.directv.com/DTVAPP/pepod/configure.jsp#package-section> (last visited Oct. 1, 2018).

62. Offering discounts to new subscribers is a common pricing strategy. MVPDs offer substantial savings to new subscribers for a short period of time because the potential revenue stream over the long term is substantial. According to S&P Global, adding and terminating subscriber accounts is expensive, so the goal of every MVPD is to maximize the length of time an account is active at the same location through subscriber retention.¹⁵⁸ DISH Network explains that the company incurs significant upfront costs to acquire subscribers and strives to “provide outstanding customer service to increase the likelihood of customers keeping their pay-TV service over longer periods of time.”¹⁵⁹ Once the promotional period is over, MVPD subscribers generally can expect their monthly bills to increase. While MVPDs display prices for service upgrades on their websites, options for lowering an existing subscriber’s monthly bill, for example by downgrading or cancelling services, are harder to find. Existing subscribers sometimes find that MVPDs offer lower ongoing prices over the phone than are available on provider websites.¹⁶⁰

63. *Bundling.* MVPDs often offer better deals to consumers who purchase video services as part of a bundle that includes some combination of video, Internet, voice, and mobile wireless services.¹⁶¹ Often the price of a bundle of video, telephone, and Internet service is only marginally different from the price of Internet service alone.¹⁶² Analysts suggest that the strategy of bundling services to subscribers has a positive effect on customer retention as the household is reliant on the MVPD for multiple services.¹⁶³ In a recent survey, 56% of MVPD subscribers responded that a top reason for keeping the video service was because it was bundled with Internet service.¹⁶⁴

64. *TV Everywhere.* Many MVPDs offer connected video services, referred to as “TV Everywhere,” which allow consumers to access cable and broadcast channels and VOD programming on a variety of Internet-connected devices both inside and outside the home.¹⁶⁵ S&P Global maintains that MVPDs offer TV Everywhere at no extra charge in order to provide incentives for consumers to subscribe

¹⁵⁸ Keith Nissen, *Most US Households Remain Loyal to Multichannel TV Service Provider*, S&P Global (Apr. 25, 2016). See also, Ian Kingwill, *What is the Cost of Customer Acquisition vs Customer Retention?* (March 3, 2015), <https://www.linkedin.com/pulse/what-cost-customer-acquisition-vs-retention-ian-kingwill>.

¹⁵⁹ DISH Network 2017 10-K at 6.

¹⁶⁰ See e.g., Christopher Elliot, *How To Negotiate A Lower Cable Bill Without Cutting The Cord*, Huffington Post (March 15, 2017), http://www.huffingtonpost.com/entry/how-to-negotiate-a-lower-cable-bill-without-cutting-us_58c7f5d9e4b0d06aa65804be; See e.g., Emily Guy Birken, *How to Negotiate Your Way to a Lower Cable Bill*, Moneying, <http://moneying.com/budgeting/how-to-negotiate-your-cable-bill/> (last visited June 27, 2018).

¹⁶¹ *18th Report*, 32 FCC Rcd at 589-90, paras. 51-54.

¹⁶² See Ashley Rodriguez, *Internet-TV Bundles Like Sling TV Aren’t Saving Cord-cutters Money Off Cable*, Quartz (Jan. 18, 2018), <https://qz.com/1182312/internet-tv-bundles-like-slingtv-arent-saving-cord-cutters-money-off-cable/>; Rani Molla, *Americans Are Still Paying for Cable Because It’s Bundled With Their Internet*, Recode (Mar. 20, 2018), <https://www.recode.net/2018/3/20/17139756/reasons-americans-us-pay-cord-cable-tv>. (Molla) (“For many, the cost they’d have to pay for internet alone isn’t much less than they would pay for [TV, telephone, and internet] individually...”).

¹⁶³ See Jeffrey Prince and Shane Greenstein, *Does Service Bundling Reduce Churn?*, 23 J. of Economics & Management Strategy 839-75 (Winter 2014) (finding that bundling reduces subscriber churn); Jeffrey Prince, *The Dynamic Effects of Triple Play Bundling in Telecommunications*, Time Warner Cable, Research Program on Digital Communications (Winter 2012) (arguing that firms bundle video, Internet, and voice services to reduce subscriber churn).

¹⁶⁴ See Molla (noting that according to a March 2018 Deloitte survey, 56% of Americans cite service bundling as a reason for subscribing to their MVPD).

¹⁶⁵ TV Everywhere uses an authentication process to ensure that users subscribe to an MVPD. The process requires users to select their MVPD service provider and then provide a user ID and password.

to higher channel packages.¹⁶⁶ There are significant differences in the number of TV Everywhere programs offered by the largest MVPDs. For example, in early 2018, S&P Global determined that Verizon FIOS offered 6,375 TV Everywhere movie titles, whereas Charter offered 293.¹⁶⁷

65. *Video Services for Consumers Who Do Not Subscribe to an MVPD.* Some MVPDs offer online video services separate from their MVPD service. DISH Network led the way in the marketplace with the introduction of Sling TV in February 2015, offering a package of linear programming channels similar to a traditional pay-TV program package. AT&T followed with DIRECTV Now in November 2016 and WatchTV in June 2018. These online video services are examined more fully in our discussion of OVDs below. While DBS MVPDs have begun offering these services, wireline MVPDs have hesitated to offer channel packages that rely for delivery on facilities owned by other providers.¹⁶⁸ For example, Comcast's Instant TV service is available only to Comcast Internet subscribers.¹⁶⁹ And Charter's Spectrum TV Stream has similar restrictions.¹⁷⁰

66. *Impact of Programming Costs.* In general, programming costs for MVPDs have increased in recent years, resulting in increased costs for MVPD subscribers. S&P Global estimates that programming costs per subscriber were \$52.68/month in 2017, up from \$48.81 in 2016.¹⁷¹ In response to increased programming costs, many MVPDs have added "broadcast fees" and "regional sports fees" to monthly billing statements to pass those costs through directly to consumers and cover a portion of the increased programming costs without appearing to raise the rate of the television service.¹⁷²

67. *Ownership of Content.* Some 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, 17 Telemundo-affiliated broadcast stations; and Universal Pictures.¹⁷³ When acquiring NBC Universal, Comcast explained that, in part, its acquisition of programming assets was designed to facilitate offering expanded VOD and TV Everywhere services.¹⁷⁴ More recently, AT&T acquired Time Warner, which included the Warner Bros Studios, as well as the HBO, Turner, and CNN channels.¹⁷⁵ When announcing plans to merge, AT&T explained that ownership of Time Warner content would

¹⁶⁶ S&P Global, Cable TV Investor at 2 (Jan. 27, 2017).

¹⁶⁷ S&P Global, Cable TV Investor at 7-8 (Feb. 23, 2018).

¹⁶⁸ S&P Global, Cable TV Investor at 8-10 (Apr. 26, 2018).

¹⁶⁹ S&P Global, Cable TV Investor at 6 (June 2018).

¹⁷⁰ *Id.*

¹⁷¹ S&P Global, Cable TV Investor at 17-20 (Apr. 26, 2018).

¹⁷² See e.g., James K. Willcox, *Your Cable Bill Probably Went Up More Than You Think*, Consumer Reports (May 9, 2018), <https://www.consumerreports.org/tv-service/your-cable-bill-probably-went-up-more-than-you-think/>. See also S&P Global, Cable Program Investor at 2-4 (Apr. 23, 2018).

¹⁷³ Comcast 2017 10-K at 5-8.

¹⁷⁴ *Applications for Consent to the Transfer of Control of Licenses, General Electric Company, Transferor, to Comcast Corporation, Transferee, Applications and Public Interest Statement* (filed Jan. 28, 2010), <https://ecfsapi.fcc.gov/file/7020394237.pdf>.

¹⁷⁵ Press Release, AT&T, AT&T Completes Acquisition of Time Warner Inc. (June 15, 2018), http://about.att.com/story/att_completes_acquisition_of_time_warner_inc.html.

accelerate innovation in the mobile environment and improve targeted advertising.¹⁷⁶

b. Recent Entry and Exit

68. In general, competition in the video delivery marketplace is enhanced by entry of new facilities-based providers and when existing providers upgrade their video delivery systems.¹⁷⁷ When existing MVPDs merge or cease operations, competition may decrease.¹⁷⁸ When two MVPDs with non-overlapping footprints merge, the number of MVPDs available to customers does not change, but the transaction may still produce public interest benefits or harms.¹⁷⁹

69. Most MVPD entry and expansion in the past decade has come from telephone companies building fiber networks to compete with cable companies for video, Internet, and phone services. Telephone companies had been extending their wireline MVPD networks to additional households. This activity appears to have slowed recently. For example, in 2015, following its acquisition of DIRECTV, AT&T began encouraging customers to use DIRECTV, rather than AT&T's wireline U-verse, for video services.¹⁸⁰ Similarly, Google Fiber stopped its buildout in 2016,¹⁸¹ and CenturyLink stopped expanding and promoting Prism TV in 2018.¹⁸²

c. Report on Cable Industry Prices

70. In the context of this 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,¹⁸³ 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)¹⁸⁴ and

¹⁷⁶ Press Release, AT&T, AT&T to Acquire Time Warner (Oct. 22, 2016), http://about.att.com/story/att_to_acquire_time_warner.html. See also Jason Lynch, *AT&T and Time Warner's CEOs Explain the Benefits of Their \$85 Billion Merger*, Adweek (Oct. 24, 2016), <https://www.adweek.com/tv-video/att-and-time-warner-ceos-explain-benefits-their-85-billion-merger-174224/>.

¹⁷⁷ *18th Report*, 32 FCC Rcd at 582, para. 34.

¹⁷⁸ *Id.*, at 583, para. 37.

¹⁷⁹ *Id.*

¹⁸⁰ S&P Global, *Cable TV Investor* at 10-12 (Feb. 28, 2017).

¹⁸¹ Chris Mills, *What's happening to Google Fiber?*, BGR (Jan. 31, 2018), <https://bgr.com/2018/01/31/google-fiber-availability-new-cities-nope/>; Jeff Kagan, *What Ever Happened to Google Fiber?*, E-commerce Times (June 14, 2018), <https://www.ecommercetimes.com/story/85391.html>.

¹⁸² Daniel Frankel, *CenturyLink No Longer Working to Expand Prism TV Service*, FierceCable (Apr. 10, 2018), <https://www.fiercecable.com/cable/centurylink-no-longer-working-to-expand-prism-tv-service>; Karl Bode, *CenturyLink Drops TV Services, May Ditch Residential Broadband*, DSL Reports (Apr. 13, 2018), <http://www.dslreports.com/shownews/CenturyLink-Drops-TV-Services-May-Ditch-Residential-Broadband-141598>.

¹⁸³ 47 U.S.C. § 522(5) (defining cable operator). Cable operators include operators of traditional coaxial and fiber cable systems, municipalities, and telephone companies including Verizon Fios. DBS providers and AT&T U-verse systems are not registered with the Commission, and thus these systems' prices are not included, although DBS and AT&T U-verse are competitors for purposes of assessing effective competition. "Service tier" refers to a cable service for which a separate rate applies. 47 U.S.C. § 522(17). Operators must provide a separately available "basic cable service" to which customers must subscribe before accessing any other tier of service. 47 U.S.C. § 543(b)(7). "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). Section II, Part C defines other cable programming for the purpose of the Report.

¹⁸⁴ 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).

the Consolidated Appropriations Act of 2018.¹⁸⁵ 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 (herein after referred to as “effective competition”).¹⁸⁶ In 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.¹⁸⁷ The following presents an overview of the Commission’s findings as of January 1, 2017, and fulfills these statutory directives.¹⁸⁸

71. *Average price over all communities (regardless of effective competition standing).* Over the 12 months ending January 1, 2017, the average monthly price paid by subscribers who take only basic cable service grew by an average of 5.2%, to \$25.06. The average price for expanded basic cable service (the next level of service above the basic tier) rose by 3.2% over the same one-year period to \$75.21. Over the five years ending January 1, 2017, the price of expanded basic service rose, on average, by 4.1% annually. Average price per channel (price divided by the number of channels offered with expanded basic service) fell by 10.1% to 49 cents per channel over the 12 months ending January 1, 2017. Over the last five years, price per channel has decreased, on average, by 0.8% annually. For comparison, the rate of general inflation measured by the Consumer Price Index (all items) rose by 2.5% over the 12 months ending January 1, 2017, and at an average annual rate of 1.4% over the last five years.

72. *Average price in the communities with a finding of effective competition (effective competition communities) compared to price in communities without a finding of effective competition (noncompetitive communities).* On January 1, 2017, the average price of basic service was more than 50% higher in effective competition communities than in noncompetitive communities. However, the increase in the average price of basic service was smaller in effective competition communities than in

¹⁸⁵ The Consolidated Appropriations Act of 2018 included the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (RAY BAUM’S Act of 2018), which now requires, among other things, that the Commission include in a single report the information formerly submitted to Congress as the annual report on cable industry prices required by section 623(k) of the Communications Act. Consolidated Appropriations Act, 2018, Pub. L. No. 115-141, Div. P—RAY BAUM’S Act of 2018, §§ 401-404, 132 Stat. 348, 1087-90 (2018) (RAY BAUM’S Act of 2018). The prior annual reports provided statistical data on the average rates for basic cable service, other cable programming service, and equipment, as well as a comparison of the average rates of cable systems that the Commission has found are subject to effective competition with those of systems that the Commission has found are not subject to effective competition. In addition, the annual report includes information related to retransmission consent fees for broadcast stations, as discussed further below.

¹⁸⁶ Commission findings of effective competition generally are made in reference to a “cable community identifier” (CUID). The Commission assigns a unique CUID to each operator for each community the operator serves. As discussed in Appendix [[XX]], 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. *Amendment to the Commission’s Rules Concerning Effective Competition, Implementation of Section 111 of the STELA Reauthorization Act, Report and Order*, 30 FCC Rcd 6574 (2015). As a result of this change, operators in nearly all communities are now subject to effective competition. 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.*

¹⁸⁷ 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.

¹⁸⁸ The Commission’s complete report, containing additional data, information, and findings, is attached at Appendix [[XX]].

non-effective competition communities. Specifically, over the 12 months ending January 1, 2017, the average price of basic service in effective competition communities rose by 5.2% to \$25.17. In noncompetitive communities, the average price of basic service grew by 9.8%, to \$16.61. The differences between these groups in both absolute price levels and in the change in prices over time likely reflect a complicated mix of factors, with operators providing different service offerings in reaction to competition and regulation.

73. On January 1, 2017, the average price of expanded basic service in effective competition communities was about 3% lower than the average price of expanded basic in the noncompetitive communities. Over the 12 months ending January 1, 2017, the average price of expanded basic service in effective competition communities rose by 3.2% to \$75.19. In noncompetitive communities, the average price of expanded basic service grew by 3.6%, to \$77.24. In contrast to the average price of expanded basic service, the average price per channel was higher in effective competition communities (49 cents per channel) than in noncompetitive communities (39 cents per channel). Although operators in noncompetitive communities charged slightly more for expanded basic service than operators in effective competition communities, they offered more channels. Operators in effective competition communities offered an average of 195 video channels, while operators in noncompetitive communities offered an average of 212 channels.

74. *Average price in effective competition subgroups compared to price in noncompetitive communities.* As in prior years, we divided operators subject to effective competition into subgroups. Compared to the noncompetitive communities, the average price of basic service was higher in every effective competition subgroup and the difference was statistically significant in all subgroups except the rival subgroup. Compared to the average price of expanded basic service charged in noncompetitive communities (\$77.24), the average prices charged by incumbent operators and rival operators of such services were each about 6% lower (\$72.87 and \$72.40 respectively). These differences are statistically significant. Looking at the other effective competition subgroups, the average price charged by operators of small systems was \$71.73 (7.1% lower); the average price charged by operators of midsize systems was \$75.35 (2.4% lower); and the average price charged by operators of large systems was \$76.25 (1.3% lower). The difference between the small systems subgroup and the noncompetitive group is statistically significant but the other two differences are not statistically significant.¹⁸⁹

75. *Broadcast retransmission consent compensation fees.* From 2015 to 2016,¹⁹⁰ total retransmission consent fees paid by cable systems to television broadcast stations increased, on average, by 31.8% per year.¹⁹¹ Similarly, these same fees calculated on a per-subscriber basis increased on average by 30%, rising from \$55.82 to \$72.59 over the same period. Average monthly retransmission consent fees per subscriber per broadcast station increased by about 25% annually increasing from \$0.50

¹⁸⁹ The subgroups are defined as follows: incumbent operators are the original cable service operator in effective competition communities that are served by at least two wireline MVPDs; rival operators are later entrants in effective competition communities that are served by at least two wireline MVPDs; and all effective competition communities are divided by number of subscribers into those served by small, medium, or large systems. The sample for noncompetitive communities is drawn separately from the 118 communities that have successfully rebutted the presumption of effective competition. We provide more detail on the sampling groups and subgroups in Appendix [[XX]].

¹⁹⁰ The data for retransmission consent fees are collected somewhat differently than the rest of the data in the report. Retransmission data are collected for complete years, whereas all the rest of the data are collected as of a certain date (January 1). As a result, the retransmission consent fee data are for the *complete years* 2015 and 2016 (the latest two years for which annual retransmission consent data were available at the time of the 2017 survey), whereas the other data in the survey, by contrast, are snapshots as of January 1, 2016, or January 1, 2017.

¹⁹¹ More recent estimates show that growth in retransmission consent fees has slowed. From 2016 to 2017, S&P Global estimates that total retransmission consent fees paid to television stations increased by 17.7%. S&P Global, U.S. TV station industry total revenue projections, 2006-2023 (accessed December 7, 2017).

to \$0.63 from 2014 to 2016. Over the period 2013-2016, the compound average annual increase in retransmission consent fees was 42.3%, and the compound average annual increase in fees calculated on a per-subscriber basis was 37.8%.

2. OVDs

a. Business Models and Competitive Strategies

76. 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.¹⁹² OVDs employ a wide variety of strategies and business models to attract and retain viewers, as reflected in the different approaches that OVDs take regarding the size and variety of their video libraries and the decisions they make regarding ownership of content. Other differences may include whether the OVD offers a linear programming service that includes cable and broadcast channels, whether it sells or rents movies and TV shows, its pricing and geographic availability, and what devices the service supports.

77. *Video Libraries and Ownership of Content.* In contrast to MVPDs, which rarely compete in terms of exclusive content, many OVDs differentiate themselves by offering original and exclusive content.¹⁹³ Some OVDs offer large libraries with thousands of movies and TV shows from many media companies covering many genres. Others offer smaller libraries focusing on content from specific media companies, networks, or genres. Although most OVD content is not original--it first appeared in theaters or on broadcast or cable networks--some OVDs negotiate exclusive streaming rights to attract consumers seeking specific movies and TV shows.

78. Some OVDs had ownership interests in content when they launched. For example, Hulu is a joint venture of Walt Disney, Comcast, and AT&T, and Sony owns Crackle. Other OVDs, like Netflix and Amazon Prime, launched without ownership interests in content but subsequently included original content in their offerings. Although final numbers are not yet available, analysts expect that in 2018, Netflix will spend \$6 billion on content acquisition, an increase of more than \$1 billion over the \$4.7 billion it spent in 2017.¹⁹⁴ Analysts also indicate that of the \$8 billion Netflix is expected to spend on content in 2018, approximately \$2.1 billion will be spent on developing original programming, with the remainder invested in content acquisition and licensing costs.¹⁹⁵ According to the Chief Content Officer for Netflix, the company's shift to original content "is driven by more favorable economics—as opposed to licensing TV shows and films owned by Hollywood studios—and the expectation that big media companies would eventually put more weight into their own streaming-subscription services."¹⁹⁶ Netflix also has explained that its decision to own content was driven by the belief that content owners like Disney would raise prices or pull licensing deals and start their own online video services.¹⁹⁷

¹⁹² See *supra* note 131. Although online video includes both professional and amateur content, our focus is on content similar to the programming offered by cable and broadcast networks.

¹⁹³ S&P Global, *Internet & OTT Industry Overview: Over-the-Top Video at 9* (April 2017).

¹⁹⁴ Deana Myers, *Netflix Content Spend Projected to Rise 29% This Year, Hit \$2B-plus on Originals* S&P Global (March 28, 2018).

¹⁹⁵ *Id.* In May 2018, the Chief Content Officer for Netflix suggested even more significant spending on original content. Todd Spangler, *Netflix Content Chief Says 85% of New Spending Is on Originals*, *Variety* (May 14, 2018), <https://variety.com/2018/digital/news/netflix-original-spending-85-percent-1202809623/> ("Netflix is sharply steering its new content spending toward original projects, with around 85% of new spending going to original TV shows, films and other productions, according to chief content officer Ted Sarandos.").

¹⁹⁶ *Id.*

¹⁹⁷ See Ashley Rodriguez, *Netflix is Preparing for a Future Where Its Content is Mostly Its Own*, *Quartz* (July 17, 2018), <https://qz.com/1329821/netflix-is-preparing-for-a-future-where-it-has-mostly-originals/>. See also Nick Statt,

(continued....)

79. Similarly, after spending \$3.7 billion on content in 2017,¹⁹⁸ Amazon is expected to increase content spending to \$5.1 billion in 2018, with \$1 billion directed toward original programming.¹⁹⁹ Amazon has explained that its investment in original content is designed to lure consumers to Amazon Prime and drive merchandise sales.²⁰⁰ Hulu spent \$2.5 billion in 2017 and plans to spend approximately \$3.1 billion in 2018. Of that total, Hulu's spending on original content is expected to total \$219 million.²⁰¹

80. OVDs focusing on offering original or exclusive VOD content may view themselves as supplements to MVPD services with every consumer a potential customer.²⁰² Many consumers appear to view these OVDs as supplements and subscribe to more than one. In the summer of 2018, Leichtman Research Group estimated that among households that subscribe to an OVD offering VOD content, 63% subscribe to more than one.²⁰³

81. *Cable and Broadcast Channels.* Apart from OVDs specializing in live sports, most OVDs traditionally offered libraries of video content available on-demand for consumer viewing. A significant recent development in the Internet delivery of video services has been the increasing number of entities offering online packages of linear cable and broadcast channels. S&P Global now refers to these entities as "virtual multichannel" providers because they offer linear content similar to traditional MVPDs.²⁰⁴ Leichtman Research Group refers to these entities as "online pay TV providers" and discusses them alongside MVPDs.²⁰⁵ Leichtman considers the Internet as simply another delivery technology akin to coaxial cable, DBS, and fiber.²⁰⁶ Entities providing online packages of cable and broadcast channels have also been referred to as "virtual MVPDs" and this is the term we will use.²⁰⁷

82. Virtual MVPDs like Sling TV, DIRECTV NOW, Hulu Live TV, YouTube TV, and PlayStation Vue offer packages of broadcast and cable channels similar to the small and medium-sized

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Netflix plans to spend \$8 billion in 2018 to help make its library 50 percent original, The Verge (Oct. 16, 2017), <https://www.theverge.com/2017/10/16/16486436/netflix-original-content-8-billion-dollars-anime-films>.

¹⁹⁸ Deana Myers, *Amazon Content Spend up Nearly 40% This Year, \$1 Billion in Originals*, S&P Global (Apr. 5, 2018).

¹⁹⁹ *Id.*

²⁰⁰ Jeffrey Dastin, *Exclusive: Amazon's internal numbers on Prime Video, revealed*, Reuters (Mar. 15, 2018), <https://www.reuters.com/article/us-amazon-com-ratings-exclusive/exclusive-amazons-internal-numbers-on-prime-video-revealed-idUSKCN1GR0FX>.

²⁰¹ Deana Myers, *Hulu Content Spend on Significant Upward Path*, S&P Global (Feb. 1, 2018).

²⁰² See Ashley Rodriguez, *Amazon Prime Video is still just a complement to Netflix, study finds*, Quartz (June 27, 2018), <https://qz.com/1315838/amazon-prime-video-is-still-just-a-complement-to-netflix-study-finds/>. See also Jayson Derrick, *Study: Netflix, Hulu, Amazon Prime Are More Complementary Than Competitive*, Benzinga (Feb. 3, 2018), <https://www.benzinga.com/tech/18/02/11107959/study-netflix-hulu-amazon-prime-are-more-complementary-than-competitive>.

²⁰³ Press Release, Leichtman Research Group, *69% of U.S. Households Have an SVOD Service* (Aug. 27, 2018), <https://www.leichtmanresearch.com/69-of-u-s-households-have-an-svod-service/>.

²⁰⁴ S&P Global, *Cable TV Investor at 3* (June 2018).

²⁰⁵ Leichtman Research Group, *Research Notes 1Q 2017*, <http://www.leichtmanresearch.com/research.html#notes>.

²⁰⁶ *Id.*

²⁰⁷ Carl Wienschenk, *vMVPD Satisfaction: Despite the Technical Shortcomings, Subscribers are Warming to Pay-TV Alternatives*, Telecompetitor (Aug. 16, 2017), <http://www.telecompetitor.com/vmvpd-satisfaction-despite-the-technical-shortcomings-subscribers-are-warming-to-pay-tv-alternatives/>.

channel packages offered by MVPDs.²⁰⁸ Layer3 TV offers a large channel package similar to the full channel lineups that MVPDs offer.²⁰⁹ Virtual MVPDs offering similar packages of cable and broadcast channels may see themselves as potential substitutes to traditional cable, telco, or satellite delivered MVPDs, and thus may view competition as winner-take-all with most consumers subscribing to only one provider. On the other hand, no two virtual MVPDs offer exactly the same channels,²¹⁰ and consumers with strong preferences for specific channels may not view all virtual MVPDs as good substitutes for one another. In particular, some virtual MVPDs do not offer access to all local broadcast stations or regional sports networks. In addition to channel offerings, consumers comparing virtual MVPDs also take account of prices and features like access to a digital video recorder (DVR) in the cloud.²¹¹

83. *Sale and Rental.* While some OVDs offer access to a library of video programming for a set monthly subscription, others offer video content for sale and rental. Online video sales allow consumers to purchase a digital copy of a video program for a one-time fee. The program is then downloaded and stored either locally (e.g., on a hard drive) or remotely via a cloud storage service. Purchased and downloaded videos can be viewed repeatedly and whenever the consumer chooses. Online video rentals allow consumers to download a digital copy but require the consumer to start watching within a set period (e.g., 30 days) and finish watching within a set period (e.g., 24 hours). Once the program has been watched or the rental period has expired, the consumer can no longer view the program.

84. *Pricing.* Some OVDs offering VOD content are fully supported by advertisements and provide unlimited viewing of a catalog of video programs for free. Others require users to pay a monthly subscription fee to access their content. The fees for such services range from \$4.99 per month to \$14.99 per month.²¹² Subscription prices for virtual MVPDs offering packages of cable and broadcast channels range from \$15 per month to \$80 per month depending on the package selected.²¹³ Our review of some OVDs specializing in sports showed season prices ranging from a low of \$4.99/month for Major League Soccer to a high of \$199.99/season for the National Basketball Association.

85. In contrast to MVPDs, which offer new customers multi-month discounts, OVDs rarely offer lower prices to new customers as an inducement to subscribe.²¹⁴ Many OVDs, however, offer a free trial period that gives consumers an opportunity to explore the provider's content library and test the service on various devices.²¹⁵ When the free trial period is over, OVDs typically offer service on a month-to-month basis, charging both new and old customers the same price for service that can be cancelled at any time.²¹⁶

86. *Geographic Availability.* Although traditional OVDs offering video content are available

²⁰⁸ S&P Global maintains that virtual MVPDs “continue to add live stations, strengthening their position as cable alternatives.” Peter Leitzinger, *VSP & OTT Live Station Streams Bring on New Affiliates*, S&P Global (July 31, 2017).

²⁰⁹ Henry T. Casey, *What Is Layer3 TV and How Does It Work?*, Tom's Guide (Dec. 13, 2017), <https://www.tomsguide.com/us/layer3-faq-price-specs-t-mobile.news-26259.html>.

²¹⁰ David Katzmaier, *All the Live TV Streaming Services Compared: Which has the Best Channel Lineup?*, CNET (July 26, 2018), <https://www.cnet.com/news/live-tv-streaming-services-channel-lineups-compared/>.

²¹¹ Ali Choukeir, *VSP Channel Comparison Exposes Interesting Contrasts*, S&P Global (June 12, 2017).

²¹² Ali Choukeir, *Economics of Internet: Profile: Netflix (U.S.)*, S&P Global (April 10, 2018).

²¹³ Ali Choukeir, *Economics of Internet: State of US Online Video: Virtual Multichannel*, S&P Global (July 23, 2018).

²¹⁴ S&P Global, *Cable TV Investor at 2* (Sept. 29, 2017).

²¹⁵ *Id.*

²¹⁶ See, e.g., DIRECTV NOW, *DIRECTV NOW Packages & Pricing*, <https://www.directvnow.com/tv-packages> (last visited July 9, 2018).

nationwide to anyone with an Internet connection, OVDs offering linear packages of cable and broadcast channels may differ in their geographic reach. Availability may be based on contractual arrangements with cable networks, broadcast stations, and other content owners.²¹⁷ Availability may also require building, or contracting with, content distribution networks (CDNs) to enhance the speed and quality of video content delivered to consumers.²¹⁸ Layer3 TV delivers its video service over existing wireline facilities, leasing the necessary capacity from local broadband providers.²¹⁹

87. *Supported Devices.* OVDs further differentiate their services by the number of devices that can be connected to the service at the same time.²²⁰ Moreover, not all devices work with all online services. For example, the Apple TV streaming device did not include an app for Amazon Prime until the end of 2017,²²¹ and the Google Chromecast streaming device currently does not have an app for Amazon Prime.²²² Notably, Amazon, Google, Apple, and Sony are each both OVDs and manufacturers of Internet-connected devices, and each has its own business plan for whether and how to make its OVD content accessible on devices manufactured by rival entities. S&P Global maintains that entities that provide both video services and devices “can give a service an edge in terms of search, discovery and app placement.”²²³

b. Select Providers

88. The following OVD providers were selected to illustrate the strategies and business models discussed above.²²⁴

- Amazon: Amazon offers a large library of subscription-based video programming on demand, including a growing amount of original content.²²⁵ Amazon Prime members pay \$12.99 per month or \$119 per year and receive access to Prime Video as part of the

²¹⁷ See, e.g., *YouTube TV Expands to 14 New Markets, Partners with Sinclair Stations*, CNBC (Aug. 17, 2017), <https://www.cnbc.com/2017/08/17/youtube-tv-expands-to-14-new-markets-partners-with-sinclair-stations.html>.

²¹⁸ Content distribution networks speed transmission and reduce latency by storing cached versions of video data in geographic locations closer to the consumer. CDNetworks, *How Content Delivery Networks Work* (April 13, 2015), <https://www.cdnetworks.com/en/news/how-content-delivery-networks-work/4258>.

²¹⁹ Bernie Arnason, *IP Video Provider Layer 3 TV Partners with Muni Broadband Provider for Hosted Video*, Telecompetitor (Mar. 13, 2017), <http://www.telecompetitor.com/ip-video-provider-layer-3-tv-partners-with-muni-broadband-provider-for-hosted-video/>.

²²⁰ Ali Choukeir, *Economics of Internet: State of US Online Video: Virtual Multichannel*, S&P Global (July 23, 2018).

²²¹ Thomas Ricker, *Amazon Prime Video Comes to Apple TV, Finally*, The Verge (Dec 6, 2017), <https://www.theverge.com/2017/12/6/16741136/download-amazon-prime-video-apple-tv>.

²²² Parker Hall, *Watch Amazon Video on Your Chromecast — No Fire TV Stick Needed*, Digital Trends (Aug. 7, 2018), <https://www.digitaltrends.com/home-theater/how-to-watch-amazon-instant-video-on-chromecast-or-android-tv/>.

²²³ S&P Global, *Internet & OTT Industry Overview: Over-the-Top Video at 13* (April 2017).

²²⁴ The description of offerings is as of summer 2018, but notably OVD business models continue to evolve. For example, Amazon initially offered video sales and rentals and later added subscription-based VOD content. Hulu initially offered ad-supported VOD content, then moved to subscription-based VOD content, and has now added a subscription-based package of channels. See Ali Choukeir, *Economics of Internet: Profile: Hulu*, S&P Global (Feb. 22, 2017).

²²⁵ Marshall Honorof, *What Is Amazon Prime?*, Tom’s Guide (June 29, 2018), <https://www.tomsguide.com/us/what-is-amazon-prime.news-18041.html>.

- membership.²²⁶ Prime Video may also be purchased as a standalone service for \$8.99 per month.²²⁷
- **Netflix:** Netflix offers a large library of subscription-based video programming and a rapidly growing amount of original content.²²⁸ Three streaming plans are available: a basic plan for one screen in standard definition (SD) for \$7.99 per month; a standard plan for two screens in high definition (HD) for \$10.99 per month; and a premium plan for four screens in HD/UHD 4K for \$13.99 per month.²²⁹
 - **Hulu:** Hulu is a joint venture co-owned by Walt Disney, Comcast, and AT&T.²³⁰ Hulu's video library includes many current-season TV shows and 20 original series.²³¹ In 2017, the company introduced Hulu Live TV, which provides 50 programming channels as well as access to video on demand.²³² Hulu offers four plans: the VOD library with commercials for \$7.99 per month; the VOD library without commercials for \$11.99 per month; the VOD library with commercials and Live TV for \$39.99 per month; and the VOD library without commercials and Live TV for \$43.99 per month.²³³
 - **YouTube:** Google's YouTube offers an ad-supported video library with a wide variety of content, including user-created videos, professionally produced video content, music videos and clips from TV shows and movies.²³⁴ YouTube Premium offers the same content without ads plus some original content for \$11.99 per month.²³⁵ In 2017, the company introduced YouTube TV, which provides 60 channels with VOD for \$40 per month.²³⁶
 - **iTunes:** Apple's iTunes offers sale and rental of over 100,000 movies and TV shows.²³⁷
 - **PlayStation Vue:** Sony's PlayStation Vue offers four subscription-based channel packages along with access to video programming on demand. "Access" provides popular channels for \$44.99 per month; "Core" includes sports channels for \$49.99 per month; "Elite" adds movie

²²⁶ Amazon, Amazon Prime, <https://www.amazon.com/Amazon-Prime-One-Year-Membership/dp/B00DBYBNEE> (last visited Aug. 1, 2018).

²²⁷ *Id.*

²²⁸ Netflix, *How Does Netflix Work?*, <https://help.netflix.com/en/node/412> (last visited July 5, 2018). Todd Spangler, *Netflix Eyeing Total of About 700 Original Series in 2018*, *Variety* (Feb. 27, 2018), <https://variety.com/2018/digital/news/netflix-700-original-series-2018-1202711940/>.

²²⁹ Netflix, *Netflix Plans, Pricing & Signup*, <https://www.netflix.com/signup/planform> (last visited July 5, 2018). In addition to online video, Netflix offers plans that deliver DVDs to customers via mail. Netflix, *Rent Movies and TV Shows on DVD and Blu-ray*, <https://dvd.netflix.com/> (last visited July 5, 2018).

²³⁰ Luke Bouma, *Hulu's Ownership Just Changed & Will Change Again Soon*, *Cord Cutters News* (June 15, 2018), <https://www.cordcuttersnews.com/hulus-ownership-just-changed-will-change-again-soon/>.

²³¹ Hulu, *Stream TV and Movies Live and Online*, <https://www.hulu.com/welcome> (last visited July 5, 2018).

²³² *Id.*

²³³ John-Michael Bond, *Hulu No Commercials vs Hulu Limited Commercials: What's the Difference?*, *The Daily Dot* (July 30, 2018), <https://www.dailydot.com/upstream/hulu-no-commercials-limited-commercials-plan/>.

²³⁴ YouTube, *YouTube*, <https://www.youtube.com/> (last visited Oct. 16, 2018).

²³⁵ YouTube, *YouTube Premium*, <https://www.youtube.com/red> (last visited Oct. 16, 2018).

²³⁶ YouTube, *YouTube TV: Watch & DVR Live Sports, Shows & News*, <https://tv.youtube.com/welcome/> (last visited July 5, 2018).

²³⁷ Apple, *iTunes – Video – Apple*, <https://www.apple.com/itunes/video/> (last visited July 5, 2018).

- channels for \$59.99 per month; and “Ultra” adds access to premium channels for \$79.99 per month.²³⁸
- **Sling TV:** DISH Network’s Sling TV offers subscription-based channel packages with access to video programming on demand. Sling Orange offers 29 channels for \$25/month, Sling Blue offers a different mix of 42 channels for \$25/month, and Sling Orange plus Sling Blue cost \$40/month.²³⁹ Additional packages (e.g., sports, news, kids) can be added for an additional \$5/month.²⁴⁰
 - **DIRECTV NOW:** AT&T’s DIRECTV NOW offers four subscription-based channel packages along with VOD. Live A Little provides 60+ channels for \$40 per month, Just Right provides 80+ channels for \$55 per month, Go Big offers 105+ channels for \$65 per month, and Gotta Have It provides 125+ channels for \$75 per month.²⁴¹
 - **Layer3 TV:**²⁴² T-Mobile’s Layer3 TV offers 200 HD-only linear broadcast and cable channels for \$75/month and is available in Chicago, Washington D.C., Los Angeles, and Dallas.²⁴³ To provide service, Layer3 TV leases capacity from backbone and last mile broadband providers and requires use of a set-top box.²⁴⁴
 - **Cable and Broadcast Networks:** Most premium cable networks, formerly available only as part of a traditional MVPD subscription, now offer subscription-based cable channels over the Internet. In addition to multiple linear programming streams, these networks also provide access to a library of programming. For example, HBO NOW costs \$14.99/month, SHOWTIME costs \$10.99/month, and STARZ costs \$8.99/month.²⁴⁵ Currently, CBS is the only major broadcast television network to offer a subscription-based broadcast channel online with VOD and original content.²⁴⁶ CBS All Access costs \$5.99/month or \$9.99/month without commercials.²⁴⁷ Other broadcast networks offer ad-supported video on demand focused primarily on their prime-time programming.

²³⁸ PlayStation Vue, *Watch Live Streaming TV*, <https://www.playstation.com/en-us/network/vue/> (last visited Aug. 1, 2018).

²³⁹ Sling TV, *Live TV Streaming Services*, <https://www.sling.com/> (last visited Aug. 1, 2018).

²⁴⁰ *Id.*

²⁴¹ DIRECTV NOW, *DIRECTV NOW Packages & Pricing*, <https://www.directvnow.com/tv-packages> (last visited Aug. 1, 2018).

²⁴² We discuss Layer3 TV in the OVD section as a virtual MVPD, but Layer3 TV could also be viewed as an MVPD as it is delivered over a closed broadband network. Bernie Arnason, *IP Video Provider Layer3 TV Partners with Muni Broadband Provider for Hosted Video*, Telecompetitor (Mar. 13, 2017), <http://www.telecompetitor.com/ip-video-provider-layer-3-tv-partners-with-muni-broadband-provider-for-hosted-video/>.

²⁴³ Layer3 TV, *Layer3 TV – A T-Mobile Company – all HD & 4K Cable TV*, <https://layer3tv.com/> (last visited July 5, 2018).

²⁴⁴ Jessi Hempel, *Layer3 TV’s Crazy Plan to Take on Comcast and Reinvent Cable*, Wired (Apr. 10, 2016), <https://www.wired.com/2016/04/layer3-tv/>.

²⁴⁵ HBO NOW, *How to Order HBO*, <https://www.hbo.com/order> (last visited July 6, 2018); SHOWTIME, *Order SHOWTIME Now*, <http://www.sho.com/order-showtime> (last visited July 6, 2018); John-Michael Bond, *How to Watch Starz Online*, The Daily Dot (Jan. 25, 2018), <https://www.dailydot.com/upstream/watch-starz-online/>.

²⁴⁶ CBS, *Stream Live TV Sports & News with Free Trial of CBS All Access*, <https://www.cbs.com/all-access/> (last visited July 6, 2018).

²⁴⁷ *Id.*

- **Sports Leagues:** Most major U.S. professional sports leagues such as Major League Baseball (MLB), the National Basketball Association (NBA), the National Hockey League (NHL), and Major League Soccer (MLS) offer subscription-based streaming of live games. Sports packages typically enable subscribers to follow single teams or all teams within a league. MLB offers MLB.TV Single Team for \$89.99/season and MLB.TV All Teams for \$115.99/season.²⁴⁸ NFL offers NFL Game Pass for \$99.99/season.²⁴⁹ NBA offers NBA Team Pass for \$119.99/season and NBA League Pass for \$199.00/season.²⁵⁰ NHL offers Single Team Pass for \$109.99, Monthly Pass for \$24.99, and All Access for \$139.99.²⁵¹ And ESPN+ offers MLS Live for \$4.99/month.²⁵²

c. Recent Entry and Exit

89. The OVD marketplace continues to expand and change. Significant recent entrants into the OVD marketplace include DIRECTV NOW, which launched in 2016, and YouTube TV and Hulu Live TV, which launched in 2017. As discussed above, these virtual MVPDs offer packages of cable and broadcast channels similar to packages offered by traditional MVPDs, as well as access to video programming on demand. Recent, more niche, subscription-based entrants offering VOD content include History Vault, STARZ, and MyOutdoorTV, which launched in 2016, and BritBox, Boomerang, and Hallmark Movies Now, which launched in 2017.²⁵³ Turner Classic Movies launched FilmStruck in November 2016 but announced in October 2018 that the service would be shut down.²⁵⁴ CenturyLink Stream, a live OTT streaming service, exited the marketplace in March 2018.²⁵⁵

3. Broadcast Television Stations

90. As noted above, the Commission licenses broadcast television stations consistent with the Communications Act.²⁵⁶ While licenses were formerly granted pursuant to comparative hearings among interested applicants, presently broadcast licenses are awarded by auction; however, the Commission has not auctioned a license for any new full power commercial television stations since 2011. While the majority of broadcast television station licensees are part of larger companies that are involved in other industries, some large owners, such as Sinclair Broadcast Group, Inc., Tribune Media Co., TEGNA, Inc., Media General/Nexstar Broadcasting Group, Inc., and Gray Television, Inc., focus almost exclusively on

²⁴⁸ MLB.TV, *MLB.TV Subscription*, <https://www.mlb.com/live-stream-games/subscribe> (last visited July 6, 2018).

²⁴⁹ NFL Game Pass, *NFL Game Pass*, <https://gamepass.nfl.com/packages> (last visited July 6, 2018).

²⁵⁰ John-Michael Bond, *NBA League Pass vs Team Pass*, *The Daily Dot* (Nov. 11, 2017), <https://www.dailydot.com/upstream/nba-league-pass-team-pass/>.

²⁵¹ NHL.TV, *Subscribe | NHL.com*, <https://www.nhl.com/subscribe> (last visited Oct. 5, 2018).

²⁵² ESPN+, *ESPN+ Stream Live Sports*, <https://watch.espnplus.com/soccer/> (last visited Aug. 1, 2018).

²⁵³ S&P Global, *Internet Media & OTT Industry Presentation*, Q1 2018 at 11 (April 2018).

²⁵⁴ Steven Zeitchik, *The Highest-quality Streaming Service Ever Created is Shutting Down. It Could be a Very Bad Omen for Fans*, *The Washington Post* (Oct. 26, 2018), https://www.washingtonpost.com/business/2018/10/26/highest-quality-streaming-service-ever-created-is-shutting-down-it-could-be-very-bad-omen-fans/?noredirect=on&utm_term=.1fc5e42e440d.

²⁵⁵ Karl Bode, *CenturyLink Drops TV Service, May Ditch Residential Broadband*, *DSLReports* (Apr. 13, 2018), <http://www.dslreports.com/shownews/CenturyLink-Drops-TV-Services--May-Ditch-Residential-Broadband-141598>.

²⁵⁶ 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 translators, which are used to increase the geographic reach of their associated main station.

the broadcast industry.²⁵⁷

91. Commercial television broadcast stations essentially serve two distinct sets of customers: consumer audiences and advertisers. While fees received from MVPDs for the right to retransmit the signals of the broadcast stations have increased in recent years, broadcasters continue to derive revenues primarily by selling time to advertisers during their broadcasts. The amount of revenue generated depends largely on the size and demographic characteristics of the audiences that broadcasters reach. Accordingly, broadcasters seek to provide content that will attract viewers and maximize their audiences.

92. Individual commercial stations compete primarily with other commercial broadcast stations within their local markets (Designated Market Areas or DMAs) for audiences and advertising revenue.²⁵⁸ Other media, including competing video providers; local, regional, and national cable networks; and Internet sites, also earn advertising revenues by attracting audiences within the geographic areas they serve. A broadcast station's advertising revenues depends on viewership of its television programs, regardless of whether consumers receive the station's signal over the air or via an MVPD.

93. As shown in Figure B-4 below, the number of broadcast television stations has remained relatively stable in recent years.

Fig. B-4
Number of Broadcast Television Stations²⁵⁹

	2015	2016	2017	2018
Commercial UHF	1,031	1,033	1,013	990
Commercial VHF	356	351	364	359
Non-Commercial	395	394	390	412

94. 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.²⁶⁰ Buildings, hills, and other objects,

²⁵⁷ S&P Global, *Broadcast Industry Overview: US TV and Radio Stations* (2017) at 44. TV station "pure-play" group, is a general term for a company that derives over half of its revenues from broadcast TV. Sinclair and Tribune Media are examples of companies that own digital assets and TV networks but are still considered TV station pure-play groups.

²⁵⁸ The Nielsen Company assigns each broadcast television station to a designated market area (DMA). The DMA boundaries and DMA data are owned solely and exclusively by Nielsen. Nielsen, *Nielsen DMA Maps*, <http://www.nielsen.com/intl-campaigns/us/dma-maps.html> (last visited Aug. 8, 2018). Each DMA is a group of counties that form an exclusive geographic area in which the home market television stations hold a dominance of total hours viewed. There are 210 DMAs, covering the entire continental United States, Hawaii, and parts of Alaska. DMAs with large populations tend to have more full-power stations, and DMAs with smaller populations usually have fewer stations and tend to rely more on multicasting and/or Low Power Television Stations to make available all of the major broadcast networks (e.g., ABC, CBS, FOX, NBC, CW, and myNetworkTV).

²⁵⁹ See FCC, Licensed Broadcast Station Totals as of September 30, 2018, <https://docs.fcc.gov/public/attachments/DOC-354386A1.pdf>; FCC, Licensed Broadcast Station Totals as of December 31, 2017, <https://docs.fcc.gov/public/attachments/DOC-348570A1.pdf>; FCC, Licensed Broadcast Station Totals as of December 31, 2016, https://apps.fcc.gov/edocs_public/attachmatch/DOC-342889A1.pdf; FCC, Licensed Broadcast Station Totals as of December 31, 2015, https://apps.fcc.gov/edocs_public/attachmatch/DOC-337189A1.pdf. Figures for 2015-2017 are as of December 31. Figures for 2018 are as of September 30. VHF stations operate on channels 2-13, while UHF stations operate on channels 14-51.

²⁶⁰ To receive signals from all local broadcast stations, the antenna may need to be able to receive both VHF channels and UHF channels. Some antennas provide good reception of VHF or UHF channels, but not both. FCC, *Antennas and Digital Television*, <https://www.fcc.gov/consumers/guides/antennas-and-digital-television> (last visited Dec. 7, 2017).

however, may interfere with over-the-air signals. As discussed in more detail below, many television broadcasters use digital transmission technologies to offer multiple program streams (multicast channels) to consumers in an effort to provide more programming and features to consumers.²⁶¹

95. MVPDs offering service within a DMA typically carry the local broadcast television stations assigned to the DMA, rebroadcasting the stations' signals to all the MVPDs' subscribers. In part this is because broadcast stations typically hold exclusive rights to broadcast the programming of their affiliated network in a market. Thus, unlike cable networks that are available nationwide, most broadcast television stations are retransmitted by MVPDs only within the station's assigned DMA. Rebroadcast of television stations by online virtual MVPDs follows a similar pattern--subscribers located in a DMA receive local broadcast television stations from the same DMA.

a. Business Models and Competitive Strategies

96. *Distribution and Delivery.* Broadcast television stations reach consumers by broadcasting signals directly over the air to homes, as well as through carriage agreement with MVPDs and OVDs, which retransmit the signals of stations to households subscribing to their services. As such, broadcasters are in the business of both content distribution and content delivery. When broadcasters negotiate with MVPDs and OVDs for carriage of their programming, they are in the business of content distribution--similar to cable networks. When broadcasters deliver programming using their free over-the-air service, they are in the business of content delivery--similar to facilities-based MVPDs.²⁶² Additionally, most commercial broadcast stations also produce some of their own programming content, typically news or local sports and events, in addition to acquiring programming from affiliated broadcast networks or from syndicators.

97. *Advertising.* A broadcast station sells advertising time based on the number or percentage of households in a market viewing the broadcast station's programming. Revenue from advertising accounts for the largest share of television broadcasters' revenue. In 2016 and 2017, respectively, broadcasters earned about 67% of total revenue (\$20.7 billion) and 62% of total revenue (\$19.1 billion) from advertising sales.²⁶³ Fees obtained from MVPDs and virtual MVPDs for the retransmission of the station's signal make up the second largest category of broadcast stations revenue.²⁶⁴

98. Broadcast television stations usually sell all the advertising time during the blocks of time containing programming produced by the station itself (most importantly local newscasts), but divide the advertising time with broadcast networks when network programming is shown.²⁶⁵ Local advertisers generally purchase advertising time directly from a station's local sales staff.²⁶⁶ In contrast, national advertisers generally work with national advertising sales representative firms to purchase advertising

²⁶¹ Digital broadcasting technology also allows broadcasters to use part of their licensed digital spectrum to provide non-broadcast "ancillary or supplementary" services (such as subscription video services, data transfer, or audio signals). 47 U.S.C. § 336(a)(2); 47 CFR § 373.624(c). If stations choose to provide such ancillary or supplementary services, they must remit a fee to the Commission of 5% of the gross revenues received from such services. 47 U.S.C. § 336(e); 47 CFR § 73.624(g). Revenue from ancillary and supplementary services remains an insignificant portion of total station revenue. In 2016, total revenue from these services was approximately \$200,000, and the Commission collected approximately \$10,000 in fees from this revenue. In 2017, total revenue from these services was approximately \$25,000, and the Commission collected approximately \$1,200 in fees from this revenue.

²⁶² Although we discuss the wider business of broadcasters, our report focuses 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.

²⁶³ S&P Global, Total TV Station Industry Revenue Projections, June 2017 (2017 S&P Global TV Revenues).

²⁶⁴ *Id.*

²⁶⁵ Harold L. Vogel, *Entertainment Industry Economics* (8th ed. 2011) at 317, n. 29.

²⁶⁶ Nexstar SEC Form 10-K for the year ended December 31, 2017 at 15 (Nexstar 2017 10-K).

time on broadcast television stations.²⁶⁷

99. Broadcast advertising rates vary by time of day, with prime time (the hours between 7 PM – 11 PM) being the most expensive.²⁶⁸ Political cycles, both federal and local, have a significant impact on broadcast advertising revenue, with even numbered years bringing in more revenue than odd numbered years.²⁶⁹ Generally, advertising rates are determined by a station's overall ability to attract viewers in its market area and its ability to attract viewers among particular demographic groups that an advertiser may be targeting.²⁷⁰ Specifically, advertising rates depend upon factors such as: (1) the size of a station's market; (2) a station's overall ratings; (3) a program's popularity among targeted viewers; (4) the number of advertisers competing for available time; (5) the demographic makeup of the station's market; (6) the availability of alternative advertising media in the market; (7) the presence of effective sales forces; (8) the development of projects, features, and programs that tie advertiser messages to programming; and (9) the level of spending commitment made by the advertiser.²⁷¹

100. *Retransmission Consent Fees.* Many television broadcast stations generate revenue by granting MVPDs the right to carry their signal. Pursuant to Section 325 of the Act, MVPDs may not retransmit a local television broadcaster's signal without the station's express permission.²⁷² If a station elects retransmission consent, the broadcaster and MVPD negotiate a carriage agreement, which often includes monetary or other types of compensation to the television broadcaster.²⁷³ In 2016 and 2017, respectively, broadcasters earned about 25% of their revenue (\$7.9 billion) and 30% of their revenue (\$9.3 billion) from retransmission consent fees.²⁷⁴

101. As shown in Figure B-5 below, advertising provides the largest amount of revenue, but its overall revenue share decreased significantly between 2016 and 2017. During the same time period, the share of overall revenue attributable to retransmission consent fees increased by a similar percentage.

²⁶⁷ *Id.*

²⁶⁸ For a discussion of broadcast network's primetime programming and the advertising rates of the top-four broadcast networks, see *2014 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*, Second Report and Order, 31 FCC Rcd 9864, 9954-58, paras. 222-28 (2016).

²⁶⁹ Steve Passwaiter, *2018 Campaign Ad Spend Will be in the Billions*, The Cook Political Report (Sept. 22, 2017), <https://www.cookpolitical.com/analysis/national/political-advertising/2018-campaign-ad-spend-will-be-billions>. See also Kate Kaye, *2016 Political Broadcast TV Spend Down 20%, Cable Up 52%*, AdAge (Jan. 3, 2017), <http://adage.com/article/media/2016-political-broadcast-tv-spend-20-cable-52/307346/>.

²⁷⁰ See, e.g., Nexstar 2017 10-K at 15; Gray Television SEC Form 10-K for the year ended December 31, 2017 at 4 (Gray 2017 10-K).

²⁷¹ Nexstar 2017 10-K at 15.

²⁷² 47 U.S.C. § 325(b). Every three years, commercial television stations must elect either the right to grant consent for the MVPDs in their DMA to retransmit their 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.

²⁷³ 47 U.S.C. § 325(b)(3)(C); 47 CFR § 76.64; see also *16th Report*, 30 FCC Rcd at 3274-76, paras. 44-46. Television stations that are carried pursuant to must-carry receive no compensation from MVPDs for signal carriage.

²⁷⁴ S&P Global, *Total TV Station Industry Revenue Projections*, June 2017 (2017 S&P Global TV Revenues).

Fig. B-5
Broadcast Television Station Industry Gross Revenue Trends (in millions)²⁷⁵

Revenue Source	2016		2017	
	Revenue	Percentage	Revenue	Percentage
Advertising	\$20,738	67%	\$18,973	61%
Network Compensation	<\$1	<1%	<\$1	<1%
Retransmission Consent	\$7,980	25%	\$9,374	31%
Digital/Online	2,117	7%	\$2,329	8%
Total	\$30,835	100%	\$30,676	100%
Percentage Change in Revenue from Previous Year		12.9% ²⁷⁶		-0.5%

102. *Programming.* Broadcast stations compete with one another, as well as with cable networks and OVDs, for viewing audiences primarily on the basis of program popularity.²⁷⁷ Broadcast television stations that are owned or affiliated with a broadcast network typically market themselves based largely on their affiliation, program popularity, and local news.²⁷⁸

103. Programming from major broadcast networks, which is aired by local television broadcast affiliates, often attracts large audiences. Such programming includes prime time entertainment programming, including sit-coms, dramas, and news/variety shows and sporting events, such as the Olympics, National Football League (NFL) games, Major League Baseball (MLB) games, and the Academy Awards.²⁷⁹ Broadcast networks often schedule their most popular programming during February, May, July, and November, when Nielsen measures television audiences for all DMAs, which serve as a basis for developing advertising rates.²⁸⁰

104. Many broadcast television stations differentiate themselves from both other stations and cable channels by offering local news, exclusive news stories, investigative reporting, regional and local sports, and coverage of community events.²⁸¹ In 2017, the average television station aired 5.6 hours of

²⁷⁵ S&P Global, *U.S. TV Station Industry Total Revenue Projections, 2008-2023 (Jun. 2018)*.

²⁷⁶ This figure represents the percentage change from 2015, when total broadcast station industry gross revenue was \$27,312,000. *Id.*

²⁷⁷ Gray 2017 10-K at 10; Sinclair Broadcast Group, Inc SEC Form 10-K for the year ended December 31, 2017 at 19 (Sinclair 2017 10-K).

²⁷⁸ Nexstar 2017 10-K at 15; Gray 2017 10-K at 8.

²⁷⁹ Sinclair 2017 10-K at 12. The network affiliation agreements, generally exclusive for each of the 210 DMAs, provide affiliates with the right to air network programming first. The contracts may run from two to ten or more years. The Commission's right-to-reject rule grants an affiliate the right to: (1) reject or refuse network programs which the station reasonably believes to be unsatisfactory, unsuitable, or contrary to the public interest, and (2) substitute a program which, in the station's opinion, is of greater local or national importance. 47 CFR § 73.658(e).

²⁸⁰ Nielsen refers to these months as "sweeps months." See Nielsen Media Research, Glossary of Media Terms, Sweeps, <http://www.nielsenmedia.com/glossary/> (last visited Aug 10, 2018).

²⁸¹ Nexstar 2017 10-K at 9; Gray 2017 10-K at 9; Sinclair 2017 10-K at 19. Nexstar states that it strives to increase the audience share of its stations by providing extensive local sports coverage and active sponsorship of community

(continued...)

local news per weekday, down slightly from 2016.²⁸² Although local news is becoming more available from other sources, local broadcast television stations remain the most viewed source and the most preferred source for emergency news.²⁸³

105. In addition to 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.²⁸⁴ Syndicated programming often represents a long-term financial commitment.²⁸⁵ Stations usually purchase syndicated programming two to three years in advance and sometimes must make multi-year commitments.²⁸⁶ An average broadcast television station spends an estimated 26.8% of its expenses on acquiring syndicated programming.²⁸⁷

106. As noted above, many broadcast television stations provide additional programming choices by offering multicast channels in both high definition (HD) and standard definition (SD). Multicast streams often carry newer networks such as Me-TV (with 164 digital multicast affiliates), This-TV (with 83 digital multicast affiliates), and Grit (with 130 digital multicasting affiliates).²⁸⁸ Broadcasters have increased the number of multicast channels.²⁸⁹ There were 6,109 broadcast channels in January 2017, up from 5,905 in February 2016, as this trend of broadcasting multicast streams expands.²⁹⁰ The revenue generated by multicasting is not large, but it is growing.²⁹¹

107. In addition, most broadcasters offer HD programming. As of the end of 2017, 1,116 (91.0%) of full-power stations were broadcasting in HD, up from 954 stations at the end of 2016.²⁹² All of the multicast channels and HD programming provided by broadcasters is available via over-the-air service, which households can receive by attaching an antenna to any digital television set. As of 2016, 106.5 million U.S. TV households, or 96% of such households, had sets capable of displaying and/or

(Continued from previous page)

events. In 2017, Nexstar earned approximately 35% of its net advertising revenues from local broadcast advertising. Nexstar 2017 10-K at 9.

²⁸² Robert Papper, *RTNDA Research: Local news by the numbers* RTDNA (June 2018). This RTNDA/Hofstra survey was conducted in fourth quarter 2017 and presents the national average hours of news for all stations. https://www.rtdna.org/article/rtdna_research_local_news_by_the_numbers_2018.

²⁸³ NAB Comments at 11-12.

²⁸⁴ See e.g., Nexstar 2017 10-K at 16; Sinclair 2017 10-K at 20; Gray 2017 10-K at 10. Cable networks occasionally acquire programs that might otherwise be offered to stations. For example, Twentieth Century Fox TV and Twentieth TV negotiated the first cable syndication and VOD deal of *The Simpsons* to FXX for all past and future episodes, within the time period of the deal, for approximately \$750 million. Cynthia Littleton, *'The Simpsons' Lands \$750 Mil Cable Syndication, VOD Pact with FXX*, Variety (Nov. 15, 2013), <http://variety.com/2013/tv/news/the-simpsons-lands-750-mil-cable-vod-syndication-pact-with-fxx-1200837036/>.

²⁸⁵ Syndicated programming can impose financial risks on stations. Broadcast stations cannot predict whether a particular show will be sufficiently popular to enable it to sell enough related advertising time to cover the costs of the program. A station may have to replace a poorly performing program before it has recovered the costs of obtaining it. Sinclair 2017 10-K at 24; Gray 2017 10-K at 21.

²⁸⁶ Sinclair 2017 10-K at 24.

²⁸⁷ National Association of Broadcasters, *Television Financial Report*, at iv (2017).

²⁸⁸ S&P Global, TV Station Multi-Platform Report-Update (Oct 2017).

²⁸⁹ NAB Comments at 15.

²⁹⁰ *Id.*

²⁹¹ *Id.* at 16.

²⁹² S&P Global, TV Station Multiplatform Analysis Update, Oct. 2017; S&P Global, TV Station Multiplatform Analysis Update, Jan. 2016.

receiving digital signals, including HD broadcast signals.²⁹³ This figure is up from 102.1 million U.S. television households, or 88% of such households, in 2015.²⁹⁴

108. Broadcasters also make use of websites, apps, and social media to extend access to broadcast programming, especially news.²⁹⁵ According to the NAB, “[i]t is now routine for TV stations’ websites to offer news video, live streaming and, increasingly, to live stream their newscasts.”²⁹⁶ Recent developments by many companies, including Internet service providers and Internet website operators, have expanded and are continuing to expand the variety and quality of broadcast and non-broadcast video programming available to consumers via the Internet. For example, broadcasters have expanded their use of Facebook, Twitter, Instagram, and Snapchat, especially for breaking news.²⁹⁷ In addition, Internet companies have developed business relationships with companies that have traditionally provided syndicated programming, network television, and other content. As a result, additional programming continues to become available through non-traditional methods, which can directly impact the number of TV viewers, and thus indirectly impact station rankings, popularity, and revenue.²⁹⁸

109. As of April 2018, 79% of all TV households received broadcast programming via an MVPD,²⁹⁹ down from 80% at the end of 2016 and 83% at the end of 2015.³⁰⁰ The downward trend in MVPD subscriptions has been accompanied by growth in the number of households relying on over-the-air broadcast service. In 2018, 16.6 million TV households (13.9%) relied exclusively on over-the-air broadcast signals,³⁰¹ up from 15.7 million TV households (13.2%) in 2017,³⁰² and 13.3 million TV households (11%) in 2016.³⁰³ While broadcast stations may lose retransmission fees as a result of increased reliance on over the air signals, they may gain advertising revenue from increased viewing of broadcast programming and a stronger connection to consumers.

110. *Ownership of Content.* Some large broadcast television station groups have ownership interests in content. The Boston Consulting Group contends that content exclusivity allows a company to differentiate itself and attract consumers.³⁰⁴ Accenture notes that several broadcasters have made a strategic shift to content production, generating revenue from international licensing deals and both global and local syndication.³⁰⁵ This has provided protection from slowing growth in advertising revenues.³⁰⁶

111. For example, Disney, which owns ABC, also owns the Disney cable channels, television and movie studios, and a majority interest in ESPN.³⁰⁷ In 2018, Disney entered into an agreement to

²⁹³ Nielsen, *2017 Universe Estimate Report* (Nielsen 2017 Universe Estimates).

²⁹⁴ *Id.*

²⁹⁵ NAB Comments at 12-15.

²⁹⁶ *Id.* at 13.

²⁹⁷ *Id.*

²⁹⁸ Gray 2017 10-K at 10; Sinclair 2017 10-K at 13-14.

²⁹⁹ Nielsen, 2018-2019 Advanced National TV Household Universe Estimates.

³⁰⁰ S&P Global, U.S. Multichannel Industry Benchmarks (last visited Dec. 13, 2017).

³⁰¹ Nielsen, 2018-2019 Final Universe Estimates Report.

³⁰² Nielsen, 2017 Final Universe Estimates Report.

³⁰³ Nielsen, 2016 Final Universe Estimates Report.

³⁰⁴ Boston Consulting Group, *The Value of Digital Content: 2016* at 12.

³⁰⁵ Accenture, *The Future of Broadcasting V: 2016* at 3.

³⁰⁶ *Id.*

³⁰⁷ The Walt Disney Company, SEC Form 10-K for the Year Ended September 30, 2017.

acquire assets from Fox, including the FX Networks, National Geographic Partners, Fox's interests in Hulu, Fox's film production business (Twentieth Century Fox, Fox Searchlight Pictures, and Fox 2000 Pictures) and Fox's television creative units (Twentieth Century Fox Television, FX Productions, and Fox21).³⁰⁸ Similarly, CBS Corporation's ownership interests include CBS Television Network, The CW (a joint venture between CBS Corporation and Warner Bros. Entertainment), Network Ten Australia, CBS Television Studios, CBS Studios International, CBS Television Distribution, CBS Consumer Products, CBS Home Entertainment, CBS Interactive, CBS Films, Showtime Networks, CBS Sports Network, Pop (a joint venture between CBS Corporation and Lionsgate), Smithsonian Networks, Simon & Schuster, CBS Television Stations, CBS EcoMedia, and CBS Experiences.³⁰⁹ Univision has ownership interests in the Univision broadcast network and 11 cable networks,³¹⁰ and Hearst Television Inc. has ownership interests that include A+E Networks, Lifetime, Cosmopolitan TV, and a minority interest in ESPN.³¹¹

b. Recent Entry and Exit

112. From time to time, the Commission makes construction permits for new full power television stations available via auction. In 2004, however, the Commission froze the allotment or auction of such permits.³¹² This freeze remains in effect. Accordingly, entities typically enter the television broadcasting industry by purchasing one or more existing stations. Recently, however, station transactions have involved mergers and deals between entities already in the television broadcasting business. Such transactions show a trend towards increased consolidation in the industry.

113. In 2016, 156 stations were sold for a total of \$5.3 billion, or an average of \$34 million per station.³¹³ In 2017, 561 stations were sold for a total of \$4.9 billion or an average of \$8.9 million per station.³¹⁴ The largest completed transaction was Nexstar Media Group's acquisition of Media General (79 stations, totaling \$4.6 billion).³¹⁵ Other notable transactions included Tegna/Midwest Communications (one station, totaling \$303 million)³¹⁶ and Sinclair Broadcast Group/Cunningham

³⁰⁸ Press Release, The Walt Disney Company, 21st Century Fox And Disney Stockholders Approve Acquisition By Disney (July 27, 2018), <https://www.thewaltdisneycompany.com/21st-century-fox-and-disney-stockholders-approve-acquisition-by-disney/>; Press Release, The Walt Disney Company, The Walt Disney Company Signs Amended Acquisition Agreement To Acquire Twenty-First Century Fox, Inc., For \$71.3 Billion In Cash And Stock (June 30, 2018), <https://www.thewaltdisneycompany.com/the-walt-disney-company-signs-amended-acquisition-agreement-to-acquire-twenty-first-century-fox-inc-for-71-3-billion-in-cash-and-stock/>. Disney also acquired the Fox Sports Regional Networks from 21st Century Fox, but a consent decree between the U.S. Department of Justice, Disney, and 21st Century Fox requires Disney to sell those assets to a third-party buyer. *Id.*

³⁰⁹ CBS Corporation, *About CBS Corporation*, <https://www.cbcorporation.com/about-cbs/> (last visited Oct. 16, 2018)

³¹⁰ Univision Communications Inc., *Portfolio*, <https://corporate.univision.com/portfolio/> (last visited Oct. 16, 2018)

³¹¹ Hearst, *About Us*, <http://www.hearst.com/about> (last visited Oct. 16, 2018).

³¹² *Freeze on the Filing of Certain TV and DTV Requests for Allotment or Service Area Changes*, Public Notice, 19 FCC Rcd 14810 (MB 2004).

³¹³ S&P Global 2017 TV Station Databook at 2.

³¹⁴ *Id.*

³¹⁵ *Id.*

³¹⁶ Press Release, Tegna Inc, Tegna to Acquire Midwest Television Inc. Broadcasting Stations in San Diego, Ca. (Dec. 18, 2017), <http://www.teгна.com/teгна-to-acquire-midwest-television-inc-s-broadcasting-stations-in-san-diego-ca/>.

Broadcasting Corporation and Bonten Media (31 stations, totaling \$240 million).³¹⁷ In addition, in May 2017, Sinclair Broadcasting announced the acquisition of Tribune Media, but that transaction was subsequently terminated in August 2018.³¹⁸ In June 2018, a merger valued at \$3.6 billion between Gray Television, Inc. and Raycom Media Inc., two mid-sized television broadcast companies, was announced, which remains pending.³¹⁹

4. Intermodal Competition

114. While the various providers discussed above are similar in the sense that they offer video programming to consumers, there are significant differences in the products they offer, the geographic availability of their services, and how consumers view their products. For example, consumers may view video services as substitutes when they offer the same or similar content, but consumers may view video services as supplements when they offer exclusive or dissimilar content. Consumers frequently subscribe to multiple OVDs (Netflix, HBO, Hulu),³²⁰ but typically to only one MVPD (cable, DBS, or telco).³²¹ Some consumers supplement OTA television viewing with one or more OVDs.³²² Consumer views on the competitive nature or substitutability of video programming providers depends on factors such as available content, prices, the number of advertisements, the ability to watch content on different devices in different locations, user interfaces, and the need for and cost of broadband access at sufficient speeds for video delivery. Whether consumers view video services as substitutes or supplements depends on the relative values they assign to these and other features.

115. MVPDs, OVDs, and television broadcasters compete with each other in several main respects. For example, consumers looking for video services can obtain: (1) linear channel packages augmented by VOD content from MVPDs or virtual MVPDs, (2) broadcast channels using the free over-the-air broadcast service, (3) premium and sports channels from MVPDs and direct-to-consumer online offerings, and (4) free and subscription VOD content from OVDs. Consumers typically compare video services based on key factors (price, devices, necessary equipment, channel lineups) and select the video service, or services, that best fit their preferences.³²³ Below, we discuss prominent aspects of intermodal competition among MVPDs, OVDs, and broadcast stations. We also discuss the similarities and

³¹⁷ Press Release, Sinclair Broadcasting Group, Inc., *Sinclair Closes on acquisition of Bonten Media Group, Holdings Inc.* (Sep 7, 2017), <http://sbginc.net/pr-news/sinclair-closes-on-acquisition-of-bonten-media-group-holdings-inc/>.

³¹⁸ Press Release, Tribune Media, *Tribune Media Terminates Merger Agreement with Sinclair Broadcast Group Inc. Files Lawsuit for Breach of Contract* (Aug. 8, 2018), <http://investors.tribunemedia.com/2018-08-09-Tribune-Media-Terminates-Merger-Agreement-with-Sinclair-Broadcast-Group-Inc-Files-Lawsuit-For-Breach-of-Contract>.

³¹⁹ Press Release, Raycom Media, *Gray and Raycom to Combine in a \$3.6 Billion Transaction* (Jun. 25, 2018), <https://www.raycommedia.com/gray-and-raycom-to-combine-in-a-3-6-billion-transaction/>.

³²⁰ See *supra* paragraph 79 and note 203. See also Ian Olgeirson and Deana Myers, *Comparing OTT and multichannel video metrics*, S&P Global (Nov. 13, 2018) (“[o]nline video subscriptions, by unit count dwarf the figures for traditional and virtual multichannel packages, which are much more likely to be limited to a single subscription per household than the mix-and-match internet alternatives.”).

³²¹ See *id.* S&P Global projects that approximately 1.1 million households and businesses subscribe to more than one MVPD in 2018. The number has been steadily declining and is projected to continue shrinking. Ian Olgeirson, Neil Barbour, and Ali Choukeir, *Traditional multichannel tested by virtual, online and over-the-air in outlook*, S&P Global (June 19, 2018).

³²² See, e.g., Press Release, Parks Associates, *One in five U.S. broadband households use a digital antenna to access live TV* (Mar. 15, 2018), <https://www.parksassociates.com/blog/article/pr-03152018>.

³²³ Leichtman Research Group, *Research Notes: 1Q 2017*, http://www.leichtmanresearch.com/research/notes03_2017.pdf, (“consumers are increasingly cobbling together services that provide an experience that works best for their household in terms of content, viewing options, and cost”).

differences among the video services that these entities provide and consider the extent to which services may be viewed by the marketplace as substitutes or supplements. Finally, we examine intermodal competition via a comparison of subscribership and revenue figures.

116. *Channel Packages.* As discussed above, an important recent trend in the video marketplace is the increasing convergence and overlap in the types of services offered by MVPDs and OVDs. Perhaps most importantly, OVDs have begun providing virtual MVPD services, as discussed above.³²⁴ As a result, many consumers may increasingly view MVPDs and virtual MVPDs as substitutes, especially for small and medium channel packages.³²⁵ Similarly, MVPDs have begun offering OVD-like services, including TV Everywhere and virtual MVPD options of their own for consumers who have Internet access but have eschewed a traditional MVPD subscription.

117. *Prices.* Price is a significant consideration when consumers compare video options.³²⁶ The inflation-adjusted price of MVPD video service increased 74%, from an average of \$698.30 per year in 2000 to \$1,211.58 in 2017.³²⁷ Of course, the service received by consumers has also been enhanced during the same period, so the value to consumers may be commensurate with the price increase.³²⁸ That said, inflation-adjusted average income grew only 4.7% over the 17-year period.³²⁹ These trends, according to S&P Global, have lowered the affordability of MVPDs' video service and increased the popularity of online video services.³³⁰ Although prices for virtual MVPD subscriptions are generally lower than prices for traditional MVPD packages, most virtual MVPDs raised prices in 2018.³³¹ In addition, prices for the largest OVDs offering VOD content also increased in the past year.³³²

118. As discussed, MVPDs usually offer lower prices to new subscribers and lower prices for long-term contracts.³³³ In contrast, virtual MVPDs and OVDs offering VOD content usually offer the same price to new and existing subscribers on a month-to-month basis, which can be cancelled at any time.³³⁴ Initiating and terminating service from an OVD, which can be achieved online in moments, is significantly easier than initiating or terminating service from an MVPD, which sometimes requires a visit to the home. This flexibility as compared to traditional MVPDs has been a significant feature of

³²⁴ See *supra* paras. 80-81.

³²⁵ Marshall Honorof, *Best and Worst Cable TV Alternatives in 2018*, Tom's Guide (Mar. 30, 2018), <https://www.tomsguide.com/us/best-cable-replacements,review-4387.html>; James K. Willcox, *Video Streaming Services That Will Let You Cut Cable TV*, Consumer Reports (Apr. 17, 2018), <https://www.consumerreports.org/streaming-video-services/video-streaming-services-that-let-you-cut-cable-tv/>.

³²⁶ Jefferson Graham, *Cutting the Cord Could Cost as Much as Cable*, USA Today (Mar. 9, 2017), <https://www.usatoday.com/story/tech/talkingtech/2017/03/08/cutting-cord-could-cost-much-cable/98894132/>. Makeda Easter, *Cutting the Cord Doesn't Necessarily Mean Cutting the Cost*, Los Angeles Times (Mary 20, 2017), <http://www.latimes.com/business/la-fi-tn-cord-cutting-20170520-htmstory.html>.

³²⁷ S&P Global, *Cable TV Investor* at 10-12 (Apr. 26, 2018).

³²⁸ *Id.*

³²⁹ *Id.*

³³⁰ *Id.*

³³¹ Ali Choukeir, *Economics of Internet, State of US Online Video: Virtual Multichannel*, S&P Global (July 23, 2018). See also, Jared Newman, *DirecTV Now, Sling TV, and PlayStation Vue Price Hikes: The Cost of More Bloated Bundles*, TechHive (July 5, 2018), <https://www.techhive.com/article/3286204/streaming-services/directv-now-sling-tv-playstation-vue-price-hikes.html>.

³³² Jeremy Bowman, *If Netflix Can Raise Prices, So Can Amazon Prime*, The Motley Fool (May 12, 2018), <https://www.fool.com/investing/2018/05/12/if-netflix-can-raise-prices-so-can-amazon-prime.aspx>.

³³³ S&P Global, *Cable TV Investor* at 6 (June 22, 2017).

³³⁴ *Id.*

online service providers. In addition, consumers can use free trials to explore content and test services on their devices in and outside their home.³³⁵ Because OVDs make it easy to sign up and cancel, some consumers make use of a free trials or a month subscription to watch one or two programs, then cancel the service.³³⁶ OVDs with small libraries appear especially susceptible to short-term subscribers.³³⁷

119. *Content.* MVPDs typically hold significant content assets, and both OVDs and television broadcasters have followed suit by seeking to own more content.³³⁸ Several MVPDs have ownership interests in cable, broadcast, and regional sports networks, which allows them to vertically integrate their ownership of content and content distribution networks.³³⁹ Because MVPDs typically make their networks and content available to OVDs and competitive MVPDs, exclusive content is not typically a point of competition between MVPDs.³⁴⁰ In addition to drawing new customers to their services, OVDs indicate that providing original content makes more economic sense than licensing content from third parties and protects against the future expectation that existing content holders will place content on their own streaming platforms or increase licensing fees substantially.³⁴¹ Unlike MVPDs, some OVDs like Netflix and Amazon that own significant VOD content have not, as yet, licensed their content to competitors.³⁴² Broadcast television station groups appear to be increasing their content ownership as well, using content exclusivity to differentiate themselves from their competitors, attract viewers, and generate content licensing revenues.³⁴³

120. *Content Discovery and Industry Fragmentation.* A 2017 report by Ericsson noted that as consumers have gained access to an unprecedented amount of content, the number of marketplace participants has increased markedly. As a result, consumers that subscribe to multiple services increasingly struggle to discover and consume content.³⁴⁴ According to the report, the total average time searching for content increased from 45 minutes per day in 2016 to 51 minutes per day in 2017. The report noted further that “[c]ontent discovery remains a challenge, and consumers are finding current discovery methods unhelpful.”³⁴⁵ The issue of content discovery is related to what some have termed

³³⁵ Brian Fung, *Meet the Sometime-streamers: TV Watchers Who Sign up for One Show, Then Cancel*, The Washington Post (Aug. 29, 2017), https://www.washingtonpost.com/news/the-switch/wp/2017/08/28/meet-the-sometime-streamer-tv-watchers-who-sign-up-for-one-show-then-cancel/?utm_term=.e2094a89e475.

³³⁶ Hayley Tsukayama and Sintia Radu, *Freedom from Cable TV Isn't Free: Flood of Streaming Options Complicates Cord-cutting*, The Washington Post (Aug. 12, 2017), https://www.washingtonpost.com/business/economy/freedom-from-cable-isnt-free-flood-of-streaming-services-will-make-cutting-the-cord-more-complicated/2017/08/11/01f9ade0-7d1f-11e7-a669-b400c5c7e1cc_story.html?utm_term=.2a158d87963e.

³³⁷ *Id.*

³³⁸ *See supra* paras. 66, 76-79, 109-110.

³³⁹ *See supra* para. 66.

³⁴⁰ *See supra* para. 56.

³⁴¹ *See supra* paras. 76-79.

³⁴² Caitlin Petrakovitz, *Everything You Need to Know About Netflix Originals*, CNET (March 19, 2015), <https://www.cnet.com/news/netpicks-everything-you-need-to-know-about-netflix-originals/>.

³⁴³ *See supra* paras. 109-110.

³⁴⁴ James K. Willcox, *Sites That Help You Find Streaming Shows*, Consumer Reports (Sept. 11, 2018), <https://www.consumerreports.org/streaming-media/sites-that-help-you-find-streaming-shows/>.

³⁴⁵ Ericsson ConsumerLab, *TV and Media 2017: A Consumer-driven Future of Media at 10-11* (Oct. 2017), <https://www.ericsson.com/en/networked-society/trends-and-insights/consumerlab/consumer-insights/reports/tv-and-media-2017>.

“fragmentation” of the video industry.³⁴⁶ Although an increasing amount of content traditionally available from MVPDs is also available from OVDs, many OVDs provide content from a single channel or content owner (e.g., HBO Now, CBS All Access, Crackle, etc.) or target a niche market (e.g., FunimationNow). Because their catalogs are focused on a particular channel or genre, some suggest that consumers face the prospect of having to purchase a growing number of subscriptions.³⁴⁷ Others, however, caution that it is unclear where the video market is going as many OVDs have yet to prove the viability of their service.³⁴⁸

121. *Devices.* Not all video display devices work with all video services. Most TVs sold today have connections for set-top receivers, Internet-connected streaming devices, and broadcast TV antennas. As such, TVs can display video from MVPDs, OVDs, and over-the-air broadcasters. Few other display devices connect to as many services. For example, personal computers connect to wireline and Wi-Fi Internet and may have input for a broadcast TV antenna to receive over-the-air broadcast service, but they are not designed to connect to MVPD set-top receivers. Smartphones and other mobile wireless devices connect to wireless and Wi-Fi Internet but are not designed to connect to set-top receivers or broadcast TV antennas.

122. In comparing services, consumers must discern what services work with what devices and where the services are available (geographically). To help consumers make informed choices, marketing materials often list the devices that work with the services and where the services are available. In addition to PCs, laptops, tablets, smart TVs, and smartphones, which can be used to both connect to and view online video, there are a number of devices that can be used to stream video from the Internet to a television or other display device. These include game consoles (such as X-Box or PlayStation 4), Blu-Ray players, and streaming media players/sticks (such as Roku, Amazon Firestick and Apple TV). S&P Global explains that online “devices can play a significant role in the success of these services, with numerous players seeking to make their offerings compatible with as many devices as possible.”³⁴⁹ Often, new online video services work with fewer devices than more established services, but providers typically add more devices over time. As software and hardware evolves, in some cases a software update will render older devices incompatible of supporting the service.

123. *Consumer Access.* Consumer access to video providers varies depending on geographic market and type of service. As noted above, most households have access to at least one cable provider and two DBS providers.³⁵⁰ Some consumers also have access to a telephone company MVPD.³⁵¹ To obtain service from an OVD, a consumer must have broadband access. In addition, the top four mobile providers offer upgraded plans with faster speeds for streaming HD video.³⁵² Absent these upgrades,

³⁴⁶ Hayley Tsukayama and Sintia Radu, *Freedom from Cable TV Isn't free: Flood of Streaming Options Complicates Cord-cutting*, The Washington Post (Aug. 12, 2017), https://www.washingtonpost.com/business/economy/freedom-from-cable-isnt-free-flood-of-streaming-services-will-make-cutting-the-cord-more-complicated/2017/08/11/01f9ade0-7d1f-11e7-a669-b400c5c7e1cc_story.html?utm_term=.2a158d87963e.

³⁴⁷ *Id.*

³⁴⁸ Sarah Barry James, *DISH CEO Says Competitors' OTT Model 'a License to Lose Money'*, S&P Global (May 1, 2017). See also S&P Global, *The State of Online Video Delivery at 16* (Oct. 2017) (where S&P Global explains that for some virtual MVPDs margins appear to be thin or potentially negative).

³⁴⁹ S&P Global, *Internet & OTT Industry Overview: Over-the-Top Video at 10* (April 2017).

³⁵⁰ See *supra* para. 50.

³⁵¹ See *id.*

³⁵² Ookla, 2018 Speedtest U.S. Mobile Performance Report (July 18, 2018), <http://www.speedtest.net/reports/united-states/>.

streaming video is typically reduced in quality.³⁵³ 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.³⁵⁴

124. *Subscribers.* One way to analyze the performance of MVPDs and OVDs is to compare their subscribership figures. The subscribership figures for the seven largest video subscription services at the end of 2017 were: Amazon Prime with 55.4 million, Netflix with 52.8 million, AT&T/DIRECTV with 24.1 million, Comcast with 22.4 million, Hulu with 17.0 million, Charter with 17.0 million, and DISH Network with 11.0.³⁵⁵ Figure B-6 shows video subscribers for MVPDs, virtual MVPDs, and OVDs offering VOD content. In general, traditional cable, DBS, and telephone company MVPDs lost subscribers from 2016 and 2017, while virtual MVPDs and large OVDs offering VOD content gained subscribers. S&P Global maintains that the growth of virtual MVPDs “shares a large part, although not all, of the blame for declining multichannel subscriptions.”³⁵⁶

³⁵³ *Id.* Mobile wireless is currently designed for smaller screens found on smartphones, tablets, and laptops. DSL Reports, [General] *Replace Cable Internet with Verizon 4g LTE Unlimited?*, <http://www.dslreports.com/forum/r31252944-General-Replace-Cable-Internet-with-Verizon-4g-LTE-Unlimited> (last visited July 20, 2018).

³⁵⁴ FCC, *DTV Reception Maps*, <https://www.fcc.gov/media/engineering/dtvmaps> (last visited July 20, 2018).

³⁵⁵ *Q4'17 Top US Video Provider Rankings*, S&P Global (Apr. 2, 2018) (*Q4'17 Rankings*). Estimates for AT&T/DIRECTV and DISH Network do not include DIRECTV NOW and Sling TV.

³⁵⁶ S&P Global, *Cable Program Investor at 1* (Oct. 26, 2017). See also S&P Global, *Broadband Cable Financial Databook at iv-v* (2017).

Fig. B-6
Video Subscribers (in millions)³⁵⁷

	2016	2017	Change
MVPD Total³⁵⁸	97.6	94.0	(3.6)
Cable	52.8	51.9	(0.9)
DBS	33.2	31.5	(1.7)
Telco	11.5	10.6	(0.9)
Virtual MVPD Total³⁵⁹	2.2	4.8	2.6
Sling TV	1.5	2.2	0.7
DIRECTV NOW	0.3	1.2	0.9
Other Virtual MVPDs³⁶⁰	0.4	1.4	1.0
Select Other OVDs³⁶¹			
Amazon Prime	43.6	55.4	11.8
Netflix	47.9	52.8	4.9
Hulu	11.7	17.0	5.3

125. As shown in Figure B-7, most households subscribe to an MVPD. The trend for MVPDs, however, is downward, while the trend for virtual MVPDs, OVDs offering VOD content, and over-the-air broadcast service is upward.

³⁵⁷ Due to rounding, individual entries in table may not sum to totals.

³⁵⁸ S&P Global, Cable TV Investor at 4 (Mar. 27, 2018). Includes residential and commercial subscribers and overlap created by households with multiple MVPD subscriptions.

³⁵⁹ *Q4'17 Rankings*.

³⁶⁰ Other virtual MVPDs include PlayStation Vue, Hulu with Live TV, and YouTube TV. S&P Global, Cable TV Investor at 7 (June 2018).

³⁶¹ *Q4'17 Rankings*.

Fig. B-7

Video Households by Delivery Method³⁶²

	2016 Occupied Households (millions)	2016 Percent of Occupied Households	2017 Occupied Households (millions)	2017 Percent of Occupied Households
Total	122.3		123.7	
MVPD³⁶³	93.1	76.1%	89.7	72.5%
Virtual MVPD	1.8	1.5%	4.8	3.8%
Online VOD-Only³⁶⁴	11.4	9.4%	12.2	9.8%
Over-the-Air Broadcast³⁶⁵	14.2	11.6%	16.1	13.0%
Other³⁶⁶	1.4	1.2%	1.0	0.8%

126. *Advertising revenue.* As discussed above, broadcasters and some OVDs generate a significant portion of their revenue via advertising, whereas other providers, most notably MVPDs, rely on subscription fees.³⁶⁷ Figure B-8 provides a breakdown of local advertising revenue by sector. Broadcaster revenue from local advertising remained relatively flat from 2016 to 2017. Cable earns a smaller share of local advertising revenue than both television broadcasters and digital platforms.

³⁶² S&P Global, Historical and Projected US Multichannel Subscriptions: 2008 - 2022 (June 19, 2018).

³⁶³ Excludes commercial subscribers. Also excludes overlap created by households taking more than one MVPD.

³⁶⁴ Excludes households that subscribe to virtual MVPDs. Also excludes households with an over-the-air antenna.

³⁶⁵ Includes households with an antenna that also access online video.

³⁶⁶ Includes non-TV households.

³⁶⁷ See *supra* paras. 49, 83-84, 96-98.

Fig. B-8
Local Advertising Gross Revenue by Sector (in millions)³⁶⁸

Revenue Source	2016		2017	
	Revenue	Percentage	Revenue	Percentage
Broadcast Television Stations	\$12,642	15.8%	\$12,269	15.0%
Cable Television	\$5,296	6.6%	\$4,923	6.0%
Radio	\$10,557	13.2%	\$10,402	12.7%
Internet/Online ³⁶⁹	\$28,280	35.4%	\$33,912	41.7%
Daily Newspaper	\$11,166	13.9%	\$9,671	11.8%
Regional Sports Networks	\$1,261	1.57%	\$1,185	1.45%
Telco	\$560	0.7%	\$555	0.68%
Other	\$10,055	12.5%	\$8357	10.2%
Total	\$79,817	100%	\$81,274	100%

127. Figure B-9 provides a breakdown of national advertising revenue by sector. Between 2016 and 2017, national advertising revenues earned by broadcast television stations decreased, while national advertising revenues for broadcast networks, cable/VOD networks, RSNs, and DBS were comparatively stable.

³⁶⁸ S&P Global, *U.S. Local versus National Advertising Revenue 2017-2027* (Jan. 2018).

³⁶⁹ Three companies, Google, Facebook, and Twitter, received 80% of total online advertising revenue in 2017. See George P. Slefo, *IAB: Another Record Breaking Year For Digital Ad Revenue*, AdAge (Dec. 20, 2017), <https://adage.com/article/digital/iab-record-breaking-year-digital-ad-revenue/311712/>.

Fig B-9
National Advertising Gross Revenue by Sector (in millions)³⁷⁰

Revenue Source	2016		2017	
	Revenue	Percentage	Revenue	Percentage
Broadcast Television Stations	\$9,119	5.6%	\$5,981	3.7%
Broadcast Networks	\$20,170	12.4%	\$18,805	11.7%
Cable & VOD Networks	\$29,539	18.2%	\$29,697	18.5%
DBS	\$1,156	0.7%	\$1,323	0.8%
Internet/Online ³⁷¹	\$38,084	23.5%	\$42,763	26.7%
Radio	\$2,661	1.6%	\$2,584	1.6%
Satellite Radio	\$135	0.1%	\$160	0.1%
Radio Network	\$1,091	0.6%	\$1,071	0.6%
Daily Newspaper	\$2,360	1.8%	\$2,129	1.3%
Barter Syndication	\$2,924	1.9%	\$2,895	1.8%
Other	\$54,423	33.6%	\$52,393	32.7%
Total	\$161,662	100%	\$159,802	100%

5. Marketplace Factors Relevant to Entry, Competition, and Expansion

128. MVPDs, OVDs, and television broadcasters all face marketplace barriers affecting entry and competition, including barriers related to infrastructure, equipment, and technology. The acquisition and significant cost of video programming are also key issues affecting all video providers.

129. *Infrastructure, Equipment, and Technology.* While it is possible to enter the MVPD marketplace by building new delivery infrastructure (e.g., a cable system or fiber optic network), data show that MVPD service is currently available to almost all consumers,³⁷² and construction of new infrastructure requires significant capital. While telephone companies installed new fiber optic networks in recent years to compete with cable video providers, this activity has slowed significantly in recent years.³⁷³ As a result, most entry into the MVPD marketplace occurs via the acquisition of existing MVPD systems. In light of ongoing consolidation in the MVPD industry, however, it may be difficult for new entities to enter the marketplace in this manner.

130. Similarly, entry into the television broadcast industry typically can occur only via acquisition of existing licensees or stations, as the Commission is not awarding permits for new full-power broadcast television stations.³⁷⁴ Acquiring broadcast stations requires significant capital.³⁷⁵ Single

³⁷⁰ *Id.*

³⁷¹ *See supra* note 369.

³⁷² *See supra* para. 50.

³⁷³ *See supra* para. 68.

³⁷⁴ *See supra* para. 89.

³⁷⁵ Capital for station purchases and operation may come in the form of debt or equity financing. In determining whether to lend money or invest in a licensee, banks or other firms look at expected revenues and expenses,

(continued....)

television stations can sometimes carry multi-million dollar price tags.³⁷⁶ While entry into the market via the purchase of a single station is possible, such purchase opportunities may be limited. In addition, it is noted that recent television broadcast transactions typically have involved merger and consolidation of existing broadcasters, not purchases by new entrants.³⁷⁷

131. OVDs face challenges relating to content delivery and consumer devices. As discussed above, OVDs must have access to the infrastructure to deliver their video content to consumers with appropriate speed and quality.³⁷⁸ This, in turn, may require additional capital expenditures. For example, an OVD may have to build its own CDN, contract with one or more third party CDNs, or lease capacity from a local broadband provider.³⁷⁹ Moreover, because OVDs make content available to consumers on a variety of Internet-connected devices,³⁸⁰ they typically must negotiate and reach agreements with multiple device manufacturers. Netflix indicates that its agreements with consumer electronics manufacturers are typically between one and three years in duration, and that the degree of accessibility and prominence of its service on the manufacturer's device are important aspects of those agreements.³⁸¹ Netflix also notes that, as it makes technological changes to its streaming capabilities, the consumer electronics manufacturers may need to update their devices in order to maintain quality of service for Netflix's subscribers.³⁸² Sometimes the business incentives facing OVDs and equipment manufacturers hamper efforts to make OVDs available on certain devices.³⁸³ Accordingly, the negotiations, and balancing of benefits, between device manufacturers and OVDs tend to evolve as technology, content availability, and consumer tastes change.

132. *Acquisition and Cost of Content.* In order to compete in the marketplace, MVPDs, OVDs, and television broadcasters must acquire programming that attracts viewers. All three types of entities face challenges in this regard. Content costs for MVPDs are significant, and they have been increasing in recent years.³⁸⁴ MVPDs that are vertically integrated with broadcast and cable networks may enjoy cost advantages. Larger MVPDs, for example, may enjoy price advantages when purchasing programming. In particular, scale economies may enable larger MVPDs to lower their costs by obtaining volume discounts for purchased programming.³⁸⁵ S&P Global has stated that while some smaller MVPDs

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especially whether new owners could increase profits by changing programming or reducing expenses. Structural changes in the media industry, combined with the strong correlation of their revenues and profits to economic cycles, indicate that financing media transactions with debt entails some risk. In particular, high interest rates may lead station owners to file for bankruptcy and transfer control to lenders or sell their stations. *See 18th Report, 32 FCC Rcd at 606, para. 97.*

³⁷⁶ *See supra* para. 112.

³⁷⁷ *See id.*

³⁷⁸ *See supra* para. 85.

³⁷⁹ *See id.*

³⁸⁰ *See supra* para. 86.

³⁸¹ Netflix Inc., SEC Form 10-K for the Year Ended December 31, 2018 at 7 (Netflix 2018 Form 10-K).

³⁸² *Id.*

³⁸³ For example, due to business disagreements between Amazon and Apple, Amazon Prime was not available on Apple TV until late 2017. *See, e.g.,* Steve Dent, *Amazon Prime Video Finally Arrives on Apple TV*, Engadget (Dec. 16, 2017), <https://www.engadget.com/2017/12/06/amazon-prime-video-on-apple-tv/>; Kif Leswing, *Amazon Prime Video is finally available for Apple TV*, Business Insider (Dec. 16, 2017), <https://www.businessinsider.com/amazon-prime-video-app-finally-available-apple-tv-2017-12>.

³⁸⁴ *See supra* para. 65.

³⁸⁵ *See, e.g., AT&T and DIRECTV MO&O*, 30 FCC Rcd at 9202, para. 188 (noting several commenters "assert[ed] that the combined entity's increased size and market power would give it the ability to negotiate substantial volume

(continued....)

have formed cooperatives to purchase programming, these cooperatives are small in comparison to the larger MVPDs and may lack significant negotiating leverage.³⁸⁶

133. Further, some MVPDs maintain that they are disadvantaged by tying and tier placement conditions imposed by programmers.³⁸⁷ These MVPDs state that programmers often use tying provisions to require carriage of additional channels.³⁸⁸ In some cases, these providers indicate that programmers impose penetration requirements that force MVPDs to place channels on the basic tier.³⁸⁹ Some MVPDs argue that tying and tiering practices make it difficult to offer video packages that their subscribers want and can afford.³⁹⁰ In contrast, others have argued that bundling is a common practice in competitive markets and is generally procompetitive.³⁹¹

134. Pre-existing business relationships may impact the availability of content to OVDs. For example, owners and producers of content may be vertically integrated with, or have exclusivity arrangements with, cable networks, broadcast networks, and/or MVPDs, and these arrangements may affect unaffiliated OVDs' ability to establish carriage agreements with content owners.³⁹² A second constraint on OVD content acquisition occurs when content owners are vertically integrated, or negotiate exclusive relationships with, other OVDs.³⁹³

135. As discussed above, OVDs are increasingly supplementing their third-party content with original content.³⁹⁴ While this strategy may be economically favorable and can help guard against some of the difficulties involved in licensing content from third parties, it is capital intensive.³⁹⁵ In 2018, for example, Netflix and Amazon are expected to spend \$2.1 billion and \$1 billion, respectively, on original content.³⁹⁶

136. Contracts and business arrangements can have an impact on television broadcasters'

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discounts for programming"). S&P Global indicated that Comcast has benefited from sizable volume discounts, and the merger of AT&T and DIRECTV was expected to lower programming costs for the combined entity. *See* Chris Young and Tony Lenoir, *Programming Expenses Exceed 50% of Video Revenue in 2015*, S&P Global (Mar. 18, 2016); Chris Young and Tony Lenoir, *Programming Expenses Exceed 50% of Video Revenue in 2015*, S&P Global (Mar. 18, 2016). Similarly, S&P Global has stated that "[s]maller operators are having more difficulty maintaining margins because their programming costs tend to be higher without the bulk discounts of their larger peers." S&P Global, *Media & Communications Report* at 4 (May 25, 2016).

³⁸⁶ *See 18th Report*, 32 FCC Rcd at 581, para. 32.

³⁸⁷ *See id.* at 582, para. 33. The Commission's NOI on the availability of diverse and independent sources of video programming addresses, tying and program tiers, among other issues. *See Promoting the Availability of Diverse and Independent Sources of Video Programming*, MB Docket No. 16-41, Notice of Inquiry, 31 FCC Rcd 1610, 1618-18, paras. 15-18 (2016).

³⁸⁸ *See 18th Report*, 32 FCC Rcd at 582, para. 33. *See also* NTCA Comments at 9-10, ITTA Comments at 2-6, WTA Comments at 6, Verizon Comments at 7-8, INSP Reply Comments at 4, 7.

³⁸⁹ *See 18th Report*, 32 FCC Rcd at 582, para. 33. *See also* ITTA Comments at 6, WTA Comments at 6, ACA Comments at 7-11.

³⁹⁰ *See 18th Report*, 32 FCC Rcd at 582, para. 33. *See also* NTCA Comments at 10, WTA Comments at 6, ACA Comments at 7, Verizon Comments at 7-8.

³⁹¹ *See 18th Report*, 32 FCC Rcd at 582, para. 33.

³⁹² *See 16th Report*, 30 FCC Rcd at 3370-71, para. 253.

³⁹³ *Id.*

³⁹⁴ *See supra* paras. 76-79.

³⁹⁵ *See id.*

³⁹⁶ *See id.*

access to content as well. In general, television broadcasters obtain programming from broadcast networks and program syndicators, under contracts that often run for several years.³⁹⁷ Broadcast network affiliations often require affiliates to pay significant compensation to the broadcast networks.³⁹⁸ A station that loses its network affiliation may not be able to affiliate with an alternative network, because that alternative network is likely to already have a distribution agreement in place with another station in the market. The loss of network programming likely would require the station to obtain replacement programming, which may be less attractive to the station's audience, at a higher cost. Similarly, popular syndicated programming may not be available for a new station due to exclusive distribution arrangements with competing outlets.³⁹⁹

C. The Audio Market

137. This chapter discusses competition in the market for the delivery of audio programming. We begin by discussing the three main categories of audio providers, providing an overview of the services offered by each type of provider, a description of some of the notable industry participants, an explanation of the business models and competitive strategies used by each, and a discussion of recent entry into and exit from the marketplace. We then discuss intermodal competition, i.e., competition among providers in the various categories, as well as some regulatory factors that may form barriers to entry or competition in this marketplace.⁴⁰⁰

138. In the United States, 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. The major participants in today's marketplace for the delivery of audio programming can be divided into three categories:

- **Terrestrial radio broadcasters:** These entities use terrestrial radio stations licensed by the Commission to broadcast audio content over the air (OTA) 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 channels⁴⁰¹ of music, news, sports, entertainment, educational, and other content.
- **Satellite radio:** Currently, SiriusXM is the only satellite radio provider in the United States.

³⁹⁷ See *18th Report*, 32 FCC Rcd at 606, para. 98. As an alternative to contracting for expensive third-party programming, stations may produce their own programming in-house or lease time to other parties (e.g., producers of infomercials) willing to pay stations for the airing of programming.

³⁹⁸ For example, television stations typically must pay a portion of the retransmission consent fees they obtain from MVPDs with the broadcast network with which they are affiliated; this is referred to as "reverse compensation." *Id.* at 620, para. 124.

³⁹⁹ See *id.* at 606, para. 98.

⁴⁰⁰ In this document, we rely on a variety of publicly available sources of industry information and data including: Securities and Exchange Commission filings; data from trade association and government entities; data from securities analysts and other research companies and consultants (e.g., S&P Global and Nielsen Media Research); company news releases and websites; newspaper and periodical articles; scholarly publications; white papers; and various public Commission filings, decisions, reports, and data. We make use of both individual company data and industry-wide data. In addition, we also rely on comments and reply comments submitted in response to the Media Bureau's Public Notice seeking input for this chapter. See *Media Bureau Seeks Comment on the Status of Competition in the Marketplace for Delivery of Audio Programming*, Public Notice, MB Docket No. 18-227, DA 18-761 (rel. July 23, 2018) (Public Notice).

⁴⁰¹ 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.

It uses satellite technology to offer subscription-based audio programming to consumers, primarily through installation in automobiles. Subscribers use specially-designed receivers that come standard or can be installed by the factory/dealer with every major automaker to access this content. Recently, consumers have also gained the ability to access this content by using computers, smartphones, and other devices through the Internet. SiriusXM provides multiple linear channels of programming and is able to offer content and features not available from other sources.

- **Online Audio Providers:** This varied group of marketplace participants uses the Internet to deliver audio content to consumers. Consumers, in turn, can access this content using computers, smartphones, and other devices. Some such providers offer linear audio channels similar to those offered by terrestrial radio stations, and some allow users to access and download audio content and listen to it at any time (e.g., podcasts). Participants in this category include larger, well-known entities like Pandora and Spotify, as well as numerous other providers, some of which focus on small or niche audiences.

139. Distinguishing features of audio providers include method of delivery, option(s) to download rather than solely stream or listen live, type and quantity of content offered, and consumer devices compatible with the service.

1. Terrestrial Radio Broadcasters

140. Terrestrial radio broadcasters, which today include full power AM and FM radio stations and LPFM stations,⁴⁰² have long been the mainstay of the audio programming market. All radio stations broadcast analog signals OTA to consumers, with some stations also transmitting higher-quality digital audio OTA to consumers as well.⁴⁰³ Stations that broadcast in digital 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 signals broadcast.⁴⁰⁴

141. Terrestrial radio stations must receive authorization from the Commission before they may construct and operate in the United States⁴⁰⁵ and are subject to both the Communications Act of 1934, as amended, and regulations promulgated by the Commission thereunder. In allocating and

⁴⁰² 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. 29, 2018). LPFM stations are authorized for 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 § 73.583; FCC, *Low Power FM (LPFM) Radio*, <https://www.fcc.gov/consumers/guides/low-power-fm-lpfm-radio> (last visited Oct. 29, 2018). LPFM license applicants must be based in the community in which they intend to broadcast. *Id.* LPFM stations typically provide opportunities for local and niche programming. See Brian Stelter, *Low Power FM Radio to Gain Space on the Dial*, New York Times (Jan. 24, 2011), https://www.nytimes.com/2011/01/25/arts/25radio.html?_r=1.

⁴⁰³ 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. 1, 2018).

⁴⁰⁴ See *id.*; FCC, *Digital Radio*, <https://www.fcc.gov/media/radio/digital-radio> (last visited Oct. 10, 2018).

⁴⁰⁵ 47 U.S.C. § 301. The Commission licenses broadcast spectrum to respective applicants and approves any assignment or transfer of control of broadcast licenses. 47 U.S.C. §§ 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, which is generally eight years. 47 U.S.C. § 307(c); 47 CFR §§ 73.1020, 73.3555.

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.⁴⁰⁶ 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.⁴⁰⁷ Licenses for broadcast radio stations have an eight-year term, but can be renewed by the Commission upon application by the licensee.⁴⁰⁸

142. The number of AM and FM radio stations in the country has been fairly steady in recent years, while the number of LPFM stations has increased somewhat. The Commission's most recent tally of stations showed 4,626 AM stations; 10,867 FM stations (consisting of 6,737 commercial stations and 4,130 non-commercial stations); and 2,175 LPFM stations, for a total of 17,668 terrestrial radio stations.⁴⁰⁹ New stations are possible only through new allocations and award of licenses, either via an auction in the case of commercial stations⁴¹⁰ or a comparative system for noncommercial stations.⁴¹¹ Some of the largest terrestrial radio licensees in the United States include:⁴¹²

- iHeartMedia: iHeartMedia operates 547 FM stations and 178 AM stations, for a total of 725 radio stations in 149 radio markets, with station ad revenue of \$2.275 billion.⁴¹³
- Cumulus Media: Cumulus operates 298 FM stations and 70 AM stations, for a total of 368 radio stations in 88 radio markets, with station ad revenues of \$676.33 million.⁴¹⁴
- Entercom Communications: Entercom operates 171 FM stations and 50 AM stations, for a total of 221 radio stations in 50 radio markets, with station ad revenue of \$1.335 billion.⁴¹⁵
- Townsquare Media: Townsquare operates 173 FM stations and 46 AM stations, for a total of 219 radio stations in 51 radio markets, with station ad revenues of \$193.84 million.⁴¹⁶

143. In addition to their OTA signals, terrestrial broadcasters have increasingly sought to expand their offerings by using digital platforms such as station websites and mobile applications. For

⁴⁰⁶ 47 U.S.C. §§ 303, 307.

⁴⁰⁷ See, e.g., 47 CFR §§ 73.1020, 73.3555.

⁴⁰⁸ *Id.*

⁴⁰⁹ See FCC, Broadcast Station Totals As of September 30, 2018 (Oct. 3, 2018), News Release, <https://docs.fcc.gov/public/attachments/DOC-354386A1.pdf>.

⁴¹⁰ 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 307(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)).

⁴¹¹ See *NCE Comparative Standards R&O*, 15 FCC Rcd at 7393-7420, paras. 16-79.

⁴¹² S&P Global Market Intelligence, Radio Station Owners by Total Radio Station Ad Revenue (last visited Oct. 9, 2018). This represents 2017 data.

⁴¹³ *Id.*

⁴¹⁴ *Id.*

⁴¹⁵ *Id.*

⁴¹⁶ *Id.*

instance, iHeartMedia offers free live audio streaming from its stations on its website,⁴¹⁷ and several popular radio apps, including NPR One, Radio Online, iHeartRadio, and TuneIn Radio, allow users to listen to radio stations and libraries of programs and podcasts for free or with a paid subscription for some premium versions.⁴¹⁸

a. Broadcast Business Models and Strategy

144. *Revenue Streams.* 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 by the station. Broadcast stations generate advertising revenue from consumers listening to programming broadcast over-the-air, as well as increasingly from listeners via Internet or mobile platforms. 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.”⁴¹⁹

145. Broadcast radio total revenue (including network, national and local spot advertising revenue) was \$17.70 billion in 2016—up 1.9% from 2015, helped largely by political ad revenue and digital/online revenue.⁴²⁰ Total revenue decreased slightly in 2017, a non-election year, by 0.4% to \$17.62 billion.⁴²¹ Annual revenue from digital/online was nearly \$1.11 billion, or 6.2% of total radio station revenues, in 2016 and nearly \$1.19 billion, or 6.7% of total radio station revenues, in 2017.⁴²²

146. Internet and mobile revenue growth in 2017 was powered by the expansion of offerings by radio stations designed to help augment traditional OTA advertising packages.⁴²³ One notable development in the radio ad-buying process has been the introduction of platforms that enable advertisers to target listeners easily across both OTA radio and Internet/mobile platforms.⁴²⁴ Targeting and employing consumer data from digital assets have helped radio groups better serve advertisers by improving the reach and effectiveness of ads.⁴²⁵ Such digital assets and products include Smart Audio ad products (iHeart Media), a new digital data-fed feature of the SoundPoint programmatic ad solution for broadcast radio stations;⁴²⁶ Radio.com (Entercom), which will offer access to all of Entercom’s stations

⁴¹⁷ iHeartRadio, *iHeartRadio/Listen to Free Radio Stations & Music Online/iHeartRadio*, <https://www.iheart.com/> (last visited Oct. 9, 2018).

⁴¹⁸ NAB Comments at 12 (citing Joe Hindy, *10 best radio apps for Android*, androidauthority.com (Sept. 3, 2018), <https://www.androidauthority.com/best-radio-apps-for-android-393884/>; Will Nicol, *Tune in and chill out with the best radio apps for Android and iOS*, digitaltrends.com (Feb. 13, 2018), <https://www.digitaltrends.com/mobile/best-radio-apps/>).

⁴¹⁹ musicFIRST Coalition and Future of Music Coalition Reply at 9-10 (citing musicFIRST Coalition and Future of Music Coalition Comments at 9). A “cluster” refers to several stations owned by the same broadcaster in a particular geographic market.

⁴²⁰ S&P Global Market Intelligence, *Radio/TV Station Annual Outlook Market-by-Market Revenue Projections 2017 Edition* (Aug. 2017) at 1, 4. SNL Kagan digital/online ad revenue calculations account for annual digital and online ad buying through terrestrial radio stations, which includes station website, station streaming, HD radio and station mobile ad revenue. Peter Leitzinger, *Broadcast Investor: Radio/digital online ad revenue projections through 2027*, S&P Global Market Intelligence (Apr. 19, 2018) at 1 (*Broadcast Investor Apr. 2018*).

⁴²¹ S&P Global Market Intelligence, *Radio/TV Station Annual Outlook Market-by-Market Revenue Projections 2018 Edition* (Aug. 2018) at 1-2 (*Radio/TV Station Annual Outlook 2018*). Advertising revenues generally increase in election years due to political ad spending.

⁴²² *Broadcast Investor Apr. 2018* at 1.

⁴²³ *Id.*

⁴²⁴ *Id.* at 2.

⁴²⁵ *Id.* at 2-3.

and podcasts;⁴²⁷ Entercom Audience Analytics (Entercom), a platform designed to give advertisers a deeper insight into on-air ad campaigns;⁴²⁸ and Headway (Entravision).⁴²⁹

147. *Programming.* Stations seek to differentiate themselves based on programming, offering programming that will be popular and well-received in the market, but which perhaps does not have a dominant outlet in the market.⁴³⁰ Broadcasters that own a cluster of stations in a geographic market often will employ a variety of different formats on their stations to achieve a broad and diverse audience.⁴³¹

b. Broadcast Radio Station Entry and Exit

148. Frequencies for radio stations are typically in high demand;⁴³² in fact, in many areas of the country no frequencies may be available on which a new station could begin operating without causing impermissible interference to existing stations.⁴³³ As a result, the Commission does not allocate many new stations and, to the extent that new stations are allocated, they tend not to be in the largest markets or the highest power stations. Spectrum limitations and the dearth of new stations pose significant barriers to entry.⁴³⁴ Consequently, a new entrant's best chance of entering the terrestrial radio broadcast business is the secondary market.

149. In 2016, 491 stations were sold for a total of \$546 million—the lowest year on record since 1982 for deal volume and number of full-power stations sold.⁴³⁵ In 2017, deal volume substantially increased to \$3.177 billion, driven largely by the merger of Entercom and CBS Radio.⁴³⁶ Some of the more significant transactions of the past two years are discussed below:

- In 2016, Beasley acquired all the outstanding stock of Greater Media Inc. for \$239.9 million. In order to come into compliance with Commission regulations, Beasley sold four stations and a translator to Entercom for \$24.0 million.⁴³⁷
- In 2017, Entercom and CBS Radio Inc. entered into a \$2.5 billion transaction for 29 AM and 88

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⁴²⁶ *Id.* at 2.

⁴²⁷ *Id.*

⁴²⁸ *Id.* at 3.

⁴²⁹ *Id.*

⁴³⁰ *See, e.g.*, Beasley Broadcasting Group, SEC Form 10-K for the fiscal year ended December 31, 2017 at 3 (Beasley Broadcast Group 2017 10-K).

⁴³¹ *See, e.g.*, Beasley Broadcast Group 2017 10-K; Cumulus Media 2017 10-K.

⁴³² *See 2002 Biennial Regulatory Review – Review of the Commission's Broadcasting Ownership Rules and Other Rules Adopted Pursuant to Section 202 of the Telecommunications Act of 1996*, Report and Order and Notice of Proposed Rulemaking, 18 FCC Rcd 13620, 13730-31, para. 288 (2003) (*2002 Biennial Regulatory Review R&O and NPRM*).

⁴³³ *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. 1, 2018).

⁴³⁴ musicFIRST and Future of Music Coalition Comments at 4, n. 9. (citing *2002 Biennial Regulatory Review R&O and NPRM*, 18 FCC Rcd 13730-31, para. 288).

⁴³⁵ Volker Moerbitz, *Databook Radio Station Deals*, S&P Global Market Intelligence (June 18, 2018), at 1 (*Databook Radio Station Deals*).

⁴³⁶ *Id.* at 2.

⁴³⁷ *Id.*

FM stations, with CBS Corp. spinning off its radio unit.⁴³⁸ In order to come into compliance with Commission regulations, Entercom/CBS engaged in station swaps with iHeartMedia and Beasley, trading 11 of its stations for seven iHeart Media stations, one Beasley station and \$12.0 million cash, transactions that had an estimated value of \$140 million.⁴³⁹

- In 2017, non-commercial Educational Media Foundation agreed to pay Entercom \$57.7 million for three FM stations in Los Angeles, San Diego, and Wilkes Barre-Scranton.⁴⁴⁰
- The largest single station sales of 2016 and 2017 were Universal Media Access's sale of KFVB in Los Angeles to Lotus Communications for \$11.2 million and Emmis Communications' sale of KPWR in Los Angeles to Meruelo Group for \$82.8 million, respectively.⁴⁴¹
- In September 2018, Entercom acquired WBWB(FM) in Philadelphia, PA from Jerry Lee Radio, LLC in Philadelphia, PA for \$57.5 million in cash.⁴⁴² Simultaneously, Entercom divested WXTU(FM), also in Philadelphia, PA, to Beasley Broadcasting.

150. Also notable were the recent Chapter 11 bankruptcy filings of the two largest radio broadcasters—iHeartMedia and Cumulus Media—in 2018 and 2017, respectively,⁴⁴³ which are undergoing capital restructuring and cost-cutting plans.⁴⁴⁴ It appears that these restructurings may be the result of substantial debt incurred in borrowing funds to purchase large numbers of radio stations, which the companies struggled to repay.⁴⁴⁵

2. Satellite Radio

151. In 1995, the Commission allocated spectrum in the 2310–2360 MHz band for satellite digital audio radio service (SDARS).⁴⁴⁶ In contrast to digital radio offered by terrestrial radio stations as a supplement to their analog signals and available free OTA, SDARS is a subscription-based satellite-delivered digital radio service.⁴⁴⁷ Following the Commission's establishment of general service rules for

⁴³⁸ *Id.*; Michael Balderston, Entercom/CBS Merger Push Q1 2017 Broadcast Station Deals, S&P Global Market Intelligence (Apr. 3, 2017), at 1, <https://www.radioworld.com/news-and-business/entercomcbs-merger-push-q1-2017-broadcast-station-deals>.

⁴³⁹ *Databook Radio Station Deals* at 2.

⁴⁴⁰ *Id.*

⁴⁴¹ *Id.*

⁴⁴² Press Release, Entercom Communications Corp, Entercom Enters Into Definitive Agreements to Acquire WBEB-FM 101.1 MORE FM and Divest WXTU-FM 92.5 FM in Philadelphia (July 19, 2018), <https://entercom.com/press/entercom-enters-into-definitive-agreements-to-acquire-wbeb-fm-101-1-more-fm-and-divest-wxtu-fm-92-5-fm-in-philadelphia/>.

⁴⁴³ See Andrew Flanagan, *iHeartMedia Turns the Dial to Bankruptcy*, NPR (Mar. 15, 2018), <https://www.npr.org/sections/thetwo-way/2018/03/15/593868390/iheartmedia-turns-the-dial-to-bankruptcy>.

⁴⁴⁴ *Radio/TV Station Annual Outlook 2018* at 1-2.

⁴⁴⁵ See musicFIRST and Future of Music Coalition Comments at 23 (citing, e.g., Parker Hall, *Is Tech Finally Killing Radio? Don't let iHeart's Bleeding Fool You*, Digital Trends (Mar. 23, 2018), <https://www.digitaltrends.com/music/is-tech-finally-killing-radio-dont-let-ihearts-bleeding-fool-you/>).

⁴⁴⁶ *Amendment of the Commission's Rules with Regard to the Establishment and Regulation of New Digital Audio Radio Services*, Report and Order, 10 FCC Rcd 2310, 2310, para. 1 (1995).

⁴⁴⁷ 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 et al., Second Further Notice of Proposed Rulemaking, 22 FCC Rcd 22123, 22150, Appx. B (2007) (*SDARS Second FNPRM*).

SDARS in 1997,⁴⁴⁸ two SDARS licensees—Sirius Satellite Radio Inc. (Sirius) and XM Radio Inc. (XM)—purchased their licenses at auction, successfully launched their satellite systems, and commenced commercial service to the public.⁴⁴⁹ SDARS provides nationally distributed subscription radio service and requires a significant investment of capital for operation.⁴⁵⁰ In 2008, Sirius and XM merged and formed SiriusXM,⁴⁵¹ which is currently the only provider of SDARS in the audio marketplace. SiriusXM reports that it had more than 27.5 million self-paying U.S. subscribers at the end of 2017.⁴⁵²

152. *Revenue Streams.* As a primarily subscription based-service,⁴⁵³ SiriusXM—unlike terrestrial broadcast radio—does not rely on advertising as its primary revenue source. In 2016, SiriusXM’s total revenue was approximately \$5.0 billion.⁴⁵⁴ Subscription revenue constituted the bulk of this revenue, accounting for \$4.2 billion while advertising represented \$138 million of total revenue, equipment revenue was \$119 million, and other revenue was \$563 million.⁴⁵⁵ In 2017, SiriusXM’s total revenue was \$5.4 billion, representing an 8% increase over 2016.⁴⁵⁶ Subscription revenue was the largest source of revenue, constituting \$4.5 billion of total revenue; while advertising revenue represented \$160 million; equipment revenue was \$132, million; and other revenue was \$661 million.⁴⁵⁷

153. *Channel and Streaming Packages.* SiriusXM offers consumers three principal subscription packages: Select (\$15.99/month), All Access (\$20.99/month), and Mostly Music (\$10.99/month).⁴⁵⁸ All three packages offer access to all of SiriusXM’s commercial-free music channels; Select and All Access also offer exclusive artist-dedicated channels, 24/7 comedy channels, top news channels, college sports, and traffic and weather.⁴⁵⁹ All Access additionally offers Howard Stern’s

⁴⁴⁸ See generally *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band*, Report and Order, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5754 (1997).

⁴⁴⁹ 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.

⁴⁵⁰ See *id.* at 22150, Appx. B.

⁴⁵¹ *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).

⁴⁵² Press Release, SiriusXM, SiriusXM Reports Fourth Quarter and Full-Year 2017 Results (Jan. 31, 2018), <http://investor.siriusxm.com/investor-overview/press-releases/press-release-details/2018/SiriusXM-Reports-Fourth-Quarter-and-Full-Year-2017-Results/default.aspx> (SiriusXM Press Release).

⁴⁵³ SiriusXM, *Will I hear commercials on SiriusXM?*, https://listencare.siriusxm.com/app/answers/detail/a_id/3562/~/~will-i-hear-commercials-on-siriusxm%3F (last visited Oct. 1, 2018).

⁴⁵⁴ SiriusXM Press Release.

⁴⁵⁵ *Id.* Equipment revenue includes revenue and royalties from the sale of satellite radios, components, and accessories. Other revenue includes amounts earned from subscribers for the U.S. Music Royalty Fee, revenue from SiriusXM’s connected vehicle business, its Canadian affiliate, and ancillary revenues. SiriusXM, SEC Form 10-K for the fiscal year ended December 31, 2017 at 29.

⁴⁵⁶ *Id.*

⁴⁵⁷ *Id.*

⁴⁵⁸ See SiriusXM, *Our Packages*, https://www.siriusxm.com/ourmostpopularpackages?intcmp=GN_HEADER_NEW_Subscriptions_SubscribeNow_CompareAllPackages (last visited Oct. 16, 2018).

⁴⁵⁹ *Id.*

channels and professional sports channels.⁴⁶⁰ SiriusXM also offers two non-satellite (i.e., online audio) plans: Streaming Add-On (\$5.00/month) and Premier Streaming (\$15.99/month), which is a stand-alone streaming package.⁴⁶¹ In addition, the company offers several specialty satellite packages, including a family-friendly package and an a la carte option.⁴⁶² SiriusXM offers over 1000 channels, providing content and features not available from other sources.

3. Online Audio Providers

154. In addition to terrestrial broadcast radio stations and satellite delivered radio service, audio programming delivered via the Internet and mobile devices has emerged as the third category of providers in the audio marketplace. Though this significant and growing group of audio providers share the characteristic that their services rely on the Internet and mobile technologies to deliver audio content to consumers, these providers take many different forms. 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; however, some services offer both non-interactive features and interactive features. In addition, as discussed above, both terrestrial radio broadcasters and SiriusXM have taken advantage of the Internet and the proliferation of mobile devices to supplement their traditional offerings with content delivered via the Internet.

155. 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.⁴⁶³ 75% of respondents reported listening to free music or watching music videos from at least one online source over the past three months.⁴⁶⁴ Of those free music service users, 47% use only one service; 28% use two services; and 25 % use three or more services.⁴⁶⁵ 34% of online music service users reported using a paid music streaming service, with the top two paid services being Amazon's Prime Music (15%) and Spotify (12%).⁴⁶⁶ 74% of paid music service subscribers use only one service.⁴⁶⁷ Many of those who subscribe to more than one service appear to subscribe to Amazon Prime Music.⁴⁶⁸

156. Among podcast listeners, the apps most commonly used are Apple's iTunes (41%), Pandora (37%), Spotify (28%), iHeartRadio (21%), and Google Play Music (18%).⁴⁶⁹ These services also offer some form of streaming music, which may suggest that podcast listeners were already using the app(s) to listen to music.⁴⁷⁰

157. *Revenue Streams.* Online Audio Providers' sources of revenue include both paid subscriptions and advertising for ad-supported tiers that are free to consumers. The portion of total

⁴⁶⁰ *Id.*

⁴⁶¹ *Id.*

⁴⁶² *Id.*

⁴⁶³ Brian Bacon, *Consumer Insights: Online music user profiles*, S&P Global Market Intelligence (July 12, 2018), at 1. S&P Global's March 2018 online consumer survey included 2,523 U.S. Internet adults.

⁴⁶⁴ *Id.* at 1.

⁴⁶⁵ *Id.*

⁴⁶⁶ *Id.* at 2.

⁴⁶⁷ *Id.*

⁴⁶⁸ *Id.* at 2-3.

⁴⁶⁹ Brian Bacon, *Consumer Insights: Podcast listeners by demographics, genre, platform and listening location*, S&P Global (Apr. 26, 2018), at 1.

⁴⁷⁰ *Id.*

revenue that these revenue sources represent varies significantly depending on the provider. For example, in 2017, Spotify reported \$5 billion in total revenue, with subscription revenue representing 90% of the company's total revenue since 2016.⁴⁷¹ In contrast, advertising comprised \$1.075 billion of Pandora's \$1.467 billion total revenue in 2017 (approximately 73%).⁴⁷² In 2016, the top three services by subscription revenue were Spotify (\$2.784 billion), Apple Music (\$1.082 billion), and Deezer (\$271.5 million), with Pandora coming in at \$237 million.⁴⁷³

158. *Tiers of Services.* Major Online Audio Providers with free offerings include Pandora, Slacker Radio, and Spotify.⁴⁷⁴ These free offerings are generally ad-supported, and while they may require users to register for the service, they do not require a subscription fee. Online Audio Providers often offer additional programming tiers and differentiate themselves based on the unique features of their premium subscriptions. Some features, like the ability to download content, are fairly common among premium offerings, including Apple Music, Napster, and Spotify. Other features are more distinctive. TuneIn, for example, offers live NFL, MLB, NBA, and NHL games as part of its Premium tier.⁴⁷⁵ Other services, like Apple Music⁴⁷⁶ and TIDAL,⁴⁷⁷ offer exclusive original content.

159. *Pricing Strategies.* Online Audio Providers employ a wide variety of pricing strategies. For example, many Online Audio Providers offer free trials for their premium subscriptions. In some cases, the length of the free trial varies depending on the tier of service selected, with more expensive services garnering longer trial periods.⁴⁷⁸ Some services offer reduced pricing for users who commit to a year-long paid subscription. These include Amazon Music for Prime members (the Individual Plan at \$79/year and the Amazon Music Unlimited Family Plan at \$149/year) and Slacker Radio (\$29.99/year for its Plus offering).⁴⁷⁹ A significant number of Online Audio Providers offer family plans that generally provide access for multiple family members. Most services' family plans—including Amazon Music, Apple Music, Deezer, Napster, Pandora, Spotify, and TIDAL (for TIDAL Premium)⁴⁸⁰—cost

⁴⁷¹ Alison Weissbrot, *Spotify's F-1 Shows Programmatic Makes Up 18% of Ad Revenue*, Ad Exchanger (Feb. 28, 2018), <https://adexchanger.com/digital-audio-radio/spotify-f-1-shows-programmatic-makes-18-ad-revenue/>.

⁴⁷² Pandora, SEC Form 10-K for the fiscal year ended December 31, 2017 at 4, 48.

⁴⁷³ S&P Global Market Intelligence, *Economics of Mobile Music: 2017 Edition* (July 2017), at 5.

⁴⁷⁴ Pandora, *Pandora – Listen to Free Music You'll Love*, <https://www.pandora.com/> (last visited Oct. 16, 2018) (Pandora Website); Slacker Radio, *Slacker Radio/ Free Internet Radio/Slacker Radio*, <https://www.slacker.com/> (last visited Oct. 16, 2018) (Slacker Website); Spotify, <https://www.spotify.com/us/premium/?checkout=false> (last visited Oct. 16, 2018) (Spotify Website).

⁴⁷⁵ TuneIn, *TuneIn/Free Internet Radio/NFL, Sports, Podcasts, Music, & News*, <https://tunein.com/> (last visited Oct. 16, 2018).

⁴⁷⁶ Apple Music, *Apple Music – Apple*, <https://www.apple.com/apple-music/> (last visited Oct. 16, 2018) (Apple Music Website).

⁴⁷⁷ Hugh McIntyre, *Sprint Takes 33% Stake in Jay-Z's Tidal for \$200M*, Forbes (Jan. 23, 2017), <https://www.forbes.com/sites/hughmcintyre/2017/01/23/jay-zs-tilal-has-been-partially-acquired-by-sprint/#3b83d8482144>.

⁴⁷⁸ Pandora offers a 30-day free trial for Pandora Plus (\$4.99/month) and a 60-day free trial for Pandora Premium (\$9.99/month for individuals and \$14.99/month for families). Pandora Website. Napster offers a 14-day free trial for unRadio (\$4.99/month) and a 30-day free trial for Napster Premier (\$9.99/month). Napster, *Napster Premier & unRadio Subscription Plans/ Napster*, <https://us.napster.com/pricing> (last visited Oct. 16, 2018). Spotify offers a 30-day free trial for Spotify Premium (\$9.99/month). Spotify Website.

⁴⁷⁹ Amazon, *Amazon Music Unlimited FAQs: Digital Music*, <https://www.amazon.com/b?ie=UTF8&node=15730321011> (last visited Oct. 29, 2018) (Prime Music Website); Slacker Website.

⁴⁸⁰ Prime Music Website; Apple Music Website; Deezer, *Plans*, <https://www.deezer.com/us/offers/> (last visited Oct. 17, 2018); Napster, *Napster Family Plan Subscriptions*, <https://us.napster.com/family> (last visited Oct. 16, 2018);

(continued....)

\$14.99/month.⁴⁸¹ Several Online Audio Providers—including Amazon Music’s Unlimited Plan, Apple Music, Spotify (with other services included), and TIDAL’s Premium—offer a student rate of \$4.99/month.⁴⁸²

160. *Bundles.* In some cases, Online Audio Providers bundle their services with other products. For instance, the Spotify Premium bundle for student users includes the video products Hulu Limited Commercials and SHOWTIME for \$0.99/month for the first 3 months and \$4.99/month thereafter, for up to 3 years.⁴⁸³ In addition to Prime Music, Amazon Prime benefits include free 2-day shipping and Prime Video.⁴⁸⁴

4. Intermodal Competition

161. Although providers in these three main categories of audio marketplace participants all deliver audio programming to consumers, there are significant differences in the availability, reach, consumer engagement, and cost of the services. For example, Nielsen estimates weekly reach among audio marketplace participants as follows: 228.5 million consumers for broadcast radio, 35.7 million for satellite radio, 68.5 million for streaming audio, and 21.9 million for podcasts (note that both streaming audio and podcasts are delivered via the Internet or mobile devices).⁴⁸⁵ In 2016, 91% of Americans ages 12 and older listened to terrestrial broadcast (AM/FM) radio in a given week,⁴⁸⁶ which dropped slightly to 90% in 2017.⁴⁸⁷ According to Edison Research’s most recent “Share of Ear” report, terrestrial broadcast radio accounts for 54% of Americans’ share of time listening to audio sources, with owned music accounting for 16%, streaming audio accounting for 15%, SiriusXM accounting for 7%, TV music channels accounting for 5%, podcasts accounting for 2%, and time spent listening to other sources accounting for 1%.⁴⁸⁸

162. *Music Licensing.* Different audio marketplace participants are subject to different music licensing conditions under law, which may affect how they compete with one another. For example, terrestrial broadcast radio—as non-subscription, non-interactive audio transmission—is exempted from

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Pandora Website; Spotify, <https://www.spotify.com/us/family> (last visited Oct. 17, 2018); TIDAL, *Subscription Types – TIDAL*, <https://support.tidal.com/hc/en-us/articles/115003662825-Subscription-Types> (last visited Oct. 29, 2018) (TIDAL Website).

⁴⁸¹ Prime Music Website.

⁴⁸² *Id.*; Apple Music Website; Spotify, *Premium for Students – Spotify*, https://support.spotify.com/us/account_payment_help/premium_for_students/student-discount/ (last visited Oct. 16, 2018) (Spotify Students Website); *Spotify, Premium and Hulu – Spotify*, <https://support.spotify.com/us/article/premium-and-hulu/> (last visited Oct. 16, 2018) (Spotify Hulu Website); TIDAL Website. TIDAL HiFi is \$9.99/month for students. *Id.*

⁴⁸³ Spotify Students Website; Spotify Hulu Website. *See also* Press Release, Hulu, Spotify and Hulu Unveil First-of-its-Kind Premium Entertainment Streaming Bundle (Sept. 7, 2017), <https://www.hulu.com/press/spotify-and-hulu-unveil-first-of-its-kind-premium-entertainment-streaming-bundle-spotify-premium-for-students-now-with-hulu-launches-today-nationwide-bundled-offerings-targeted-at-broader-market/>.

⁴⁸⁴ *See* Brian Bacon, *Consumer Insights: Online music user profiles*, S&P Global (July 12, 2018), at 2-3.

⁴⁸⁵ The Nielsen Company, *Audio Today 2018: How America Listens* (Apr. 2018) at 1, <https://www.nielsen.com/us/en/insights/reports/2018/state-of-the-media--audio-today-2018.html#>.

⁴⁸⁶ Pew Research Center Journalism & Media, *Audio and Podcasting Fact Sheet*, <http://www.journalism.org/fact-sheet/audio-and-podcasting/> (citing Nielsen Audio RADAR 136 (March 2018), publicly available via Radio Advertising Bureau) (July 12, 2018).

⁴⁸⁷ *Id.*

⁴⁸⁸ Edison Research, Share of Ear, <https://www.shareofear.com/#audiomesurement> (last visited Oct. 4, 2018).

paying royalties for use of sound recordings over the air.⁴⁸⁹ In 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,⁴⁹⁰ the rate for which is set by the Copyright Royalty Board (CRB) through a rate determination proceeding.⁴⁹¹ Subscription non-interactive services like Pandora are granted compulsory/statutory licenses as well.⁴⁹² Pandora, however, has chosen to make direct deals with many major record industry entities instead of relying on CRB's compulsory license rates.⁴⁹³ Subscription interactive services like Spotify must reach commercial agreements with music labels.⁴⁹⁴ In January 2018, the CRB announced a ruling on streaming rates to be paid by on-demand streaming subscription services that estimates suggest will raise total content costs between 2017 and 2022 by 43.8% based on the percentage of revenue and by 31.0% based on total content cost.⁴⁹⁵

163. *Strategic Partnerships.* In an effort to distinguish themselves in the marketplace and better compete with their rivals, some audio marketplace participants have formed various strategic partnerships, including with wireless providers, equipment or other manufacturers, and other streaming services. For instance, Amazon Music and Pandora Premium are offered as choices in AT&T's Unlimited & More Premium wireless offering.⁴⁹⁶ Another example is Sprint, which, after purchasing a 33% stake in TIDAL,⁴⁹⁷ offers users of its Unlimited Plus Plan access to TIDAL Premium streaming service for the duration of the Unlimited Plus subscription.⁴⁹⁸ In a similar fashion, T-Mobile has partnered with Pandora to offer Pandora Plus free for one year to certain T-Mobile subscribers,⁴⁹⁹ and Verizon has announced that it would be partnering with Apple Music to offer its mobile subscribers six months of Apple's streaming service.⁵⁰⁰ In addition, T-Mobile's Music Freedom feature allows subscribers to T-Mobile's Simple Choice plan to stream unlimited music from a host of participating music streaming services while on its network without data charges.

164. In terms of partnerships with manufacturers, one unique aspect of SiriusXM's

⁴⁸⁹ See, e.g., Citi GPS: *Putting the Band Back Together – Remastering the World of Music*, Citi GPS: *Global Perspectives and Solutions* (Aug. 2018) at 18, <https://privateclientsolutions.citi.com/insights/citi-gps-putting-the-band-back-together/> (Citi GPS). Terrestrial radio broadcasters do pay copyright royalties to songwriters, however, which is separate from the copyright in the sound recording.

⁴⁹⁰ See, e.g., *id.*; Dana A. Scherer, *Money for Something: Music Licensing in the 21st Century*, Congressional Research Service (June 7, 2018), at 22, <https://crsreports.congress.gov/product/pdf/R/R43984>.

⁴⁹¹ See *id.* at 22-23.

⁴⁹² Citi GPS at 18.

⁴⁹³ *Id.* at 1.

⁴⁹⁴ *Id.*

⁴⁹⁵ Peter Leitzinger, *Economics of Internet: New Kagan Report: Economics of Internet Music and Radio 2018*, S&P Global (Apr. 25, 2018), at 1. In 2017, prior to the CRB ruling, total content costs represented 10.5% of revenue and 20.0% of total content costs for on-demand streaming services. *Id.*

⁴⁹⁶ Eli Blumenthal, *T-Mobile adds free Pandora Plus subscription as latest wireless perk*, USA Today (Aug. 16, 2018), <https://www.usatoday.com/story/money/2018/08/16/t-mobile-free-pandora-plus-subscription/1006857002/> (Blumenthal).

⁴⁹⁷ Hugh McIntyre, *Sprint Takes 33% Stake in Jay-Z's Tidal for \$200M*, Forbes (Jan. 23, 2017), <https://www.forbes.com/sites/hughmcintyre/2017/01/23/jay-zs-tilal-has-been-partially-acquired-by-sprint/#3b83d8482144>.

⁴⁹⁸ Sprint, TIDAL X Sprint, <http://sprint.tidal.com/us> (last visited October 16, 2018).

⁴⁹⁹ Blumenthal.

⁵⁰⁰ *Id.*

marketplace position is that the service comes as a standard (or factory/dealer-installed) option with every major automaker,⁵⁰¹ and car dealerships have long offered free trials or free year-long subscriptions when customers buy a satellite-equipped new or pre-owned vehicle.⁵⁰² More recently, Spotify 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 speaker, and Bixby digital assistant.⁵⁰³ Smart speakers have begun to emerge as an important focus for audio marketplace participants, as smart speaker owners tend to listen to more audio than they did prior to becoming smart speaker owners.⁵⁰⁴

165. *Mergers and Acquisitions.* In September 2018, satellite radio provider SiriusXM announced plans to acquire digital audio streaming company Pandora in an all-stock deal worth \$3.5 billion.⁵⁰⁵ According to some observers, the acquisition could offer the combined company key benefits including: (1) an online, streaming presence for SiriusXM as vehicles become increasingly digitized, (2) the largest digital audio advertising offering currently available, (3) access to Pandora's 71.4 million monthly access users, and (4) the ability to invest in new products, such as seamless listening from vehicle to phone, placement of Pandora's content on SiriusXM's satellite system, or adding SiriusXM's content to Pandora's offerings.⁵⁰⁶

5. Marketplace Factors Relevant to Entry, Competition, and Expansion

166. Terrestrial radio broadcasters, satellite radio, and Online Audio Providers all face marketplace barriers that affect entry and competition in the audio marketplace. As with most businesses involving the creation and distribution of entertainment programming to consumers, entry into the audio marketplace typically requires significant capital. For example, given that entry in the terrestrial broadcast radio industry occurs primarily via acquisition of existing licensees, new market entrants must have the ability to acquire a license (or multiple licenses) on the secondary market, which, along with operational expenses, can be a significant barrier to entry.⁵⁰⁷ Even more restrictive than terrestrial broadcasting, currently, there is only one satellite radio provider, and no additional spectrum is currently allocated for new SDARS entrants.⁵⁰⁸ To enter the marketplace as an Online Audio Provider, an entity must have access to necessary delivery infrastructure and must develop and maintain apps or other mechanisms for delivery of content to consumers. In the current marketplace, such entry may be challenging given the multiplicity of streaming options available to consumers and the fact that many incumbent providers have strategic partnerships with wireless service providers, video providers, or particular consumer devices. Finally, satellite radio and Online Audio Providers must contend with content costs that terrestrial radio does not due to its unique music licensing status.⁵⁰⁹

⁵⁰¹ NAB Comments at 11.

⁵⁰² Nicole Lyn Pesce, *These companies are now offering free Netflix, Hulu, Spotify and more*, Moneyish (Sept. 11, 2017), <https://moneyish.com/upgrade/these-companies-are-now-offering-free-netflix-hulu-spotify-and-more/>.

⁵⁰³ 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/>.

⁵⁰⁴ See Miller at 18.

⁵⁰⁵ See Richard Windsor, *Sirius XM Paying Cash Would Open Pandora's Box*, Forbes (Sept. 24, 2018), <https://www.forbes.com/sites/richardwindsoreurope/2018/09/24/sirius-xm-paying-cash-would-open-pandoras-box/#22453fe24453>.

⁵⁰⁶ *Id.*

⁵⁰⁷ See *supra* para. 146.

⁵⁰⁸ See *supra* para. 149.

⁵⁰⁹ See *supra* para. 160; musicFIRST Coalition and the Future of Music Coalition Comments at 26.

167. Consumers must use devices to receive content from audio marketplace participants. The radios necessary to receive the signals of terrestrial radio broadcasters are ubiquitous in the marketplace, as are computers, smartphones, and other devices needed to receive online audio content. As discussed above, audio marketplace participants continue to work with equipment manufacturers and other parties to make their content accessible on multiple devices.⁵¹⁰

D. The Fixed Broadband Market

168. We next assess the state of competition in the fixed broadband market. We will first examine the various fixed technologies that Internet service providers currently deploy and how some technologies have begun to merge in the face of competition from other services. 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. We will then present data, based on the Commission's December 2017 FCC Form 477 data collection, on fixed broadband competition in the United States.

169. Internet service providers continue to invest in their networks to improve the quality and availability of their services, typically in competition with each other.⁵¹¹ Further, as we have identified 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.⁵¹² Based on Internet service providers' incentives to invest and our actions to facilitate broadband deployment, we are optimistic that Internet service providers will continue to close the digital divide and give more Americans the benefits of fixed broadband competition.

1. Overview of the Fixed Broadband Communications Marketplace

170. The RAY BAUM's Act directs the Commission to consider "all forms of competition"⁵¹³ in its competition assessment, "including the effect of intermodal competition, facilities-based competition, and competition from new and emergent communications services."⁵¹⁴ While some commenters advocate in favor of the Commission's competition analysis including both fixed and mobile broadband,⁵¹⁵ this Chapter will focus only on the state of competition for fixed broadband services and

⁵¹⁰ See *supra* paras. 161-162.

⁵¹¹ See *Restoring Internet Freedom*, WC Docket No. 17-108, Declaratory Ruling, Order, Report and Order, 33 FCC Rcd 311, 385, para. 126-27 (2018) (*Restoring Internet Freedom Order*).

⁵¹² *Restoring Internet Freedom Order*, 33 FCC Rcd at 383-85, paras. 126-27.

⁵¹³ 47 U.S.C. § 163(d)(1).

⁵¹⁴ *Id.*

⁵¹⁵ See, e.g., USTelecom Comments, GN Docket No. 18-231, at 6 (Aug. 17, 2018) (USTelecom Fixed Competition Comments); Verizon Comments, GN Docket No. 18-231, at 3-4 (Aug. 17, 2018) (Verizon Fixed Competition Comments); NCTA Comments, GN Docket No. 18-231, at 6 (Aug. 17, 2018) (Verizon Fixed Competition Comments); cf. American Cable Association (ACA) Comments, GN Docket No. 18-231, at 2-3 (Aug. 17, 2018) (ACA Fixed Competition Comments) (stating that mobile service is "increasingly being viewed by consumers in markets served by smaller providers as a substitute for fixed service . . . it [is] necessary for any fixed broadband competition analysis to take into account future trends and the possible emergence of new sources of competition not foreseen today"). Other commenters contend that fixed and mobile broadband should not be viewed as competitors. See, e.g., Common Cause, Public Knowledge, Center for Rural Strategies, & The Benton Foundation Comments, GN Docket No. 18-231, at 2-5 (Aug. 17, 2018) (Common Cause et al. Fixed Competition Comments); INCOMPAS Comments, GN Docket No. 18-231, at 6 (Aug. 17, 2018) (INCOMPAS Fixed Competition

(continued....)

mobile competition is evaluated in a separate Chapter of this Report.⁵¹⁶ This Chapter makes no finding with respect to whether fixed and mobile broadband services are competitive substitutes. In February, the *2018 Broadband Deployment Report* found that there are “salient differences between the two technologies” and that mobile services are not “currently full substitutes for fixed services.”⁵¹⁷

a. Technologies Deployed

171. Today, consumers can access the Internet through many types of fixed technologies, including fiber to the end user, cable broadband services, digital subscriber lines (DSL), fixed wireless, and satellite. Each service differs in function, speed, and cost of deployment. In the current broadband marketplace, to compete with the technological advancements of other services, providers are continually investing in network upgrades.⁵¹⁸ To provide context on the state of broadband competition today, we review several common types of service, including the technology used, speed, latency,⁵¹⁹ cost of deployment, and other unique characteristics.

172. *Fiber optics.* Some Internet service providers provide broadband services entirely over optical fiber, or over a combination of optical fiber and other transmission technology such as copper wire or coaxial cable.⁵²⁰ Fiber-to-the-premises (FTTP),⁵²¹ uses optical fiber to deliver a communications signal

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Comments); New America Comments, GN Docket No. 18-238, at 20 (Sept. 17, 2018) (New America Fixed Competition Comments).

⁵¹⁶ See *supra* section II.A.

⁵¹⁷ *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, 33 FCC Rcd 1660, 1666, para. 18 (2018) (*2018 Broadband Deployment Report*); see also Common Cause et al. Fixed Competition Comments at 2 (“[M]obile broadband services typically come with data caps where the mobile network operator places a limit on the amount of data a customer can use over their internet connection. . . . mak[ing] it difficult for consumers to continuously use data-intensive applications like video streaming or video conferencing on a mobile connection as compared to a fixed connection where large amounts of data usage are generally permitted. Other key character differences between fixed and mobile broadband include pricing models, variability of speed, and reliability.”); INCOMPAS Fixed Competition Comments at 6; New America Fixed Competition Comments at 20 (“Mobile wireless Internet service providers operate in a separate market from fixed Internet service providers and the distant prospect of 5G is unlikely to change that reality.”). In the most recent Broadband Deployment Report Notice of Inquiry, the Commission sought comment on “whether and to what extent fixed and mobile services of similar functionality are substitutes for each other.” *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 18-238, Fourteenth Broadband Deployment Report Notice of Inquiry, FCC 18-119, para. 11 (Aug. 9, 2018) (*Fourteenth Notice*).

⁵¹⁸ The lines between the services we describe below are not rigid. For instance, fiber-to-the-curb (FTTC) and hybrid fiber/coaxial use a mix of fiber and legacy copper wire or coaxial cable to provide service. As carriers deploy 5G technology, Internet service providers may combine wireline backhaul and 5G fixed wireless access last-mile connections to offer high-speed services at reduced costs. See *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, WT Docket No. 17-79, Declaratory Ruling and Third Report and Order, FCC 18-133, paras. 2, 24 (Sept. 27, 2018); *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Third Report and Order and Declaratory Ruling, FCC 18-111, para. 2 (Aug 3, 2018). Some fixed carriers may also rely on satellite backhaul. See, e.g., *Connect America Fund; Universal Service Reform—Mobility Fund; Connect America Fund—Alaska Plan*, Report and Order and Further Notice of Proposed Rulemaking, WC Docket Nos. 10-90 and 16-271, WT Docket No. 10-208, 31 FCC Rcd 10139, 10147, para. 24.

⁵¹⁹ Latency refers to the time it takes for a data packet to travel back and forth through a network.

⁵²⁰ Electronic Frontier Foundation (EFF) Comments, GN Docket No. 18-231, at 3 (Aug. 17, 2018) (EFF Fixed Competition Comments).

from the operator's switching equipment to a home or business.⁵²² FTTP has the potential to offer higher speeds than other broadband technologies, such as cable broadband service⁵²³ or DSL, as it "can carry high bandwidth signals over long distances without degradation."⁵²⁴ An all-fiber network allows providers to offer end-users equal upload and download speeds (i.e., symmetrical service), "as well as high-quality voice and video services."⁵²⁵ In contrast, other technologies allocate greater capacity to download speeds than upload speeds to reflect typical consumer use. According to the *Eighth Measuring Broadband America Fixed Broadband Report* (Eighth MBA Report),⁵²⁶ as of September 2017, for participating Internet service providers using fiber technology,⁵²⁷ (1) the maximum advertised download speeds among the service tiers measured in the report range from 100 to 150 Mbps;⁵²⁸ (2) the median download speed experienced by their subscribers is 73 Mbps;⁵²⁹ and (3) approximately 60% of

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⁵²¹ *Id.* FTTP is also sometimes referred to as fiber-to-the-home (FTTH). See *Differences between FTTH, FTTC, and FTTN*. AT&T High-Speed Internet & Resource Directory, <https://www.attinternetservice.com/resources/different-types-fiber/>.

⁵²² Dan Mahoney and Greg Rafert, *Broadband Competition Helps to Drive Lower Prices and Faster Download Speeds for U.S. Residential Consumers*, 3 (Nov. 2016), http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/broadband_competition_report_november_2016.pdf (Mahoney and Rafert).

⁵²³ Cable companies, such as Xfinity Comcast, Charter and CenturyLink, currently use FTTC technology to serve some customers. See Laurel Ridge Comments, GN Docket No. 18-231, at 2 (Aug. 17, 2018); Charter Spectrum Availability Map, <https://broadbandnow.com/Charter-Communications> (last visited Sept. 18, 2018); Sean Buckley, *Century Link says G.Fast is a non-disruptive means to enhance Ethernet delivery, upgrade existing FTTC sites*, FierceTelecom (Sept. 14, 2016), <https://www.fiercetelecom.com/installer/centurylink-says-g-fast-a-non-disruptive-means-to-enhance-ethernet-delivery-upgrade>; TV, Internet and Voice Connection Types for Your Xfinity Service, <https://www.xfinity.com/support/articles/identifying-video-connection-types> (last visited Sept. 18, 2018).

⁵²⁴ *Building Fiber-to-the-Home Communities Together*, FTTH Council, 1, <https://www.jaxenergy.com/broadband/faq/downloads/FTTHQ&A.pdf>; see also Mahoney at Rafert at 3-4. Cable and DSL rely on copper wire to deliver signals, which can carry high bandwidth only for a few hundred yards until the signal begins to degrade. *Building Fiber-to-the-Home Communities Together*, FTTH Council, 1, <https://www.jaxenergy.com/broadband/faq/downloads/FTTHQ&A.pdf>.

⁵²⁵ Verizon Fixed Competition Comments at 6.

⁵²⁶ *Eighth Measuring Broadband America Fixed Broadband Report*, OET (2018) (Eighth MBA Report) (attached as Appendix F-2). The Measuring Broadband America (MBA) program is a rigorous, ongoing nationwide study of consumer broadband performance that relies upon a sample of more than 4,000 actual broadband subscribers spread across different fixed Internet service providers serving over 80% of the residential marketplace, and across different technologies, subscription speeds, and geographic regions. *Id.* at 6. The Seventh and Eighth MBA Reports contain validated data collected in September 2016 and September 2017, respectively, from fourteen Internet service providers. *Id.* at 6; *Seventh Measuring Broadband America Fixed Broadband Report*, OET, 6 (Seventh MBA Report) (attached as Appendix F-1). The maximum advertised download speeds among the service tiers measured in the reports ranged between 3 and 200 Mbps. Seventh MBA Report at 6; Eighth MBA Report at 6. Among the key findings of the Seventh and Eighth MBA Reports are that (1) the median download speeds experienced by subscribers of participating providers was 57 Mbps as of September 2016 and 72 Mbps as of September 2017; and (2) for the majority of the providers that were tested, measured download speeds were 100% or better of advertised speeds during peak usage periods (i.e., 7 to 11 pm local time). *Id.*

⁵²⁷ Participation in the program by Internet service providers 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 MBA 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 n.818.

⁵²⁸ Eighth MBA Report at 10.

⁵²⁹ *Id.* at 25.

subscribers experience median download speeds exceeding the advertised download speed.⁵³⁰ The Eighth MBA Report also found that, as of September 2017, participating fiber providers demonstrate the lowest median latencies in comparison to cable and DSL providers, ranging from 12 milliseconds (ms) to 20 ms.⁵³¹ Another advantage of using fiber is that Internet service providers can generally upgrade fiber networks to higher speeds, or in other ways, less expensively than other broadband services that require new infrastructure.⁵³²

173. *Cable broadband services.* Cable broadband services use infrastructure that was initially deployed for cable television to deliver high-speed broadband service.⁵³³ Through the use of coaxial cables that deliver cable TV programming and Internet service on separate channels (or frequencies), users can access the Internet without disrupting the cable TV service.⁵³⁴ Today, most cable systems rely on hybrid fiber-coaxial (HFC) technology that uses fiber connections to send signals from the operator's facility to an optical node near the customer's premises.⁵³⁵ Unlike FTTP, cable providers typically do not use fiber to carry connections directly to individual subscribers.⁵³⁶ Instead, they use coaxial cable to send the signal to cover the remaining distance from the node to the customer's premises.⁵³⁷ According to NCTA, propelled by a competitive landscape, cable operators have invested "over \$50 billion in the last three years alone and by the end of 2018 are expected to offer gigabit services reaching 70 to 75% of American households."⁵³⁸ Indeed, cable providers are steadily upgrading their networks to provide high speed broadband service to a larger percentage of customers.⁵³⁹ The newest technological standard for

⁵³⁰ *Id.* at 30.

⁵³¹ *Id.* at 17.

⁵³² EFF Fixed Competition Comments at 5.

⁵³³ Mahoney and Rafert at 3; *see also Applications Filed by Altice N.V. and Cable Vision Systems Corporation to Transfer Control of Authorizations from Cablevision Systems Corporation to Altice N.V.*, WC Docket No. 15-257, 4380, para. 33 (May 3, 2016) ("Cable modems connect consumer equipment to the broadband Internet access service offered by cable operators.").

⁵³⁴ David N. Beede, Economist, Office of the Chief Economist, Competition Among U.S. Broadband Service Providers, U.S. Dept. of Commerce, 12, Technical Appx., Tbl. 3 (Dec. 2014), <http://esa.doc.gov/sites/default/files/competition-among-us-broadband-service-providers.pdf> (Beede).

⁵³⁵ *The State of the Art and Evolution of Cable Television and Broadband Technology*, Columbia Telecommunications Corporation, 4 (prepared for Public Knowledge, Nov. 2014), <https://ecfsapi.fcc.gov/file/60000983290.pdf>.

⁵³⁶ *Id.*

⁵³⁷ *Id.* Some commenters discuss anticipated technological advancements with the deployment of 5G networks. *See* ADTRAN Comments, GN Docket No. 18-231, at 8 (Aug. 17, 2-18) (ADTRAN Fixed Competition Comments); NCTA Fixed Competition Comments at 9; Verizon Fixed Competition Comments at 8; USTelecom Fixed Competition Comments at 4-5. Given its potential, it is conceivable that 5G technology could also eventually be incorporated into a hybrid service with an existing fixed broadband service. *But see* New America Fixed Competition Comments at 3 (arguing that 5G networks are years away from deployment).

⁵³⁸ NCTA Fixed Competition Comments at 8.

⁵³⁹ *See, e.g.*, Thomson Reuters StreetEvents, Edited Transcript: CMCSA – Q1 2018 Comcast Corp Earnings Call, 6 (Apr. 25, 2018), <https://www.cmcsa.com/static-files/fdafc0ba-9422-4659-ac3b-898fdaf1115c> (statement by Comcast Corp. Senior EVP & CFO Michael Cavanagh); Charter Communications, Inc. Press Release, Charter Announces Second Quarter 2018 Results (July 31, 2018), <https://newsroom.charter.com/press-releases/charter-announces-second-quarter2018-results/> (stating that Charter's DOCSIS 3.1 service is now available to approximately 60% of its footprint); Midco, Midco Gig, <https://www.midco.com/services/internet/midco-gig> (last visited Sept. 18, 2018); Cox Communications, Inc. Press Release, Cox Expands Gigabit Speeds at Rapid Pace (Jan. 9, 2018), <http://newsroom.cox.com/2018-01-09-Cox-Expands-Gigabit-Speeds-atRapid-Pace> (asserting Cox offers gigabit service to 40% of its footprint with plans to expand).

cable broadband services is Data Over Cable Service Interface Specifications 3.1 (“DOCSIS 3.1”), which offers faster broadband service than older standards, and is capable of achieving upload and download speeds of up to 10 gigabits per second.⁵⁴⁰ As of 2017, according to NCTA, the most commonly deployed cable technology is still DOCSIS 3.0, which has the capability of delivering download speeds up to 900 Mbps.⁵⁴¹ According to the Eighth MBA Report, as of September 2017, for participating Internet service providers using cable technology, (1) the maximum advertised download speeds among the service tiers measured in the report are between 100 and 200 Mbps;⁵⁴² (2) the median download speed experienced by their subscribers is 97 Mbps;⁵⁴³ and (3) approximately 80% of subscribers experience median download speeds exceeding the advertised download speed.⁵⁴⁴ The Eighth MBA Report also found that, as of September 2017, the median latencies for participating cable-based providers range from 15 ms to 34 ms.⁵⁴⁵

174. *Digital Subscriber Lines (DSL)*. DSL, the technology that telephone companies most commonly use to provide high-speed data services,⁵⁴⁶ “transmits data over traditional copper telephone lines to homes and businesses (using separate lines to carry voice traffic),” enabling users “to connect to the high-speed Internet via a modem without disruption [of] their telephone service.”⁵⁴⁷ DSL speeds “depend[] on the distance between the subscriber and the central office.”⁵⁴⁸ According to the Eighth MBA Report, as of September 2017, for participating DSL providers, (1) the maximum advertised download speeds among the service tiers measured in the report range from 3 to 45 Mbps;⁵⁴⁹ (2) the median download speed experienced by their subscribers is 16 Mbps;⁵⁵⁰ and (3) 40% of subscribers to DSL-based services experience median download speeds exceeding the advertised download speed.⁵⁵¹ The majority of DSL service used primarily by residential consumers is asymmetric (i.e., download speeds are greater than upload speeds).⁵⁵² Symmetric DSL, on the other hand, is typically used by businesses that move large data files, and provides equal bandwidth for uploading and downloading data.⁵⁵³ The costs of providing, and hence the prices for, symmetric DSL services are considerably

⁵⁴⁰ See Verizon Fixed Competition Comments at 5; USTelecom Fixed Competition Comments at Exh. B (Patrick Brogan, VP of Industry Analysis, U.S. Broadband Availability Year-End 2016, 7 (Feb. 22, 2018)) at 16. According to NCTA, an update to the DOCSIS 3.1 technology, Full Duplex DOCSIS 3.1, “enables up to 10 gigabits for both download and upload speeds.” The Near Future Becomes Closer with New Cable Broadband Technology, NCTA (Oct. 18, 2017), <https://www.ncta.com/whats-new/the-near-future-becomes-closer-with-new-cable-broadband-technology>. The previous version of the DOCSIS 3.1 allowed for download speeds of up to 10 gigabits, but upload speeds of only up to 1 gigabit for uploads and downloads. *Id.*

⁵⁴¹ How Cable Networks Deliver Ultra-Fast Internet, NCTA (Apr. 5, 2017), <https://www.ncta.com/how-cable-networks-deliver-ultra-fast-internet>.

⁵⁴² Eighth MBA Report at 11.

⁵⁴³ *Id.* at 25.

⁵⁴⁴ *Id.* at 30.

⁵⁴⁵ *Id.* at 17.

⁵⁴⁶ Beede at 12, Technical Appx., Tbl. 3.

⁵⁴⁷ *Id.*

⁵⁴⁸ Eighth MBA Report at 30.

⁵⁴⁹ *Id.* at 11.

⁵⁵⁰ *Id.* at 25.

⁵⁵¹ *Id.* at 30.

⁵⁵² Bradley Mitchell, What Are the Different Types of DSL Technology, Lifewire (May 10, 2018), <https://www.lifewire.com/different-types-of-dsl-technology-817522>; see also Beede at 12, Technical Appx., Tbl. 3.

⁵⁵³ Beede at 12, Technical Appx., Tbl. 3.

higher—generally prohibitively so for mass marketing of the service—than costs and prices of providing asymmetric DSL.⁵⁵⁴

175. Fiber-to-the-node or neighborhood (FTTN), offered by Internet service providers such as AT&T, is a short-loop DSL service relying on fiber-optic connections from a local central office into a neighborhood, and twisted-pair copper wiring (traditional telephone lines) to cover the remaining distance to the home.⁵⁵⁵ Fiber-to-the-curb (FTTC) uses fiber to send signals to and from a mounted communications device, often located on a utility pole, and then employs twisted-pair copper to transmit the signal from the pole or other location to a home.⁵⁵⁶ FTTP has the potential for the highest speeds but is the most expensive to install, while FTTN and FTTC deliver broadband at a lower cost because both technologies rely on pre-existing copper networks.⁵⁵⁷ With the existence of a copper network, FTTN is the least expensive of the three alternatives, followed by FTTC then FTTP when the sunk costs of the existing copper network are not counted.

176. *Terrestrial Fixed Wireless Broadband Technology.* Fixed wireless providers deliver broadband service to consumers in fixed wireless locations, including residences and businesses, primarily using wireless spectrum technology for the end connection to users while often relying on fiber optics to form parts of the rest of their network infrastructure.⁵⁵⁸ Providers deliver services using a combination of licensed spectrum, shared access spectrum, and unlicensed spectrum.⁵⁵⁹ According to WISPA, fixed wireless broadband technology is defined by its “low start-up costs” and “ability to quickly deploy affordable high-speed broadband at a low cost, particularly in geographically challenging areas and for low density populations” not typically serviced by traditional broadband providers.⁵⁶⁰ Currently, fixed wireless providers primarily serve “rural and suburban markets where fiber and cable deployment is not cost-effective.”⁵⁶¹ Typically, a fixed wireless provider receives broadband content “from an external distribution point via fiber or microwave connections,” then wireless transmitters on towers that are connected by licensed or unlicensed spectrum deliver the signals to the customer’s fixed antennas.⁵⁶² WISPA reports that typical download speeds are in the range of 5 to 50 Mbps, but that speeds can reach

⁵⁵⁴ See generally *Business Data Services in an Internet Protocol Environment*, WC Docket Nos. 16-43, 05-25, GN Docket No. 13-5, RM-10593, Report and Order, 32 FCC Rcd 3459, 3463, paras. 1-9 (2017) (taking several steps to reduce government intervention and allow market forces to further spur entry, innovation, and competition in business data services markets served by price cap carriers).

⁵⁵⁵ See *Differences between FTTH, FTTC, and FTTN*. AT&T High-Speed Internet & Resource Directory, <https://www.attinternetservice.com/resources/different-types-fiber/>. This remaining distance is sometimes referred to as the “last mile.” *Id.*

⁵⁵⁶ See *id.*

⁵⁵⁷ See *id.*

⁵⁵⁸ WISPA Comments, GN Docket No. 18-231, at Attach. at 5 (Aug. 17, 2018) (WISPA Fixed Competition Comments).

⁵⁵⁹ *Id.*

⁵⁶⁰ *Id.* at 2-3. According to WISPA, “[wireless internet service providers] can deploy fixed wireless broadband to residential consumers at about one-seventh of the capital cost of FTTH and about one-fourth of the capital cost of cable.” *Id.* at 6, at Attach. at 12.

⁵⁶¹ *Id.* at Attach. at 6.

⁵⁶² *Id.* at Attach. at 7. Unlicensed fixed wireless, such as WiFi and Worldwide Interoperability for Microwave Access (WiMAX) uses spectrum shared among Internet service providers to provide broadband service to a specific geographic area. See Beede at 12, Technical Appx., Tbl. 3. It requires an unimpeded line of line for transmission of data. *Id.* Licensed fixed wireless is similar to unlicensed except that it uses spectrum licensed to the Internet service provider. *Id.*

up to 1 Gbps.⁵⁶³

177. *Satellite Services.* Today, satellite providers deliver broadband service to consumers through geostationary satellites (GSO) that operate at approximately 22,300 miles above the earth, and appear to be fixed above a particular point on the Earth.⁵⁶⁴ GSO satellite broadband operators, namely ViaSat and Hughes, provide satellite broadband services to consumers in the United States through the use of satellite constellations in authorized spectrums for fixed satellite service.⁵⁶⁵ According to SIA, satellite operators “began broadly providing users across the United States” with services at the Commission’s fixed speed advanced telecommunications capability benchmark of 25 Mbps/3 Mbps.⁵⁶⁶ In February 2018, ViaSat announced that it now offers unlimited data plans with speeds up to 100 Mbps through its new ViaSat-2 satellite system.⁵⁶⁷ ViaSat expects to launch beginning in 2020 the ViaSat-3 system, which is a trio of Ka-band satellites that will “provide unprecedented capabilities in terms of service speed and flexibility for a satellite platform” and are “expected to deliver more than 1-Terabit per second of network capacity.”⁵⁶⁸ In August 2017, Hughes announced it will launch Jupiter 3/EchoStar XXIV in early 2021 that will deliver greater capacity and broadband at higher speeds, including broadband services of 100 Mbps download speeds or more in parts of the United States.⁵⁶⁹ In 2017 and 2018, the Commission approved a number of non-geostationary orbit (NGSO) satellite systems⁵⁷⁰ for launch and operation or market access that plan to provide high-throughput, lower-latency⁵⁷¹ broadband services than currently offered by GSO satellite services, including to remote or rural areas, using a new

⁵⁶³ WISPA Fixed Competition Comments at 2, Attach. at 5.

⁵⁶⁴ *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*, Third Report, 26 FCC Rcd 17284, 17288, para. 8, n.9 (2011).

⁵⁶⁵ See EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC Comments, GN Docket No. 18-231, at 2 (Aug. 17, 2018) (EchoStar and Hughes Fixed Competition Comments). For example, Hughes provides broadband service through the use of a three-satellite, Ka-band constellation over the United States. *Id.* ViaSat and Hughes are the only operators that provide satellite broadband service directly to consumer end users.

⁵⁶⁶ Satellite Industry Association (SIA) Comments, GN Docket No. 18-231, at 1-2 (Aug. 17, 2018) (SIA Fixed Competition Comments). In 2016, ViaSat began providing 25 Mbps /3 Mbps broadband service in the United States. *Id.* at 2, n.3. Hughes launched 25 Mbps/3 Mbps broadband services “across the continental United States and southeastern Alaska in March 2017, Puerto Rico in July 2017, and the U.S. Virgin Islands in November 2017.” *Id.*; EchoStar and Hughes Fixed Competition Comments at 3.

⁵⁶⁷ ViaSat, *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service—Nationwide* (Feb. 27, 2018), <https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide>.

⁵⁶⁸ ViaSat, *Viasat, Boeing Enter Next Phase of ViaSat-3 Satellite Integration* (Aug. 30, 2018), <https://www.viasat.com/news/viasat-boeing-enter-next-phase-viasat-3-satellite-integration>.

⁵⁶⁹ Hughes, *Hughes Selects Space Systems Loral to Build Next-Generation Ultra High Density Satellite* (Aug. 9, 2017), <https://www.echostar.com/en/Press/Newsandmedia/Hughes%20Selects%20Space%20Systems%20Loral%20To%20Build%20Next-Generation%20Ultra%20High%20Density%20Satellite.aspx>; EchoStar and Hughes Fixed Competition Comments at 2; SIA Fixed Competition Comments at 2.

⁵⁷⁰ Non-geostationary orbits include a number of orbital configurations. Medium earth orbits (MEO) range from 6,000 to 12,000 miles above the earth and circle the earth in five to 12 hours. Howard Hausman, *Fundamentals of Satellite Communications*, Part 1, at 23 (2008), https://www.ieee.li/pdf/viewgraphs/fundamentals_satellite_communication_part-1.pdf (*Fundamentals*). Low-earth orbits (LEO) range from 100 to 300 miles above the earth and circle the earth approximately every 90 minutes. *Fundamentals* at 25.

⁵⁷¹ In this context, lower latency times may be 100 milliseconds or less round trip.

generation of medium-Earth or low-Earth orbit satellite technologies.⁵⁷²

b. Intermodal Competition Among Fixed Broadband Services

178. We next evaluate competition between fixed broadband providers that rely on different types of transmission technology. Today, most fixed broadband services include fiber, cable, and DSL, each occupying a different percentage of the market and offering varying download speeds and latencies to consumers. Fixed wireless and satellite broadband providers have lower market shares, but can be important sources of broadband for consumers in rural and suburban areas.

179. According to the Commission's December 2017 Form 477 subscriber data, cable providers hold 62% of the overall residential fixed broadband market in the United States, and 79% of all residential subscribers with speeds of at least 25 Mbps/3 Mbps.⁵⁷³ Companies offering DSL or FTTP (generally telephone companies) have 35% of the overall residential fixed broadband market in the United States and 20% of all residential subscribers with speeds of at least 25 Mbps/3 Mbps.⁵⁷⁴ Satellite, fixed wireless, and other technologies make up 3% of the overall residential fixed broadband market in the United States with 1% of all residential subscribers with speeds of at least 25 Mbps/3 Mbps.⁵⁷⁵ December 2017 Form 477 data also indicates that 89% of Americans in the United States reside in areas where DSL is deployed, 89% live in areas where cable broadband is deployed, and 40% live in areas where fiber broadband is deployed.⁵⁷⁶

180. According to a 2016 survey of WISPA members, "76.7% . . . reported serving 2,000 or fewer residential consumers, [] more than 56% reported having 1,000 or fewer residential customers," and over 75% serve primarily rural areas.⁵⁷⁷ As demonstrated by this survey, fixed wireless providers are more likely to serve rural and suburban markets when other fixed Internet services such as cable and fiber are less effective.⁵⁷⁸ However, with wireless technology advancements producing improving speeds that "are approaching cable and ultimately will catch up to fiber," fixed wireless service may over time become a more attractive option for more consumers.⁵⁷⁹

⁵⁷² See, e.g., *Space Exploration Holdings, LLC; Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System; Application For Approval For Orbital Deployment And Operating Authority for the SpaceX NGSO Satellite System Supplement*, Memorandum Opinion, Order and Authorization, FCC 18-38 (Mar. 29, 2018), 2018 WL 1559848; *WorldVu Satellites Limited, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, 32 FCC Rcd 5366 (2017); *Space Norway AS, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission*, Order and Declaratory Ruling, 32 FCC Rcd 9649 (2017); *Telesat Canada, Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation*, Order and Declaratory Ruling, 32 FCC Rcd 9663 (2017); *Karousel Satellite LLC; Application for Authority to Launch and Operate a Non-Geostationary Earth Orbit Satellite System in the Fixed Satellite Service*, Memorandum Opinion, Order and Authorization, FCC 18-125 (Aug. 16, 2018), 2018 WL 3955599.

⁵⁷³ FCC Form 477 subscriber data, as of December 31, 2017.

⁵⁷⁴ *Id.*

⁵⁷⁵ *Id.*

⁵⁷⁶ FCC Form 477 deployment data, as of December 31, 2017.

⁵⁷⁷ WISPA Fixed Competition Comments at 10.

⁵⁷⁸ *Id.* at Attach. at 6. Currently, over 2,000 fixed wireless providers deliver services to approximately four million customers and "each state has at least one fixed wireless provider," with the largest concentrations of providers located in the Midwest, Northwest, Southwest, and central and northern California. *Id.* Fixed wireless providers are typically small and medium-sized businesses that "serve an average of 1,200 customers" in the United States. *Id.*

⁵⁷⁹ *Id.* at Attach. at 12, Fig. 6. In fact, "Google, AT&T, Verizon, Windstream, and other carriers have recently announced plans to deploy more fixed wireless, generally as an extension of their wired services." *Id.* at 16.

181. With the deployment of new high-throughput satellites in 2017 and 2018, satellite broadband providers can play an increasingly important role in helping close 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.⁵⁸⁰ According to SIA, satellite broadband providers serve approximately 2 million subscribers in the United States at rates and speeds that meet and surpass the Commission's 25 Mbps/3 Mbps fixed speed benchmark for advanced telecommunications capability.⁵⁸¹ The recent launches and commencement of service of the high throughput satellites Jupiter 2/EchoStar XIX and ViaSat-2 in the last two years by Hughes and ViaSat, respectively, have further increased 25 Mbps/3 Mbps satellite offerings.⁵⁸² Both Hughes and ViaSat have been awarded funding to serve remote areas through the CAF II auction process.⁵⁸³ 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.

2. Fixed Broadband Competition Data

182. We provide an overall assessment of the number of fixed broadband provider options deployed to consumers using Form 477 deployment data at five minimum speed thresholds—10 Mbps/1 Mbps, 25 Mbps/3 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps. Using this data and American Community Survey demographic data,⁵⁸⁴ we also offer an analysis to provide insight into the demographics of areas that have multiple broadband providers, and those that do not.

a. Data Sources and Methodologies

183. In assessing fixed broadband competition, we rely primarily upon our Form 477 deployment data to evaluate consumers' broadband options for fixed terrestrial services.⁵⁸⁵ Consistent

⁵⁸⁰ See SIA Fixed Competition Comments at 2.

⁵⁸¹ *Id.* As of June 30, 2018, ViaSat had approximately 577,000 fixed broadband subscribers in the United States. ViaSat, *Viasat Announces First Quarter Fiscal Year 2019 Results*, <https://www.viasat.com/news/viasat-announces-first-quarter-fiscal-year-2019-results> (last visited Oct. 9, 2018).

⁵⁸² *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51; EchoStar Corporation, Form 10-K (For the fiscal year ended December 31, 2017) at 8, <http://ir.echostar.com/static-files/d98e3836-bb15-4957-b05d-2743be5f110f>; ViaSat, Inc., Form 10-K (For the fiscal year ended March 31, 2018) at 3, <http://investors.viasat.com/static-files/e75b82fb-e7df-4273-8212-984c1fd332fb>; ViaSat, *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service—Nationwide* (Feb. 27, 2018), <https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide>.

⁵⁸³ Hughes was awarded funding to serve 76,873 units in New York state, while ViaSat was a winning bidder in 20 states, potentially serving 190,575 locations. NYS Broadband Program Office, *Phase 3 Awards*, <https://nysbroadband.ny.gov/new-ny-broadband-program/phase-3-awards> (last visited Oct. 9, 2018); Press Release, FCC, Connect America Fund Auction to Expand Broadband to Over 700,000 Rural Homes and Businesses (Aug. 28, 2018); *Wireline Competition Bureau Announces FCC Deadlines For New York Broadband Program Winning Bidders*, WC Docket No. 10-90, Public Notice, DA 18-510 (May 18, 2018) at Attachment A (listing Hughes among applicants awarded support through Phase 3 of New York's New NY Broadband Program); *Connect America Fund Phase II Auction (Auction 903) Closes; Winning Bidders Announced; FCC Form 683 Due October 15, 2018*, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, DA 18-887 (Aug. 28, 2018) at Attachment A.

⁵⁸⁴ For this analysis we examine population density, the number of households and median household income. We rely upon the American Community Survey Five-Year Estimates 2012-2016 for Median Household Income (in 2016 inflation-adjusted dollars) reported at the census block group level and the county level.

⁵⁸⁵ On August 3, 2017, the Commission adopted a Further Notice of Proposed Rulemaking seeking comment on ways to improve the quality and accuracy of information collected on Form 477. See generally *Modernizing the FCC Form 477 Data Program*, Further Notice of Proposed Rulemaking, 32 Rcd 6329 (2017) (*Form 477 Modernization FNPRM*).

with previous findings by the Commission,⁵⁸⁶ the Form 477 data are currently the most accurate data available to the Commission for this analysis.⁵⁸⁷ The Form 477 deployment data are collected at the census block level.⁵⁸⁸ For purposes of this analysis, a whole census block is classified as served if the Form 477 data indicate that service can be provided anywhere in the census block. Therefore, it is not necessarily the case that every household,⁵⁸⁹ housing unit, or person will have coverage to a service in a census block that this analysis indicates is served.⁵⁹⁰ Furthermore, although staff examine our Form 477 data for quality and consistency, the data may understate or overstate deployment of services to the extent that broadband providers fail to report data or misreport data.⁵⁹¹ Our deployment data for fixed terrestrial services are evaluated using 2010 census block population data that the Commission staff has updated to account for population growth and economic development.⁵⁹²

184. Our analysis examines Form 477 consumer deployment data as of December 31, 2016, and data as of December 31, 2017, for fixed terrestrial broadband provider options with a minimum advertised speed of 10 Mbps/1 Mbps, 25 Mbps/3 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps. Data for the U.S. Territories is reported separately as it may not accurately reflect damage to infrastructure in Puerto Rico and the U.S. Virgin Islands from Hurricanes Maria and Irma.

⁵⁸⁶ *2018 Report*, 31 FCC Rcd at 1677, para. 43.

⁵⁸⁷ The Commission continues to analyze whether, and how the Form 477 data collection might be revised to address concerns about accuracy. See *Modernizing the FCC Form 477 Data*, FNPRM, 32 FCC Rcd, 6329, 6337, paras. 26-27 (2017) (*Form 477 Modernization*). In this report, we use the best data available while recognizing improvements to the data may be needed. We note that our 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* (Nov. 20, 2017), <https://www.fcc.gov/general/explanation-broadband-deployment-data> (describing quality and consistency checks performed on providers' submitted data and explaining any adjustments made to the Form 477 data as filed).

⁵⁸⁸ For purposes of this form, fixed broadband connections are available to consumers 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 (2016), <https://transition.fcc.gov/form477/477inst.pdf>.

⁵⁸⁹ 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, *Current Population Survey Subject Definitions* (Aug. 25, 2018), <https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#household>.

⁵⁹⁰ We note that these coverage estimates represent deployment of networks to consumers and do not indicate the extent to which service providers affirmatively offer service to residents in the covered areas. Further, this analysis likely overstates the coverage experienced by some consumers, especially in large or irregularly shaped census blocks. We therefore acknowledge that this analysis may overstate or understate the deployment of fixed and mobile services. See *2018 Broadband Deployment Report*, 33 FCC Rcd at 1677, para. 43.

⁵⁹¹ See FCC, *Explanation of Broadband Deployment Data* (Nov. 20, 2017), <https://www.fcc.gov/general/explanation-broadband-deployment-data> (describing quality and consistency checks performed on providers' submitted data and explaining any adjustments made to the Form 477 data as filed).

⁵⁹² FCC Staff developed population estimates for 2011-2017 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, i.e., 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>.

b. Consumer Fixed Terrestrial Broadband Competition

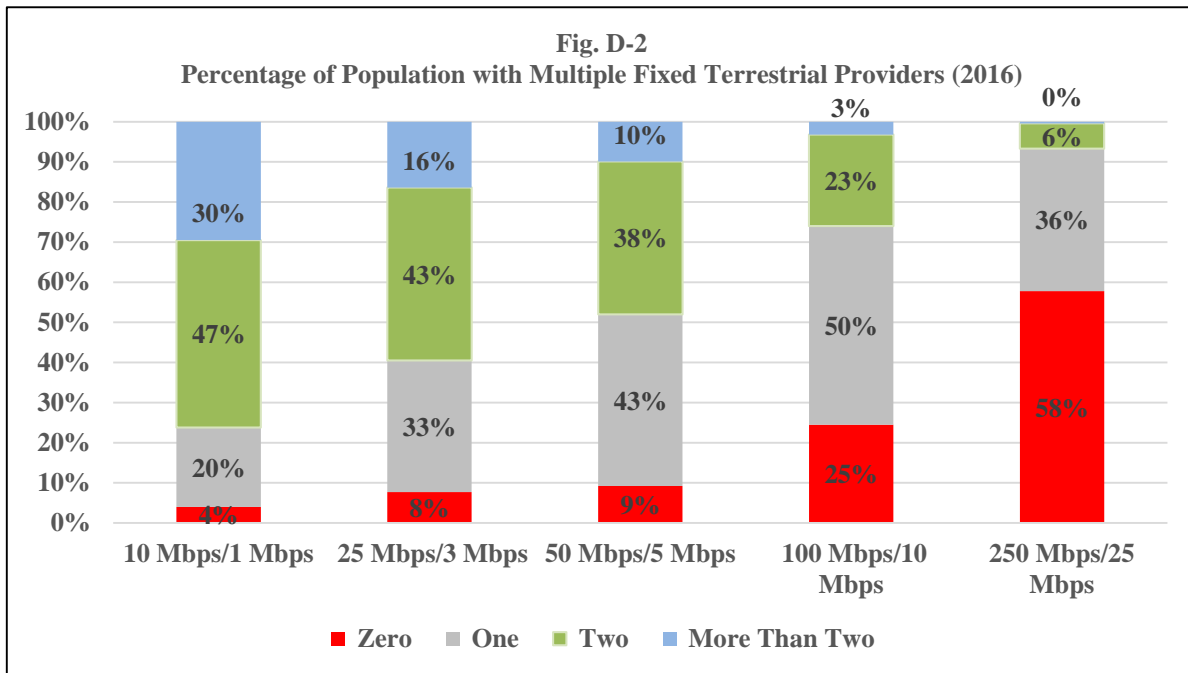
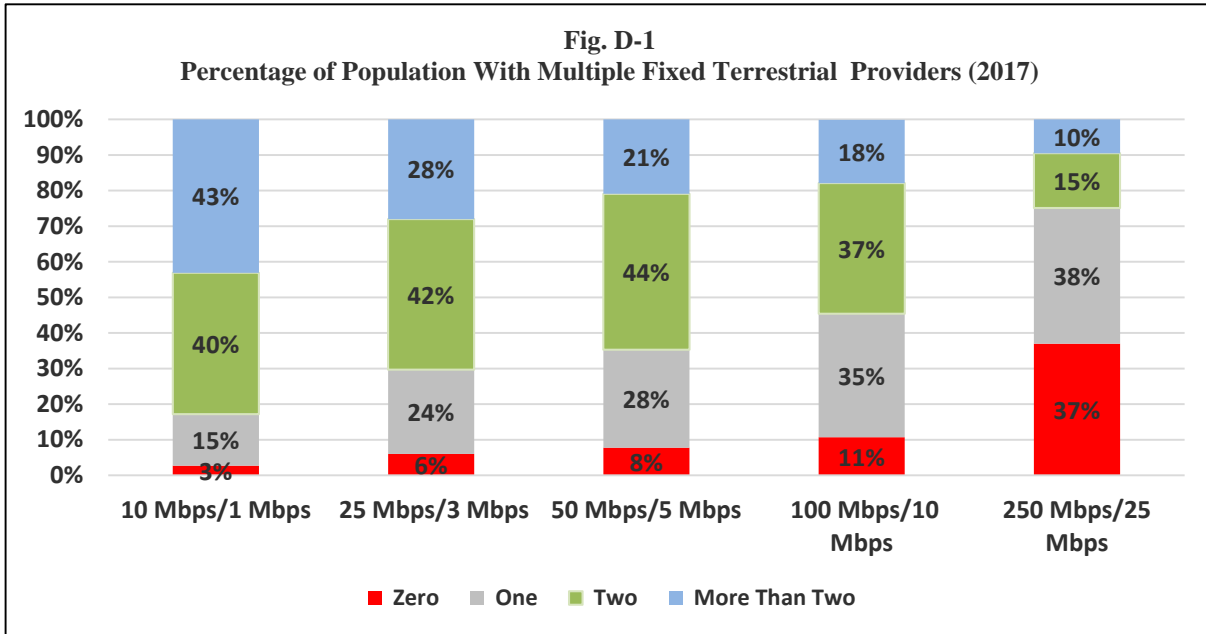
185. First, we present an evaluation of fixed terrestrial broadband deployment to consumers.⁵⁹³ Figures D-1 and D-2 report estimates of the percentage of the U.S. population where Form 477 consumer deployment data indicate that zero, one, two, and more than two providers of fixed terrestrial broadband services are deployed as of December 31, 2016 and as of December 31, 2017. Focusing on the population with access to two or more providers, the 2017 data shows that 83% of Americans have at least 2 options for 10 Mbps/1 Mbps fixed terrestrial service, 70% have at least two options for 25 Mbps/3 Mbps fixed terrestrial service, 65% have at least two options for 50 Mbps/5 Mbps service, 55% have at least two options for 100 Mbps/10 Mbps service, and 25% have at least 2 options for 250 Mbps/25 Mbps service.⁵⁹⁴ Comparing the data year over year also shows an increase in the service options available for all speed tiers, where, for example, between 2016 and 2017, the percentage of the population with two or more provider options offering 10 Mbps/1 Mbps service increased from 77% to approximately 83%, and percentage of the population with two or more provider options offering 25 Mbps/3 Mbps service increased from approximately 59% to 70%. If we were to include satellite broadband in the analysis below, the Form 477 data indicate that nearly all areas in the country⁵⁹⁵ have access to satellite broadband as an alternative for fixed terrestrial broadband service at both the 10 Mbps/1 Mbps and 25 Mbps/3 Mbps levels, but not yet at the higher speeds.⁵⁹⁶

⁵⁹³ The Form 477 data discussed in this Chapter is exclusively focused on deployment to consumer end users.

⁵⁹⁴ The percentage of the population with estimated number of fixed terrestrial provider options in a census block equals the population with coverage from the specific number of providers (e.g., zero, one, two, more than two) within the geographic area divided by the total population in census block. Percentages reported in Figures 1 and 2 may not sum to 100% due to rounding.

⁵⁹⁵ The Form 477 deployment data for satellite broadband indicate that satellite service offering 25 Mbps/3 Mbps speeds is available to all but 0.04% of the population. As we have noted in the past, 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. See *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, Fourteenth Broadband Deployment Report Notice of Inquiry, GN Docket No. 18-238, FCC 18-119, para. 17, n.46 (Aug. 9, 2018) (*Fourteenth Notice*); *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51, n.148.

⁵⁹⁶ We note that, more recently than reflected in the Measuring Broadband America Reports, satellite broadband services are being offered at higher speeds. See Eighth MBA Report at 10-11 (noting that the maximum offered download speed tier included in the report for ISPs using satellite technology is between 12-25 Mbps).



186. 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.⁵⁹⁷ Our analysis of the population shows that, in general, more Americans have multiple provider options in 2017 than in 2016 regardless of the speed tier. Figures D-3 and D-4, below, show that for

⁵⁹⁷ We separately provide estimates of the population and the percentage of the population with multiple provider options for fixed terrestrial broadband services, for each state and the District of Columbia, as of December 31, 2017. See *infra* Appendices 1, 2, 3, 4 and 5. 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 add 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).

rural areas, there was a 12 percentage point increase between 2016 and 2017 for 10 Mbps/1 Mbps service, a 13 percentage point increase for 25 Mbps/3 Mbps service, a 12 percentage point increase for 50 Mbps/5 Mbps services, a 15 percentage point increase for 100 Mbps/10 Mbps service, and an 8 percentage point increase for 250 Mbps/25 Mbps service. In urban areas there was an increase of 5 percentage points for 10 Mbps/1 Mbps service, an increase of 10 percentage points for 25 Mbps/3 Mbps services, an increase of 18 percentage points for 50 Mbps/5 Mbps service, an increase of 32 percentage points for 100 Mbps/10 Mbps service, and an increase of 21 percentage points for 250 Mbps/25 Mbps service. On Tribal lands, while the change in the percentage of the population with multiple provider options decreased by 0.8 percentage points for 10 Mbps/1 Mbps service, it increased by 0.2 percentage points for 25 Mbps/3 Mbps service, increased 2.5 percentage point for 50 Mbps/5 Mbps service, increased 7.5 percentage points for 100 Mbps/10 Mbps service, and increased over a 3 percentage points for 250 Mbps/25 Mbps service.

Fig. D-3

Population (Millions) by Provider Options for Fixed Terrestrial Services (As of December 31, 2017)

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
All Areas										
Zero	8.905	2.7%	19.387	6.0%	25.247	7.8%	34.838	10.7%	120.484	37.0%
One	47.139	14.5%	77.199	23.7%	89.660	27.5%	113.075	34.7%	124.154	38.1%
Two	129.102	39.6%	137.957	42.4%	142.683	43.8%	119.688	36.7%	50.250	15.4%
More than Two	140.570	43.2%	91.173	28.0%	68.125	20.9%	58.115	17.8%	30.829	9.5%
Rural Areas										
Zero	6.850	10.7%	15.494	24.3%	19.804	31.0%	24.629	38.6%	39.918	62.6%
One	19.834	31.1%	24.494	38.4%	25.252	39.6%	24.843	38.9%	18.341	28.8%
Two	22.064	34.6%	17.862	28.0%	15.200	23.8%	11.729	18.4%	4.710	7.4%
More than Two	15.035	23.6%	5.933	9.3%	3.527	5.5%	2.583	4.0%	0.815	1.3%
Urban Areas										
Zero	2.055	0.8%	3.893	1.5%	5.444	2.1%	10.209	3.9%	80.566	30.8%
One	27.305	10.4%	52.706	20.1%	64.408	24.6%	88.232	33.7%	105.813	40.4%
Two	107.038	40.9%	120.095	45.8%	127.483	48.7%	107.959	41.2%	45.540	17.4%
More than Two	125.535	47.9%	85.239	32.5%	64.598	24.7%	55.532	21.2%	30.014	11.5%
Tribal Lands										
Zero	0.688	17.1%	1.286	32.0%	1.552	38.6%	1.816	45.2%	2.397	59.7%

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
One	1.406	35.0%	1.450	36.1%	1.674	41.7%	1.724	42.9%	1.465	36.5%
Two	1.232	30.7%	0.846	21.1%	0.725	18.1%	0.434	10.8%	0.156	3.9%
More than Two	0.691	17.2%	0.435	10.8%	0.066	1.7%	0.043	1.1%	0.000	0.0%

Fig. D-4

Population (Millions) by Provider Options for Fixed Terrestrial Services (As of December 31, 2016)

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
All Areas										
Zero	12.905	4.0%	24.753	7.7%	29.714	9.2%	78.870	24.5%	186.428	57.8%
One	63.848	19.8%	105.940	32.8%	138.037	42.8%	159.676	49.5%	114.356	35.5%
Two	150.746	46.7%	138.875	43.1%	122.935	38.1%	73.538	22.8%	20.310	6.3%
More than Two	95.019	29.5%	52.950	16.4%	31.832	9.9%	10.434	3.2%	1.424	0.4%
Rural Areas										
Zero	10.159	16.1%	19.322	30.7%	22.674	36.0%	36.928	58.7%	53.198	84.5%
One	23.411	37.2%	28.502	45.3%	29.542	46.9%	21.579	34.3%	9.175	14.6%
Two	20.447	32.5%	12.039	19.1%	9.323	14.8%	4.017	6.4%	0.525	0.8%
More than Two	8.909	14.2%	3.062	4.9%	1.387	2.2%	0.402	0.6%	0.027	0.0%
Urban Areas										
Zero	2.745	1.1%	5.430	2.1%	7.040	2.7%	41.942	16.2%	133.229	51.3%
One	40.438	15.6%	77.438	29.8%	108.495	41.8%	138.097	53.2%	105.181	40.5%
Two	130.299	50.2%	126.836	48.9%	113.612	43.8%	69.521	26.8%	19.785	7.6%
More than Two	86.110	33.2%	49.888	19.2%	30.445	11.7%	10.033	3.9%	1.397	0.5%
Tribal Lands										
Zero	0.727	18.2%	1.413	35.4%	1.663	41.7%	2.134	53.5%	2.685	67.3%
One	1.318	33.0%	1.317	33.0%	1.638	41.0%	1.683	42.2%	1.274	31.9%
Two	1.123	28.1%	0.921	23.1%	0.643	16.1%	0.152	3.8%	0.032	0.8%
More than Two	0.822	20.6%	0.340	8.5%	0.047	1.2%	0.023	0.6%	0.000	0.0%

187. Figure D-5 presents an analysis of the Form 477 deployment data for the U.S. Territories as of December 31, 2017. We caution that these data may significantly overstate current deployment in Puerto Rico and the U.S. Virgin Islands given the damage to infrastructure in these areas from Hurricanes Maria and Irma in 2017. We do not compare 2017 data to 2016 data because this may be misleading about any gains in deployment that could have occurred in the U.S. Territories since 2016. The

December 31, 2017 data suggest that approximately 77.7% of the population in the U.S. Territories have multiple provider options for 10 Mbps/1 Mbps, 58.3% have multiple provider options for 25 Mbps/3 Mbps and approximately 2.4% have multiple provider options for 50 Mbps/5 Mbps.

Fig. D-5

**Population (Millions) by Provider Options for Fixed Terrestrial Services in the U.S. Territories
(As of December 31, 2017)**

Providers	10 Mbps/ 1 Mbps		25 Mbps/ 3 Mbps		50 Mbps/ 5 Mbps		100 Mbps/ 10 Mbps		250 Mbps/ 25 Mbps	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
All Areas										
Zero	0.273	7.4%	0.524	14.1%	1.451	39.1%	3.525	94.9%	3.525	94.9%
One	0.555	14.9%	1.026	27.6%	2.173	58.5%	0.188	5.1%	0.189	5.1%
Two	0.874	23.5%	1.501	40.4%	0.087	2.3%	0.003	0.1%	0.002	0.0%
More Than Two	2.014	54.2%	0.664	17.9%	0.005	0.1%	0.000	0.0%	0.000	0.0%

188. Figures D-6 to D-10 present a demographic analysis of the average percentage of the population with coverage from provider services and speed tiers by population density quartile, median household income quartile and household count quartile. 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. In general, the census block groups in rural areas will have the 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.⁵⁹⁸

⁵⁹⁸ 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 is available.

Fig. D-6

Average Percentage of Population With Multiple Provider Options for 10 Mbps/1 Mbps by Census Block Group Demographic Variable (As of December 31, 2017)

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	10.1%	30.8%	35.1%	24.0%
Second Quartile	1.0%	14.3%	42.5%	42.3%
Third Quartile	0.5%	10.1%	40.1%	49.3%
Fourth Quartile (Highest Pop. Density)	0.5%	8.1%	37.6%	53.7%
Median Household Income				
First Quartile (Lowest Median Household Income)	3.9%	22.4%	38.3%	35.5%
Second Quartile	4.2%	18.4%	39.3%	38.1%
Third Quartile	2.8%	14.1%	39.9%	43.2%
Fourth Quartile (Highest Median Household Income)	1.0%	7.7%	38.4%	53.0%
Number of Households				
First Quartile (Lowest Household Count)	3.9%	18.9%	37.7%	39.5%
Second Quartile	3.2%	16.3%	37.6%	42.9%
Third Quartile	2.9%	15.4%	38.9%	42.8%
Fourth Quartile (Highest Household Count)	2.1%	12.6%	41.1%	44.1%

Fig. D-7

Average Percentage of Population with Multiple Provider Options for 25 Mbps/3 Mbps by Census Block Group Demographic Variable (As of December 31, 2017)

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	23.0%	39.7%	28.1%	9.1%
Second Quartile	2.2%	27.9%	45.6%	24.3%
Third Quartile	0.9%	20.5%	46.7%	31.9%
Fourth Quartile (Highest Pop. Density)	0.8%	14.7%	42.6%	42.0%
Median Household Income				
First Quartile (Lowest Median Household Income)	8.1%	34.6%	37.4%	19.9%
Second Quartile	9.5%	29.2%	39.8%	21.4%
Third Quartile	6.8%	24.0%	42.4%	26.9%
Fourth Quartile (Highest Median Household Income)	2.1%	14.2%	44.4%	39.3%

	Zero	One	Two	More Than Two
Number of Households				
First Quartile (Lowest Household Count)	8.4%	29.7%	36.9%	25.0%
Second Quartile	7.4%	26.6%	39.1%	26.9%
Third Quartile	6.7%	25.0%	41.9%	26.4%
Fourth Quartile (Highest Household Count)	4.4%	21.4%	45.2%	29.0%

Fig. D-8

Average Percentage of Population with Multiple Provider Options for 50 Mbps/5 Mbps by Census Block Group Demographic Variable (As of December 31, 2017)

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	28.9%	41.4%	24.3%	5.4%
Second Quartile	3.2%	33.5%	45.6%	17.6%
Third Quartile	1.3%	25.1%	50.3%	23.3%
Fourth Quartile (Highest Pop. Density)	0.9%	17.0%	46.8%	35.3%
Median Household Income				
First Quartile (Lowest Median Household Income)	9.8%	38.8%	37.5%	13.9%
Second Quartile	12.0%	32.6%	39.9%	15.5%
Third Quartile	9.2%	27.5%	43.2%	20.2%
Fourth Quartile (Highest Median Household Income)	3.0%	17.5%	47.4%	32.0%
Number of Households				
First Quartile (Lowest Household Count)	10.4%	32.8%	37.5%	19.3%
Second Quartile	9.5%	30.1%	39.9%	20.6%
Third Quartile	8.6%	28.7%	42.7%	20.0%
Fourth Quartile (Highest Household Count)	5.9%	25.5%	47.0%	21.7%

Fig. D-9

**Average Percentage of Population with Multiple Provider Options for 100 Mbps/10 Mbps by
Census Block Group Demographic Variable (As of December 31, 2017)**

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	36.4%	40.9%	18.8%	4.0%
Second Quartile	6.4%	41.5%	37.6%	14.5%
Third Quartile	2.5%	35.3%	42.8%	19.3%
Fourth Quartile (Highest Pop. Density)	1.4%	25.0%	41.1%	32.5%
Median Household Income				
First Quartile (Lowest Median Household Income)	13.9%	43.9%	30.6%	11.5%
Second Quartile	16.1%	38.2%	33.0%	12.7%
Third Quartile	12.2%	34.4%	36.2%	17.2%
Fourth Quartile (Highest Median Household Income)	4.2%	25.8%	41.2%	28.7%
Number of Households				
First Quartile (Lowest Household Count)	13.5%	38.1%	31.3%	17.0%
Second Quartile	12.8%	35.9%	33.4%	17.9%
Third Quartile	11.8%	35.2%	35.8%	17.2%
Fourth Quartile (Highest Household Count)	8.6%	33.6%	39.7%	18.1%

Fig. D-10

**Average Percentage of Population with Multiple Provider Options for 250 Mbps/25 Mbps by
Census Block Group Demographic Variable (As of December 31, 2017)**

	Zero	One	Two	More Than Two
Population Density				
First Quartile (Lowest Pop. Density)	61.3%	30.0%	7.5%	1.2%
Second Quartile	37.2%	40.4%	16.2%	6.2%
Third Quartile	29.3%	44.1%	17.7%	8.9%
Fourth Quartile (Highest Pop. Density)	22.4%	36.4%	18.7%	22.6%
Median Household Income				
First Quartile (Lowest Median Household Income)	45.1%	37.7%	11.3%	5.8%
Second Quartile	44.1%	37.4%	12.5%	6.0%
Third Quartile	37.3%	38.4%	15.4%	8.9%
Fourth Quartile (Highest Median Household Income)	23.5%	37.5%	21.0%	18.0%

	Zero	One	Two	More Than Two
Number of Households				
First Quartile (Lowest Household Count)	39.1%	36.6%	13.9%	10.4%
Second Quartile	37.9%	36.9%	14.6%	10.6%
Third Quartile	37.4%	38.1%	15.1%	9.4%
Fourth Quartile (Highest Household Count)	35.8%	39.2%	16.5%	8.5%

189. Figures D-11 through D-15 present a visual analysis of population that have at least two options for fixed terrestrial providers across the different speed tiers. This analysis focuses on the estimated average percentage of the population with two or more provider options and examines this percentage simultaneously by population density and income quantiles. For this analysis, census block group data are grouped into 400 density/income quantiles based upon population per square mile and median household income. Each column in a figure represents one of these combinations. For each quantile, the height of the grid represents the population-weighted average ratio of the population with at least two provider options to the population across the census block groups in the decile.⁵⁹⁹

190. Each figure has three axes (x, y, and z). The x axis shows population density, ranging from the lowest population density to the highest population density, and the y axis shows the median household income ranging from lowest income to highest income. The vertical axis (z) shows the average percentage of the population with at least two provider options, ranging from 0% to 100%. These percentages are grouped into five color coded categories (0% to less than 20%, 20% to less than 40%, 40% to less than 60%, 60% to less than 80%, and 80% to 100%). By presenting the data in this manner, the relationship of both population density and household income on the incidence of multiple provider options can be visualized simultaneously. For example, in Figure D-11, the uppermost right corner shows that the census blocks with the highest population density (the x axis) and the highest median household income (the y axis) have at least two providers close to 100% of the time (the z axis). In general, the figures demonstrate that both variables appear to influence the incidence of multiple provider options.

⁵⁹⁹ We exclude from this analysis any census block group with a zero population.

Fig. D-11
Percentage of Population with at least Two Providers of 10 Mbps/1 Mbps by Income and Population Density as of December 31, 2017

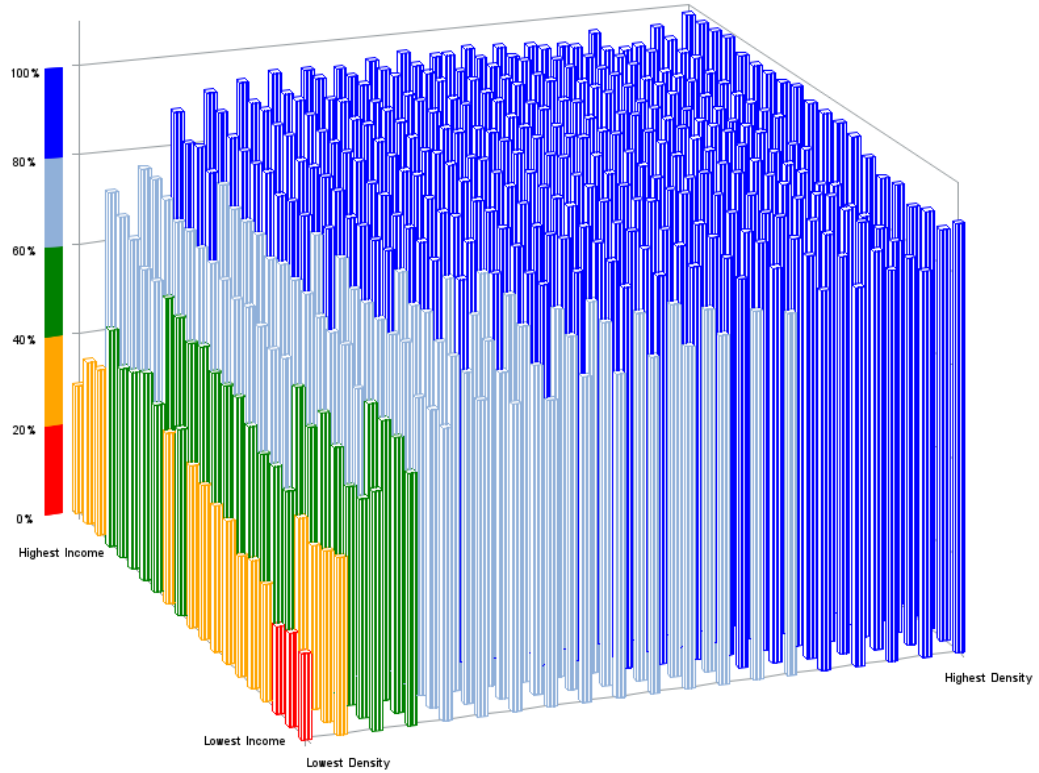


Fig. D-12
Percentage of Population with at least Two Providers of 25 Mbps/3 Mbps by Income and Population Density as of December 31, 2017

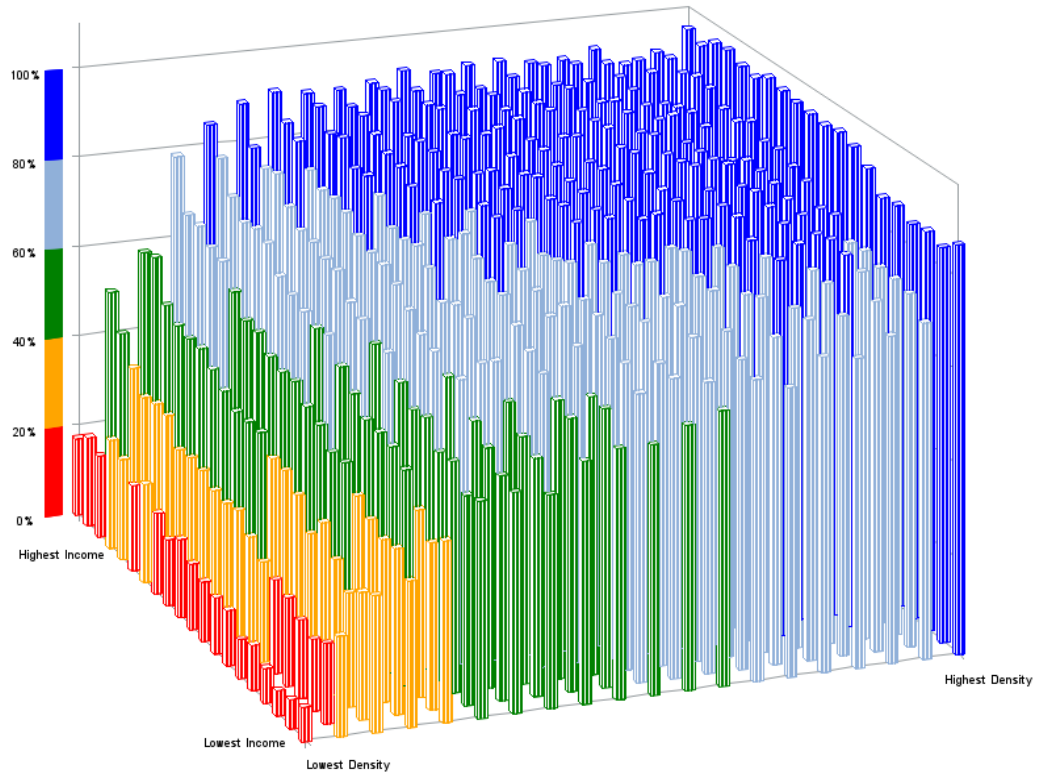


Fig. D.13
Percentage of Population with at least Two Providers of 50 Mbps/5 Mbps by Income and Population Density as of December 31, 2017

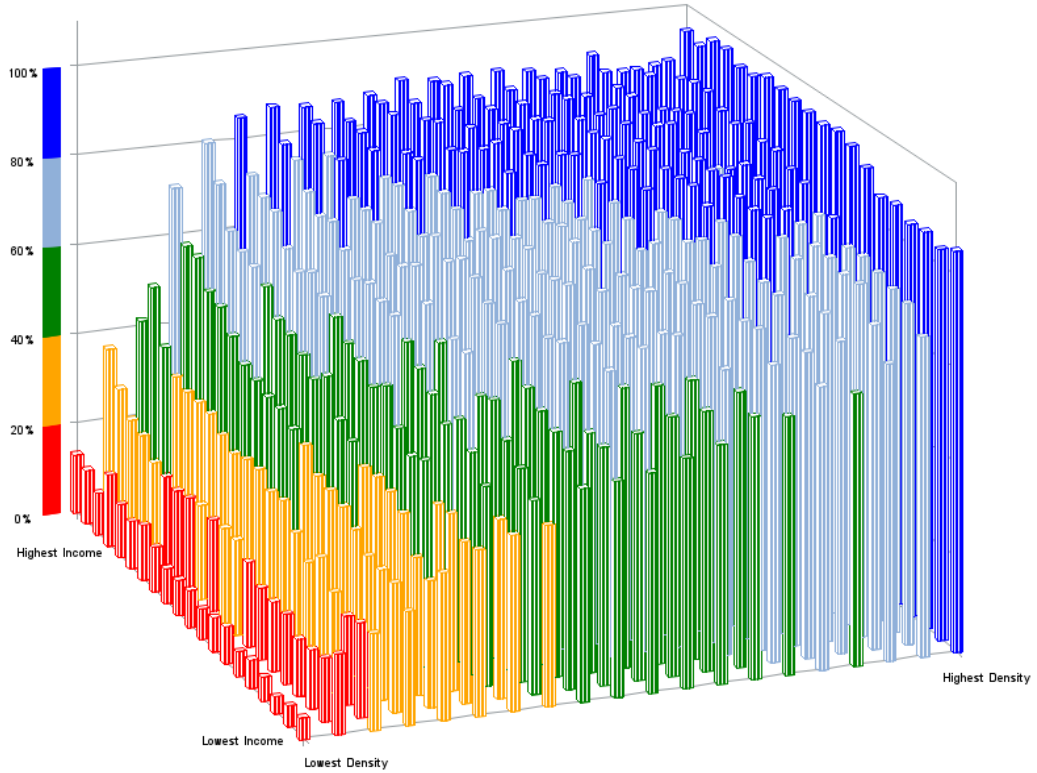


Fig. D.14
Percentage of Population with at least Two Providers of 100 Mbps/10 Mbps by Income and Population Density as of December 31, 2017

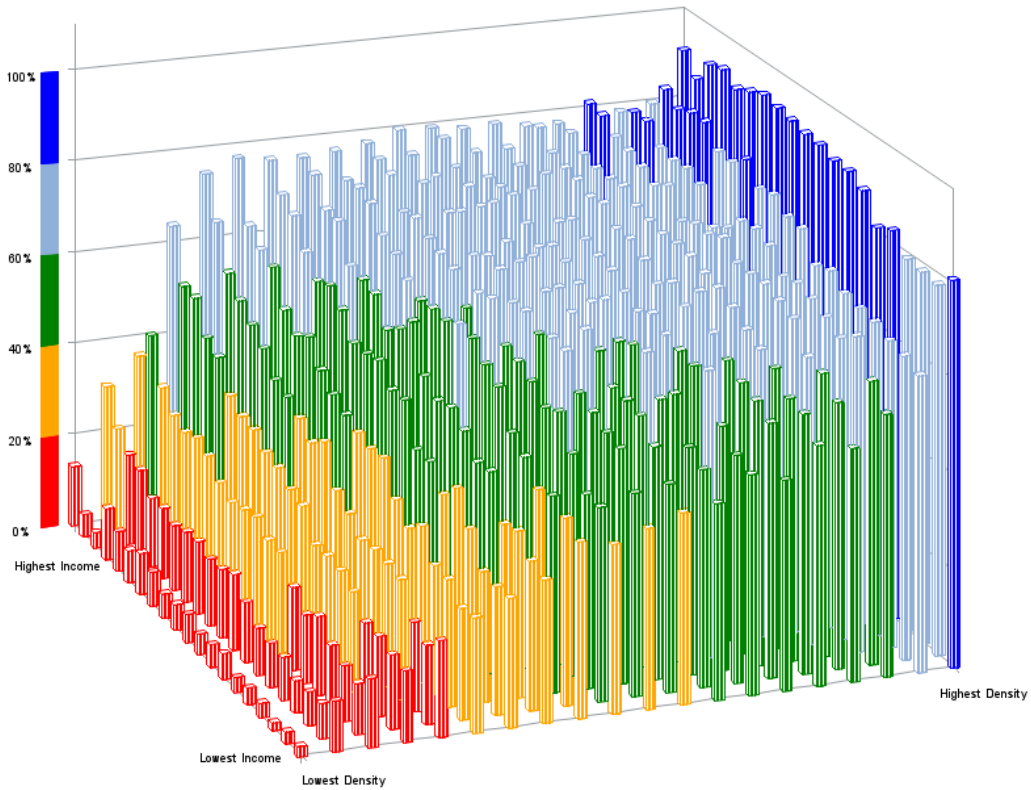
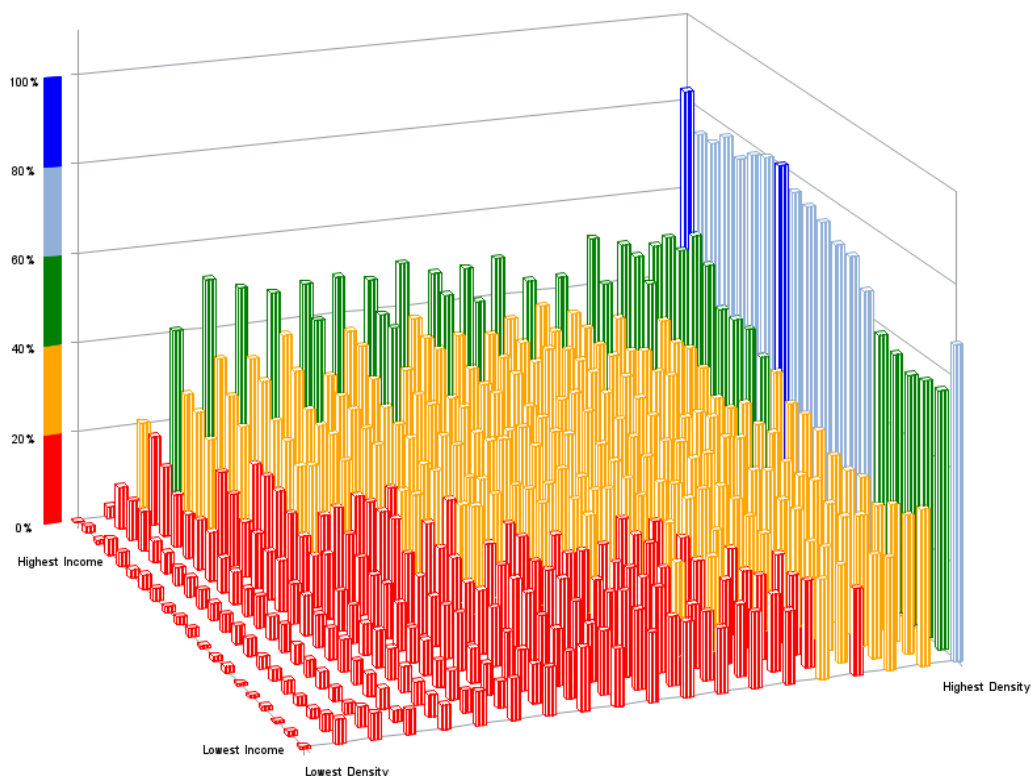


Fig. D-15
 Percentage of Population with at least Two Providers of 250 Mbps/25 Mbps by Income and Population Density as of December 31, 2017



3. Regulatory and Market Barriers

191. We also assess barriers to competitive entry. Identifying regulations that act as roadblocks to Internet service providers' investment in their networks and infrastructure, as well as market entry barriers for emerging and small Internet service providers, are key to assessing the current state of broadband competition.⁶⁰⁰ While commenters highlight in the record some of the recent Commission efforts to eliminate regulatory barriers to network investment and deployment,⁶⁰¹ they also point to numerous other existing barriers that constrain the development of a robust broadband marketplace. These barriers include geography, existing Commission regulations—many of which are currently under review—local and state regulations, and a lack of access to spectrum resources.

192. The record indicates that a major barrier to additional competition throughout the United States is the high costs and low population densities common in rural parts of the country.⁶⁰² USTelecom comments that “[t]he economics of providing broadband at affordable and nationally comparable rates in many rural areas is difficult and in some cases prohibitive for wired providers who must deploy facilities all the way to end user locations.”⁶⁰³ The American Cable Association (ACA) identifies the costs

⁶⁰⁰ See 47 U.S.C. § 257(a). See also 47 U.S.C. § 163(c) (stating that in the course of conducting a review of the state of competition and regulatory barriers in the communications marketplace, “the Commission shall consider market barriers for entrepreneurs and other small businesses . . . in accordance with . . . [47 U.S.C. § 257(b)].”).

⁶⁰¹ See NCTA Fixed Competition Comments at 11-12; ACA Fixed Competition Comments at 8-9; ADTRAN Fixed Competition Comments at 9.

⁶⁰² See USTelecom Fixed Competition Comments at Exh. B at 7 (Patrick Brogan, VP of Industry Analysis, U.S. Broadband Availability Year-End 2016, 7 (February 22, 2018)). Indeed, the deployment data illustrated above in figures 1 through 4 support these assertions.

⁶⁰³ USTelecom Fixed Competition Comments at Exh. B at 7 (Patrick Brogan, VP of Industry Analysis, U.S.

(continued....)

associated with service upgrades in less competitive rural markets as a deterrent for small cable operators with modest profit margins and limited access to capital.⁶⁰⁴ An additional barrier to fixed broadband competition in rural communities is the dearth of wholesale fiber providers with access to longer term financing that could facilitate providing fiber networks in these communities.⁶⁰⁵

193. While numerous commenters commend the Commission for its efforts to remove regulatory barriers to broadband deployment,⁶⁰⁶ some also allege that regulatory barriers remain.⁶⁰⁷ Among the barriers cited are the subsidization of LECs,⁶⁰⁸ conflicting Connect America Fund (CAF) subsidy requirements,⁶⁰⁹ duplicative franchise fees imposed on broadband and other new services over the

(Continued from previous page)

Broadband Availability Year-End 2016, 7 (February 22, 2018)). As a potential solution, USTelecom advocates for “the Commission to fully fund programs such as CAF and find other means to assist providers in closing the digital divide.” USTelecom Fixed Competition Comments at 6.

⁶⁰⁴ ACA Fixed Competition Comments at 7.

⁶⁰⁵ EFF Fixed Competition Comments at 5.

⁶⁰⁶ Some commenters claim that recent Commission actions, such as the 2017 decisions to return to a light-touch regulatory regime under Title I and to deregulate the rates for business data services, where competition exists or is likely to exist and reject regulation of packet-based services offered by competitive providers, precipitated increased network investment and increased marketplace competition. *See* NCTA Fixed Competition Comments at 11; *see also* ACA Fixed Competition Comments at 8 (“By restoring the classification of broadband Internet access service as an information service, the Commission has freed ACA members from the heavy costs of regulatory compliance and uncertainty under a Title II regime. . . . ACA members can now invest their limited resources in improving and expanding their broadband networks with renewed confidence.”). *But see* Common Cause et al. Fixed Competition Comments at 11 (“Deregulating the BDS market has detrimental impact on more than just businesses which rely on it. . . . The Commission’s move to deregulate and exacerbate this already lucrative profit margin for incumbents was and is bad for consumers.”); ADTRAN Fixed Competition Comments at 9. Similarly, the record commends Commission efforts to streamline pole attachment and discontinuance procedures for facilitating easier, faster, and less expensive deployment. *See* NCTA Fixed Competition Comments at 12; ACA Fixed Competition Comments at 9 (“The Commission’s recent pole attachment reforms should make the process faster, less expensive, and more transparent, paving the way for more fixed broadband upgrades and new deployments, and with them increased competition.”); ADTRAN Fixed Competition Comments at 9. *But see* Common Cause et al. Fixed Competition Comments at 9-10 (“[T]he Commission’s gutting of Section 214 Discontinuance rules will result in a downgrade for American consumers who still rely on the copper network (particularly rural Americans).”).

⁶⁰⁷ Numerous commenters also address the Commission’s Form 477 data collection policy, either expressing frustration over current collection practices, suggesting preservation of current requirements, or advocating that any changes made to the FCC Form 477 data collection not impose greater burdens on smaller providers that are necessary to achieve the goals of collection. *See* new America Fixed Competition Comments at 2; WISPA Fixed Competition Comments at 18; ACA Fixed Competition Comments at 12; Verizon Fixed Competition Comments at 12; INCOMPAS Fixed Competition Comments at 6, 12-13. The Commission is currently considering a proceeding to review the Form 477 filing requirements. *See Form 477 Modernization FNPRM*, 32 FCC Rcd at 6329-30, para. 1.

⁶⁰⁸ NCTA Fixed Competition Comments at 14 (citing the subsidization of LECs “at the expense of all other providers” as a policy that impedes closing the digital divide and growing broadband competition).

⁶⁰⁹ ACA Fixed Competition Comments at 4 (contending that providers must maintain “prices in subsidized areas below defined benchmarks and provide service that meets minimum speeds” in order to receive CAF subsidies, but the Commission uses these same benchmarks to identify an area as ineligible for CAF subsidies, which “constrain[s] prices and ensure[s] a baseline level of service” because “unsubsidized rural providers must ensure their own prices and minimum service tier meets these benchmarks to protect themselves from the threat of a subsidized overbuild”); 15 (arguing that the Commission should allow “CAF funds to subsidize overbuilds of privately funded networks in the territories served by price-cap carriers”). New America contends that Internet service providers tend to invest the minimum required to obtain a CAF subsidy in areas where there is no competition and focus greater investment in competitive areas. New America Fixed Competition Comments at 16. EchoStar and Hughes express frustration

(continued....)

same network,⁶¹⁰ rates that exceed a locality's costs for access to public rights-of-way and poles,⁶¹¹ and excessive pole attachment fees charged by electric cooperatives.⁶¹² The record also reflects some commenters' views that exclusive agreements and revenue sharing agreements between landlords of multiple tenant environments (MTEs) and fixed broadband providers that prevent other Internet service providers from offering service to tenants pose a barrier to a competitive fixed marketplace, even in areas where there are multiple providers.⁶¹³

194. Some commenters identify technology-specific barriers. According to WISPA, an existing barrier to the ability of fixed wireless broadband to compete with incumbent fixed services is the lack of availability of government subsidies to aid deployment.⁶¹⁴ WISPA contends that another barrier for fixed wireless broadband is the "absence of comprehensive and consistent spectrum infrastructure policy" as many fixed wireless providers who rely on spectrum currently have limited access to dedicated spectrum resources.⁶¹⁵

195. Regarding satellite broadband, SIA contends that to enable further competition, the Commission should "ensure that its regulations are technology neutral, including for the allocation of

(Continued from previous page) _____

over the CAF Phase II bidding process and what they call its "penalty on latency"— "the one service characteristic that satellite providers uniquely cannot control." EchoStar and Hughes Aug. 17, 2018 Comments at 5.

⁶¹⁰ NCTA Fixed Competition Comments at 15 (contending that "prohibiting local governments from imposing duplicative franchise requirements on broadband and other new services provided over the same network," would encourage greater deployment.).

⁶¹¹ Verizon Fixed Competition Comments at 10-11 (arguing that "constru[ing] Section 253(a) to preclude rates that exceed a locality's costs for access to public rights-of-way and poles" will remove roadblocks to the installation of equipment and facilities required for small cell and fiber deployment); *see also* INCOMPAS Fixed Competition Comments at 7. INCOMPAS supports (1) strengthening shot clocks applicable to wireless siting applications, and (2) limiting rights-of-way use charges and siting application fees, consistent with Sections 253 and 332. *Id.*

⁶¹² ACA Fixed Competition Comments at 10 ("[U]rg[ing] the Commission to recommend to Congress that it enact legislation to bring electric cooperatives under Commission authority, placing them on the same playing field as the investor-owned utilities the Commission regulates today."). Some commenters express frustration over state-imposed barriers to broadband deployment, such as laws that restrict or prohibit municipal broadband. New America Fixed Competition Comments at 8-14; ACA Fixed Competition Comments at 10; Common Cause et al. Fixed Competition Comments at 13 ("Municipal broadband, or broadband provided by citizens as a utility, is an innovative practice that spurs competition while narrowing the digital divide."). In 2016, the Sixth Circuit concluded that the FCC could not preempt state statutory provisions that limited a municipality from expanding the service area of its own municipal-owned network. *See Tennessee v. FCC*, 832 F.3d 597, 597 (6th Cir. 2016).

⁶¹³ *See* New America Fixed Competition Comments at 18; Common Cause et al. Fixed Competition Comments at 15-17; INCOMPAS Fixed Competition Comments at 5, 10-11. The Commission has sought comment on the effect of state and local regulatory barriers, exclusive marketing and bulk billing agreements, revenue sharing agreements, and exclusive wiring agreements on the current state of broadband competition in MTEs. *See Improving Competitive Broadband Access to Multiple Tenant Environments*, Notice of Inquiry, GN Docket No. 17-142, 5387-5389, paras. 11-15 (2017).

⁶¹⁴ WISPA Fixed Competition Comments at 16 (expressing frustration that larger incumbents are awarded government subsidies to deploy broadband in the same geographic area where the small wireless Internet service provider has already used its own capital to invest in equipment and infrastructure).

⁶¹⁵ WISPA Fixed Competition Comments at 16; GeoLinks Comments, GN Docket No. 18-231, at 1-3 (Aug. 17, 2018) (arguing that the opportunity to obtain additional access to additional spectrum resources, would allow fixed wireless providers to better compete with traditional fixed broadband providers by enabling them to "deliver enterprise-grade connections that rival those of traditional, wired broadband providers"); Common Cause et al. Fixed Competition Comments at 15 ("[T]he Commission should consider spectrum reforms that enhance the deployment of fixed wireless to rural America.").

scarce resources, such as spectrum and funding.”⁶¹⁶ EchoStar and Hughes assert that another barrier for satellite broadband is failure to harmonize spectrum regionally and internationally, which, among other things, “creates a significant technical barrier, and competitive hurdle for satellite providers, endangering [] the emergence of existing and planned next generation satellite networks.”⁶¹⁷

196. The Commission remains committed to addressing where possible regulatory and market barriers to broadband deployment to help ensure that as many Americans as possible receive the benefits of broadband competition. The Commission’s past and future efforts towards this end are discussed later in this Report.⁶¹⁸

197. *ISP Transparency and Identifying and Eliminating Market Barriers for Entrepreneurs and Small Businesses Accessing and Provisioning Broadband Internet Access Service.* The Restoring Internet Freedom Order,⁶¹⁹ which modified the transparency requirements that apply to Internet service providers, took effect on June 11, 2018.⁶²⁰ As the Commission explained in that order, information about how Internet service providers manage their networks assists entrepreneurs and other small businesses, including edge providers, as they “judge which broadband Internet access service offerings will best meet their needs given the applications and service they wish to use.”⁶²¹ The transparency requirements also reduce barriers for entrepreneurs and small businesses who wish to enter the market for the provision of broadband Internet access services.⁶²²

198. In keeping with our ongoing obligation to “identify[] and eliminat[e] . . . market entry barriers for entrepreneurs and other small businesses,”⁶²³ Commission staff conducted a review of Internet service provider compliance with the revised disclosure requirements.⁶²⁴ The Commission staff review

⁶¹⁶ SIA Fixed Competition Comments at 3; *see also* EchoStar and Hughes Fixed Competition Comments at 4-9.

⁶¹⁷ EchoStar and Hughes Fixed Competition Comments at 9.

⁶¹⁸ *See infra*. Section III.B., IV.B.

⁶¹⁹ *Restoring Internet Freedom Order*, 33 FCC Rcd 311.

⁶²⁰ *Wireline Competition Bureau Announces Effective Date of Restoring Internet Freedom Order*, WC Docket No. 17-108, Public Notice, DA 18-485 (WCB May 11, 2018), <https://www.fcc.gov/document/wcb-announces-effective-date-restoring-internet-freedom-order>. While Congress repealed the triennial reporting requirement of section 257(c) earlier this year, it replaced that provision with a biennial reporting requirement codified at 47 U.S.C. § 163. *See* RAY BAUM’S Act of 2018, Pub. L. No. 115-141, Div. P, §§ 401, 402(f), 132 Stat. at 1087-89. Like the now-repealed section 257(c), section 163 continues to require the Commission to report to Congress periodically on “market entry barriers for entrepreneurs and small businesses in the communications marketplace.” 47 U.S.C. § 163(d)(3). Congress thus recodified the reporting requirement of section 257(c) under another provision of the Communications Act. And a savings clause in the legislation confirmed that “[n]othing in this title or the amendments made by this title shall be construed to expand or contract the authority of the Commission.” Pub. L. No. 115-141, Div. P, § 403, 132 Stat. at 1090. As a result, nothing in the new legislation altered the FCC’s authority to adopt a transparency rule so that the agency can collect the information it needs to perform its statutory duty to report to Congress on market entry barriers.

⁶²¹ *Restoring Internet Freedom Order*, 33 FCC Rcd at 447, para. 233; *see id.* at 446 n.850 (describing examples of applications which may require quality-of-service guarantees from Internet service providers).

⁶²² 47 U.S.C. § 257(a); *see Restoring Internet Freedom Order*, 33 FCC Rcd at 446, para. 233.

⁶²³ *See* 47 U.S.C. § 257(a). *See also* 47 U.S.C. § 163(c) (stating that in the course of conducting a review of the state of competition and regulatory barriers in the communications marketplace, “the Commission shall consider market barriers for entrepreneurs and other small businesses . . . in accordance with . . . [47 U.S.C. § 257(b)].”).

⁶²⁴ Internet service providers can either post their transparency disclosures on a “publicly available, easily accessible website” or transmit them to the Commission, which posts them at CG Docket No. 18-142. *Restoring Internet Freedom Order*, 33 FCC Rcd at 444, para. 229; FCC, ISP Transparency Disclosures Portal, <https://www.fcc.gov/isp-disclosures>.

found that all Internet service providers with more than 100,000 subscribers, based on FCC Form 477 data, were in compliance with the transparency requirements at the time of the review.⁶²⁵ These Internet service providers collectively serve over 99% of mobile Internet service provider subscribers and over 94% of fixed Internet service provider subscribers. The overwhelming majority of entrepreneurs and small businesses are therefore able to “make the most educated choice among Internet service providers and particular broadband Internet access service offerings.”⁶²⁶ Commission staff also reviewed the disclosures of each of the remaining Internet service providers in the United States based on FCC Form 477 data, finding that the vast majority of smaller Internet service providers at the time of the review were complying with the transparency requirements. Commission staff are currently taking steps to help ensure that all smaller Internet service providers come into compliance with the transparency requirements.⁶²⁷

4. Investment Trends

199. Recent marketplace developments suggest that increased investments by Internet service providers should, over time, increase broadband competition. For instance, according to USTelecom, in 2017 broadband providers invested approximately \$76.3 billion dollars in network infrastructure, an increase of \$1.5 billion over 2016 levels.⁶²⁸ Such an increase marked a reversal from the declines in investment observed in 2015 and 2016 when the Commission regulated broadband providers under Title II of the Communications Act.⁶²⁹ Multiple commenters cite the substantial investment in higher speed services by Internet service providers as evidence of a competitive marketplace.⁶³⁰ According to these commenters, this investment by Internet service providers has resulted in aggressive and ongoing efforts by competing Internet service providers to upgrade their networks, facilities, and services, which will likely continue into the future especially with the anticipated deployment of 5G networks.⁶³¹ For instance, NCTA claims that cable operators have spent over \$50 billion upgrading their networks over the last three years in direct response to aggressive competition in the broadband marketplace.⁶³² ACA also

⁶²⁵ The subscriber count is based on FCC Form 477 data.

⁶²⁶ *Restoring Internet Freedom Order*, 33 FCC Rcd at 447, para. 233.

⁶²⁷ Internet service providers with fewer than 100,000 subscribers (later increased to Internet service providers with fewer than 250,000 subscribers) were exempt from the enhanced transparency requirements adopted in the *Title II Order*. See *Protecting and Promoting the Open Internet*, Report and Order on Remand, Declaratory Ruling, and Order, 30 FCC Rcd 5677-79, paras. 172-75 (2015) (*Title II Order*); *Small Business Exemption From Open Internet Enhanced Transparency Requirements*, GN Docket No. 14-28, Order, 32 FCC Rcd 1772 (2017). The enhanced transparency requirements were eliminated by the *Restoring Internet Freedom Order*. 33 FCC Rcd at 442-43, paras. 225-226. However, the transparency requirements adopted in the *Open Internet Order* in 2010, affirmed by the D.C. Circuit in *Verizon v. FCC*, 740 F.3d 623, 659 (D.C. Cir. 2014), and reaffirmed and refined in the *Restoring Internet Freedom Order* continue apply to all Internet service providers, regardless of size. *Preserving the Open Internet, Broadband Industry Practices*, Report and Order, 25 FCC Rcd 17936-40, paras. 53-58 (2010) (*Open Internet Order*); *Restoring Internet Freedom Order*, 33 FCC Rcd at 444, para. 227.

⁶²⁸ See Patrick Brogan, VP, Industry Analysis, USTelecom, U.S. Broadband Investment Rebounded in 2017, 1 (Oct. 18, 2018).

⁶²⁹ *Id.* at 1-2.

⁶³⁰ See, e.g., USTelecom Fixed Competition Comments at 3-4, Exh. A at 18 (Patrick Brogan, VP Industry Analysis, USTelecom Industry Metrics and Trends 2018, 18 (March 1, 2018)); NCTA Fixed Competition Comments at 8; ACA Fixed Competition Comments at 15.

⁶³¹ See, e.g., NCTA Fixed Competition Comments at 8; ACA Fixed Competition Comments at 15; Verizon Fixed Competition Comments at 7.

⁶³² NCTA Fixed Competition Comments at 8 (“Cable operators have been consistently upgrading their networks for years, investing over \$50 billion in the last three years alone, and by the end of 2018 they are expected to offer gigabit services reaching 70 to 75% of American households. There would be no reason for cable operators to invest in these upgrades if they were not competing aggressively in the broadband marketplace.”).

reports that in order to keep pace with competitors, its members “invested more than \$10 billion to expand and upgrade their broadband networks” between 2013 and 2017 and “continue to invest more than \$1 billion annually.”⁶³³ Similarly, Verizon claims that it faces “nearly ubiquitous competition from cable providers” and that the “advanced services that Verizon brings prompts those competitors to upgrade their own facilities and services.”⁶³⁴

200. In his analysis of FCC Form 477 data, Dr. George S. Ford supports these claims of competition among fixed Internet service providers, finding that Comcast “faces competition from one of the six largest broadband providers at the 25/3 level in 74% of its territory where another provider offers service” and at the 10/1 Mbps level from “another large provider of broadband across 81% of its footprint.”⁶³⁵ He also found that “AT&T faces competition from another of the large providers of broadband across 81% of its broadband footprint at the 25/3 level, and 88% at the 10/1 Mbps level.”⁶³⁶

201. At the same time, despite these encouraging levels of Internet service provider network investments, some commenters suggest that fixed broadband competition could improve,⁶³⁷ and we agree that we must continue efforts to promote broadband deployment and competition. For instance, several commenters assert that even when multiple fixed broadband providers are available in a market, one single incumbent provider tends to dominate the market share.⁶³⁸ FCC Form 477 subscription data indicates that this is the case in some, but certainly not all instances. These commenters also discuss the limited broadband options in rural America,⁶³⁹ and the FCC Form 477 data show that competitive options for broadband are more limited in rural areas.⁶⁴⁰ We agree that the business case to serve rural areas is often more difficult, which is why the Commission has consistently worked to provide universal service funding to rural areas and decrease the costs of the broadband investment,⁶⁴¹ an effort we are committed to continuing.⁶⁴²

E. Voice Telephone Services

202. Although the public switched telephone network used to be the only means to connect, there now exists a multitude of other voice service options for consumers. We focus on interconnected voice in our reporting, but acknowledge there are many other types of telecommunications offerings, including apps running solely on data networks that are nearly indistinguishable to the consumer from the core communications functionality of the public switched telephone network, and nearly indistinguishable to providers and the Commission from other network data traffic. Many of these apps combine the benefits of voice, video, and text communication into one data-based service.

203. Modern interconnected voice services are divided between fixed and mobile voice. Fixed is further divided into traditional switched access connections and interconnected VoIP. VoIP is voice

⁶³³ ACA Fixed Competition Comments at 15.

⁶³⁴ Verizon Fixed Competition Comments at 7.

⁶³⁵ Dr. George S. Ford, *Rhetoric Aside: What the Data Actually Say About Broadband Deployment*, Perspectives: Phoenix Center for Advanced Legal & Economic Public Policy Studies, 6 (Sept. 4, 2018).

⁶³⁶ *Id.*

⁶³⁷ See Common Cause et al. Fixed Competition Comments at 15; New America Fixed Competition Comments at 2.

⁶³⁸ Common Cause et al. Fixed Competition Comments at 15.

⁶³⁹ See Common Cause et al. Fixed Competition Comments at 13 (“[O]ver 31% of Americans with a rural zip code lack access to high speed internet at home. . . . [and] often only have one choice in service providers.”); WISPA Fixed Competition Comments at 2-3; ADTRAN Fixed Competition Comments.

⁶⁴⁰ See *infra* Table 1.

⁶⁴¹ See *infra* Section III.B.

⁶⁴² See *infra* Section IV.B.

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”).

204. *Fixed Voice.* There are two fixed technologies through which retail voice subscriptions are provided: traditional switched access and interconnected VoIP subscriptions. Our most recent data from the June 2017 Form 477 show there are 55 million end-user switched access lines, including 22.5 million residential lines, and 64 million interconnected VoIP subscriptions, including 40 million residential subscriptions.⁶⁴³ Of these combined 119 million fixed retail voice telephone service subscriptions, 53% were residential connections, and 47% were business connections.⁶⁴⁴ 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 growth rate of 11%, while interconnected VoIP subscriptions increased a compound annual growth rate of 8%.⁶⁴⁵ Unsurprisingly, the number of fixed switched access providers also decreased, with 1,014 providers reporting fixed end-user switched access lines in June 2017, down from 1,029 in June 2016.⁶⁴⁶ There were also 1,078 providers of interconnected VoIP subscriptions in June 2017, up from 1,004 a year earlier.⁶⁴⁷ As of June 2017, residential fixed voice connections were about 36% switched access and 64% interconnected VoIP, with residential switched access connections comprising only 18.8% of all fixed retail voice connections.⁶⁴⁸

205. *Mobile Voice.* In June 2017, our Form 477 data indicate there were 336 million mobile 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.⁶⁴⁹ The number of households that eschew fixed subscriptions altogether in favor of relying solely on mobile services has been increasing. Approximately 54% of all households were mobile-only in late 2017, with the percentage of adults living in mobile-only households decreasing as age increased.⁶⁵⁰ In the age group 25-29, over 75% of adults lived in mobile-only households; 73.3% of those aged 30-34 lived in mobile-only households; 64.5% of those aged 35-44 lived in mobile-only households; 48.1% of those aged 45-64 lived in mobile-only households; and 26.4% of those 65 and older lived in mobile-only households.⁶⁵¹ Yet even in these older groups, the proportion of adults living in mobile only households has increased in recent years; among those aged 45 and older, the percentage has increased from 36.2% in 2014 to 40.4% in late 2017.⁶⁵² About 3.2% of households had neither mobile nor fixed voice subscriptions, as of late 2017.⁶⁵³

⁶⁴³ FCC, Voice Telephone Services: Status as of June 30, 2017 at 2, (2018).

⁶⁴⁴ FCC, Voice Telephone Services: Status as of June 30, 2017 at 2, (2018).

⁶⁴⁵ FCC, Voice Telephone Services: Status as of June 30, 2017 at 2, (2018).

⁶⁴⁶ FCC, Voice Telephone Services: Status as of June 30, 2017, Table 2, (2018).

⁶⁴⁷ FCC, Voice Telephone Services: Status as of June 30, 2017, Table 2, (2018).

⁶⁴⁸ FCC, Voice Telephone Services: Status as of June 30, 2017, Figure 2, (2018).

⁶⁴⁹ FCC, Voice Telephone Services: Status as of June 30, 2017 at 2, (2018).

⁶⁵⁰ 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 1-2 (2018).

⁶⁵¹ 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).

⁶⁵² 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).

⁶⁵³ 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).

206. *Over the Top*. Fixed VoIP carriers distinguish over the top (“OTT”) VoIP where the consumer uses an independent data service over a broadband connection, from all other types of interconnected VoIP.⁶⁵⁴ The June 2017 Form 477 data show 7.8 million OTT VoIP subscriptions, with far more non-OTT VoIP, numbering 56.7 million subscriptions.⁶⁵⁵ Mobile VoIP presents a more complicated picture, given the plethora of communications apps in smartphone app ecosystems. Figures on how customers use these apps for voice communication are not reported on Form 477, as many of them do not permit users to receive calls that originate on the public switched telephone network or terminate calls on the public switched telephone network, and therefore not classified as interconnected VoIP.⁶⁵⁶ The dynamic nature of this subsector makes it difficult to quantify the number of users, though we find that consumers benefit from the ever evolving choices available to meet their voice communication needs.

F. The Satellite Market

207. We next assess the state of competition to deliver voice, video, audio, and data services by providers of satellite communications.⁶⁵⁷ Satellite communications services constitute a technology sector that participates in multiple marketplaces. Our analysis and the comments we received indicate that providers of satellite communications offer a wide range of services across the United States and globally today.⁶⁵⁸

1. Overview of the Commercial Satellite Services Industry

208. In the United States and globally, satellites provide telecommunications infrastructure for communications, including voice, video, audio, and data services. 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.⁶⁵⁹ In broad terms, satellites operate in either

⁶⁵⁴ FCC, Voice Telephone Services: Status as of June 30, 2017 at 1, (2018).

⁶⁵⁵ FCC, Voice Telephone Services: Status as of June 30, 2017 Figure 3, (2018).

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

⁶⁵⁷ Consolidated Appropriations Act, 2018, Pub. L. No. 115-141, Div. P-Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018, § 401, 132 Stat. 348, 1087-88 (RAY BAUM’S Act); 47 U.S.C. § 163(b)(1) (requiring the Commission to assess the state of competition in the communications marketplace, including competition to deliver voice, video, audio, and data services among providers of communications services, including providers of satellite communications).

⁶⁵⁸ To inform our analysis, on August 17, 2018, the International Bureau requested data, information, and comment on the delivery of services by providers of satellite communications. *International Bureau Seeks Comment on Satellite Communications Services for the Communications Marketplace Report*, IB Docket No. 18-251, Public Notice, DA 18-858 (Aug. 17, 2018). Several commenters contend that services from current satellites and from planned satellite launches ensure that satellite services not only play an important role today but will continue to do so in the future. EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC Comments, IB Docket No. 18-251, at 1-2, 4 (Sept. 7, 2018) (EchoStar and Hughes Sept. 7, 2018 Comments); Iridium Communications Inc., IB Docket No. 18-251, at 2, 5-6 (Sept. 7, 2018) (Iridium Comments); Satellite Industry Association (SIA) Comments, IB Docket No. 18-251, at 2 (Sept. 7, 2018) (SIA Sept. 7, 2018 Comments) (“Satellites also play a critical role in situations where terrestrial communication infrastructure networks are not available such as natural disasters and electrical outages.”). We do not address other industry sectors, such as launch industry, satellite manufacturing, earth station and network equipment manufacturing, consumer terminal equipment, and launch insurance. Nor do we address military applications of satellite services.

⁶⁵⁹ 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 (*Earth station*). 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) (*ITU Radio Regulations*), <http://search.itu.int/history/HistoryDigitalCollectionDocLibrary/1.43.48.en.101.pdf>.

a geostationary (GSO) or non-geostationary (NGSO) orbit.⁶⁶⁰ Satellite communications services may be provided in several ways based on the specific business context and objective. Satellite operators provide commercial satellite services to other business entities, government organizations, and consumer end users. For purposes of this report, we describe five major types of services provided by the commercial satellite services industry.

209. *Fixed Satellite Service (FSS)*. The Commission defines FSS as involving the transmitting and receiving of communications signals from earth stations, including customer stations, that are located at fixed points on earth, and has allocated specific spectrum bands for FSS, most importantly, the C-, Ku-, and Ka-bands.⁶⁶¹ More recently, there also has been interest in use of the V-band frequencies.⁶⁶² Examples of FSS offerings include wholesale transponder⁶⁶³ services, managed services (also known as

⁶⁶⁰ GSO satellites operate on an equatorial plane at approximately 22,300 miles above the earth and rotate around the earth at the same speed that the earth rotates. *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*, Third Report, 26 FCC Rcd 17284, 17291, para. 8, n.9 (2011) (*Third Satellite Competition Report*); see also National Oceanic and Atmospheric Administration, *NOAA's Geostationary and Polar-Orbiting Weather Satellites*, <https://noaasis.noaa.gov/NOAASIS/ml/genlsatl.html> (last visited Sept. 10, 2018). As a result, a GSO satellite appears as a stationary point in the sky relative to a receiving and transmitting earth station. Non-geostationary orbits include a number of orbital configurations. Medium-earth orbits (MEO) range from 6,000 to 12,000 miles above the earth and circle the earth in five to 12 hours. Howard Hausman, *Fundamentals of Satellite Communications*, Part 1, at 23 (2008), https://www.ieee.li/pdf/viewgraphs/fundamentals_satellite_communication_part-1.pdf. Low-earth orbits (LEO) range from 100 to 300 miles above the earth and circle the earth approximately every 90 minutes. *Id.* at 25.

⁶⁶¹ 47 CFR § 25.103 (*Fixed-Satellite Service (FSS)*). The conventional C-band refers to the 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-space) FSS frequency bands, and 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, and 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.

⁶⁶² 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 systems in portions of 37.5-50.2 GHz frequency range. See, e.g., *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, FCC 18-70, para. 30 (rel. June 6, 2018) (*O3b Modification Order*); *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, FCC 18-72, para. 20 (rel. June 6, 2018) (*Audacy Authorization Order*); *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*, Memorandum Opinion, Order and Authorization, FCC 18-161 (rel. Nov. 19, 2018); *Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-Band NGSO Constellation*, Order and Declaratory Ruling, FCC 18-163 (rel. Nov. 19, 2018).

⁶⁶³ A communications satellite 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 transponders. U.S. Government Accountability Office, *Telecommunications:*

(continued....)

enterprise services), and consumer broadband services.⁶⁶⁴ Over the last ten years, however, the Commission has allowed mobile services within the spectrum bands allocated to FSS.⁶⁶⁵ Earth Stations on Vessels, Vehicle-Mounted Earth Stations, and Earth Stations Aboard Aircraft, collectively designated as Earth Stations in Motion (ESIMs),⁶⁶⁶ are mobile in nature, but operate in FSS spectrum. Given the significant bandwidth allocated to FSS, ESIMs are able to transmit and receive very high data rate broadband communications while in motion.⁶⁶⁷ 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.

210. *Mobile Satellite Service (MSS)*. MSS generally involves the transmitting and receiving of communications signals from mobile earth stations located on land, on sea, or on airplanes⁶⁶⁸ and operates in the limited bandwidth allocated in the L-band, the 2 GHz MSS band, and the Big and Little Low Earth Orbit (LEO) bands.⁶⁶⁹ Voice and 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.⁶⁷⁰ 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.

211. *Earth Exploration Satellite Service (EESS)*. EESS satellites are increasingly used to gather Earth observation information for commercial purposes, including information to assess needs in

(Continued from previous page) _____
Competition, Capacity, and Costs in the Fixed Satellite Services Industry at 5 (2011),
<https://www.gao.gov/assets/330/322861.pdf>.

⁶⁶⁴ Broadband to aircraft and vessels can also be provided via wholesale transponder services.

⁶⁶⁵ 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*, 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*, Report and Order, 24 FCC Rcd 10414 (2009).

⁶⁶⁶ See *O3b Modification Order* at para. 21, n.59.

⁶⁶⁷ *Id.* 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. *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, FCC 18-138 at para. 3 (Sept. 27, 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* at 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.”).

⁶⁶⁸ 47 CFR § 25.103 (*Mobile-Satellite Service (MSS)*).

⁶⁶⁹ 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, 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.

⁶⁷⁰ 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*, 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).

disaster recovery, monitor strategic assets, and check crop growth. The EESS is a radiocommunication service in specified spectrum bands between earth stations and one or more space stations, which may include links between space stations that, for example, provides information relating to the characteristics of the Earth from active or passive sensors on earth satellites.⁶⁷¹ Many different frequency bands are allocated for the provision of EESS, including, for example, 1215-1300 MHz, 1400-1427 MHz, 2025-2110 MHz, 2200-2290 MHz, and 8025-8400 MHz. The frequency band allocation for EESS may be for sensing purposes or for feeder link use to associated Earth stations.

212. *Satellite Digital Audio Radio Service (SDARS)*. SDARS is a radiocommunication service in the 2.3 GHz band in which audio programming is digitally transmitted by one or more space stations directly to fixed, mobile, and/or portable stations.⁶⁷² Satellite-delivered radio programming is supplied nationwide by SiriusXM, presently the only SDARS operator in the nation.⁶⁷³ SDARS is examined in more detail in Section III.C.

213. *Direct Broadcast Satellite (DBS) Service*. DBS service is a radiocommunication service in which signals transmitted or retransmitted by Broadcasting Satellite Service space stations in the 12.2–12.7 GHz band are intended for direct reception by subscribers or the general public.⁶⁷⁴ DBS satellite operators (e.g., DISH Network and DIRECTV) provide nationwide video programming to video customers in direct competition with terrestrial television companies. DBS services are examined in more detail in Section III.B.

2. Satellite Revenues

214. Satellite operators provide a number of different kinds of services with varying revenue streams.⁶⁷⁵ For example, some operators provide transponders for lease through arrangements that are multi-dimensional and tailored for specific applications required by the customer. Operators may also supply a complete, end-to-end communications solution to customers, referred to as managed services. Consumer retail services include satellite broadband service, SDARS, and satellite television (e.g., DBS). Customers of enterprise services include terrestrial telecommunications companies, television networks, and resellers of satellite transponder capacity.⁶⁷⁶ Examples of resellers that are not the operators themselves include Digisat International Inc.,⁶⁷⁷ Globecom, ⁶⁷⁸ Ultisat, Inc.,⁶⁷⁹ and Artel, LLC.⁶⁸⁰

⁶⁷¹ See *ITU Radio Regulations* at 12 (Article 1, 1.51); 47 CFR § 2.106.

⁶⁷² 47 CFR § 25.103 (*Satellite Digital Audio Radio Service (SDARS)*).

⁶⁷³ In 2017, SiriusXM's total revenue was \$5.4 billion, which represents an increase of 8% over total revenue in 2016. SiriusXM, *SiriusXM Reports Fourth Quarter and Full-Year 2017 Results* (Jan. 31, 2018), <http://investor.siriusxm.com/investor-overview/press-releases/press-release-details/2018/SiriusXM-Reports-Fourth-Quarter-and-Full-Year-2017-Results/default.aspx>.

⁶⁷⁴ 47 CFR § 25.103 (*Direct Broadcast Satellite (DBS) Service*).

⁶⁷⁵ Intelsat, SES, Hughes, ViaSat, Iridium, Eutelsat, and Telesat are examples of facilities-based satellite operators. Facilities-based operators may also lease some excess capacity from each other to expand their geographic coverage or meet the unique transmission requirements of specific customers.

⁶⁷⁶ Some satellite resellers combine leased transponder capacity with terrestrial telecommunications facilities, which the resellers may lease from terrestrial telecommunications entities or use their own facilities, to create a complete telecommunications service for corporate and government users.

⁶⁷⁷ Digisat, *Satellite Communications Network Management Solutions*, <https://www.digisat.org/managed-network-services> (last visited Oct. 16, 2018); Digisat, *Satellite Footprint Maps and Spot Beam Coverage Areas*, <https://www.digisat.org/satellite-footprint-maps> (last visited Oct. 26, 2018).

⁶⁷⁸ Globecom, *Globecom Chosen by Broadcasting Board of Governors and Middle East Broadcasting Network for Direct-to-Home Services* (May 8, 2018), <http://www.globecom.com/news/press-releases/globecom-chosen-broadcasting-board-governors-middle-east-broadcasting-network-direct-home-services/>.

215. Fig. F-1 below provides aggregated U.S. satellite services revenues from SIA for 2013 to 2017 with respect to consumer, fixed, and mobile satellite services.⁶⁸¹

Fig. F-1 U.S. Satellite Services Revenue (2013-2017)					
Service	Total Revenue (Billions, U.S.\$)				
	2013	2014	2015	2016	2017
Consumer	44.0	46.0	48.0	46.4	45.5
Satellite TV (DBS/DTH)⁶⁸²	38.6	40.1	41.7	39.7	38.3
Satellite Radio (SDARS)	3.8	4.2	4.6	5.0	5.4
Satellite Broadband	1.6	1.7	1.7	1.7	1.8
Fixed	3.7	3.8	4.1	4.4	5.0
Managed Services⁶⁸³	3.4	3.5	3.8	4.1	4.7
Transponder Agreements⁶⁸⁴	0.3	0.3	0.3	0.3	0.3
Mobile	0.4	0.4	0.5	0.5	0.6
Total	48.1	50.2	52.6	51.3	51.1

(Continued from previous page)

⁶⁷⁹ Ultisat, *Custom Satellite Communications Solutions (CS3)*, <https://ultisat.com/custom-satellite-communications-solutions-cs3> (last visited Oct. 26, 2018); Ultisat, *Coverage*, <https://ultisat.com/coverage> (last visited Oct. 26, 2018).

⁶⁸⁰ Artel, *Company*, <https://www.artellic.com/company/> (last visited Oct. 26); Artel, *Complex SatCom Solutions—Bandwidth Procurement*, <https://www.artellic.com/solutions/satcom-complex-satcom/#tab-header1> (last visited Oct. 26, 2018); Artel, *Air Force Awards Artel \$18.9M Contract for Commercial Satellite Communications* (May 26, 2018), <https://www.artellic.com/air-force-awards-artel-18-9m-contract-for-commercial-satellite-communications/>.

We note that we have limited reliable information about resellers or other suppliers and the types of satellite services provided by these entities in the communications marketplace.

⁶⁸¹ SIA Sept. 7, 2018 Comments at 23 (referring to Appendix B of SIA State of the Satellite Industry Report (Prepared by Bryce Space and Technology, formerly Tauri Group Space and Technology)). SIA estimates that the U.S. share of global satellite services revenue in 2017 was 40 percent. *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 Earth observation services. *Id.* at 21.

⁶⁸² DTH refers to television service provided in the FSS, rather than BSS, allocation. *See Policies and Rules for the Direct Broadcast Satellite Service*, Report and Order, 17 FCC Rcd 11331, 11333, para. 3 (2002).

⁶⁸³ According to SIA, the revenue represented for “Managed Services” includes VSAT, mobility, and in-flight connectivity. SIA Sept. 7, 2018 Comments at 23.

⁶⁸⁴ According to SIA, the revenue represented for “Transponder Agreements” includes capacity for DTH satellite TV and some mobility service platforms. *Id.*

3. Examination of Satellite Communications Services and Providers

a. Fixed Satellite Service (FSS)

216. Intelsat, SES, Eutelsat, Telesat Canada, EchoStar,⁶⁸⁵ and ViaSat provide nearly all of the communications services in FSS spectrum in the United States.⁶⁸⁶ Telesat Canada 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.⁶⁸⁷ ViaSat and Hughes both provide wholesale and retail commercial broadband services to customers in the United States.⁶⁸⁸ Intelsat, Telesat Canada, SES, ViaSat, and EchoStar have high throughput satellites⁶⁸⁹ serving in the North America region.⁶⁹⁰

217. Some FSS operators, as well as some third-party integrators, supply a complete, end-to-end communications solution that includes ground facilities, terrestrial transmission links, and management of the end-to-end communications service. Intelsat, SES, Hughes, ViaSat, and Iridium are examples of satellite operators that provide managed services. FSS operators may offer specialized services in the form of managed networks by leasing existing satellite bandwidth and combining it with

⁶⁸⁵ EchoStar provides its consumer broadband and managed services through its wholly-owned subsidiary, Hughes Network Services.

⁶⁸⁶ Intelsat S.A., Form 20-F: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the fiscal year ended December 31, 2017) at 6, 19 (*Intelsat Form 20-F*), <http://investors.intelsat.com/phoenix.zhtml?c=131114&p=irol-SECText&TEXT=aHR0cDovL2FwaS50ZW5rd2l6YXJkLmNvbS9maWxpbnmcueG1sP2lwYWdlPTEyMDgzNTgxJkRTRVE9MCZTRVE9MCZTUURFU0M9U0VDVEIPTl9FTIRJUKUmc3Vic2lkPTU3>; SES, *Our Services*, <https://www.ses.com/north-america/our-services> (last visited Nov. 2, 2018); Eutelsat, Find Your Satellite, <https://www.eutelsat.com/en/satellites/find-your-satellite.html> (Nov. 2, 2018); Telesat Canada, Form 20-F: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the fiscal year ended December 31, 2017) at 8, 26 (*Telesat Form 20-F*), https://www.sec.gov/Archives/edgar/data/1465191/000161577418001535/s108785_20f.htm; EchoStar and Hughes Sept. 7, 2018 Comments at 2-4; ViaSat, Inc., Form 10-K: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the fiscal year ended March 31, 2018) at 3 (*ViaSat Form 10-K*), <http://investors.viasat.com/static-files/e75b82fb-e7df-4273-8212-984c1fd332fb>; *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, 1676, para 51.

⁶⁸⁷ *Telesat Form 20-F* at 32.

⁶⁸⁸ See ViaSat, *Services*, <https://www.viasat.com/services> (last visited Sept. 10, 2018); EchoStar and Hughes Sept. 7, 2018 Comments at 3. Hughes states that it is “currently in the process of constructing EchoStar XXIV, its next-generation, Commission-licensed, ultra-high density satellite, which will provide expanded services to consumers throughout the United States and the Americas at speeds of 100 Mbps or more” and “is expected to begin service in 2021.” EchoStar and Hughes Sept. 7, 2018 Comments at 4.

⁶⁸⁹ 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 its small beams and therefore making higher throughput available anywhere in its coverage area. Intelsat General, *Defining High Throughput Satellites (HTS)* (Mar. 25, 2013), <https://www.intelsatgeneral.com/blog/defining-high-throughput-satellites-hts/>; Hughes Network Systems, LLC, The View from JUPITER: High-Throughput Satellite Systems (2013) at 2, https://www.hughes.com/sites/hughes.com/files/2017-04/JUPITER_H50283_HR_08-01-13.pdf. For example, ViaSat indicates that “high-capacity satellite systems are designed to grow with that demand, providing more bandwidth capacity and throughput with higher internet service speeds, quality and reliability.” ViaSat, *High-Capacity Satellite System: Transforming Satellite Broadband*, <https://www.viasat.com/products/high-capacity-satellites> (last visited Nov. 16, 2018).

⁶⁹⁰ Euroconsult, 2018 Brochure: FSS Operators—Benchmarks & Performance Review at 5 (2018), <http://euroconsult-ec.com/research/FSS-operators-2018-brochure.pdf>.

fully managed, end-to-end communications infrastructure, such as Very Small Aperture Terminal (VSAT) networks, machine-to-machine (M2M) platforms, and supervisory control and data acquisition (SCADA) applications.⁶⁹¹ Customers of third-party providers of managed satellite services include U.S. and foreign government agencies, government contractors, and commercial entities.⁶⁹² Examples of providers of these services include Digisat International Inc., Globecomm, Ultisat, Inc., and Artel, LLC. Managed services include satellite-based data communication networks that are operated by government, corporate, and other entities to provide a combination of data, voice, and video communications to widely separated or remotely located facilities through one or more transponders.⁶⁹³

218. *Broadband Satellite Services to Aircraft and Vessels.*⁶⁹⁴ FSS operators provide broadband services to aircraft and maritime vessels, which include government organizations, commercial entities, and individual clients. For example, Intelsat and Telesat Canada offer broadband services for maritime vessels (including maritime enterprise VSAT services⁶⁹⁵ and broadband connectivity for cruise ships), as well as broadband connectivity for in-flight entertainment and Wi-Fi services for the aeronautical industry.⁶⁹⁶ SES and ViaSat provide broadband service on commercial airlines⁶⁹⁷ and cruise

⁶⁹¹ See, e.g., SES, *Managed Services*, <https://www.ses.com/networks/government/managed-services> (last visited Sept. 11, 2018); Hughes, *Retail Petroleum*, <https://business.hughes.com/what-we-do/industries/retail-petroleum> (last visited Sept. 17, 2018); EchoStar Corporation, Form 10-K: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the fiscal year ended December 31, 2017) at 1, 4, <http://ir.echostar.com/static-files/d98e3836-bb15-4957-b05d-2743be5f110f>; Intelsat General, *The Clear Trend Towards Managed Services* (Feb. 12, 2015), <https://www.intelsatgeneral.com/blog/the-clear-trend-towards-managed-services/>.

⁶⁹² See, e.g., *Third Satellite Competition Report*, 26 FCC Rcd at 17304, paras. 41-42 (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); Ultisat, *Ultisat to Provide USG Customer COMSATCOM Services to Support Homeland & Civil Defense Activities* (Oct. 23, 2018), <https://ultisat.com/blog/ultisat-provide-usg-customer-comsatcom-services-support-homeland-civil-defense-activities>; Globecomm, *Communications and Transmission Systems (CTS)*, <http://www.globecomm.com/industries/government/communications-transmission-systems-cts/> (last visited Oct. 25, 2018).

⁶⁹³ See *Third Satellite Competition Report*, 26 FCC Rcd at 17290, para. 11, n.17.

⁶⁹⁴ These services are being addressed here within the managed services category, but in some cases, they may be closer to the transponder service category, as the involvement of the satellite operator may be limited to simply leasing satellite capacity. See *infra* note [[698]] (describing Telesat’s contractual relationship with Panasonic).

⁶⁹⁵ Vessels can connect to the global communications network with VSAT technology, which provides crew and passengers with high-speed Internet access and phone service. VT iDirect, *The Coming Wave of Maritime VSAT Growth* (2015), <https://www.satellitetoday.com/long-form-stories/maritime-vsats/>.

⁶⁹⁶ *Intelsat Form 10-K* at 24; Intelsat, *Mobility*, <http://www.intelsat.com/solutions/mobility/> (last visited Oct. 3, 2018); *Telesat Form 20-F* at 28, 32. 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. Intelsat, *Gogo Partners with Intelsat on Major Capacity Agreement Across Intelsat Globalized Network and Becomes Anchor Tenant for World’s First GEO/LEO Shared Network* (Mar. 7, 2016), <http://www.intelsat.com/news/press-release/gogo-partners-with-intelsat-on-major-capacity-agreement-across-intelsat-globalized-network-and-becomes-anchor-tenant-for-worlds-first-geoleo-shared-network/>.

⁶⁹⁷ SES, *Sky High Connectivity* (2016), <https://www.ses.com/sites/default/files/2016-10/Sky%20High%20Connectivity.pdf>; *ViaSat 10-K* at 3-4.

ships.⁶⁹⁸ Hughes also provides broadband service on commercial airlines.⁶⁹⁹ According to SIA, a “[s]ubstantial share of in-flight and other managed services is provided by the same satellite operators that provide consumer satellite broadband services, their [High-Throughput System] capacity divided between the two types of service.”⁷⁰⁰

219. FSS operators in the U.S. also provide transponder capacity for lease through complex contracts for variable quantities of bandwidth, frequency, orbital location, geographic coverage, power, and length of service of the transponders required by the customer.⁷⁰¹ 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.⁷⁰² Leased transponders can also be used for the provision of broadband to aircraft and vessels.

220. Satellite broadband providers Hughes and ViaSat play an increasingly important role in the efforts to close 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.⁷⁰³ These operators now serve nearly 2 million subscribers and, as their infrastructure expands, they are increasing the speeds made available to consumers.⁷⁰⁴ For example, the launches and commencement of service of the high throughput satellites Jupiter 2/EchoStar XIX and ViaSat-2 in the last two years by Hughes and ViaSat, respectively, have further increased 25 Mbps/3 Mbps satellite offerings.⁷⁰⁵ 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.⁷⁰⁶

b. Mobile Satellite Service (MSS)

221. Currently, five satellite operators provide MSS to the United States. Inmarsat, a global satellite service provider, as well as Ligado (formerly known as LightSquared), use GSO satellites to

⁶⁹⁸ SES, *Maritime Powered by O3b*, <https://www.ses.com/networks/maritime/maritime-powered-o3b> (last visited Sept. 17, 2018); ViaSat, *High-Speed Internet Service for Maritime Markets*, <https://www.viasat.com/services/maritime> (last visited Oct. 1, 2018).

⁶⁹⁹ Hughes, *Airline and Cargo Broadband*, <https://www.hughes.com/what-we-do/by-industry/aeronautical-broadband-solutions> (last visited Oct. 18, 2018).

⁷⁰⁰ Satellite Industry Association, *State of the Satellite Industry Report* at 14 (2017), <https://www.sia.org/wp-content/uploads/2017/07/SIA-SSIR-2017.pdf>.

⁷⁰¹ See *Third Satellite Competition Report*, 26 FCC Rcd at 17291-99, 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.

⁷⁰² *Id.* at 17296-97, paras. 26-28.

⁷⁰³ SIA Comments, GN Docket No. 18-231, at 2 (Aug. 17, 2018) (SIA Aug. 17, 2018 Comments).

⁷⁰⁴ *Id.*

⁷⁰⁵ *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51; EchoStar Corporation, Form 10-K (For the fiscal year ended December 31, 2017) at 8 (*EchoStar 10-K*), <http://ir.echostar.com/static-files/d98e3836-bb15-4957-b05d-2743be5f110f>; ViaSat 10-K at 3; ViaSat, *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service—Nationwide* (Feb. 27, 2018), <https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide>.

⁷⁰⁶ *ViaSat 10-K* at 3; Hughes, *EchoStar XXIV*, <https://www.hughes.com/technologies/hughes-high-throughput-satellite-constellation/echostar-xxiv> (last visited Nov. 20, 2018); SIA Sept. 7, 2018 Comments at 7.

provide MSS within the contiguous United States (CONUS). Iridium, Globalstar, and ORBCOMM use a constellation of LEO satellites capable of providing global coverage.⁷⁰⁷ Given the relatively little allocated bandwidth, MSS data services are more limited than the mobile data services offered in FSS spectrum bands.

222. Due to technological differences in how MSS operators provide services, their services vary significantly in characteristics, such as cost, geographic availability, required customer equipment, data bandwidth and allowances, two-way capabilities, latency, network reliability, customer support, and ease of use.⁷⁰⁸ According to SIA, in 2017 MSS generated approximately \$600 million in U.S. revenues (\$4.0 billion globally).⁷⁰⁹

223. *MSS via GSO Satellites.* The Commission issues licenses authorizing GSO satellites to operate MSS in the 1525-1559 MHz and 1626.5-1660.5 MHz bands of the L-band, and in the 2000-2020 MHz and 2180-2200 MHz bands of the 2 GHz MSS band.⁷¹⁰ Currently, two MSS GSO operators provide service to the United States. Inmarsat is the largest MSS operator, providing extensive voice, video, and data communications services to mobile earth stations using GSO satellites, six of which have been granted access to the U.S. market.⁷¹¹ Ligado provides some services in the United States that could be considered IoT, using the SkyTerra 1 satellite.⁷¹²

224. *MSS via LEO Satellites.* The Big LEO bands consist of the 1610-1626.5 MHz band and the 2483.5-2500 MHz band.⁷¹³ The Big LEO systems of Iridium and Globalstar provide low-latency voice and data services to portable handsets and other devices. Iridium, with its constellation of 66 satellites, provides low-latency mobile voice, data, and IoT communications services with fully global coverage.⁷¹⁴ Iridium provides services to industries such as maritime, aviation, government/military, emergency/humanitarian services, mining, forestry, oil and gas, heavy equipment, transportation and utilities.⁷¹⁵ According to Iridium, it provides “highly reliable and secure communications that are critical

⁷⁰⁷ Iridium, *Iridium Global Network*, <https://www.iridium.com/network/globalnetwork/> (last visited Oct. 18, 2018); Globalstar, *Our Technology*, <https://www.globalstar.com/en-us/corporate/about/our-technology> (last visited Oct. 18, 2018); ORBCOMM, *ORBCOMM OG2 Next-Generation Satellite Constellation*, <https://www.orbcomm.com/en/networks/satellite/orbcomm-og2> (last visited Oct. 18, 2018).

⁷⁰⁸ See, e.g., SIA, *Satellite 101: Satellite Technology and Services at 25* (identifying MSS satellite systems and locations where MSS operators provide coverage) (*Satellite 101*), <https://www.sia.org/wp-content/uploads/2014/11/Website-Refresh14-Satellite-101.pdf>; Inmarsat Plc, *Annual Report and Accounts (2017)* at 2-3, <https://investors.inmarsat.com/results-centre/2017-results>; Iridium Communications, Inc., *Form 10-K: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the Fiscal Year Ended December 31, 2017)* at 2-5 (*Iridium 10-K*), https://www.sec.gov/Archives/edgar/data/1418819/000141881918000005/irdm_12312017x10k.htm; Globalstar, *10-K Report: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the Fiscal Year Ended December 31, 2017)* at 3-5 (*Globalstar 10-K*), <https://www.globalstar.com/en-us/corporate/investors/sec-filings?page=2>.

⁷⁰⁹ SIA Sept. 7, 2018 Comments at 21, 23.

⁷¹⁰ 47 CFR § 25.103.

⁷¹¹ FCC, *Space Station Approval List* (updated Nov. 9, 2018).

⁷¹² Ligado Networks, *Next Generation Networks Powering 5G and the Industrial Internet of Things* at 9, <https://ligado.com/wp-content/uploads/MarketVision-2018.pdf> (last visited Nov. 7, 2018).

⁷¹³ See *Amendment of the Commission's Rules to Establish Rules & Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, CC Docket No. 92-166, Report and Order, 9 FCC Rcd 5936 (1994), *recon.*, 11 FCC Rcd 12861 (1996).

⁷¹⁴ *Iridium 10-K* at 4-5, 16-19;; Iridium, *Iridium Edge*, <https://www.iridium.com/products/iridium-edge/> (last visited Nov. 7, 2018).

⁷¹⁵ Iridium, *Company Profile*, <https://www.iridium.com/company-info/companyprofile/> (last visited Sept. 3, 2018).

for public safety, whether through daily aviation and maritime communications or in facilitating disaster response and recovery after major disasters.”⁷¹⁶ According to Globalstar, it uses its fleet of 24 second generation satellites to provide two-way voice and data and one-way IoT low-latency services for much of North America, Europe, South America, Australia, and limited parts of Asia and Africa.⁷¹⁷

225. The Little LEO bands consist of the 137-138 MHz, 400.15-401 MHz bands, and 148-150.5 MHz. Orbcomm’s Little LEO system provides data services, including M2M and IoT, that remotely track, monitor, and control fixed and mobile assets.⁷¹⁸ Little LEO systems are restricted to non-voice low data rate services because of the relatively small uplink bandwidth and the fact that they must operate in spectrum shared with terrestrial mobile operations.⁷¹⁹ Non-GSO LEO systems offer much lower latency due to their low earth orbit, which is useful for satellite voice telephony and interactive data applications, and require smaller antennas.⁷²⁰

c. Earth Exploration Satellite Service (EESS)

226. Five companies operate or plan to operate Earth observation satellites that the Commission authorized as EESS: Planet Labs, Spire Global, DG Consents Sub, Inc. (part of Digital Globe, a subsidiary of Maxar), BlackSky, and Astro Digital U.S.⁷²¹ Some of these companies operate or plan to operate large numbers of satellites. For example, Planet Labs has authorization for 544 satellites (of which approximately 150 satellites are currently in orbit),⁷²² and Spire Global has authorization for 128 satellites (of which approximately 48 satellites are currently in orbit).⁷²³ These satellites are situated in Low Earth Orbit, and many are small satellites.

227. Planet Labs operates satellites that capture frequent high-resolution optical images of the

⁷¹⁶ Iridium Comments at 2.

⁷¹⁷ Globalstar, *Mission Accomplished! Globalstar Announces Successful Fourth Launch of Six Second-Generation Satellites* (Feb. 6, 2013), <https://www.globalstar.com/en-us/corporate/press/release-archive?pr=775®ion=en-ca>; Globalstar 10-K at 3-4, 6, 18; Globalstar, *Our Technology*, <https://www.globalstar.com/en-us/corporate/about/our-technology> (last visited Nov. 7, 2018); Globalstar, *Coverage*, <https://www.globalstar.com/en-us/products/coverage-maps> (last visited Nov. 7, 2018).

⁷¹⁸ Orbcomm, *Satellite IoT and M2M Networks*, <https://www.orbcomm.com/en/networks/satellite> (last visited Nov. 7, 2018); Orbcomm, *Orbcomm*, <https://www.orbcomm.com/> (last visited Sept. 3, 2018); ; ORBCOMM Inc., 10-K Report: Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 (For the Fiscal Year Ended December 31, 2017) at 5, 9, <http://investors.orbcomm.com/node/11671/html>.

⁷¹⁹ *Third Satellite Competition Report*, 26 FCC Rcd at 17315, para. 71.

⁷²⁰ European Commission, *Low-Earth Orbit Satellites: Spectrum Access* (2017) at 3, https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_LEO%20-%20Spectrum%20access%20v1_0.pdf.

⁷²¹ FCC, *Space Station Approval List* (updated Nov. 9, 2018), <https://www.fcc.gov/approved-space-station-list> (*FCC Space Station Approval List*).

⁷²² *Id.*; Planet, *FAQs*, <https://www.planet.com/faqs/> (last visited Oct. 31, 2018).

⁷²³ *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 32 FCC Rcd 5579 (2017); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 32 FCC Rcd 4048 (2017); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 32 FCC Rcd 3034 (2017); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 31 FCC Rcd 11768 (2016); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 31 FCC Rcd 6985 (2016); *Policy Branch Information, Satellite Space Applications Actions Taken*, Public Notice, 31 FCC Rcd 2183 (2016); Debra Werner, *Spire Global is Expanding Cubesat Constellation to Offer Persistent Global View* (Jan. 10, 2018) (*Spire Global Cubesat Constellation*), <https://spacenews.com/spire-global-is-expanding-cubesat-constellation-to-offer-persistent-global-view/>.

earth for various purposes, including agriculture and disaster relief.⁷²⁴ Spire Global operates satellites that provide weather data and the location of ships and planes in remote locations.⁷²⁵ DigitalGlobe, using five satellites, provides optical high-resolution imaging with the ability to revisit the same location relatively frequently.⁷²⁶ BlackSky, a fully-owned subsidiary of Spaceflight Industries, plans to deploy a constellation of 60 satellites over the next several years to enable frequent revisit rates (forty to seventy times a day in some places) over 95% of the Earth's population. BlackSky plans to provide color imagery at a resolution of one meter (one square meter equals one image pixel) to make it easier to see such activity as ships in ports, earthquake damage, or herd migration.⁷²⁷ Astro Digital has one satellite in orbit and plans for 30 satellites in its Landmapper constellation, which will optically image all agricultural land daily.⁷²⁸ According to SIA estimates, in 2017, Earth observation revenues in the United States were \$1.0 billion.⁷²⁹

4. Recent Changes and Trends

a. Developments in Satellite Communications Services and Technologies

228. *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 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 below, the Commission has taken actions to remove regulatory barriers in order to enable market-based efficient use of spectrum and facilitate the deployment of these systems.⁷³⁰

229. *Technological Developments.* Recent trends in the satellite industry include the increased use of LEO and Middle Earth Orbit (MEO) satellite systems. For example, by December 2018, Iridium is

⁷²⁴ Michael Baylor, *Planet Labs Targets a Search Engine of the World* (Jan. 29, 2018), <https://www.nasaspacesflight.com/2018/01/planet-labs-targets-search-engine-world/>; GIS Geography, *Planet Labs Imagery: The Entire Earth, Everyday* (last updated Apr. 21, 2018), <https://gisgeography.com/planet-labs-imagery/>.

⁷²⁵ Lora Kolodny, *A Start-Up Fighting Pirates with Satellites Just Raised \$70 Million* (Nov. 16, 2017), <https://www.cnbc.com/2017/11/16/spire-global-raises-70-million-to-stop-pirates-with-satellites.html>; Spire, *Spire*, <https://spire.com/> (last visited Oct. 3, 2018); *Spire Global Cubesat Constellation*; Spire, *GNSS-RO & GPS-RO*, <https://spire.com/data/weather/?spirepedia=gnss-ro-gps-ro> (last visited Aug. 30, 2018).

⁷²⁶ Digital Globe, *About Us—Our Constellation*, <https://www.digitalglobe.com/about/our-constellation> (last visited Nov. 5, 2018); Digital Globe, *The DigitalGlobe Constellation* (2018), https://dg-cms-uploads-production.s3.amazonaws.com/uploads/document/file/223/Constellation_Brochure_2018.pdf.

⁷²⁷ BlackSky, *Black Sky*, www.blacksky.com (last visited Nov. 15, 2018).

⁷²⁸ One part of the constellation (Landmapper-HD, a constellation of 20 satellites) will optically image all agricultural land at 2.5 meters resolution. Another part of the constellation (Landmapper-BC, a constellation of 10 satellites) will image all agricultural land daily at 22 meters resolution. Astro Digital, *Annual Report* (2018), https://licensing.fcc.gov/myibfs/download.do?attachment_key=1435981; Astro Digital, *IBFS File No. SAT-LOA-20170508-00071*, at Exhibit 43; Peter B. de Selding, *Astro Digital Reduces Planned Constellation and by Maximizing Use of Europe's Sentinels & Landsat 8 Satellites* (Aug. 7, 2018), <https://www.spaceintelreport.com/astro-digital-reduces-planned-constellation-by-maximizing-use-of-europes-sentinels-landsat-8-satellites/>. Astro Digital satellites will travel in sun-synchronous orbit (SSO). SSO is a nearly polar orbit that allows satellites to pass over the same location each day, always in sunlight, which “lets the satellites see as much of the Earth as possible each day, let[ts] the satellites see our ground station on every orbit, and maintains consistent image capture time for every place on Earth.” Astro Digital, *Why sun synch orbit?*, <https://blog.astrodigital.com/why-sun-synch-orbit-f5c7cb74a5da> (last visited Sept. 4, 2018).

⁷²⁹ SIA Sept. 7, 2018 Comments at 23.

⁷³⁰ See *infra* Section V.

scheduled to have replaced its existing fleet of 66 LEO satellites with a new fleet of 75 LEO satellites (including, nine on-orbit spare satellites), collectively known as the Iridium NEXT constellation.⁷³¹ Other developments include new satellite launch technologies, and next generation high throughput satellite systems (i.e., GSO systems with spot beams that enable higher power transmission and spectrum reuse providing greater bandwidth availability).⁷³² LEO and MEO systems differ from GSO systems in their reduced power requirements and lower latency. As discussed below, a number of applications for LEO and MEO NGSO systems are pending with or have recently been approved by the Commission. Further, there have been advances in launch technology, including the development of reusable hardware and vehicles designed to launch smaller satellites.⁷³³ In addition, several new high throughput systems have been recently launched. For example, EchoStar XIX, a high-throughput geostationary satellite employing a multi-spot beam, bent pipe Ka-band architecture, was launched in December 2016 and commenced service in March 2017.⁷³⁴ ViaSat-2, a high-capacity Ka-band Spot-beam satellite, was launched in June 2017 and commenced service in February 2018.⁷³⁵

230. *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.⁷³⁶ The Commission has implemented amateur and experimental satellite rules to facilitate use of satellites for scientific and research missions and experimental testing.⁷³⁷ The Commission recently proposed rules designed to facilitate commercial deployment of small satellites (many of which seek to operate in the EESS) by reducing application processing times and lowering application processing fees, while offering protection for critical communication links and enabling efficient use of spectrum.⁷³⁸ There is also ongoing development of optical laser technologies for satellite communications, which may

⁷³¹ See Iridium, *Iridium Completes Seventh Successful Iridium® NEXT Launch* (Jul. 25, 2018) <http://investor.iridium.com/2018-07-25-Iridium-Completes-Seventh-Successful-Iridium-R-NEXT-Launch>; Caleb Henry, *Final Iridium Next Launch Scheduled for Dec. 30 Falcon 9 Mission* (Oct. 18, 2018), <https://spacenews.com/final-iridium-next-launch-scheduled-for-dec-30-falcon-9-mission/>.

⁷³² Organisation of Economic Cooperation and Development (OECD), *The Evolving Role of Satellite Networks in Rural and Remote Broadband Access* (2017) at 17, https://www.oecd-ilibrary.org/science-and-technology/the-evolving-role-of-satellite-networks-in-rural-and-remote-broadband-access_7610090d-en.

⁷³³ *Id.* at 21-22.

⁷³⁴ *EchoStar 10-K* at 8.

⁷³⁵ *ViaSat 10-K* at 3; ViaSat, *Viasat Announces Highest-Speed, Unlimited Satellite Internet Service—Nationwide* (Feb. 27, 2018), <https://www.viasat.com/news/viasat-announces-highest-speed-unlimited-satellite-internet-service-nationwide>.

⁷³⁶ See *Streamlining Licensing Procedures for Small Satellites*, IB Docket 18-86, Notice of Proposed Rulemaking, 33 FCC Rcd 4152, 4155 at para. 5 (2018) (noting “[i]n the last 15 years . . . the miniaturization of components and the ability of small satellite developers to capitalize on commercial off-the-shelf equipment has enabled smaller, cheaper satellites to be built and launched into space”) (*Small Satellites NPRM*); The Aerospace Corporation, *Small Satellite Technology: Industry Update* (May 15, 2014), https://www.nesdis.noaa.gov/CRSRA/files/Cubesat_ACCRES-15May2014_final_v2.pdf.

⁷³⁷ 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).

⁷³⁸ See generally *Small Satellites NPRM*.

well enhance the capacity, flexibility, and reliability of satellite communications.⁷³⁹ Proposed deployments of large satellite constellations in the intensely used LEO region, along with other satellites deployed in the LEO region, will have the potential to increase the risk of debris-generating events.⁷⁴⁰ On November 15, 2018, the Commission undertook the first comprehensive look at the Commission’s orbital debris rules since their adoption in 2004, and proposed changes to improve and clarify these rules based on experience gained in the satellite licensing process and on improvements in mitigation guidelines and practices.⁷⁴¹

b. Recently Granted and Proposed NGSO FSS Systems

231. In 2017 and 2018, the Commission has approved a number of NGSO FSS MEO and LEO systems for operation in the U.S. market—completing a regulatory prerequisite for setting up such systems to serve U.S. customers. According to the applications filed with the Commission, these systems would serve a variety of purposes, such as the provision of high-throughput, low-latency broadband services to remote locations, satellite mission extension services, and inter-satellite connectivity. The authorization of a number of these systems furthers the Commission’s efforts to close the digital divide across the United States.

232. For example, in 2017, the Commission adopted an order granting market access⁷⁴² to WorldVu d/b/a OneWeb for its NGSO FSS system of 720 satellites, which OneWeb plans to use to further its goal to “provide high-speed, affordable broadband connectivity to anyone, anywhere” in the United States.⁷⁴³ Also, the Commission granted the request of Space Norway AS (Space Norway) to access the U.S. market using a two-satellite NGSO FSS system, in a highly-elliptical orbit, to enable Space Norway to pursue its goal of providing broadband Internet access to currently unserved and underserved communities in the Arctic region of the United States.⁷⁴⁴ In addition, the Commission

⁷³⁹ 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 *Small Satellites NPRM*, 33 FCC Rcd at 4176, para. 58; 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) at Attachment A, page 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.”).

⁷⁴⁰ *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, FCC 18-159, para. 8 (rel. Nov. 19, 2018) (*Orbital Debris NPRM*). Orbital debris, also known as “space debris,” consists of artificial objects orbiting the Earth that are not functional spacecraft. *Id.*

⁷⁴¹ *Id.* at para. 2.

⁷⁴² In 1997, the Commission developed a market access procedure to facilitate the participation of non-U.S.-licensed satellite systems in the U.S. market even though such systems do not have a U.S. space station license. Favorable action on such a request is in the nature of a policy statement or declaratory ruling, which enables access to by the space station to spectrum in the United States and to U.S.-licensed earth stations, subject to public interest considerations. *WorldVu Satellites Limited; Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, 32 FCC Rcd 5366, para. 2, n.3 (2017); see also *Amendment of the Commission’s Regulatory Policies to Allow Non-U.S. Licensed Satellites to Provide Domestic and International Service in the United States*, Report and Order, 12 FCC Rcd 24094, 24106, 24173-74, paras. 29, 184-188 (1997).

⁷⁴³ *Id.* at para. 1; *WorldVu Satellites Limited, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb System*, IBFS File No. SAT-LOI-20160428-00041, Narrative at 2 (filed Apr. 28, 2016).

⁷⁴⁴ *Space Norway AS; Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission*, Order and Declaratory Ruling, 32 FCC Rcd 9649, 9649, paras. 1, 22 (2017); *Space Norway*

(continued....)

granted the request of Space Logistics, LLC to construct, deploy, and conduct telemetry, tracking and command functions with its mission extension vehicle (MEV-1), which provides services to other satellite operators.⁷⁴⁵ In 2018, the Commission granted O3b Limited's request to expand its grant of U.S. market access for its NGSO constellation in order to allow O3b to pursue its goal of expanding broadband Internet access to communities across the United States.⁷⁴⁶ The Commission also authorized Audacy to construct, deploy, and operate a NGSO satellite system to provide continuous, high-speed communications between other NGSO satellites and gateway earth stations, using frequencies in intersatellite service (ISS) and FSS spectrum bands.⁷⁴⁷ In addition, the Commission authorized Karousel Satellite LLC to construct, deploy and operate an NGSO FSS system comprising twelve satellites for the provision of video and data distribution around the world.⁷⁴⁸

233. On November 15, 2018, the Commission adopted a number of Orders granting the applications of NGSO FSS LEO systems for market access. Specifically, the Commission (1) granted Kepler's request for U.S. market access to offer global connectivity for the Internet of Things using a proposed constellation of 140 NGSO LEO satellites;⁷⁴⁹ (2) granted Telesat Canada's request to access the U.S. market to provide broadband services using a proposed constellation of 117 NGSO LEO satellites;⁷⁵⁰ and (3) granted LeoSat's request for U.S. market access to provide satellite broadband services in the United States using a proposed constellation of 78 NGSO LEO satellites, including high-speed connectivity for enterprises.⁷⁵¹ The Commission also granted SpaceX's application to construct, deploy

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AS, *Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission*, IBFS File No. SAT-PDR-20161115-00111, Narrative at 1, 12-14 (filed Nov. 15, 2016).

⁷⁴⁵ *Policy Branch Information, Satellite Space Actions Taken*, Public Notice, 32 FCC Rcd 10270 (2017) (granting in part and deferring in part, with conditions). According to Space Logistics, the MEV-1 "has the capability to service multiple in-orbit satellites in geosynchronous orbit ('GSO') by cooperatively docking with the satellites and performing the station keeping and attitude control functions for the satellites as a combined vehicle stack ('CVS')." Space Logistics, *Application of Space Logistics, LLC for Authority to Launch and Operate a Mission Extension Vehicle*, IBFS File No. SAT-LOA-20170224-00021, Narrative at 1 (filed Feb. 24, 2017).

⁷⁴⁶ *O3b Modification Order* at paras. 1, 44. According to O3b, "O3b's system offers satellite capacity and low-latency, high-throughput connectivity—generally ten to one-hundred times the throughput of a traditional satellite—to Internet service providers, telecom operators, large enterprises and governments, to enable fast, flexible and affordable broadband connectivity in locations unserved or underserved by other broadband services, such as fiber and mobile networks." O3b Limited; *Modification to U.S. Market Access Grant for the O3b MEO Satellite System*, IBFS File No. SAT-MOD-20160624-00060, Narrative at 13-14 (filed June 24, 2016).

⁷⁴⁷ *Audacy Authorization Order* at para. 1. According to Audacy, anticipated users would include operators of Earth observation satellites, launch providers, and operators of large LEO constellations. Audacy Corporation, *Application for Authority to Launch and Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services*, IBFS Filing No. SAT-LOA-20161115-00117, Narrative at 2 (filed Nov. 15, 2016); *Audacy Authorization Order* at paras. 1, 38.

⁷⁴⁸ *Karousel Satellite LLC; Application for Authority to Launch and Operate a Non-Geostationary Earth Orbit Satellite System in the Fixed Satellite Service*, Memorandum Opinion, Order and Authorization, FCC 18-125 (Aug. 16, 2018). The system would "deploy a novel video and data distribution service to rural consumers in the United States and around the world who lack access to adequate or affordable broadband connectivity." *Id.* at para. 1.

⁷⁴⁹ *Kepler Communications Inc. Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System*, Order and Declaratory Ruling, FCC 18-162 (Nov. xx, 2018).

⁷⁵⁰ *Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-Band NGSO Constellation*, Order and Declaratory Ruling, FCC 18-163 (Nov. 15, 2018).

⁷⁵¹ *LeoSat MA, Inc. Petition for Declaratory Ruling Concerning U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System*, Order and Declaratory Ruling, FCC 18-164 (rel. Nov. 19, 2018). In its petition for declaratory ruling, LeoSat stated that it will "ensure access to new broadband services for remote and underserved

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and operate a proposed NGSO satellite system using frequencies in the V-band, which will provide SpaceX with additional flexibility to provide both diverse geographic coverage and the capacity to support a wide range of proposed broadband and communications services in the United States and globally.⁷⁵²

234. In addition, a number of applications for NGSO FSS MEO and LEO systems for market access are pending with the Commission: (1) ViaSat filed a petition for declaratory ruling requesting market access for a 24-satellite NGSO MEO system;⁷⁵³ (2) New Spectrum filed a letter of intent requesting market access for a 15-satellite NGSO inclined elliptical orbit system that it intends to use to provide “state-of-the-art, affordable, digital fixed satellite services directly to users,” including “high-speed Internet access at megabit rates, video and broadband data distribution, and two-way video conferencing and content delivery via streaming”;⁷⁵⁴ (3) OneWeb filed a petition for declaratory ruling requesting market access for its next-generation V-band satellites for its NGSO system to provide broadband connectivity;⁷⁵⁵ and (4) Hiber applied for market access for a 24-satellite NGSO system for IoT using MSS frequencies.⁷⁵⁶ Currently, one application is pending for licensing or market access for additional satellites or frequencies for approved NGSO EESS systems.⁷⁵⁷

G. Broadband Deployment

235. American consumers rely on the Internet for virtually every facet of daily life. Connection via high-speed broadband is an important gateway to employment, education, entertainment, healthcare, and economic development. Americans expect accessibility to broadband at home, at work, and while on the go. Efforts to close the digital divide—reducing regulatory barriers to the deployment of wireline and wireless infrastructure, increasing universal service funding, and expanding access to spectrum for broadband services—are essential to spur broadband deployment to all American communities.

236. This Chapter assesses the state of broadband deployment, including deployment of advanced telecommunications capability, fulfilling the statutory directive.⁷⁵⁸ Overall, the available data

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communities in Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands” and that its network will deliver “enterprise-to-enterprise communications, Internet and 5G/4G cellular backhaul, video content delivery, oil field services and operations, and maritime communications.” LeoSat, Petition for Declaratory Ruling to Permit U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System, IBFS File No. SAT-PDR-20161115-00112, Narrative at 1-4 (filed Nov. 15, 2016).

⁷⁵² *Space Exploration Holdings, LLC; Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System*, Memorandum Opinion, Order and Authorization, FCC 18-161 (rel. Nov. 19, 2018).

⁷⁵³ ViaSat, Inc., *Petition for Declaratory Ruling Granting Access to the U.S. for a Non-U.S.-Licensed Nongeostationary Orbit Satellite Network*, IBFS File No. SAT-PDR-20161115-00120 (filed Nov. 15, 2016).

⁷⁵⁴ New Spectrum Satellite, Ltd., Letter of Intent of New Spectrum Satellite, Ltd. For a Global Fixed Satellite Service System Employing Nongeostationary Satellites in Sub-Geosynchronous Elliptical Orbits, IBFS File No. SAT-PDR-20170726-00111, Narrative at 8 (filed Jul. 26, 2017).

⁷⁵⁵ WorldVu Satellites Limited, *Petition for Declaratory Ruling Granting Access to the U.S. Market for the OneWeb V-Band System*, IBFS File No. SAT-LOI-20170301-00031 (filed Mar. 1, 2017).

⁷⁵⁶ Hiber Inc., *Petition for Declaratory Ruling to Access U.S. Market Using the Hiberband Low-Earth Orbit System*, IBFS File No. SAT-PDR-20180910-00069 (filed Sept. 10, 2018).

⁷⁵⁷ Theia Holdings A, Inc., *Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service, Mobile-Satellite Service, and Earth Exploration Satellite Service*, IBFS File No. SAT-LOA-20161115-00121 (filed Nov. 15, 2016).

⁷⁵⁸ See 47 U.S.C. § 163(a), (b)(2). This Chapter is not intended to fulfill the Commission’s statutory responsibility under section 706 of the Telecommunications Act of 1996 to “determine whether advanced telecommunications

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shows that Internet service providers deliver high-quality broadband to most Americans, but additional work remains to close the digital divide.

1. Scope of Reporting

237. To assess deployment, we employ a holistic examination of fixed and mobile services over a five year period (2013-2017) using the same four categories for evaluation that were presented in the *2018 Broadband Deployment Report*: (1) fixed services only; (2) mobile LTE services only; (3) fixed and mobile LTE services; and (4) fixed or mobile LTE services.⁷⁵⁹

238. To assess the state of deployment of advanced telecommunications capability, we rely on the *2018 Broadband Deployment Report*'s fixed service speed benchmark of 25 Mbps/3 Mbps adopted by the Commission.⁷⁶⁰ The *2018 Broadband Deployment Report* found that fixed services meeting this speed benchmark satisfy the section 706 definition of advanced telecommunications capability; that is, such services "enable[] users to originate and receive high-quality voice, data, graphics and video telecommunications."⁷⁶¹ Because the RAY BAUM'S Act of 2018 requires a more holistic assessment of broadband deployment, we also provide deployment figures for 10 Mbps/1 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps fixed service. Showing broadband deployment in additional speed tiers year over year is helpful to assess the pace and patterns of deployment.⁷⁶²

239. With respect to mobile services, the *2018 Broadband Deployment Report* found that adoption of a single speed benchmark for advanced telecommunications capabilities is inappropriate given the inherent variability of the mobile experience,⁷⁶³ combined with data limitations and methodological issues.⁷⁶⁴ Therefore, consistent with the *2018 Report*, to reasonably evaluate the progress of high-speed mobile deployment, we present LTE coverage data based on the Form 477 minimum advertised speeds of 5 Mbps/1 Mbps, and then supplement our analysis with Ookla's actual speed test data with a median speed of 10 Mbps/3 Mbps or higher.⁷⁶⁵ Given the limitations on mobile broadband speed data availability, at this point in time we are unable to present various speed thresholds that are

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capability is being deployed to all Americans in a reasonable and timely fashion." 47 U.S.C. § 1302(b). The Commission intends to complete the inquiry initiated in August by releasing a Broadband Deployment Report to fulfill this section 706 obligation. See *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, Fourteenth Broadband Deployment Report Notice of Inquiry, GN Docket No. 18-238, FCC 18-119 (Aug. 9, 2018).

⁷⁵⁹ *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, 1678, 1708, paras. 45-46 (2018) (*2018 Report*). The Commission's holistic approach in the *2018 Report* considered improvements to deployment over time; however, the data for 2012 and 2013 are not directly comparable to the data collected by the Commission since 2014. *Id.* at 1678, paras. 45-46.

⁷⁶⁰ *Id.* at 1667-68, para. 21.

⁷⁶¹ *Id.* at 1667-68, para. 21.

⁷⁶² *Id.* at 1667, 1678, 1686, paras. 20, 45, 57.

⁷⁶³ *Id.* at 1670-71, 1673-74, paras. 27, 34. The Commission noted that network speed is one of the key characteristics of mobile wireless performance, and mobile broadband speeds experienced by consumers may vary greatly with a number of factors, including the service provider's received signal quality, cell traffic loading, and network capacity in different locations. In addition, mobile broadband speeds can vary with the capability of consumers' devices. *Id.* at 1672, para. 30.

⁷⁶⁴ *Id.* at 1673-74, para. 34.

⁷⁶⁵ *Id.* at 1670-71, 1672-74, paras. 27, 31-34, n.97.

similar to the data presentation for fixed broadband.⁷⁶⁶

2. Data Sources and Methodologies

240. We rely primarily upon the Commission's Form 477 data to evaluate deployment, which are the most accurate data available to the Commission.⁷⁶⁷ For deployment data prior to 2014, we rely on data from the State Broadband Initiative (SBI), which, prior to the Commission's revision of the Form 477 data collection, were the most comprehensive and geographically granular deployment data publicly available.⁷⁶⁸ Unless otherwise noted, we rely upon year-end data for our analysis.

241. The Form 477 fixed deployment data and the SBI data report service at the census block level.⁷⁶⁹ For purposes of this Chapter, a whole census block is classified as served if Form 477 or SBI data indicate that service can be provided anywhere in the census block. Therefore, it is not necessarily the case that every household,⁷⁷⁰ housing unit, or person will have coverage for a service in a census block that this Chapter indicates is served.⁷⁷¹ Furthermore, although staff examine Form 477 data for quality and consistency, the data may understate or overstate deployment of services to the extent that broadband providers fail to report or misreport data.⁷⁷² Staff evaluate deployment data for fixed terrestrial services using 2010 census block population data that the Commission staff has updated to account for population

⁷⁶⁶ Unlike the Form 477 data for fixed services, wireless service providers submit coverage shape files and report the minimum advertised speed associated with the coverage area. We supplement the Form 477 data with crowd-sourced speed test data from Ookla. However, there are counties where few speed tests are observed in the Ookla data. Thus, we do not evaluate whether the median download and upload speeds exceed 10 Mbps/3 Mbps in these counties because the sample of tests is insufficient. In this regard, the Ookla data do not permit an evaluation of wireless service speeds for the overall population of Americans in the same manner as the Form 477 data.

⁷⁶⁷ See *supra* Section II.D..

⁷⁶⁸ 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*, GN Docket No. 11-121, Eighth Broadband Progress Report, 27 FCC Rcd 10342, 10364-65, para. 28 (2012) (*2012 Broadband Progress Report*). The SBI data were collected semi-annually through state-led efforts and maintained by the National Telecommunications and Information Administration for the National Broadband Map, in collaboration with the Commission. *Id.* at 10365, para. 28.

⁷⁶⁹ 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 (2016), <https://transition.fcc.gov/form477/477inst.pdf>.

⁷⁷⁰ 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, Current Population Survey Subject Definitions (Aug. 25, 2018), <https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#household>.

⁷⁷¹ We note that these coverage estimates represent deployment of networks to consumers and do not indicate the extent to which service providers affirmatively offer service to residents in the covered areas. Further, this analysis likely overstates the coverage experienced by some consumers, especially in large or irregularly shaped census blocks. We therefore acknowledge that this analysis may overstate or understate the deployment of fixed and mobile services. See *2018 Broadband Deployment Report*, 33 FCC Rcd at 1677, para. 43.

⁷⁷² See Federal Communications Commission, *Explanation of Broadband Deployment Data* (Nov. 20, 2017), <https://www.fcc.gov/general/explanation-broadband-deployment-data> (describing quality and consistency checks performed on providers' submitted data and explaining any adjustments made to the Form 477 data as filed).

growth and economic development.⁷⁷³ We present an analysis of deployment data for fixed terrestrial services and for mobile LTE. In general, we report data separately on the U.S. Territories because the data for 2017 may significantly overstate current deployment in Puerto Rico and the U.S. Virgin Islands, which account for over 92% of the total combined population of the U.S. Territories. We are uncertain as to the current deployment of broadband services in these areas given the damage to infrastructure in Puerto Rico and the U.S. Virgin Islands from Hurricanes Maria and Irma in 2017.

242. *Fixed Terrestrial Services.* Using the available Form 477 data since 2014, we evaluate deployment of fixed terrestrial services with a minimum advertised speed of 10 Mbps/1 Mbps, 25 Mbps/3 Mbps, 50 Mbps/5 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps. For 2013, which pre-dates the current version of the Form 477 data collection, we evaluate deployment of fixed terrestrial services using SBI data. The SBI data collection compiled data on 25 Mbps/3 Mbps and 100 Mbps/10 Mbps, but not the other download and upload speed combinations reported in this Chapter.⁷⁷⁴ Therefore, where applicable, we use the most comparable speed combinations collected in the 2013 SBI data as reasonable proxies. For 10 Mbps/1 Mbps, we use SBI reported speed of 10 Mbps/768 kbps, and for 50 Mbps/5 Mbps, we use the SBI reported speed of 50 Mbps/6 Mbps. The SBI data does not include a reasonable proxy for 250 Mbps/25 Mbps, so we do not report data at that speed for 2013. Finally, we use Form 477 subscriber data to calculate adoption rates for fixed terrestrial services.

243. *Satellite Services.* The Form 477 deployment data for satellite broadband indicate that satellite service offering 25 Mbps/3 Mbps speeds is available to nearly all the population.⁷⁷⁵ These data could overstate the deployment of these services.⁷⁷⁶ In Appendix F, we provide deployment estimates for all fixed services, including satellite, from 2014 to 2017.⁷⁷⁷

244. *Mobile services.* While recognizing certain limitations of the Form 477 data, our Form 477 LTE technology coverage data are the most reliable and comprehensive data that we have to assess the deployment of mobile LTE to American consumers at a minimum advertised speed of 5 Mbps/1

⁷⁷³ Commission Staff developed population estimates for 2011-2017 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, i.e., new housing development, to distribute population amongst the census blocks comprising each county (or county-equivalent). Federal Communications Commission, Staff Block Estimates, <https://www.fcc.gov/reports-research/data/staff-block-estimates>.

⁷⁷⁴ The fixed terrestrial estimates using the SBI data are based upon deployment data for the following services: Asymmetric xDSL, Symmetric xDSL, Other Wireline (all copper-wire based technologies other than xDSL), Cable Modem—DOCSIS 3.0, Cable Modem—Other, optical carrier (fiber to the home or FTTH), Fixed Terrestrial Wireless (provisioned/equipped over licensed spectrum or over spectrum used on an unlicensed basis), Electric Power Line, and All Other. For 2013, we exclude the satellite service data from our analysis because the SBI data for satellite services have significant inconsistencies in the data. *2015 Report*, 30 FCC Rcd at 1416, para. 76.

⁷⁷⁵ More specifically, the Form 477 deployment data for satellite broadband indicate that satellite service offering 25 Mbps/3 Mbps speeds is available to all but 0.04% of the population.

⁷⁷⁶ *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51, n.148. 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. *See Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, Fourteenth Broadband Deployment Report Notice of Inquiry, GN Docket No. 18-238, FCC 18-119, para. 17, n.46 (Aug. 9, 2018) (*Fourteenth Notice*); *2018 Broadband Deployment Report*, 33 FCC Rcd at 1681, para. 51, n.148.

⁷⁷⁷ *See infra* Broadband Deployment Appendix D-6 (Deployment (Millions) of Fixed Services at Different Speed Tiers (2014-2017)).

Mbps.⁷⁷⁸ For 2013, we use SBI data, which only include a speed component for mobile services,⁷⁷⁹ while for 2014 through 2017, we use the Form 477 LTE deployment shapefiles with a minimum advertised speed of 5 Mbps/1 Mbps. SBI data are not available for 5 Mbps/1 Mbps, so our analysis of the 2013 data uses maximum advertised speeds of 6 Mbps/768 kbps, which are the most comparable speeds collected in the SBI data in this period. As the Commission has previously done, we employ the centroid methodology in evaluating the Form 477 deployment data for LTE.⁷⁸⁰ We apply the same methodology as we use for fixed services and consider a census block to be covered by LTE services if there is at least one service provider serving that census block that reports 5 Mbps/1 Mbps as the minimum advertised speed, based on their Form 477 submission.

245. We recognize, however, that actual speeds tend to be much faster than the minimum advertised speed. Therefore, we also present estimates based on Ookla speed test data to evaluate the deployment of LTE with a median actual speed of 10 Mbps/3 Mbps or higher. We rely on the Ookla data⁷⁸¹ to supplement our Form 477 analysis, primarily because it allows us to better evaluate the extent to which the typical consumer receives speeds of 10 Mbps/3 Mbps or higher, and these data provide us with the greatest number of observations of actual speeds that customers receive.⁷⁸² Our analysis of the deployment of mobile LTE services with a median speed of 10 Mbps/1 Mbps, includes actual speed test data in counties with at least 300 test observations in each time frame.⁷⁸³ The more densely populated

⁷⁷⁸ For fixed services, the Commission has been able to rely upon Form 477 reported maximum advertised speeds to track actual speeds. However, the relationship between actual speeds and the advertised speed reported in the Form 477 data 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. *2018 Report*, 33 FCC Rcd at 1678, para. 46 n.133. By contrast, the Ookla data provide us with the actual speeds that consumers experience.

⁷⁷⁹ The SBI data for mobile services are not directly comparable to the Form 477 data. First, we are unable to limit the SBI data to LTE technology because the SBI data does not identify mobile services by technology. Second, the SBI data include mobile coverage area boundaries by *maximum* advertised download/upload speeds whereas the Form 477 collects data for mobile services by *minimum* advertised speeds. *2018 Report*, 33 FCC Rcd at 1679, para. 47.

⁷⁸⁰ *See, e.g., id.* at 1678, para. 46.

⁷⁸¹ Generally, crowd-sourced data can provide a large volume of data at a very low cost and provides insights into actual consumer experience on a network in a wide variety of locations, including those indoors and outdoors. Crowd-sourced data, however, are often not collected using statistical sampling techniques, and may require adjustments to be representative. For instance, crowd-sourced mobile data come from a self-selected group of users, and there often is little control for most tests regarding parameters such 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. *Id.* at 1679, para. 47, n.139.

⁷⁸² 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. The results presented in this Chapter are based on tests that were executed in the second half of the year for 2014, 2015, 2016 and 2017 on the smartphone's cellular connection, and using LTE technology. Test data was excluded if it had missing GPS locations data or if the reported download or upload speed was less than zero or greater than 100 Mbps. Multiple tests by a single phone in the same locality and in the same day were averaged (using the median).

⁷⁸³ *2018 Report*, 32 FCC Rcd at 1679, para. 47. This sample size threshold applies to each county for each time frame (2H2014, 2H2015, 2H2016, and 2H2017): if a county does not have at least 300 observations during any of these time frames, it is not included in the actual speed analysis because the sample size is not sufficient. The 300 observations threshold is a conservative threshold and is based on a general mean and median sample size analysis. 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 four-year time period, for counties in which approximately 93% of the U.S. population live (not including the U.S. Territories). If a census block has LTE coverage of at least 5 Mbps/1 Mbps based on the Form 477 minimum advertised speeds, it is assigned the median upload and download speeds that are

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counties have a higher likelihood of being included in this analysis because there generally are more observations in geographical areas with a higher population density. Although we do not have reliable, on-the-ground speed data for every county in the United States, the Ookla data covers well over 90% of the population of the United States,⁷⁸⁴ and as such, can reasonably be used to show progress over time.

3. Broadband Deployment Estimates

246. In Figures G-1 through G-3 below, we present our measurement of deployment, evaluating progress by comparing deployment in the present year to deployment in the previous four years.⁷⁸⁵ For purposes of this Chapter, we aggregate federally recognized Tribal lands into 4 Tribal Lands categories, the Lower 48 States;⁷⁸⁶ Tribal Statistical Areas,⁷⁸⁷ Alaskan Villages,⁷⁸⁸ and Hawaiian Homelands.⁷⁸⁹ We report on deployment for each combination of fixed and mobile deployment.

a. Deployment of Fixed Advanced Telecommunications Capability

247. Figure G-1 shows the deployment of fixed terrestrial broadband at speeds of 25 Mbps/3 Mbps, the Commission's current benchmark for fixed advanced telecommunications capability. As of year-end 2017, 94% of the overall population had coverage of such services, up from 92.3% in 2016. Nonetheless, the gap in rural and Tribal America remains notable: 24% of Americans in rural areas and 32% of Americans in Tribal lands lack coverage from fixed terrestrial 25 Mbps/3 Mbps broadband, as compared to only 1.5% of Americans in urban areas. The data demonstrate, however, that the gap between urban and rural or Tribal areas has narrowed each year over the last five years.

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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.

⁷⁸⁴ 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 Figure G-2b is a subset of the total U.S. population evaluated in Figure G-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. We do not have Ookla speed data for the U.S. Territories. In 2017, for example, the U.S. population, not including the U.S. territories, was 325.716 million, whereas in Figure G-2b, we use 302.940 million as the basis for our 2017 calculations. The population evaluated figure, 302.940 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.

⁷⁸⁵ 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, all urban areas). We present additional deployment data for each state and the District of Columbia in an Appendix. See *infra* Broadband Deployment Appendix D-3.

⁷⁸⁶ 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.

⁷⁸⁷ Tribal Statistical areas are Statistical American Indian areas. These are 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).

⁷⁸⁸ Alaskan Native village statistical area.

⁷⁸⁹ Hawaiian Home Lands established by the Hawaiian Homes Commission Act of 1921.

Fig. G-1

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	263.971	83.6%	284.277	89.4%	286.911	89.6%	297.766	92.3%	306.329	94.0%
Rural Areas	29.077	47.6%	37.202	60.4%	37.795	60.7%	43.604	69.3%	48.289	75.7%
Urban Areas	234.893	92.3%	247.075	96.4%	249.116	96.5%	254.162	97.9%	258.040	98.5%
Tribal Lands	1.449	37.1%	2.250	57.2%	2.289	57.8%	2.578	64.6%	2.731	68.0%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

248. In 2016, 25 Mbps/3 Mbps satellite service was reported for the first time in the Form 477 data collection.⁷⁹⁰ If we include satellite service in our estimate, fixed 25 Mbps/3 Mbps service is deployed to nearly every American as of December 2017.⁷⁹¹

b. Deployment of Mobile LTE

249. Figure G-2a shows that as of year-end 2017, approximately 100% of the American population lives in geographical areas covered by mobile LTE with a minimum advertised speed of 5 Mbps/1 Mbps, while approximately 98% had such coverage in 2013. Further, between 2013 and 2017, the percentage of Americans living in rural areas with coverage of LTE at 5 Mbps/1 Mbps increased from approximately 90% to approximately 99%.⁷⁹² The percentage of Americans living in Tribal lands with coverage of mobile LTE rose from approximately 87% in 2013, to 97% in 2017. Figure G-2b also shows some improvement since 2016 in the deployment of mobile LTE services at median speeds of 10 Mbps/3 Mbps for the United States and urban areas.

⁷⁹⁰ 2018 Report, 32 FCC Rcd at 1681, para. 51.

⁷⁹¹ *Id.* at 1681, para. 51, n.148; Broadband Deployment Appendix D-6 (Deployment (Millions) of Fixed Services at Different Speed Tiers (2014-2017)). These data could overstate the deployment of these services. The data indicate that fixed 25 Mbps/3 Mbps services are deployed to 93% of Americans residing in the U.S. Territories.

⁷⁹² The results reported in Table 2a for 2013 are based upon SBI data for mobile services at *maximum* advertised speeds of 6 Mbps/768 kbps as compared to the Form 477 data for mobile services which are based on *minimum* advertised speeds of 5 Mbps/1 Mbps. .

Fig. G-2a

Deployment (Millions) of Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	308.527	97.8%	315.506	99.2%	318.923	99.6%	321.347	99.6%	325.117	99.8%
Rural Areas	55.044	90.2%	59.463	96.5%	60.969	97.9%	61.802	98.2%	63.204	99.1%
Urban Areas	253.483	99.6%	256.043	99.9%	257.954	100.0%	259.545	100.0%	261.912	100.0%
Tribal Lands	3.386	86.7%	3.626	92.2%	3.722	93.9%	3.788	94.9%	3.896	97.0%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

Fig. G-2b

Deployment (Millions) of Mobile LTE with a Median Speed of 10 Mbps/3 Mbps.⁷⁹³

	2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	237.210	80.1%	245.843	82.5%	261.898	87.3%	269.494	89.0%
Rural Areas	32.638	70.3%	32.193	69.3%	32.962	70.1%	32.966	69.3%
Urban Areas	204.573	81.9%	213.650	85.0%	228.936	90.5%	236.528	92.6%
Pop. Evaluated	296.204	93.2%	297.899	93.0%	300.036	93.0%	302.940	93.0%

c. Deployment of Fixed Services and Mobile LTE

250. Figure G-3a shows deployment across all geographic areas for both fixed terrestrial 25 Mbps/3 Mbps services and 5 Mbps/1 Mbps mobile LTE. Overall, as of year-end 2017, approximately 306 million Americans, or 94% of the population are covered by both 25 Mbps/3 Mbps fixed terrestrial service and mobile LTE with a minimum advertised speed of 5 Mbps/1 Mbps, an increase from 92.2% in 2016.⁷⁹⁴ In rural areas, 75.3% of Americans are covered by both services, as opposed to 98.5% of Americans in urban areas, up from 68.6% and 97.9%, respectively, in 2016. On Tribal lands, 67.7% of Americans have coverage for both services, as opposed to 94% of the United States, up from 63.9% and 92.2%, respectively, in 2016. Figure G-3b shows deployment of fixed terrestrial speeds of 25 Mbps/3 Mbps and mobile LTE with median speed of 10 Mbps/3 Mbps. As of December 31, 2017, approximately 261 million Americans live in geographic areas covered by both services, an increase of 10.4 million Americans since 2016.

⁷⁹³ The analyses in Figures G-2a, G-3a and G-3c include all areas of the United States. In contrast, the analyses in Figures G-2b, G-3b and G-3d 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 Figures G-2b, G-3b, and G-3d because we have concerns with the representativeness 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 these figures is the population evaluated for the reported time period and the percentage is the percentage of the U.S. population evaluated. Accordingly, the 302.94 population evaluated figure for 2017 in Figure G-2b represents 92% of the overall population in the 50 U.S. states (i.e., $302.94/325.716=0.93$). Regardless of our deployment estimates for mobile LTE with a median speed of 10 Mbps/3 Mbps, Americans residing in the counties without sufficient Ookla data to create a statistically significant county sample to be included in Figures G-2b, G-3b, and G-3d, receive minimum advertised or expected speeds of 5 Mbps/1 Mbps, and likely receive mobile services with speeds higher than 5 Mbps/1 Mbps.

⁷⁹⁴ The results reported for 2013 are based upon SBI data for mobile services at *maximum* advertised speeds of 6 Mbps/768 kbps as compared to the Form 477 data which are based on *minimum* advertised speeds of 5 Mbps/1 Mbps.

Fig. G-3a

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE Based on Minimum Advertised Speed of 5 Mbps/1 Mbps

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	261.977	83.0%	283.417	89.1%	286.447	89.4%	297.304	92.2%	306.055	94.0%
Rural Areas	27.776	45.5%	36.517	59.2%	37.366	60.0%	43.164	68.6%	48.021	75.3%
Urban Areas	234.200	92.0%	246.900	96.3%	249.081	96.5%	254.141	97.9%	258.034	98.5%
Tribal Lands	1.385	35.5%	2.212	56.2%	2.258	57.0%	2.550	63.9%	2.720	67.7%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

Fig G-3b

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE with a Median Speed of 10 Mbps/3 Mbps

	2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	221.255	74.7%	229.918	77.2%	250.494	83.5%	260.927	86.1%
Rural Areas	22.637	48.8%	22.284	48.0%	25.411	54.0%	27.185	57.2%
Urban Areas	198.617	79.5%	207.635	82.6%	225.082	89.0%	233.743	91.5%
Pop. Evaluated	296.204	93.2%	297.899	93.0%	300.036	93.0%	302.940	93.0%

251. Figure G-3c reports deployment of fixed terrestrial 25 Mbps/3 Mbps service *or* mobile LTE with a minimum advertised speed of 5 Mbps/1 Mbps and shows that services are deployed to approximately 100% of the American population as of year-end 2017. Figure G-3d shows that approximately 298 million Americans, or approximately 98.5% of the population in the evaluated areas are covered by either 25 Mbps/3 Mbps fixed terrestrial service or Mobile LTE with a median speed of 10 Mbps/3 Mbps.

Fig. G-3c

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services or Mobile LTE Based on Minimum Advertised Speed of 5 Mbps/ 1 Mbps

Area	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	310.521	98.4%	316.366	99.5%	319.386	99.7%	321.809	99.8%	325.391	99.9%
Rural Areas	56.345	92.3%	60.148	97.6%	61.397	98.6%	62.242	98.9%	63.472	99.5%

Area	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Urban Areas	254.176	99.9%	256.218	100.0%	257.989	100.0%	259.567	100.0%	261.919	100.0%
Tribal Lands	3.449	88.3%	3.664	93.2%	3.753	94.7%	3.816	95.6%	3.907	97.3%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

Fig. G-3d

Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services or Mobile LTE with a Median Speed of 10 Mbps/3 Mbps

	2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%
United States	288.119	97.3%	290.258	97.4%	294.341	98.1%	298.449	98.5%
Rural Areas	40.332	86.9%	40.612	87.4%	42.192	89.7%	43.652	91.8%
Urban Areas	247.787	99.2%	249.646	99.3%	252.149	99.7%	254.796	99.8%
Pop. Evaluated	296.204	93.2%	297.899	93.0%	300.036	93.0%	302.940	93.0%

d. Additional Deployment Estimates

252. Figure G-4 shows deployment of fixed terrestrial services at various speed tiers since 2013.⁷⁹⁵ As of December 2017, fixed terrestrial service of 10 Mbps/1 Mbps is deployed to 97% of all Americans, up from 96% in 2016, and deployment of fixed terrestrial 50 Mbps/5 Mbps service is deployed to 92% of the population, up from 91% in 2016. From 2016 to 2017, the deployment of 100 Mbps/10 Mbps increased from 75.5% to over 89% of the population, and the deployment of 250 Mbps/25 Mbps increased from 42.2% to 63% of the population. Deployment in rural areas and on Tribal lands lags behind deployment in urban areas at all five speed tiers, but the data show year-over-year improvements for all speeds in these areas.

⁷⁹⁵ We present deployment estimates for all fixed services including satellite broadband in an appendix. *See infra* Broadband Deployment Appendix D-6 (Deployment (Millions) of Fixed Services at Different Speed Tiers (2014-2017)).

Fig. G-4

Deployment (Millions) of Fixed Terrestrial Services at Different Speed Tiers

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
10 Mbps/1 Mbps										
United States	294.244	93.2%	297.826	93.7%	303.201	94.7%	309.614	96.0%	316.811	97.3%
Rural Areas	42.573	69.7%	46.219	75.0%	48.942	78.6%	52.767	83.9%	56.934	89.3%
Urban Areas	251.671	98.9%	251.608	98.2%	254.258	98.5%	256.847	98.9%	259.878	99.2%
Tribal Lands	2.622	67.1%	2.709	68.9%	2.970	74.9%	3.264	81.8%	3.329	82.9%
25 Mbps/ 3 Mbps										
United States	263.971	83.6%	284.277	89.4%	286.911	89.6%	297.766	92.3%	306.329	94.0%
Rural Areas	29.077	47.6%	37.202	60.4%	37.795	60.7%	43.604	69.3%	48.289	75.7%
Urban Areas	234.893	92.3%	247.075	96.4%	249.116	96.5%	254.162	97.9%	258.040	98.5%
Tribal Lands	1.449	37.1%	2.250	57.2%	2.289	57.8%	2.578	64.6%	2.731	68.0%
50 Mbps/5 Mbps										
United States	187.416	59.4%	270.771	85.2%	282.364	88.2%	292.804	90.8%	300.469	92.2%
Rural Areas	15.571	25.5%	32.127	52.1%	34.831	55.9%	40.252	64.0%	43.980	69.0%
Urban Areas	171.844	67.5%	238.644	93.1%	247.533	95.9%	252.552	97.3%	256.489	97.9%
Tribal Lands	1.161	29.7%	1.919	48.8%	2.116	53.4%	2.328	58.3%	2.465	61.4%
100 Mbps/10 Mbps										
United States	165.184	52.3%	201.905	63.5%	214.355	66.9%	243.648	75.5%	290.878	89.3%
Rural Areas	12.568	20.6%	16.484	26.7%	19.934	32.0%	25.998	41.3%	39.154	61.4%
Urban Areas	152.616	60.0%	185.422	72.3%	194.421	75.3%	217.651	83.8%	251.724	96.1%
Tribal Lands	1.058	27.1%	1.320	33.6%	1.669	42.1%	1.858	46.5%	2.202	54.8%
250 Mbps/ 25 Mbps										
United States	NA	NA	15.674	4.9%	67.912	21.2%	136.091	42.2%	205.232	63.0%
Rural Areas	NA	NA	2.020	3.3%	5.460	8.8%	9.728	15.5%	23.866	37.4%
Urban Areas	NA	NA	13.654	5.3%	62.452	24.2%	126.363	48.7%	181.367	69.2%
Tribal Lands	NA	NA	0.047	1.2%	0.276	7.0%	1.306	32.7%	1.621	40.3%
Pop. Evaluated	315.596	100.0%	317.954	100.0%	320.289	100.0%	322.518	100.0%	325.716	100.0%

253. Figure G-5 presents deployment data for fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE service with a speed of at least 5 Mbps/1 Mbps from 2013 through 2017 for the U.S.

Territories.⁷⁹⁶ As of 2017, Puerto Rico and the U.S. Virgin Islands accounted for over 92% of the population in the U.S. Territories. The data suggest that as of December 2017, 85.9% of Americans in the U.S. Territories were covered by 25 Mbps/3 Mbps fixed terrestrial service and 5 Mbps/1 Mbps mobile LTE, which represented an increase of approximately 20 percentage points since 2013. The 2017 data may significantly overstate current deployment in the U.S. Territories, however, given the deployment data provided by providers do not appear to reflect infrastructure damage caused by Hurricanes Maria and Irma in 2017 even though the December 2017 data postdates the hurricanes and should reflect such damage. Aside from the potential impact of the hurricanes, there appear to be anomalies in the underlying data presented in Figure G-5.⁷⁹⁷ Thus, the changes in reported deployment in the Form 477 data may not reflect actual changes in deployment.

Fig. G-5

Deployment (Millions) in U.S. Territories of Terrestrial Fixed 25 Mbps/3 Mbps Services and Mobile LTE Based on Minimum Advertised Speed of 5 Mbps/1 Mbps

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Fixed Terrestrial 25 Mbps/3 Mbps Fixed										
U.S. Territories	2.627	66.2%	3.217	82.4%	2.368	61.5%	3.151	83.2%	3.192	85.9%
Rural Areas	0.218	85.5%	0.135	53.5%	0.095	38.1%	0.143	57.9%	0.151	61.6%
Urban Areas	2.409	64.9%	3.082	84.4%	2.273	63.1%	3.008	85.0%	3.040	87.6%
Mobile LTE with a Speed of 5 Mbps/1 Mbps										
U.S. Territories	3.866	97.5%	3.762	96.3%	3.701	96.1%	3.717	98.2%	3.658	98.4%
Rural Areas	0.228	89.5%	0.226	89.4%	0.224	89.5%	0.230	93.0%	0.233	94.8%
Urban Areas	3.638	98.1%	3.537	96.8%	3.477	96.5%	3.487	98.6%	3.425	98.7%
Fixed Terrestrial 25 Mbps/3 Mbps and Mobile LTE with a Speed of 5 Mbps/1 Mbps										
U.S. Territories	2.576	65.0%	3.214	82.3%	2.365	61.4%	3.147	83.1%	3.188	85.8%
Rural Areas	0.199	78.0%	0.132	52.3%	0.093	37.0%	0.139	56.2%	0.148	60.3%
Urban Areas	2.377	64.1%	3.082	84.3%	2.272	63.1%	3.008	85.0%	3.040	87.6%
Fixed Terrestrial 25 Mbps/3 Mbps or Mobile LTE with a Speed of 5 Mbps/1 Mbps										
U.S. Territories	3.917	98.8%	3.766	96.4%	3.704	96.1%	3.722	98.3%	3.661	98.5%
Rural Areas	0.247	97.0%	0.229	90.5%	0.227	90.5%	0.234	94.6%	0.236	96.2%
Urban Areas	3.669	98.9%	3.537	96.8%	3.477	96.5%	3.488	98.6%	3.425	98.7%
Pop. Evaluated	3.965	100.0%	3.906	100.0%	3.853	100.0%	3.786	100.0%	3.716	100.0%

⁷⁹⁶ We present additional deployment data on the territories in an Appendix. *See infra* Broadband Deployment Appendix D-2 (Deployment of Fixed Terrestrial 25 Mbps/3 Mbps Services and/or Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps in the U.S. Territories).

⁷⁹⁷ For instance, the data in 2015 appears to show a significant drop in deployment for fixed and mobile services that is not continued in 2016.

4. Demographic Data

254. Figures G-6 and G-7 compare the available demographic data for Americans with and without coverage to fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE.⁷⁹⁸ Figure G-6 presents this analysis for the United States as a whole, urban areas, rural areas, and Tribal lands for fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE with a minimum advertised speed of 5 Mbps/1 Mbps in 2017.⁷⁹⁹ The data show that generally, Americans in areas where these services are deployed typically live in census block groups with a lower percentage of households living in poverty, and with higher average populations, population densities, per capita incomes, and median household incomes than Americans living in areas without coverage by these services.

Fig. G-6

Comparison of Demographic Data Between Areas Where Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps Have Been Deployed and Where These Services Have Not Been Deployed (As of December 31, 2017)

	Average Population	Average Population Density	Average Per Capita Income (\$2016)	Average Median Household Income (\$2016)	Average Poverty Rate
United States (All Areas)					
With Deployment	1,509.0***	7,427.5***	\$30,630.91***	\$62,736.45***	15.0%***
Without Deployment	1,424.3	992.4	\$25,120.07	\$50,134.57	16.0%
U.S. Rural Areas					
With Deployment	1,418.4***	190.9***	\$29,437.85***	\$60,089.63***	11.5%***
Without Deployment	1,333.7	74.6	\$25,151.72	\$50,275.08	14.7%
U.S. Urban Areas					
With Deployment	1,520.1***	8,318.1***	\$30,777.72***	\$63,066.05***	15.5%***
Without Deployment	1,644.1	3,217.8	\$25,042.81	\$49,782.62	19.2%
Tribal Lands					
With Deployment	1,351.4	2,170.3***	\$25,461.83***	\$49,535.37***	17.2%***

⁷⁹⁸ To compare the demographic data between areas where these 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 aggregation can result in census blocks being grouped together that may not be uniformly deployed or be uniformly categorized as urban, rural, or on Tribal lands. We designate a census block group as without deployment if more than 5% of the population in the census block group is without services; 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, and 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. Population Density is the total population residing in the census block group divided by the square miles of land in the census block group. The estimate of land area is based upon the 2010 Census. We use the American Community Survey (ACS) Five-Year Estimates 2012–2016 for income and poverty measures. Per capita income and median household income in the past twelve months are measured in 2016 Inflation-Adjusted Dollars. The poverty rate is the proportion of households living below the poverty level.

⁷⁹⁹ We provide more granular state-by-state and county-by-county deployment information in an Appendix. See *infra* Broadband Deployment Appendix D-3.

	Average Population	Average Population Density	Average Per Capita Income (\$2016)	Average Median Household Income (\$2016)	Average Poverty Rate
Without Deployment	1,359.7	244.9	\$21,197.64	\$43,858.52	20.9%
Tribal Rural Areas					
With Deployment	1,334.3	178.4***	\$24,756.76***	\$49,302.17***	17.0%***
Without Deployment	1,345.1	76.9	\$21,452.79	\$44,185.76	20.5%
Tribal Urban Areas					
With Deployment	1,355.4	2,643.4***	\$25,626.78***	\$49,589.85***	17.3%***
Without Deployment	1,417.4	904.7	\$20,199.10	\$42,570.14	22.6%
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 a superscript: 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.					

255. Figure G-7 compares the available demographic data across urban and rural areas for Americans with and without coverage by both fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE service with a median speed of 10 Mbps/3 Mbps in 2017.⁸⁰⁰ Like Figure G-6, Figure G-7 shows that Americans living in areas where these services are deployed typically live in census block groups where there is a lower percentage of households living in poverty, and where there are higher average populations, population densities, per capita incomes, and median household incomes.

Fig. G-7

Comparison of Demographic Data Between Areas Where Fixed Terrestrial 25 Mbps/3 Mbps Services and Mobile LTE with a Median Speed of 10 Mbps/3 Mbps Has Been Deployed and Where These Services Have Not Been Deployed (As of December 31, 2017)

	Average Population	Average Population Density	Average Per Capita Income (\$2016)	Average Median Household Income (\$2016)	Average Poverty Rate
United States (All Areas)					
With Deployment	1,530.4***	8,313.9***	\$31,627.62***	\$65,047.18***	14.6%***
Without Deployment	1,430.7	1,591.3	\$25,489.18	\$51,213.31	16.3%
U.S. Rural Areas					
With Deployment	1,424.9***	189.8***	\$31,426.04***	\$65,372.88***	10.1%***
Without Deployment	1,300.2	98.5	\$26,379.11	\$53,263.10	13.6%
U.S. Urban Areas					
With Deployment	1,539.0***	8,978.6***	\$31,644.09***	\$65,020.27***	15.0%***

⁸⁰⁰ As is the case with other 10 Mbps/3 Mbps Ookla data for Tribal lands, we do not report results because of concerns with the representativeness of the Ookla data for these areas. See *supra* Section II.G.3.b.

	Average Population	Average Population Density	Average Per Capita Income (\$2016)	Average Median Household Income (\$2016)	Average Poverty Rate
Without Deployment	1,565.3	3,131.8	\$24,569.35	\$49,052.07	19.1%

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 a superscript: The absence of a star indicates no statistical difference between the reported figures. A * 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.

256. Figure G-8 shows, for 2017, how the average proportion of the population with coverage by fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE service with a minimum advertised speed of 5 Mbps/1 Mbps varies with census block group-level median household income, census block group-level population density, and census block group-level poverty rate.⁸⁰¹ On average, deployment is highest in census block groups with the highest median household income, the highest population density and the lowest poverty rate.

Fig. G-8

Average Percentage of Population with Fixed Terrestrial 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps by Census Block Group Level Demographic Variable (As of December 31, 2017)

	Fixed	Mobile LTE	Both Fixed and Mobile LTE
Median Household Income			
First Quartile (Lowest Median Household Income)	91.9%	99.5%	91.6%
Second Quartile	90.5%	99.6%	90.3%
Third Quartile	93.2%	99.8%	93.1%
Fourth Quartile (Highest Median Household Income)	97.9%	100%	97.9%
Population Density			
First Quartile (Lowest Pop. Density)	76.9%	98.9%	76.4%
Second Quartile	97.8%	100%	97.8%
Third Quartile	99.1%	100%	99.1%
Fourth Quartile (Highest Pop. Density)	99.2%	100%	99.2%
Household Poverty Rate			
First Quartile (Lowest Poverty Rate)	96.2%	99.9%	96.1%
Second Quartile	93.1%	99.8%	93.0%
Third Quartile	91.1%	99.6%	90.9%
Fourth Quartile (Highest Poverty Rate)	93.1%	99.6%	92.9%

⁸⁰¹ We present these results at the census block group, the smallest geographic areas for which income data is available, to accurately examine how the deployment rate varies with income measures in the geographic area.

257. Figure G-9 shows, for 2017, how the average proportion of the population with coverage of fixed terrestrial services by speed tier varies with census block-level median household income, census block-level population density, and census block-level poverty rate. On average, deployment is highest in census block groups with the highest median household income, the highest population density and the lowest poverty rate.

Fig. G-9

Average Percentage of Population with Fixed Terrestrial Services by Census Block Group Level Demographic Variable (As of December 31, 2017)

	10 Mbps/ 1 Mbps	25 Mbps/ 3 Mbps	50 Mbps/ 5 Mbps	100 Mbps/ 10 Mbps	250 Mbps/ 25 Mbps
Median Household Income					
First Quartile (Lowest Median Household Income)	96.1%	91.9%	90.2%	86.1%	54.9%
Second Quartile	95.8%	90.5%	88.0%	83.9%	55.9%
Third Quartile	97.2%	93.2%	90.8%	87.8%	62.7%
Fourth Quartile (Highest Median Household Income)	99.0%	97.9%	97.0%	95.8%	76.5%
Population Density					
First Quartile (Lowest Pop. Density)	89.8%	76.9%	71.0%	63.6%	38.6%
Second Quartile	99.0%	97.8%	96.8%	93.6%	62.8%
Third Quartile	99.5%	99.1%	98.7%	97.5%	70.7%
Fourth Quartile (Highest Pop. Density)	99.5%	99.2%	99.1%	98.6%	77.6%
Poverty Rate					
First Quartile (Lowest Poverty Rate)	98.3%	96.2%	94.8%	93.0%	71.5%
Second Quartile	97.1%	93.1%	91.0%	88.0%	63.0%
Third Quartile	96.1%	91.1%	88.8%	84.9%	57.6%
Fourth Quartile (Highest Poverty Rate)	96.6%	93.1%	91.4%	87.9%	58.1%

5. Tribal Lands Data

258. In Figures G-10 and G-11 we present additional deployment estimates for Americans living on Tribal lands by Tribal lands category.⁸⁰² The Commission’s data indicate that deployment in rural Tribal lands continue to lag deployment in urban Tribal lands.

⁸⁰² We group tribal lands as designated by their 2010 census block delineations. Alaskan Villages include census blocks that are designated as Alaskan Native village statistical areas. Hawaiian Home Lands include census blocks that were established by the Hawaiian Homes Commission Act of 1921. Tribal Statistical areas are Statistical American Indian areas. These are 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). The Lower 48 States category includes census blocks designated as: (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

(continued....)

259. Figure G-10 presents deployment on Tribal lands from 2013 to 2017 of both fixed terrestrial 25 Mbps/3 Mbps services and mobile LTE service with a speed of at least 5 Mbps/1 Mbps. Overall, in 2017, 67.7% of Tribal lands are covered by fixed terrestrial 25 Mbps/3 Mbps services and mobile LTE with a speed of 5 Mbps/1 Mbps based on Form 477 data. Rural Tribal lands continue to lag behind urban Tribal lands, with only 45.6% of all Tribal lands in rural areas having deployment of both services, as compared to 91.6% of Tribal lands in urban areas.

Fig. G-10

Deployment (Millions) on Tribal Lands of Fixed 25 Mbps/3 Mbps Fixed Terrestrial Services and Mobile LTE Services with a Minimum Advertised Speed of 5 Mbps/1 Mbps

	2013		2014		2015		2016		2017	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
Tribal Lands	1.385	35.5%	2.212	56.2%	2.258	57.0%	2.550	63.9%	2.720	67.7%
Rural Areas	0.283	14.1%	0.597	29.5%	0.614	30.1%	0.845	40.9%	0.951	45.6%
Urban Areas	1.102	57.9%	1.615	84.5%	1.644	85.6%	1.705	88.5%	1.768	91.6%
Alaskan Villages	0.071	28.2%	0.113	44.4%	0.110	42.7%	0.135	51.5%	0.151	57.0%
Rural Areas	0.021	13.1%	0.042	25.8%	0.039	23.7%	0.061	36.2%	0.073	42.4%
Urban Areas	0.050	54.9%	0.071	77.4%	0.071	76.7%	0.074	79.0%	0.079	83.3%
Hawaiian Homelands	0.029	90.6%	0.032	96.9%	0.030	88.9%	0.030	88.6%	0.030	89.4%
Rural Areas	0.002	45.0%	0.005	83.0%	0.002	43.9%	0.002	43.5%	0.003	47.7%
Urban Areas	0.027	99.4%	0.027	99.8%	0.027	98.0%	0.027	98.0%	0.027	98.2%
Lower 48 States	0.321	30.0%	0.419	38.8%	0.452	41.5%	0.493	44.6%	0.598	53.5%
Rural Areas	0.134	18.9%	0.185	25.8%	0.207	28.4%	0.234	31.6%	0.314	41.7%
Urban Areas	0.187	51.9%	0.233	64.8%	0.245	67.8%	0.259	71.2%	0.284	78.1%
Tribal Statistical Areas	0.964	37.8%	1.648	64.2%	1.666	64.5%	1.892	73.0%	1.940	74.6%
Rural Areas	0.126	11.2%	0.365	32.1%	0.365	32.0%	0.547	47.6%	0.562	48.6%
Urban Areas	0.838	58.8%	1.283	89.7%	1.301	90.3%	1.345	93.3%	1.378	95.4%
Pop. Evaluated	3.905	100%	3.933	100%	3.964	100%	3.991	100%	4.017	100%

260. In Figure G-11 we present deployment estimates for fixed terrestrial 25 Mbps/3 Mbps service and mobile LTE service with a speed of at least 5 Mbps/1 Mbps on Tribal lands. As of December 31, 2017, fixed terrestrial 25 Mbps/3 Mbps services is deployed to 68% of Americans on Tribal Lands, 97% are covered by mobile LTE 5 Mbps/1 Mbps and 67.7% of Americans on Tribal lands are covered by both services. The figures show variability in deployment across the Tribal lands categories, with the least deployment occurring in Alaskan Villages and the Lower 48 states.

(Continued from previous page) _____

American Indian area consisting of off-reservation trust land only. We present more granular state-by-state Tribal lands data in an appendix. See *infra* Broadband Deployment Appendix D-4 (Deployment of Fixed Terrestrial 25 Mbps/3 Mbps Services and/or Mobile LTE with a Minimum Advertised Speed of 5 Mbps/1 Mbps on Tribal Lands by State).

Fig. G-11

**Deployment (Millions) of Fixed Terrestrial 25 Mbps/3 Mbps Services and/or Mobile LTE
with a Minimum Advertised Speed of 5 Mbps/1 Mbps on Tribal Lands**

(As of December 31, 2017)

	Total Pop.	Fixed 25 Mbps/3 Mbps		Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps and Mobile LTE 5 Mbps/1 Mbps		Fixed 25 Mbps/3 Mbps or Mobile LTE 5 Mbps/1 Mbps	
		Pop.	%	Pop.	%	Pop.	%	Pop.	%
Tribal Lands	4.017	2.731	68.0%	3.896	97.0%	2.720	67.7%	3.907	97.3%
Alaskan Villages	0.265	0.154	58.0%	0.197	74.3%	0.151	57.0%	0.200	75.4%
Hawaiian Homelands	0.034	0.030	89.4%	0.034	99.9%	0.030	89.4%	0.034	99.9%
Lower 48 States	1.117	0.607	54.3%	1.069	95.7%	0.598	53.5%	1.078	96.5%
Tribal Statistical Areas	2.601	1.941	74.6%	2.596	99.8%	1.940	74.6%	2.596	99.8%

6. Adoption Data

261. We also include an assessment of adoption because adoption of services is necessarily a lower bound on fixed deployment.⁸⁰³ We report adoption rates based upon data as of December 2013 to December 2017. The reported adoption rates are the ratio of residential Form 477 data subscriptions to fixed terrestrial services at the designated speed divided by the total number of households in the area where our Form 477 deployment data indicated that fixed terrestrial services are deployed.⁸⁰⁴

262. Figure G-12 shows the overall adoption rates,⁸⁰⁵ using Form 477 subscribership data, from 2013 through 2017 for fixed terrestrial services for the U.S. as a whole, urban and non-urban core

⁸⁰³ We present adoption data for each state and the District of Columbia in an Appendix. *See infra* Broadband Deployment Appendix D-5 (Overall Adoption Rate for Fixed Terrestrial Services by State and District of Columbia (2017)).

⁸⁰⁴ The subscriber data is reported for the census tract, not census block. Thus, we aggregate the deployment data up to the census tract. We calculate adoption rates for the following geographic areas: the U.S. as a whole, all urban core census tracts, all non-urban core census tracts, the county (or county equivalent), and for each state and the District of Columbia. 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. A census tract is designated Tribal lands if more than 50% of the land area is Tribal land.

⁸⁰⁵ We have insufficient information to determine the proportion of the population for which 50 Mbps/5 Mbps service is deployed prior to December 31, 2014. *See 2015 Report*, 30 FCC Rcd at 1413, para. 69 n.278. The reported adoption rates for 2014 to 2017 are based upon the Form 477 deployment data and subscriber data as of December 31, 2014, December 31, 2015, December 31, 2016, and December 31, 2017. The reported adoption rates for 2013 are based upon the SBI Deployment data as of December 31, 2013, and the Form 477 subscriber data as of December 31, 2013. For the 2013, a 768 kbps upload speed is used as a proxy for a 1 Mbps upload speed because this is the speed closest to 1 Mbps that was collected in the SBI data collection and the FCC’s Form 477 data collection during this time period. *See id.*, 30 FCC Rcd at 1413.

areas, and Tribal lands. The data show year-to-year increases across the vast majority of areas, including Tribal lands, for adoption of 10 Mbps/3 Mbps, 25 Mbps/3 Mbps, 50 Mbps/3 Mbps, 100 Mbps/10 Mbps, and 250 Mbps/25 Mbps fixed terrestrial services.⁸⁰⁶

Fig. G-12

Adoption Rates for Fixed Terrestrial Services

	2013	2014	2015	2016	2017
10 Mbps/1 Mbps					
United States	53.4%	56.0%	62.0%	66.2%	69.4%
Non-Urban Core Areas	48.9%	49.7%	55.4%	60.0%	63.0%
Urban Core Areas	56.7%	60.7%	67.0%	71.0%	74.6%
Tribal Lands	33.0%	35.5%	41.1%	42.2%	46.5%
Non-Urban Core Areas	28.9%	30.6%	34.6%	35.9%	40.8%
Urban Core Areas	41.6%	46.0%	56.8%	59.0%	62.3%
25 Mbps/3 Mbps					
United States	29.7%	38.5%	48.3%	53.3%	59.8%
Non-Urban Core Areas	28.5%	34.4%	43.5%	48.5%	54.5%
Urban Core Areas	30.4%	41.3%	51.5%	56.8%	63.9%
Tribal Lands	31.9%	27.2%	31.7%	32.7%	37.9%
Non-Urban Core Areas	27.8%	23.3%	28.5%	29.2%	34.5%
Urban Core Areas	36.6%	33.9%	37.1%	39.4%	45.1%
50 Mbps/ 5 Mbps					
United States	NA	24.8%	34.1%	44.2%	54.4%
Non-Urban Core Areas	NA	19.9%	28.1%	40.7%	50.0%
Urban Core Areas	NA	28.0%	38.0%	46.7%	57.7%
Tribal Lands	NA	22.6%	25.0%	28.2%	34.2%
Non-Urban Core Areas	NA	17.9%	20.4%	24.4%	30.8%
Urban Core Areas	NA	28.9%	32.0%	34.9%	40.5%
100 Mbps/10 Mbps					
United States	0.9%	11.2%	16.8%	19.2%	29.4%
Non-Urban Core Areas	0.8%	11.7%	16.7%	17.9%	26.5%
Urban Core Areas	0.9%	11.0%	16.9%	20.0%	31.3%
Tribal Lands	0.3%	7.1%	7.4%	10.6%	18.3%

⁸⁰⁶ Prior to the Commission's revision of the Form 477 data collection, which is reflected for the first time in the 2014 data, Form 477 filers did not report subscribers specifically at the 50 Mbps/5 Mbps or the 250 Mbps/25 Mbps service tiers. This does not indicate there were no subscribers to these services in 2013.

	2013	2014	2015	2016	2017
Non-Urban Core Areas	0.3%	7.4%	6.4%	9.9%	17.0%
Urban Core Areas	0.3%	6.8%	8.7%	11.6%	20.4%
250 Mbps/25 Mbps					
United States	NA	2.6%	4.2%	1.9%	3.8%
Non-Urban Core Areas	NA	3.0%	6.7%	2.4%	3.5%
Urban Core Areas	NA	2.3%	3.1%	1.6%	3.9%
Tribal Lands	NA	0.1%	1.4%	1.8%	4.4%
Non-Urban Core Areas	NA	0.1%	1.7%	2.2%	4.4%
Urban Core Areas	NA	0.0%	0.2%	1.5%	4.3%

263. Figure G-13 reports average county level overall adoption rates for fixed terrestrial services by speed tier 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. These data suggest that the average household adoption rate increases with median household income and population density, although the adoption rate decreases as the poverty rate and rural population rate increase.

Fig. G-13

**Average County Overall Adoption Rate for Fixed Terrestrial Services
by County Level Demographic Variable (As of December 31, 2017)**

	10 Mbps/ 1 Mbps	25 Mbps/ 3 Mbps	50 Mbps/ 5 Mbps	100 Mbps/ 10 Mbps	250 Mbps/ 25 Mbps
County Median Household Income (\$2016)					
First Quartile (Lowest Median Household Income)	33.6%	23.7%	22.2%	15.5%	1.8%
Second Quartile	42.4%	40.2%	28.8%	14.9%	3.8%
Third Quartile	48.7%	37.2%	32.7%	16.1%	4.3%
Fourth Quartile (Highest Median Household Income)	62.3%	52.8%	47.2%	22.8%	4.3%
County Population Density					
First Quartile (Lowest Population Density)	40.0%	25.6%	21.8%	9.6%	5.0%
Second Quartile	34.4%	33.8%	23.3%	11.2%	2.4%
Third Quartile	44.2%	36.4%	33.1%	20.9%	3.0%
Fourth Quartile (Highest Population Density)	68.3%	57.6%	51.7%	26.6%	4.4%
County Poverty Rate					
Fourth Quartile (Lowest Poverty Rate)	57.9%	47.0%	42.0%	20.6%	4.5%

	10 Mbps/ 1 Mbps	25 Mbps/ 3 Mbps	50 Mbps/ 5 Mbps	100 Mbps/ 10 Mbps	250 Mbps/ 25 Mbps
Third Quartile	48.5%	45.6%	33.7%	17.2%	3.8%
Second Quartile	45.1%	35.4%	33.1%	20.8%	4.3%
First Quartile (Highest Poverty Rate)	35.5%	25.8%	21.9%	10.8%	1.8%
County Rural Population Rate					
Fourth Quartile (Lowest Rural Population Rate)	67.1%	57.5%	51.4%	25.2%	5.2%
Third Quartile	48.1%	38.8%	34.7%	16.2%	2.8%
Second Quartile	36.4%	34.7%	24.5%	17.6%	2.8%
First Quartile (Highest Rural Population Rate)	35.3%	22.6%	19.5%	9.6%	3.4%

H. International Broadband Data Report

264. We next provide comparative international information on broadband services and, where possible, a year-to-year measure of the extent of broadband service capability in the United States and select communities and countries abroad.⁸⁰⁷ In this chapter, we present updated data and information on broadband service capability since the International Bureau released the *2018 Sixth IBDR* on February 2, 2018.⁸⁰⁸ In particular, we compare fixed and mobile broadband, including LTE speeds in the United States, with the selected countries. We assess whether there were indications of statistically significant changes in fixed and mobile broadband prices since the *2018 Sixth IBDR* by reviewing a smaller subset of eight countries. We include a comparison of high-speed fixed and mobile broadband deployment in the United States and in Europe. Finally, we present demographic, market, and other regulatory information relating to broadband service capability. We include the highlights of our findings in this chapter and present the detailed data sources and additional discussion in the relevant appendices.

1. Background

265. As part of its assessment in 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 utilized by the Commission to reflect different speed tiers.”⁸⁰⁹ We must choose international communities comparable to various communities in the United States with respect to population size, population density, topography, and demographic profile.⁸¹⁰ The Commission is required to include “a geographically diverse selection of countries” and “communities including the capital cities of such countries.”⁸¹¹ The Commission must “identify relevant similarities and differences in each community, including their market structures, the

⁸⁰⁷ 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.*

⁸⁰⁸ *International Comparison Requirements Pursuant to the Broadband Data Improvement Act; International Broadband Data Report*, Sixth Report, 33 FCC Rcd 978 (2018) (*2018 Sixth IBDR*).

⁸⁰⁹ 47 U.S.C. § 1303(b)(1).

⁸¹⁰ *Id.* § 1303(b)(2).

⁸¹¹ *Id.*

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.”⁸¹²

2. Discussion

266. *Selection of Countries for Comparison.* The 2018 Sixth IBDR selected 28 foreign countries⁸¹³ to meet the statutory directive of developing a geographically diverse set of countries for comparison with the United States concerning international broadband service capability.⁸¹⁴ Consistent with the 2018 Sixth IBDR, the same 28 foreign countries are used in this International Broadband Data Report (IBDR) for the comparison of broadband speed and demographics.⁸¹⁵ The countries selected in alphabetical order are Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Latvia, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, Sweden, Switzerland, and United Kingdom.⁸¹⁶ Maintaining the same set of countries for comparison will facilitate and enhance assessments of international broadband developments over time. For fixed and mobile broadband price comparison, we rely on a smaller subset of eight countries for our analysis. For the comparison of fixed high-speed and mobile broadband deployment, we rely on the 21 European countries (the “EU21”).

a. Broadband Speed Comparison

267. Based on our review of data on actual⁸¹⁷ fixed and mobile broadband speeds gathered by Ookla, fixed and mobile broadband speeds in the United States have improved over time compared to broadband speeds in the 28 comparison countries. We rank speeds from fastest (1st) to slowest (29th). The methodology for our broadband speed comparison is set forth in IB-Appendix B.

268. *Fixed Broadband Speed Results.* In 2017, the United States ranked 5th out of 29 countries (73.79 Mbps) in terms of actual download speeds—an improvement over 11th in 2016 (55.07 Mbps). Actual mean fixed download speeds in the United States increased by 34% from 2016 to 2017. With respect to the alternate speed measure, median weighted fixed download speeds, the United States ranked 5th in 2017 (73.99 Mbps), also an improvement over 11th in 2016 (55.44 Mbps) out of the 29 countries.

269. *Mobile Broadband Speed Results.* In 2017, the United States ranked 23rd (24.78 Mbps), an improvement over 25th in 2016 (19.97 Mbps) out of the 29 countries. Actual mean mobile download speeds in the United States increased by 24% from 2016 to 2017. With respect to the alternate measure, median weighted mobile download speeds, the United States ranked 23rd in 2017 (24.66 Mbps), also an improvement over 25th in 2016 (19.62 Mbps) out of 29 countries.

270. *Historical Overview of U.S. Fixed Broadband Speed.* The data from prior International Broadband Data Reports indicate that fixed speeds for the United States have been on a rising trend since 2012, and the U.S. rank among the selected countries has been on a rising trend since 2012.⁸¹⁸ Based on

⁸¹² *Id.* § 1303(b)(3).

⁸¹³ 2018 Sixth IBDR, 33 FCC Rcd 980-81, paras. 5-6.

⁸¹⁴ 47 U.S.C. § 1303(b)(2).

⁸¹⁵ See IB-Appendix A for the full list of countries examined.

⁸¹⁶ 2018 Sixth IBDR, 33 FCC Rcd 980-81, paras. 5-6.

⁸¹⁷ In this analysis, “actual speed” here refers to mean actual speed unless otherwise specified. The means are weighted by the number of tests performed in each city. See *id.* at 996, para. 2, n.4.

⁸¹⁸ The Fourth International Broadband Data Report and the Fifth International Broadband Data Report relied on Ookla speed data for 2012 to 2014 that consisted of daily speed test results for cities in a total of 40 countries (to

(continued....)

mean speed measurement, the United States ranked 25th fastest of 40 countries in 2012 (14.50 Mbps). The mean U.S. speed rank has since risen to 10th fastest of 29 countries in 2016 (55.07 Mbps) and 5th fastest of 29 countries in 2017 (73.79 Mbps).

b. Broadband Price Comparison

271. The 2018 *Sixth IBDR* examined in detail advertised broadband prices for fixed and mobile service plans in the United States and up to 28 countries.⁸¹⁹ Given the recent nature of that analysis, we limit the scope of our analysis here to whether there were indications of statistically significant changes in broadband prices since the 2018 *Sixth IBDR* by reviewing a smaller subset of eight countries, including the United States.⁸²⁰ Based on our analysis, we find statistically significant quality-adjusted price changes in four of the eight countries. The methodology for our broadband price comparison is set forth in IB-Appendix C.

272. *Fixed Broadband Statistical Test Pricing Results.* Based on our statistical test, we find that one of the eight countries (Germany) displays a statistically significant change in quality-adjusted fixed broadband prices from 2017 to 2018. In Germany, quality-adjusted prices have decreased. For the United States, we find a statistically insignificant decrease in quality-adjusted prices.

273. *Mobile Broadband Statistical Test Pricing Results.* We find that four of the eight countries (Denmark, Estonia, Germany, and South Korea) display a statistically significant change in quality-adjusted mobile broadband prices from 2017 to 2018. Of these four countries, quality-adjusted prices have decreased in Denmark, Estonia, Germany, and South Korea. For the United States, we find a statistically insignificant decrease in quality-adjusted prices.

c. High-Speed Broadband Deployment Comparison with Europe

274. Based on data gathered by the FCC and the European Commission (EC) in June 2016 and June 2017,⁸²¹ we observe that the United States has greater fixed high-speed and mobile LTE broadband coverage than Europe. This result is consistent with our longer term comparison of fixed deployment in the United States and the EU21 from 2012 to 2017. The methodology for our fixed high-speed and mobile LTE broadband deployment comparison is set forth in IB-Appendix D along with maps that show fixed high-speed broadband deployment in the United States and Europe.

275. *Fixed High-Speed Broadband, 2016-2017.* In the United States and the EU21, fixed high-speed broadband deployment increased from June 2016 to June 2017 with respect to all households.

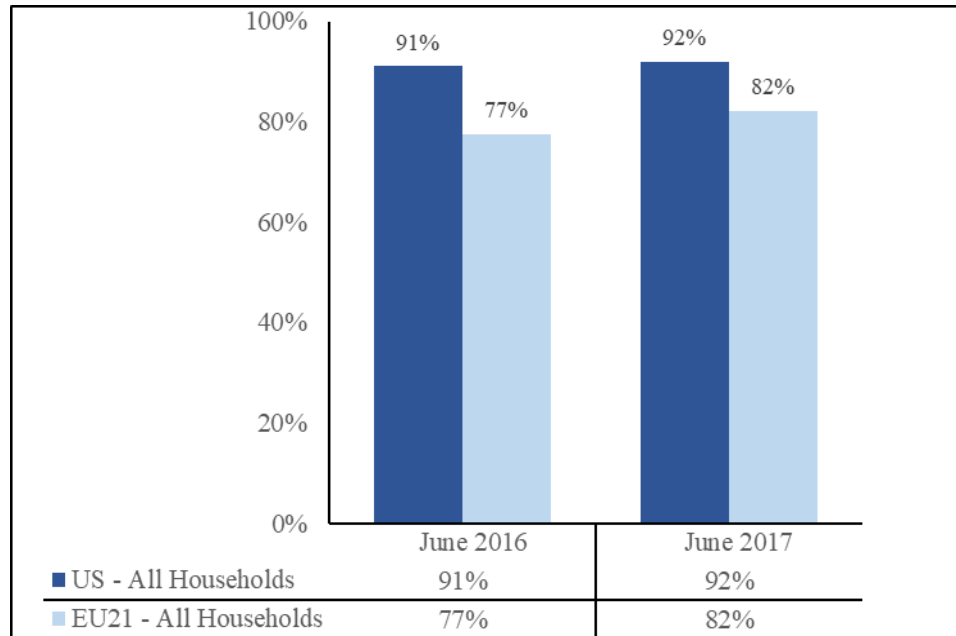
Fig. H-1 Fixed High-Speed Broadband Deployment All Households (June 2016)

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which we refer as the “previous methodology”). The 2018 *Sixth IBDR* relied on Ookla speed data for 2014 to 2016 that consist of city speed test results averaged up to the yearly level, which has far fewer observations than the previous methodology (new methodology). As in the 2018 *Sixth IBDR*, we here present: (1) speed data for 2012 to 2013 under the previous methodology; (2) speed data for 2015 to 2017 under the new methodology; and (3) speed data for 2014 under both methodologies. Additional discussion of these methodologies is provided in the 2018 *Sixth IBDR*. *Id.* at 1018-19, Appx. B, paras. 24-25.

⁸¹⁹ *Id.* at 1020, Appx. C, para. 1.

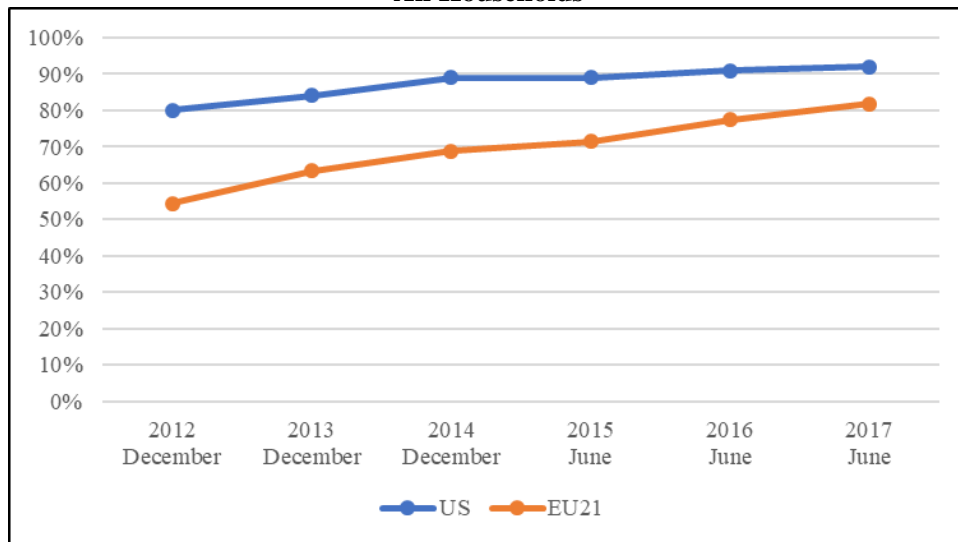
⁸²⁰ For fixed broadband, we collected advertised prices and terms for fixed broadband plans in the following countries and cities: Denmark (Copenhagen); Estonia (Tallinn); France (Paris); Germany (Berlin); Mexico (Mexico City and Guadalajara); South Korea (Seoul), United Kingdom (London), and the United States (Washington, D.C. and Los Angeles). Mobile broadband plans are collected at the national level.

⁸²¹ We assess deployment as of June 2017 and June 2016 to match the time period in the *EC Broadband Report*. European Commission, Broadband Coverage in Europe 2017 at 5 (2018) (*EC Broadband Report*), <https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2017>.



276. *Fixed High-Speed Broadband Historical Overview.* Our historical overview for 2012 to 2017 shows that the United States had higher deployment rates than the EU21 countries as a whole during the period both generally and separately in rural and non-rural areas.⁸²²

Fig. H-2
Fixed High-Speed Deployment
All Households



277. *Mobile LTE Broadband.* In the United States, mobile LTE coverage was already nearly ubiquitous as of June 2017, reaching almost 100% of all households and 99% of rural households.⁸²³ In the EU21, during the same period, mobile LTE coverage reached 98% of all households and 91% of rural

⁸²² See *id.* at Figs. 13-15.

⁸²³ See *id.* at Figs. 11-12.

households.

d. Demographics Dataset

278. In IB-Appendix E, we present updated data since the release of the *2018 Sixth IBDR* on the population size, population density, and other indicators such as gross domestic product (GDP) and educational attainment for the United States and the comparison countries and, in the aggregate, of almost 300 province/county communities. Based on OECD data, Denmark, Mexico, Norway, and Sweden demonstrated a 5% or greater increase from 2015 to 2016 in the percentage of households that have at least one subscription to access fixed and/or mobile broadband.⁸²⁴

e. Market and Regulatory Developments

279. Below, we discuss several new market and regulatory developments, including national broadband, satellite, and 5G developments.⁸²⁵ We limit our discussion to recent developments that occurred since the *2018 Sixth IBDR*, which identified the relevant similarities and differences between the United States and the 28 comparison countries with respect to multiple criteria.

280. *Market Developments.* In 2018, providers in a number of countries launched new broadband services through the deployment of additional broadband technologies.⁸²⁶ For example, in 2018, Shaw Communications in Canada, Unitymedia in Germany, Nos in Portugal, and Com Hem in Sweden launched new services offering broadband at higher speeds via DOCSIS 3.1.⁸²⁷ In April 2018, TalkTalk in the United Kingdom announced the launch of broadband connectivity with download speeds of up to 300 Mbps using DSL G.fast technology to new customers.⁸²⁸ In July 2018, Cosmote, Wind Hellas, and Vodafone in Greece launched commercial fiber-to-the-home services.⁸²⁹

⁸²⁴ OECD, *OECD.Stats: Regions and Cities (OECD Regions and Cities)*, <http://stats.oecd.org/> (last visited Oct. 29, 2018). We note that only Mexico and South Korea have updated their OECD data on households with broadband as of 2016 since the *2018 Sixth IBDR*, and that the OECD data do not include any data on household broadband penetration for 2017.

⁸²⁵ 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.”).

⁸²⁶ TeleGeography GlobalComms Database (*TeleGeography GlobalComms Database*), www.telegeography.com (last visited Sept. 28, 2018).

⁸²⁷ TeleGeography GlobalComms Database (last updated June 2018); Broadband Technology Report, *Shaw Launches 300 Mbps Tier Based on DOCSIS 3.1* (July 13, 2018), <https://www.broadbandtechreport.com/articles/2018/07/shaw-launches-300-mbps-tier-based-on-docsis-3-1.html>; TeleGeography, *Unitymedia Set for Bochum DOCSIS 3.1 Launch Next Month* (Apr. 27, 2018), <https://www.telegeography.com/products/commsupdate/articles/2018/04/27/unitymedia-set-for-bochum-docsis-3-1-launch-next-month/>; Andrew McDonald, *Unitymedia Launches 1 Gbps Broadband in Germany* (May 8, 2018), <https://www.digitaltveurope.com/2018/05/08/unitymedia-launches-1-gbps-broadband-in-germany/>; Stuart Thompson, *Half of NOS Subs Taking Convergence Products as TV Base Grows* (July 23, 2018), <https://www.digitaltveurope.com/2018/07/23/half-of-nos-subs-taking-convergence-products-as-tv-base-grows/>; TeleGeography, *Com Hem Launches a 1.2 Gbps Service* (Aug. 16, 2018), <https://www.telegeography.com/products/commsupdate/articles/2018/08/16/com-hem-launches-1-2gbps-service/>.

⁸²⁸ TeleGeography GlobalComms Database (last updated June 2018); TeleGeography, *TalkTalk Expands Availability of Its G.fast-Based Plans to All Customers* (Apr. 25, 2018), <https://www.telegeography.com/products/commsupdate/articles/2018/04/25/talktalk-expands-availability-of-its-g-fast-based-plans-to-all-customers/>.

⁸²⁹ TeleGeography GlobalComms Database (last updated June 2018); TeleGeography, *Cosmote Launches FTTH* (July 11, 2018), <https://www.telegeography.com/products/commsupdate/articles/2018/07/11/cosmote-launches-ftth/>;

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281. The use of Internet services such as online news, video on demand, voice and video calling, participating in social networks, or online shopping, has also grown in certain countries. For example, the proportion of Internet users in Ireland that read news online increased from 49% in 2016 to 65% in 2017.⁸³⁰ The proportion of Internet users in Austria that use video calls increased from 32% in 2016 to 42% in 2017.⁸³¹ The proportion of Internet users in Canada that shop online increased from 46% as of February 2016 to 52% as of March 2018.⁸³²

282. *National Broadband Developments.*⁸³³ Many countries continue to develop comprehensive digital agendas,⁸³⁴ increasingly with a view towards future applications and services such as 5G, the Internet of Things (IoT), and artificial intelligence (AI), as seen recently in Brazil⁸³⁵ and India,⁸³⁶ among others. For example, in March 2018, Latvia adopted a new Electronic Communications Sector Policy Plan 2018-2020, which incorporates common European Union (EU) gigabit broadband targets.⁸³⁷ Similarly, in April 2018, Denmark announced its Strategy for Denmark's Digital Growth,

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TeleGeography, *Wind Hellas Adds Fibre Services* (July 13, 2018),

<https://www.telegeography.com/products/commsupdate/articles/2018/07/13/wind-hellas-adds-fibre-services/>;

Telecompaper, *Vodafone Joins Greece FTTH Market* (July 13, 2018),

<https://www.telecompaper.com/news/vodafone-joins-greek-ftth-market--1252590>; Vodafone, *Vodafone Super Fiber*, <https://www.vodafone.gr/eshop/vodafone-home/vodafone-super-fiber/> (last visited Oct. 25, 2018).

⁸³⁰ See *id.*, Country Report Ireland at 7.

⁸³¹ See European Commission, Digital Single Market: Digital Economy & Society Index 2018, Country Report Austria at 6 (2018) (*DESI 2018*), <https://ec.europa.eu/digital-single-market/en/news/digital-economy-and-society-index-2018-report>.

⁸³² Canadian Internet Registration Authority (CIRA), CIRA Internet Factbook 2018 (2018),

[https://cira.ca/factbook/canada%E2%80%99s-internet-factbook-2018#section-1:2018 Sixth IBDR, 33 FCC Rcd at 1122, Appx. E, Tbl. 5](https://cira.ca/factbook/canada%E2%80%99s-internet-factbook-2018#section-1:2018%20Sixth%20IBDR,33%20FCC%20Rcd%20at%201122,Appx.E,Tbl.5).

⁸³³ Many countries continue to adopt national broadband plans to expand broadband access and use. According to the International Telecommunication Union (ITU), as of September 2018, 159 countries have national broadband plans. Broadband Commission for Sustainable Development, *The State of Broadband: Broadband Catalyzing Sustainable Development* at 35 (Sept. 2018) (*State of Broadband Report 2018*), https://www.itu.int/dms_pub/itu-s/opb/pol/S-POL-BROADBAND.19-2018-PDF-E.pdf. The United Nations' Broadband Commission for Sustainable Development "has set seven ambitious yet achievable 2025 targets in support of 'Connecting the Other Half' of the world's population," 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. Press Release, ITU, UN Broadband Commission Sets Global Broadband Targets to Bring Online the World's 3.8 Billion Not Connected to the Internet (Jan. 23, 2018), <https://www.itu.int/en/mediacentre/Pages/2018-PR01.aspx>.

⁸³⁴ Broadband Commission for Sustainable Development, *The State of Broadband: Broadband Catalyzing Sustainable Development* at 44 (Sept. 2017) (*State of Broadband Report 2017*), https://www.itu.int/dms_pub/itu-s/opb/pol/S-POL-BROADBAND.18-2017-PDF-E.pdf; see also OECD, OECD Digital Economy Outlook 2017 at 34 (2017) (noting that "[national digital strategies] have become the norm across OECD countries") (*OECD Report 2017*), <http://www.oecd.org/internet/oecd-digital-economy-outlook-2017-9789264276284-en.htm>.

⁸³⁵ Ministry of Sci., Tech., Innovation & Comm'n, *Estratégia Brasileira Para A Transformação Digital (E-Digital)* (2018), <http://www.mctic.gov.br/mctic/export/sites/institucional/estrategiadigital.pdf>.

⁸³⁶ Dep't of Telecomm., *Draft National Digital Communications Policy 2018* (2018), http://dot.gov.in/sites/default/files/2018%2005%2025%20NDCP%202018%20Draft%20for%20Consultation_0.pdf.

⁸³⁷ Euro. Comm'n, *Digital Single Market: Country Information – Latvia*, <https://ec.europa.eu/digital-single-market/en/country-information-latvia> (last visited Oct. 24, 2018). 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 Euro. Comm'n, *Digital Single Market: Connectivity for a European*

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which seeks to leverage broadband infrastructure to position Denmark as a digital frontrunner in new technologies.⁸³⁸ Meanwhile, in October 2018, Ireland launched a public consultation for a new National Digital Strategy, which will update a previous policy from 2013.⁸³⁹ Likewise, New Zealand is currently engaging with stakeholders to develop a digital government strategy to replace the Government ICT Strategy 2015.⁸⁴⁰

283. *Satellite Developments.* Many countries are also increasingly recognizing the possible impact of innovative satellite technologies, such as non-geostationary orbit (NGSO) constellations, in the provision of broadband services, particularly in rural and remote areas.⁸⁴¹ In March 2018, the Commission authorized SpaceX to provide broadband satellite services, the first approval of a U.S.-licensed satellite constellation to provide broadband services using a new generation of low-Earth orbit (LEO) satellite technologies.⁸⁴² In recent years, the Commission has authorized a number of NGSO FSS systems designed to deliver broadband services, such as OneWeb, Space Norway, and Telesat.⁸⁴³ These approvals enable these systems to pursue their plans of expanding broadband to communities across the United States.

284. Other regulators are likewise examining how best to deploy this new generation of satellite technologies, both independently and collectively. In October 2018, for example, the UK Space Agency introduced a pre-application licensing scheme, the Traffic Light System (TLS), which will provide prospective satellite operators (particularly new operators) with a more tailored, streamlined regulatory process.⁸⁴⁴ In June 2018, the Australian Communications and Media Authority (ACMA) closed the public consultation on its draft Five-Year Spectrum Outlook 2018-2022 and among other topics, the ACMA solicited stakeholder input on its proposed efforts to support the deployment of novel satellite systems.⁸⁴⁵ Similarly, as of March 2018, the Swedish Post and Telecom Authority (PTS) has been considering possible new license exceptions in several frequency bands for mobile satellite systems

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Gigabit Society, <https://ec.europa.eu/digital-single-market/en/policies/improving-connectivity-and-access> (last visited Oct. 24, 2018).

⁸³⁸ Ministry of Indus., Bus. & Fin. Affairs, Strategy for Denmark's Digital Growth (2018), <https://em.dk/english/publications/2018/strategy-for-denmarks-digital-growth>.

⁸³⁹ Dep't of the Taoiseach, *Public Consultation on Ireland's New National Digital Strategy*, https://www.taoiseach.gov.ie/DOT/eng/Publications/Publications_2018/Public_Consultation_on_Ireland%E2%80%99s_new_National_Digital_Strategy.html (last visited Oct. 24, 2018).

⁸⁴⁰ New Zealand Gov't, *Progress Towards a Digital Government Strategy*, <https://www.digital.govt.nz/digital-government/strategy/progress-towards-a-digital-government-strategy/> (last visited Oct. 24, 2018).

⁸⁴¹ See Chapter III.F.4; *State of Broadband Report 2017* at 34-38.

⁸⁴² Press Release, FCC, FCC Authorizes SpaceX to Provide Broadband Satellite Service (Mar. 29, 2018), <https://www.fcc.gov/document/fcc-authorizes-spacex-provide-broadband-satellite-services>; *Space Exploration Holdings, LLC; Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System; Application For Approval For Orbital Deployment And Operating Authority for the SpaceX GNSO Satellite System Supplement*, Memorandum Opinion, Order and Authorization, FCC 18-38 (Mar. 29, 2018).

⁸⁴³ See, e.g., *WorldVu Satellites Limited; Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, 32 FCC Rcd 5366, 5366 (2017); *Space Norway AS; Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission*, Order and Declaratory Ruling, 32 FCC Rcd 9649 (2017); *Telesat Canada, Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's NGSO Constellation*, Order and Declaratory Ruling, 32 FCC Rcd 9663 (2017).

⁸⁴⁴ UK Space Agency, *Modern Regulation to Support UK's Growing Space Sector* (Oct. 1, 2018), <https://www.gov.uk/government/news/modern-regulation-to-support-uks-growing-space-sector>.

⁸⁴⁵ Australian Commc'ns & Media Auth., *Draft Five-Year Spectrum Outlook 2018-2022*, <https://www.acma.gov.au/theACMA/draft-five-year-spectrum-outlook-2018-22> (last visited Aug. 21, 2018).

(among other technologies).⁸⁴⁶ At the pan-European level, in July 2018, CEPT's Electronic Communications Committee (ECC) approved a regulatory framework for the harmonized use of Earth Stations in Motion (ESIM) operating with NGSO fixed satellite service (FSS) in the 10.7-12.75 GHz and 14.0-14.5 GHz bands.⁸⁴⁷

285. *5G Developments.* 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 development efforts vary across countries. The Commission's 5G strategy encompasses a forward-looking spectrum policy, modern infrastructure policy and market-based network regulation, reducing unnecessary barriers to the investment and deployment of next generation wireless networks.⁸⁴⁸ Some countries and regions have developed or are developing 5G plans that cover a range of policy initiatives, such as the European Commission's 2016 5G Action Plan, and Chile's July 2018 consultation to develop a national 5G plan.⁸⁴⁹ Additionally, as part of Europe's Digital Single Market Strategy and reform of its Electronic Communications Code, the European Commission is aiming to stimulate infrastructure investment and streamline procedures to facilitate the deployment of small cells, which the EC defines as small size mobile base stations that can reach several meters.⁸⁵⁰

286. The United States has taken steps to make available low-, mid-, and high-band spectrum for next-generation wireless networks. With respect to low-band spectrum, in 2017, the Commission completed a first-of-its-kind two-part incentive auction to repurpose 84 megahertz of spectrum in the 600 MHz band, laying the groundwork for 5G applications and services.⁸⁵¹ In terms of mid-band spectrum, in July 2018, the Commission adopted a Notice of Proposed Rulemaking identifying new opportunities for flexible use in up to 500 megahertz of spectrum between 3.7 and 4.2 GHz.⁸⁵² In October 2018, the Commission made modifications to its rules governing the Citizens Broadband Radio Service in the 3.5

⁸⁴⁶ Swedish Post & Telecom Auth., PTS Orientation Plan for Spectrum Management (Mar. 29, 2018), <https://pts.se/en/news/radio/2018/pts-orientation-plan-for-spectrum-management/>.

⁸⁴⁷ Elec. Comm'n Comm., ECC Decision 18(05) (July 6, 2018), <https://www.ecodocdb.dk/download/a885e3f1-0c26/ECCDec1805.pdf>. The ECC is part of the Conference of European Postal and Telecommunications Administrations (CEPT), a voluntary association of regulators from 48 countries (including, of the IBDR comparison countries, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the UK).

⁸⁴⁸ See e.g., *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, FCC 18-133 (Sept. 27, 2018); *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, GN Docket No. 14-177, Fourth Further Notice of Proposed Rulemaking, FCC 18-110 (Aug. 3, 2018); FCC, The FCC's 5G FAST Plan (Sept. 28, 2018), <https://www.fcc.gov/document/fccs-5g-fast-plan>.

⁸⁴⁹ 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/>.

⁸⁵⁰ European Commission Fact Sheet: *Digital Single Market: Political Agreement on the Rules Shaping the Telecommunication Markets in the 5G Era* (June 6, 2018), http://europa.eu/rapid/press-release_MEMO-18-4084_en.htm.

⁸⁵¹ See generally FCC, *Broadcast Incentive Auction and Post-Auction Transition*, <https://www.fcc.gov/about-fcc/fcc-initiatives/incentive-auctions> (last visited Aug. 21, 2018).

⁸⁵² *Expanding Flexible Use of the 3.7 GHz to 4.2 GHz Band et al.*, GN Docket No. 18-122 *et al.*, Order and Notice of Proposed Rulemaking, FCC-18-91 (July 13, 2018). This NPRM builds upon an earlier Notice of Inquiry (NOI) seeking comment on ways to expand next-generation wireless broadband services in spectrum bands between 3.7 GHz and 24 GHz. See *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd 6373 (2017).

GHz band to spur additional investment and broader deployment in the band, promote robust and efficient spectrum use, and help ensure the rapid deployment of advanced wireless technologies—including 5G—in the United States.⁸⁵³ Additionally, in October 2018, the Commission adopted a Notice of Proposed Rulemaking proposing rules 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.⁸⁵⁴ Finally, with respect to high-band spectrum, through its *Spectrum Frontiers* proceeding, the Commission has made available nearly 13 total gigahertz of licensed and unlicensed high-band millimeter wave (mmW) spectrum. In June 2018, the Commission finalized the rules for these previously identified mmW bands and began exploring the possibility of making available an additional 2.75 gigahertz of spectrum in the 26 GHz and 42 GHz bands.⁸⁵⁵ In November 2018, the Commission began auctioning spectrum in the 28 GHz band, to be followed immediately by the auction of the 24 GHz band;⁸⁵⁶ the Commission intends to move forward with a single auction of three more mmW bands (37 GHz, 39 GHz, and 47 GHz) in the second half of 2019.⁸⁵⁷

287. Regulators around the world are also in the midst of allocating, auctioning and/or licensing additional spectrum across various bands to support 5G services.⁸⁵⁸ Notably, in June 2018, Korea's Ministry of Science & ICT (MSIT) concluded a 5G auction in the 3.5 GHz and 28 GHz bands, which is expected to facilitate early 5G commercialization by a target date of March 2019.⁸⁵⁹

⁸⁵³ *Promoting Investment in the 3550-3700 MHz Band*, GN Docket No. 17-258, Report and Order, FCC 18-149 (rel. Oct. 24, 2018); Press Release, FCC, FCC Takes Action to Encourage Increased Investment and Deployment in the 3.5 GHz Band (Oct. 23, 2018), <https://docs.fcc.gov/public/attachments/DOC-354694A1.pdf>.

⁸⁵⁴ Press Release, FCC, FCC Proposes More Spectrum for Unlicensed Use (Oct. 23, 2018), <https://docs.fcc.gov/public/attachments/DOC-354692A1.pdf>; *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, Notice of Proposed Rulemaking, FCC 18-147 (rel. Oct. 24, 2018).

⁸⁵⁵ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services et al.*, GN Docket No. 14-177 *et al.*, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, FCC-18-73 (June 8, 2018); Press Release, FCC, FCC Takes Next Steps to Make High-Band Spectrum Frontiers Available for 5G Use (June 7, 2018), <https://docs.fcc.gov/public/attachments/DOC-351388A1.pdf>.

⁸⁵⁶ The Commission finalized the bidding procedures and other rules for the auctions in August 2018. *Auctions of Upper Microwave Flexible Use Licenses for Next-Generation Wireless Services et al.*, AU Docket No. 18-85, Public Notice, FCC-18-109 (Aug. 3, 2018). See generally FCC, *Auction 101: Spectrum Frontiers – 28 GHz*, <https://www.fcc.gov/auction/101> (last visited Aug. 22, 2018); FCC, *Auction 102: Spectrum Frontiers – 26 GHz*, <https://www.fcc.gov/auction/102> (last visited Aug. 22, 2018).

⁸⁵⁷ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services et al.*, GN Docket No. 14-177 *et al.*, Fourth Further Notice of Proposed Rulemaking, FCC-18-110 (Aug. 3, 2018); Press Release, FCC, FCC Proposes Steps Towards Auction of 37 GHz, 39 GHz, and 47 GHz Bands (Aug. 2, 2018), <https://docs.fcc.gov/public/attachments/DOC-353229A1.pdf>.

⁸⁵⁸ See generally David Abecassis, Chris Nickerson and Janette Stewart, Final Report for CTIA: Global Race to 5G – Spectrum and Infrastructure Plans and Priorities (2018), https://api.ctia.org/wp-content/uploads/2018/04/Analysys-Mason-Global-Race-To-5G_2018.pdf (detailing 5G spectrum policies in ten leading markets: Canada, China, France, Germany, Russia, Japan, Singapore, South Korea, the United Kingdom, and the United States).

⁸⁵⁹ 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/>. See also Analysys Mason, *Analysys Mason 2018 July Report at 1* (2018), https://api.ctia.org/wp-content/uploads/2018/04/Analysys-Mason-Global-Race-To-5G_2018.pdf (noting that the U.S. sharing approach in 3.5 GHz differs from all other benchmark countries noted in the report which have developed plans for exclusive assignment to mobile).

288. In line with the European Commission's 5G Action Plan,⁸⁶⁰ EU Member States are focusing on several "pioneer spectrum bands" to harmonize the initial launch of 5G services across Europe,⁸⁶¹ with an initial emphasis on the 3.4-3.6 GHz band.⁸⁶² For example, in April 2018, the UK auctioned 150 megahertz of spectrum from the 3.4-3.6 GHz band.⁸⁶³ In July 2018, Finland invited applications for its upcoming 3.5 GHz auction, to be held later in 2018.⁸⁶⁴ Similarly, in May 2018, Germany announced plans to auction spectrum in the 3.6 GHz band (along with the 2 GHz band) for 5G use in early 2019.⁸⁶⁵ Germany also plans to award 400 megahertz of spectrum in the 3.4-3.8 GHz band in early 2019.⁸⁶⁶

III. COMMISSION ACTIONS ALREADY TAKEN TO CLOSE DIGITAL DIVIDE, ENHANCE COMPETITION, AND ENCOURAGE DEPLOYMENT OF COMMUNICATIONS SERVICES

289. RAY BAUM's Act also 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.⁸⁶⁷ In this *Report*, we take this opportunity to describe the significant steps the Commission has taken over the previous two years to close the digital divide, enhance competition and encourage the deployment of communications services.

A. The Mobile Wireless Market

1. Universal Support Challenges and Commission Actions

290. The Commission has taken several steps over the past two years to make universal service support available to mobile providers. For example, a unanimous Commission adopted rules and took several other steps to allocate up to \$4.53 billion over the next decade to advance the deployment of 4G LTE service to areas that are so costly that the private sector has not yet deployed there and to

⁸⁶⁰ See generally European Commission, 5G for Europe: An Action Plan (2016), <https://ec.europa.eu/digital-single-market/en/news/communication-5g-europe-action-plan-and-accompanying-staff-working-document>.

⁸⁶¹ See Radio Spectrum Policy Group, Strategic Roadmap Towards 5G for Europe: Opinion of Spectrum-Related Aspects for Next-Generation Wireless Systems (5G) (2016), http://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion_5G.pdf (identifying the following "pioneer spectrum bands:" 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).

⁸⁶² See Radio Spectrum Policy Group, Strategic Spectrum Roadmap Towards 5G in Europe: RSPG Second Opinion on 5G Networks (2018), https://circabc.europa.eu/sd/a/fe1a3338-b751-43e3-9ed8-a5632f051d1f/RSPG18-005final-2nd_opinion_on_5G.pdf (identifying the 3.4-3.8 GHz band as the "key for success of 5G in Europe").

⁸⁶³ David Abecassis, Janette Stewart, Michael Kende, Chris Nickerson, Final Report for CTIA: Mid-band spectrum geographical licensing approaches at 3 (2018), <https://api.ctia.org/wp-content/uploads/2018/07/Analysys-Mason-mid-band-5G-spectrum-paper-7-03-18.pdf>, (*Mid-band Spectrum Report*).

⁸⁶⁴ Press Release, Finnish Communications Regulatory Authority, Finland's Path to Becoming a Leading 5G Country: Registration Open for the 3.5 GHz Auction (July 11, 2018), <https://www.viestintavirasto.fi/en/ficora/news/2018/finland8217spathtobecomingaleading5gcountryregistrationopenforthe3.5ghzauction.html>.

⁸⁶⁵ Bundesnetzagentur, *President's Chamber Decision of 14 May 2018 on the Order For and Choice of Proceedings for the Award of Spectrum in the 2 GHz and 3.6 GHz Bands for Mobile/Fixed Communications Networks* (May 14, 2018), https://www.bundesnetzagentur.de/EN/Areas/Telecommunications/Companies/FrequencyManagement/ElectronicCommunicationsServices/ElectronicCommunicationServices_node.html (BNetzA Decision).

⁸⁶⁶ *Mid-band Spectrum Report* at 3. Each of the three mobile network operators in Germany has been assigned 42 megahertz of spectrum in the 3.4 GHz band on nationwide basis. *Id.* at 3, n.3.

⁸⁶⁷ Section 401 of the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (RAY BAUM'S Act), Pub. L. No. 115-141, 132 Stat. 1087 (codified at 47 U.S.C. § 163) (RAY BAUM'S Act).

preserve such service where it might not otherwise exist.⁸⁶⁸ The Commission’s 2017 Order found that “[d]espite a surge in private investment in mobile deployment, recent analysis shows that at least 575,000 square miles (approximately 750,000 road miles and 3 million people) either lack 4G LTE service or are being served only by subsidized 4G LTE providers.”⁸⁶⁹ The Commission further explained that funding for this effort will come from the redirection of legacy subsidies and distributed using a market-based, multi-round reverse auction and will come with defined, concrete compliance requirements so that rural consumers will be adequately served by the mobile carriers receiving universal service support. in support available to unserved and underserved areas.⁸⁷⁰

291. In addition, the Commission issued an Order and Notice of Proposed Rulemaking in May 2018, making universal service support in Puerto Rico and the U.S. Virgin Islands to restore communications networks that hurricanes ravaged.⁸⁷¹ In that Order, the Commission stated that, through the Uniendo a Puerto Rico Fund, it will make available up to \$254 million would be made available over a 3-year term for 4G Long-Term Evolution (LTE) mobile voice and broadband.⁸⁷² Through the Connect USVI Fund, the Commission will make available up to \$4.4 million over a 3-year term for 4G LTE mobile voice and broadband.⁸⁷³

2. Spectrum Challenges and Commission Actions.

292. Recognizing the importance of spectrum in the provision of mobile wireless services, Congress, under the Communications Act, 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.⁸⁷⁴ Consistent with this statutory mandate, the Commission has established policies to make spectrum available to existing mobile service providers and potential new entrants through initial licensing, primarily by competitive bidding, and through secondary market transactions.⁸⁷⁵

293. In recent years the Commission has made available a significant amount of additional spectrum across a range of frequencies.⁸⁷⁶ For example, the Commission in 2017 made available 70

⁸⁶⁸ In the Matter of Connect America Fund, Universal Service Reform – Mobility Fund, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 2152, 2154, para. 2 (2017).

⁸⁶⁹ *Id.* at 2156, para. 14.

⁸⁷⁰ *Id.* at 2154, para. 2

⁸⁷¹ *The Uniendo a Puerto Rico Fund and the Connect USVI Fund*, Order and Notice of Proposed Rulemaking, FCC 18-57 at 2, para. 2.

⁸⁷² *Id.* at 2, para. 3

⁸⁷³ *Id.*

⁸⁷⁴ 47 U.S.C. § 309(j)(3)(B).

⁸⁷⁵ *Mobile Spectrum Holdings Report and Order*, 29 FCC Rcd at 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.

⁸⁷⁶ Note that 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 (collectively “designated entities”). 47 U.S.C. § 309(j)(3)(B), (j)(4)(D); *see also* 47 CFR § 1.2110. Updating Part 1 Competitive Bidding Rules; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions; Petition of DIRECTV Group, Inc. and EchoStar LLC for Expedited Rulemaking to Amend Section 1.2105(a)(2)(xi) and 1.2106(a) of the Commission’s Rules and/or for Interim Conditional Waiver; Implementation of the Commercial Spectrum Enhancement Act and Modernization of the Commission’s Competitive Bidding Rules and Procedures, WT Docket No. 14-170, GN Docket No. 12-268, RM 11395, WT Docket No. 05-211, *Report and Order, Order on Reconsideration of the First Report and Order, Third Order on Reconsideration of the Second Report and*

(continued....)

megahertz of licensed low-band spectrum in the 600 MHz band in the broadcast television spectrum incentive auction.⁸⁷⁷ In 2018, the Commission released the *Third Report and Order* in the *Spectrum Frontiers* proceeding. In a series of three orders, the Commission adopted rules to facilitate flexible terrestrial wireless use of 4950 megahertz of mmW spectrum across five bands, which will be licensed in multiple blocks of different sizes and geographic areas.⁸⁷⁸ Also, in the Citizens Broadband Radio service (3.5 GHz band), the Commission has established service rules for 150 megahertz of spectrum for licensed and unlicensed sharing with federal incumbents.⁸⁷⁹

294. The Commission also has created incentives for efficient relocation, which allows spectrum to be put to its best use as technology changes while compensating incumbents. For example, in the broadcast television incentive auction the Commission implemented an auction framework that allowed for incumbent broadcast television licensees to sell licenses for commercial wireless use while also compensating remaining broadcast television licensees for spectrum repacking.⁸⁸⁰ Further, the Commission is addressing entry barriers in spectrum policy by implementing innovative spectrum sharing frameworks. For example, in 3.5 GHz band, the Commission introduced dynamic sharing whereby Spectrum Access Systems (SASs) will optimize frequency use to allow maximum capacity and co-existence in the band.⁸⁸¹ The SAS will also incorporate information from the Environmental Sensing Capability, which will be used to increase available spectrum in coastal areas while continuing to protect incumbent Department of Defense radar systems.⁸⁸² The SAS will enable a three-tiered priority sharing framework, in which incumbent federal users, priority access licensees, and general authorized access (GAA) users can share the same spectrum band.⁸⁸³ Where competitive rivalry for spectrum access is low, the GAA tier will provide a low-cost entry point to the band, similar to unlicensed access.⁸⁸⁴ This sharing framework has the potential to lower the barriers to entry significantly for innovative entrepreneurs and smaller businesses. The Commission has also increased the license area, lengthened the license terms, and changed the performance requirements for the 70 megahertz of priority access licenses in order to spur additional investment and broader deployment in the 3.5 GHz band, promote robust and efficient

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Order, and Third Report and Order, 30 FCC Rcd 7493 (2015) (*Part 1 Report and Order*) (modified by Erratum; rel. Aug. 25, 2015).

⁸⁷⁷ *Auction Of Advanced Wireless Services (AWS-3) Licenses Closes, Winning Bidders Announced For Auction 97, Public Notice*, 30 FCC Rcd 630 (2015); *Incentive Auction Closing and Channel Reassignment Public Notice; The Broadcast Television Incentive Auction Closes; Reverse Auction and Forward Auction Results Announced; Final Television Band Channel Assignments Announced; Post-Auction Deadlines Announced*, Public Notice, 32 FCC Rcd 2786 (MB, WTB 2017) (*Closing and Channel Reassignment Public Notice*).

⁸⁷⁸ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, FCC 18-73, at 14, para. 33 (Jun. 8, 2018) (*Spectrum Frontiers Third Report and Order*); see also *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 (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).

⁸⁷⁹ See generally *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd at 3962 (2015) (*3.5GHz Report and Order*)

⁸⁸⁰ See *Closing and Channel Reassignment Public Notice*.

⁸⁸¹ *3.5GHz Report and Order*, 30 FCC Rcd at 5962, para. 7.

⁸⁸² *Id.*

⁸⁸³ *Id.* at 5961, para. 5.

⁸⁸⁴ *3.5 GHz Report and Order*, 30 FCC Rcd at 3962, para. 5.

spectrum use, and help ensure the rapid deployment of advanced wireless technologies.⁸⁸⁵

295. In recent years, the Commission has expanded the amount of spectrum available for wireless use and is making use of multiple innovative policy tools to make more spectrum available such as incentivizing efficient relocation of incumbent licensees or implementing sharing frameworks between potential entrants and licensees. Overall, this expanded availability of spectrum in various bands will facilitate entry of next generation wireless services and promote continued development of innovative uses of spectrum.

3. Wireless Infrastructure Siting Challenges and Commission Actions

296. Federal, state, and local rules all impose regulatory costs on the deployment of wireless infrastructure, costs that have become even more significant in light of the massive new deployments needed to support 5G services. With its *2017 Wireless Infrastructure NPRM and NOI*, the Commission began a fundamental rethinking of wireless infrastructure policy and launched a comprehensive rulemaking proceeding designed to identify regulatory barriers to wireless infrastructure deployment and eliminate or reduce as many of them as possible.⁸⁸⁶ The Commission has made tremendous progress in modernizing its wireless infrastructure rules with that proceeding, particularly by adopting two major orders. The first reformed the federal government's review process pertaining to wireless infrastructure,⁸⁸⁷ while the second addressed barriers to wireless infrastructure deployment erected by state and local governments.⁸⁸⁸ In addition, the Commission has reformed and streamlined pole attachment and copper network retirement policies which will help facilitate the buildout of advanced services including 5G wireless broadband.⁸⁸⁹

297. In March 2018, the Commission adopted the *Wireless Infrastructure Second Report and Order*, which: (1) excluded from National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA) review certain small wireless facilities;⁸⁹⁰ (2) clarified procedures for engaging Tribal Nations and Native Hawaiian Organizations (NHOs) in historic preservation review;⁸⁹¹ and (3) exempted from NEPA review requirements certain structures placed on flood plains.⁸⁹² That decision is already expediting the deployment of wireless infrastructure. And according to an Accenture analysis, this Order will reduce small cell deployment costs by about \$1.6 billion over the next 8 years.⁸⁹³

⁸⁸⁵ *Promoting Investment in the 3550-3700 MHz Band*, Report and Order, FCC 18-149, at 2, para. 2 (Oct. 24, 2018) (*Investment in 3.5 GHz Report and Order*).

⁸⁸⁶ *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Deployment*, Notice of Proposed Rulemaking and Notice of Inquiry, 32 FCC Rcd 3330 (2017).

⁸⁸⁷ *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Deployment*, Second Report and Order, FCC 18-30 (rel. Mar. 30, 2018). (*Wireless Infrastructure Second Report and Order*).

⁸⁸⁸ *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Deployment*, Declaratory Ruling and Third Report and Order, FCC 18-133 (rel. Sep. 27, 2018). (*Wireless Infrastructure Third Report and Order*).

⁸⁸⁹ See *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, WT Docket No. 17-79, Report and Order, 32 FCC Rcd 9760 (2017) (*Wireless Infrastructure First Report and Order*), and *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Report and Order, Declaratory Ruling, and Further Notice of Proposed Rulemaking, 32 FCC Rcd 11128 (2017) (*Wireline Infrastructure First Report and Order*).

⁸⁹⁰ *Wireless Infrastructure Second Report and Order* at 3, para. 4.

⁸⁹¹ *Id.* at 3, para. 6.

⁸⁹² *Id.* at 4, para. 8.

⁸⁹³ See Accenture Strategy, "Impact of Federal Regulatory Reviews on Small Cell Deployment," March 12, 2018, available at https://api.ctia.org/docs/default-source/default-document-library/small-cell-deployment-regulatory-review-costs_3-12-2018.pdf (visited Oct. 17, 2018).

In August 2018, the Commission adopted One-Touch Make Ready rules⁸⁹⁴ and issued a Declaratory Ruling making clear that state and local moratoria, which are plainly a barrier to entry, violate section 253(a) of the Communications Act.⁸⁹⁵

298. In September 2018, the Commission adopted the *Wireless Infrastructure Declaratory Ruling and Third Report and Order*, addressing state and local barriers to deployment.⁸⁹⁶ State and local zoning rules for erecting towers and other structures or attaching equipment to pre-existing towers and structures (e.g., rooftops, water tanks, power lines, and utility poles) can affect the timing and cost of deploying mobile wireless networks. Regulatory delay can slow entry, and local regulatory fees can represent sunk costs that can deter or diminish entry. Thus, regulatory fees and regulatory delays can be a significant barrier to entry.⁸⁹⁷ Siting fees such as excessive one-time application fees, annual recurring fees, unreasonable or discriminatory gross revenue fees, and franchise or use fees may be especially burdensome to smaller providers and may prevent or discourage investment. In addition, review processes designed for large macro cells may be applied to small cell deployments in some localities.⁸⁹⁸ These review processes could pose significant barriers to entry or expansion because of the large number of small cells that need to be deployed relative to large towers.⁸⁹⁹ The review processes may be less important for small cells because their deployment causes less disruption to an area than the deployment of large towers.⁹⁰⁰ In addition, state and local zoning requirements may prevent or delay entry and expansion by requiring that all facilities along rights-of-way (ROW) be underground, or by imposing burdensome and/or unpublished aesthetic restrictions.⁹⁰¹

299. In the *Declaratory Ruling*, the Commission reaffirmed that a state or local legal requirement constitutes an effective prohibition if it “materially limits or inhibits the ability of any competitor or potential competitor to compete in a fair and balanced legal and regulatory environment.”⁹⁰² The *Declaratory Ruling* also concluded that state and local application fees, fees for access to the ROW, and fees for use of government-owned facilities in the ROW are preempted unless (1) the fees are a reasonable approximation of the state or local government’s costs, (2) only objectively reasonable costs are factored into those fees, and (3) the fees are no higher than the fees charged to similarly-situated actual or possible competitors in similar situations.⁹⁰³ The *Third Report and Order* established two new “shot clocks” for small wireless facilities, codified existing shot clocks for other wireless facilities, and clarified that failure to act within the shot clock period presumptively has the effect of prohibiting

⁸⁹⁴ “One-Touch Make Ready” means that it must be possible for a single construction team to make a pole ready for a new attachment.

⁸⁹⁵ See *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, Third Report and Order and Declaratory Ruling, FCC 18-111, at 71, para. 140 (Aug. 3, 2018) (*Wireline Infrastructure Third Report and Order*).

⁸⁹⁶ See *Wireless Infrastructure Third Report and Order*.

⁸⁹⁷ *Sixteenth Report*, 28 FCC Rcd at 3765, para.76.

⁸⁹⁸ *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, Notice of Proposed Rulemaking, 32 FCC Rcd at 3330, 3343, paras. 32-34 (April 21, 2017).

⁸⁹⁹ An estimated 100,000 to 150,000 small cells will be constructed by the end of 2018, and these numbers are projected to reach 455,000 by 2020, and 800,000 by 2026. *Wireline Infrastructure Third Report and Order*, at 2, para. 1.

⁹⁰⁰ *Wireless Infrastructure Third Report and Order* at 3, para. 3.

⁹⁰¹ *Wireless Infrastructure Third Report and Order* at 43-46, paras. 84-91.

⁹⁰² *Wireless Infrastructure Third Report and Order* at 15, para. 35.

⁹⁰³ *Wireless Infrastructure Third Report and Order* at 25-6, para. 50.

personal wireless services, in violation of Section 332(c) of the Communications Act.⁹⁰⁴

B. The Fixed Communications Market

300. The Commission has taken numerous steps to accelerate the deployment of broadband networks and facilities. The Broadband Deployment Advisory Committee's (BDAC), for example, was chartered on March 1, 2017 and makes recommendations to the Commission on how to accelerate broadband deployment by reducing and/or removing regulatory barriers to infrastructure investment.⁹⁰⁵ The BDAC provides a means for stakeholders to exchange ideas and develop recommendations to the Commission on broadband deployment, thereby enhancing the Commission's ability to carry out its statutory responsibility to encourage broadband deployment to all Americans.⁹⁰⁶ Since the Commission released the *2018 Report*, the BDAC has met three times, first on April 25, 2018⁹⁰⁷ then on July 26-27, 2018,⁹⁰⁸ and again on December 6-7, 2018.⁹⁰⁹

301. In 2018, the BDAC considered reports and recommendations from its various working groups, including draft model codes for states and municipalities to encourage the development and deployment of broadband infrastructure.⁹¹⁰ The BDAC adopted the model code for municipalities at the July 2018 meeting.⁹¹¹ In August, the BDAC solicited nominations for membership on a new Disaster Response and Recovery Working Group, which will be charged with making recommendations on additional measures that can be taken before a disaster to improve resiliency of broadband infrastructure, strategies that can be used during the response to a disaster to minimize the downtime of broadband networks, and actions that can be taken to restore broadband infrastructure during disaster recovery.⁹¹²

302. The BDAC's efforts have been particularly influential in the Commission's infrastructure proceedings. A number of the BDAC's recommendations⁹¹³ provided the framework for many of the

⁹⁰⁴ *Wireless Infrastructure Third Report and Order* at 5, para. 13.

⁹⁰⁵ FCC, *Broadband Deployment Advisory Committee Charter, Committee's Objective and Scope of its Activities* (Mar. 1, 2017), <https://www.fcc.gov/sites/default/files/bdac-charter.pdf>.

⁹⁰⁶ FCC, *Broadband Deployment Advisory Committee Charter, Committee's Objective and Scope of its Activities* (Mar. 1, 2017), <https://www.fcc.gov/sites/default/files/bdac-charter.pdf>.

⁹⁰⁷ *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, DA 18-138 (Feb. 12, 2018).

⁹⁰⁸ *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, DA 18-706 (July 6, 2018).

⁹⁰⁹ *FCC Announces the Next Meeting of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, DA 18-XXX (DATE, 2018)

⁹¹⁰ BDAC Model Code for States Working Group, State Model Code for Accelerating Broadband Infrastructure Deployment and Investment (July 19, 2018), <https://www.fcc.gov/sites/default/files/bdac-07-2627-2018-harmonization-wg-model-code-states.pdf>; BDAC Model Code for Municipalities Working Group, Model Code for Municipalities (July 19, 2018), <https://www.fcc.gov/sites/default/files/bdac-07-2627-2018-harmonization-wg-model-code-muni.pdf>.

⁹¹¹ BDAC Model Code for Municipalities Working Group, Model Code for Municipalities (DATE, 2018), [link to final version of adopted muni model code when available; not up as of 10/5/2018.]

⁹¹² *FCC Solicits Nominations for New Disaster Response and Recovery Working Group of the Broadband Deployment Advisory Committee*, Public Notice, GN Docket No. 17-83, DA 18-837 (rel. Aug. 9, 2018).

⁹¹³ *See, e.g.*, BDAC January 2018 Recommendations at 19-22, 26-27, 29, 37, 39; BDAC, Addendum to the Report of the Competitive Access to Broadband Infrastructure Working Group (April 25, 2018), <https://www.fcc.gov/sites/default/files/bdac-cabi-report-04252018.pdf>.

Commission's actions in the August 2018 *Third Report and Order and Declaratory Ruling*,⁹¹⁴ including the BDAC's January 2018 proposal to streamline pole attachment make-ready workflows under a "one-touch make-ready" (OTMR) model.⁹¹⁵ Similarly, the BDAC's findings, reports, and recommendations⁹¹⁶ informed the conclusions in the Commission's September 2018 *Wireless Infrastructure Declaratory Ruling and Third Report and Order*.⁹¹⁷

303. The Commission has also been at the forefront of supporting areas affected by natural disasters. In October 2017, the Commission pledged to repair communications networks in Puerto Rico and the U.S. Virgin Islands damaged by Hurricane Maria⁹¹⁸ and in May 2018, the Commission approved additional funding to accelerate the restoration of communications networks in those territories.⁹¹⁹ It also sought comment on providing almost \$900 million in medium- and long-term funding into expanding and improving broadband access on the islands.⁹²⁰ The *Order and Notice of Proposed Rulemaking* includes an immediate infusion of approximately \$64 million in additional funding for short-term restoration efforts, and sought public comment on a proposal to allocate approximately \$444.5 million in funding for Puerto Rico and \$186.5 million for the U.S. Virgin Islands over the next decade for the expansion of fixed broadband connectivity.⁹²¹

304. Universal service also played an essential role in deployment of broadband networks and encouraging competition. The Commission's Universal Service Fund (USF) provides funding to increase the availability of fixed and mobile broadband services in unserved and rural areas.⁹²² The Fund targets

⁹¹⁴ *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Third Report and Order and Declaratory Ruling, FCC 18-111 (Aug. 3, 2018) (*Wireline Infrastructure Third Report and Order*).

⁹¹⁵ See Letter from Paul D'Ari, Designated Federal Officer, Broadband Deployment Advisory Committee, FCC, to Marlene H. Dortch, Secretary, FCC, WC Docket No. 17-84 (filed July 3, 2018), at Attach. Broadband Deployment Advisory Committee, FCC, Report of the Competitive Access to Broadband Infrastructure Working Group, at 18-31 (2018), <https://ecfsapi.fcc.gov/file/107030255502405/Competitive%20Access%20to%20Broadband%20Infrastructure%20R%20e%20p%20o%20r%20t.pdf> (BDAC January 2018 Recommendations). By some estimates, OTMR alone could result in approximately 8.3 million incremental premises passed with fiber, and about \$12.6 billion in incremental fiber capital expenditures. See Letter from Thomas J. Navin, Counsel to Corning, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 17-84, at Attach. A; Ed Naef and Alex King, CMA Strategy Consulting, *Assessing the Impact of Removing Regulatory Barriers on Next Generation Wireless and Wireline Broadband Infrastructure Investment: Annex 1, Model Sensitivities* at 5-6 (filed Feb. 26, 2018).

⁹¹⁶ See, e.g., BDAC, Model Code for Municipalities Working Group, Model Code for Municipalities (July 19, 2018), <https://www.fcc.gov/sites/default/files/bdac-07-2627-2018-harmonization-wg-model-code-muni.pdf>; BDAC, Report of the Removal of State and Local Regulatory Barriers Working Group (Jan. 10 2018), <https://www.fcc.gov/sites/default/files/bdac-regulatorybarriers-01232018.pdf>; BDAC, Rates and Fees Committee, Draft Final Report to the BDAC (v 2.5) (July 24, 2018), <https://www.fcc.gov/sites/default/files/bdac-07-2627-2018-rates-fees-wg-report-07242018.pdf>.

⁹¹⁷ *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment*, WT Docket No. 17-79, Declaratory Ruling and Third Report and Order, FCC 18-XXX (Sept. xx, 2018) (*Wireless Infrastructure Third Report and Order*).

⁹¹⁸ *Connect America Fund*, WC Docket No. 10-90, Order, 32 FCC Rcd 7981 (2017).

⁹¹⁹ *The Uniendo a Puerto Rico Fund and the Connect USVI Fund*, Order and Notice of Proposed Rulemaking, WC Docket No. 18-143, FCC 18-57 (rel. May 29, 2018) (*Uniendo PR and Connect USVI Funds Order and NPRM*).

⁹²⁰ *Uniendo PR and Connect USVI Funds Order and NPRM*, [2018 WL 3207439], at paras. 3-5.

⁹²¹ *Uniendo PR and Connect USVI Funds Order and NPRM*, at paras. 30-33.

⁹²² *Connect America Fund et al.*, Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663, 17668-69, paras. 1-5 (2011) (*USF/ICC Transformation Order*), *aff'd sub nom*, *In re: FCC 11-161*, 753 F.3d 1015 (10th Cir. 2014).

support to these areas and, as part of its oversight responsibilities, the Commission routinely considers ways to maximize the impact of available USF funding to support broadband deployment.⁹²³

305. Over the past two years, for example, 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 February 2017, the Commission adopted a *Report and Order and Order on Reconsideration* finalizing bidding rules and establishing weights to compare bids in the auction.⁹²⁴ In August 2017, the Commission released a *Public Notice* proposing procedures to implement the Phase II auction. The Phase II auction, which offered up to nearly \$2 billion over the next decade to expand fixed, high-speed Internet service to unserved rural areas, ran from July 24, 2018 to August 21, 2018.⁹²⁵ At its conclusion, 103 bidders won \$1.49 billion over 10 years to provide fixed broadband and voice services to over 700,000 locations in 45 states.⁹²⁶ Separately, the Commission provided small, rural carriers with an infusion of over \$500 million to promote more high-speed broadband deployment in rural areas in March 2018.⁹²⁷

306. In December 2017, the Commission issued a *Notice of Proposed Rulemaking* to review the Rural Health Care program and sought comment on ways to improve connectivity for health care providers in rural areas including whether to lift the program's funding cap to make additional money available for broadband to rural health care providers. In an accompanying *Order*, the Commission granted relief to rural health care providers facing potential funding cuts in funding year 2017.⁹²⁸ In June 2018, the Commission increased the funding cap for the Rural Health Care program from \$400 million to \$571 million to prevent pro-rata funding reductions that could have disproportionately impacted rural health care providers, especially those in Alaska.⁹²⁹

307. In June 2018, the Commission set aside enforcement of rules that were unfairly driving

⁹²³ *Connect America Fund, et al.*, Report and Order, Third Order on Reconsideration, and Notice of Proposed Rulemaking, FCC 18-29, 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); *Bridging the Digital Divide for Low-Income Americans*, Fourth Report and Order, Order on Reconsideration, Memorandum Opinion and Order, Notice of Proposed Rulemaking, Notice of Inquiry, 32 FCC Rcd. 10475, para. 1 (2018) (directing Lifeline funds to the areas in which they are most needed, to encourage investment in broadband-capable networks); *Promoting Telehealth in Rural America*, Report and Order, FCC 18-82, para. 1 (2018) (increased the funding cap for the Rural Healthcare program to \$571 million to prevent pro-rata funding reductions that could have disproportionately impacted rural health care providers, especially those in Alaska).

⁹²⁴ *Connect America Fund et al.*, WC Docket Nos. 10-90 et al., Report and Order and Order on Reconsideration, 32 FCC Rcd 1624 (2017).

⁹²⁵ *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, DA 18-658 (WCB/WTB June 25, 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, DA 18-887 (WCB/WTB Aug. 28, 2018).

⁹²⁶ News Release, FCC, Connect America Fund Auction to Expand Broadband to Over 700,000 Rural Homes and Businesses (Aug. 28, 2018), <https://docs.fcc.gov/public/attachments/DOC-353840A1.pdf>.

⁹²⁷ *Connect America Fund, et al.*, Report and Order, Third Order on Reconsideration, and Notice of Proposed Rulemaking, WC Docket Nos. 10-90, 14-58, 07-135, CC Docket No. 01-92, FCC 18-29, para. 4 (Mar. 23, 2018).

⁹²⁸ *Promoting Telehealth in Rural America*, WC Docket No. 17-310, Notice of Proposed Rulemaking and Order, FCC 17-164 (rel. Dec 18, 2017).

⁹²⁹ *Promoting Telehealth in Rural America*, Report and Order, WC Docket No. 17-310, FCC 18-82, para. 1 (June 25, 2018).

up the cost of broadband service for the customers of some rural providers.⁹³⁰ Unlike all other ISPs, our rules require certain small, rural providers to pay into the USF fees on the revenues they earn from broadband Internet access transmission service.⁹³¹ These fees ultimately get passed on to their customers. To level the playing field and reduce the cost of broadband in many rural areas, the Commission granted a petition for forbearance effectively waiving that requirement for these rural carriers.⁹³²

308. To remove the impediments that Title II classification had placed on broadband investment and deployment, in May 2017, the Commission proposed to restore the pre-2015 “information service” classification of broadband Internet access service.⁹³³ In December 2017, the Commission adopted a *Declaratory Ruling, Report and Order, and Order*⁹³⁴ that reinstated the pre-2015 “information service” classification of broadband Internet access service⁹³⁵ and restored the determination that mobile broadband is not a “commercial mobile service.”⁹³⁶ The Commission found that these measures would “encourage broadband investment and innovation, furthering our goal of making broadband available to all Americans.”⁹³⁷

309. The Commission has also taken steps to remove impediments to deployment and network transitions. In April 2017, the Commission sought comment on addressing barriers to investment in and deployment of wireline infrastructure.⁹³⁸ In November 2017, the Commission addressed pole attachment, copper retirement and discontinuance issues and sought further comment on reducing barriers to broadband deployment.⁹³⁹ In June 2018, the Commission eliminated unnecessary impediments and costs to timely network upgrades, while maintaining protections for consumers and enabling providers to invest in next-generation networks.⁹⁴⁰ The Commission took these actions to build on the work begun in 2017 to reform our copper retirement, network change disclosure, and discontinuance processes and remove regulatory barriers causing unnecessary costs or delay to deployment of next-generation networks.⁹⁴¹

⁹³⁰ *Petition of NTCA—The Rural Broadband Association and the United States Telecom Association for Forbearance Pursuant to 47 U.S.C. § 160(c) from Application of Contribution Obligations on Broadband Internet Access Transmission Services*, Order, WC Docket No. 17-206, FCC 18-85 (June 8, 2018).

⁹³¹ See 47 U.S.C. § 254(d), 47 CFR § 54.706.

⁹³² *Auctions of Upper Microwave Flexible Use Licenses for Next-Generation Wireless Services*, Public Notice, AU Docket No. 18-85, FCC 18-109 (Aug. 3, 2018).

⁹³³ *Restoring Internet Freedom*, WC Docket No. 17-108, Notice of Proposed Rulemaking, 32 FCC Rcd 4434 (2017).

⁹³⁴ *Restoring Internet Freedom*, WC Docket No. 17-108, Declaratory Ruling, Report and Order, and Order, FCC 17-166 (rel. Jan. 4, 2018), https://transition.fcc.gov/Daily_Releases/Daily_Business/2018/db0105/FCC-17-166A1.pdf.

⁹³⁵ *Id.* at 8-42, paras. 20-64.

⁹³⁶ *Id.* at 42-52, paras. 65-85.

⁹³⁷ *Id.* at 52, para. 86.

⁹³⁸ *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Notice of Proposed Rulemaking, Notice of Inquiry, and Request for Comment, 32 FCC Rcd 3266 (2017). (*Wireline Infrastructure NPRM*).

⁹³⁹ *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Report and Order, Declaratory Ruling, and Further Notice of Proposed Rulemaking, FCC 17-154 (rel. Nov. 29, 2017) (*Wireline Infrastructure Order and FNPRM*).

⁹⁴⁰ *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Second Report and Order, FCC 18-74 (June 8, 2018).

⁹⁴¹ *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Report and Order, Declaratory Ruling, and Further Notice of Proposed Rulemaking, 32 FCC Rcd 11128 (2017) (*Wireline Infrastructure Order and FNPRM*).

310. In August 2018, the Commission adopted measures to expedite the process and reduce the costs of attaching new network facilities to utility poles.⁹⁴² Consistent with the recommendations of the BDAC,⁹⁴³ the Commission established a new pole attachment process that allows the party with the strongest incentive to prepare the pole quickly for new attachments, rather than spreading the work across multiple parties.⁹⁴⁴ The Commission also addressed two forms of state and local regulatory barriers to deployment, clarifying that (1) it will preempt, on a case-by-case basis, state and local laws that inhibit the rebuilding or restoration of broadband infrastructure after a disaster; and (2) state and local moratoria on the deployment of telecommunications services and facilities are barred section 253(a) by the Communications Act because they “prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service.”⁹⁴⁵

311. The Commission also removed regulatory barriers in the competitive market for business data services. In April 2017, the Commission recognized widespread competition in the business data services market and eliminated pricing regulation and tariffing requirements for most types of business data services.⁹⁴⁶

C. The Video and Audio Markets

312. *Broadcast Ownership Rules.* The Commission’s rules contain structural limits governing ownership of television stations. Section 202(h) of the Telecommunications Act of 1996 requires the Commission to review its media ownership rules every four years to determine whether they remain “necessary in the public interest as a result of competition.”⁹⁴⁷ Rule modifications enacted by the Commission after such reviews may enhance competition and reduce barriers to entry in the media marketplace.

313. On August 10, 2016, the Commission adopted a Second Report and Order that completed the 2010 and 2014 quadrennial reviews of the media ownership rules (*Quadrennial Review Order*).⁹⁴⁸ On November 20, 2017, the Commission released an Order on Reconsideration that reversed certain elements of the earlier Order, most notably by repealing the long-standing Newspaper/Broadcast Cross-Ownership Rule and Radio/Television Cross-Ownership Rule.⁹⁴⁹ The Order on Reconsideration also revised the

⁹⁴² *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment*, WC Docket No. 17-84, Third Report and Order and Declaratory Ruling, FCC 18-111 (Aug. 3, 2018) (*Wireline Infrastructure Third Report and Order*).

⁹⁴³ See BDAC January 2018 Recommendations at 18-31.

⁹⁴⁴ *Wireline Infrastructure Third Report and Order* at paras. 2, 16-35.

⁹⁴⁵ *Wireline Infrastructure Third Report and Order* at paras. 4, 137-39.

⁹⁴⁶ *Business Data Services in an Internet Protocol Environment et al.*, WC Docket No. 16-143 et al., Report and Order, 32 FCC Rcd 3459 (2017) (*2017 Business Data Services Report and Order*).

⁹⁴⁷ Telecommunications Act of 1996, Pub. L. No. 104-104, § 202(h), 110 Stat. 56, 111-12 (1996) (1996 Act); Consolidated Appropriations Act, 2004, Pub. L. No. 108-199, § 629, 118 Stat. 3, 99-100 (2004) (Appropriations Act) (amending Sections 202(c) and 202(h) of the 1996 Act). In 2004, Congress revised the then-biennial review requirement to require such reviews quadrennially. See Appropriations Act § 629, 118 Stat. at 100.

⁹⁴⁸ *2014 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*, Second Report and Order, 31 FCC Rcd 9864 (2016).

⁹⁴⁹ *2014 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*, Order on Reconsideration and Notice of Proposed Rulemaking, 32 FCC Rcd 9802, 9803, para. 2 (2017) (*Quadrennial Review Reconsideration*). Elimination of the Newspaper/Broadcast Cross-Ownership and Radio/Television Cross-Ownership Rules removed all restrictions prohibiting a single entity from owning a newspaper and broadcast stations in the same market. *Id.* at

(continued....)

Local Television Ownership Rule⁹⁵⁰ and eliminated the attribution rule for television joint sales agreements (JSAs).⁹⁵¹ Under the revised Local Television Rule, an entity may own two television stations in the same DMA if (1) the digital noise limited service contours of the stations (as determined by Section 73.622(e)) do not overlap; or (2) at least one of the stations is not ranked among the top four stations in the market.⁹⁵² Under the revised Local Television Ownership Rule, the Commission will consider combinations otherwise barred by the top-four prohibition on a case-by-case basis.⁹⁵³

314. The Commission also repealed the attribution rule for television JSAs. As a result, the Commission will no longer consider TV JSAs of any type to be attributable ownership interests for the purposes of its media ownership rules.⁹⁵⁴ The Commission stated that the repeal effectively removes a regulatory disincentive for entering into JSAs and enables the stations to better serve their communities.⁹⁵⁵

315. In addition to modifying the local television ownership rules, the Commission recently sought comment on whether to repeal or modify the national television audience reach rule.⁹⁵⁶ This rule prohibits a single entity from owning television stations that collectively reach more than 39% of the total nationwide audience.⁹⁵⁷ To compensate for the technical limitations of analog UHF signals, the rule previously allowed the licensee of a UHF station to count only 50% of the television households in its market area for purposes of assessing compliance with the 39% cap.⁹⁵⁸ In 2016, the Commission eliminated this UHF discount, finding that the nation's transition from analog to digital television eliminated the technical justification for the discount.⁹⁵⁹ In 2017, the Commission reversed this decision on reconsideration, finding that when the UHF discount was eliminated, the Commission failed to consider whether the resulting *de facto* tightening of the national cap was in the public interest and justified by current marketplace conditions.⁹⁶⁰ On reconsideration, the Commission reinstated the UHF discount and stated that the Commission would conduct a comprehensive rulemaking proceeding to determine whether to retain the discount and/or modify the national cap.⁹⁶¹

316. On August 2, 2018, the Commission adopted a Report and Order establishing the requirements that will govern an incubator program that seeks to promote the entry of new and diverse

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9806-07, 9824-25, paras. 8, 49. Although the cross-ownership restrictions have been repealed, broadcast ownership remains subject to the Local Television Ownership Rule and Local Radio Ownership Rule. *Id.* at 9824-25, para. 49.

⁹⁵⁰ *Id.* at 9803, para. 2.

⁹⁵¹ *Id.*

⁹⁵² *Id.* at 9831, para. 66.

⁹⁵³ *Id.* at 9836, para. 78.

⁹⁵⁴ *Id.* at 9848, para. 101.

⁹⁵⁵ *Id.* at 9881, Appendix B, para. 29.

⁹⁵⁶ 47 CFR § 73.3555(e).

⁹⁵⁷ *Id.* § 73.3555(e)(2);

⁹⁵⁸ *Id.*; *Amendment of Section 73.3555(e) of the Commission's Rules, National Television Multiple Ownership Rule*, Report and Order, 31 FCC Rcd 10213, 10215, para. 5 (2016).

⁹⁵⁹ *Id.* at 10214, para. 2 (2016).

⁹⁶⁰ *Amendment of Section 73.3555(e) of the Commission's Rules, National Television Multiple Ownership Rule*, Order on Reconsideration, 32 FCC Rcd 3390, 3390, para. 1 (2017).

⁹⁶¹ *Id.* at 3391, para. 1.

voices into the broadcast industry.⁹⁶² Under the incubator program, an established broadcaster can provide financial and operational support, including training and mentoring, to a new or small broadcaster.⁹⁶³ At the end of a successful incubation relationship, if the new or small broadcaster either owns and operates a new station independently or the previously struggling broadcaster's station is on a firmer footing,⁹⁶⁴ the established broadcaster is eligible to receive a waiver of the Commission's Local Radio Ownership Rule that it can use either in the incubated market or in a comparable market, subject to certain requirements.⁹⁶⁵ Participation in the incubator program initially will be limited to full-service AM and FM broadcast radio stations, as the costs of obtaining and operating radio stations make the radio sector a significantly more accessible entry point than television for entities with limited capital resources and operational experience.⁹⁶⁶ The incubator program addresses the need for more innovative approaches to provide access to capital, as well as technical, operational, and management training, to new entrants and small broadcasters that otherwise would not be able to own a full-service broadcast radio station, acquire an additional station, or remain in the broadcasting business.⁹⁶⁷

317. *Next Generation Broadcast Television Transmission Standard.* On November 20, 2017, the Commission released a Report and Order and Further Notice of Proposed Rulemaking adopting proposals to authorize broadcasters to use the new Advanced Television Systems Committee (ATSC) 3.0 broadcast transmission standard.⁹⁶⁸ This enhanced transmission standard has the potential to enable broadcast television stations to serve consumers and advertisers in new, innovative ways that may allow such stations to compete with features offered by MVPDs and OVDs. Advocates of ATSC 3.0 assert that the new standard could greatly improve broadcast signal reception, particularly on mobile devices and television receivers without outdoor antennas.⁹⁶⁹ Advocates also state that ATSC 3.0 will enable broadcasters to offer enhanced and innovative new features to consumers, including Ultra High Definition (UHD) picture and immersive audio, more localized programming content, an advanced emergency alert system (EAS) capable of waking up sleeping devices to warn consumers of imminent emergencies, better accessibility options, and interactive services.⁹⁷⁰ In the recent Order, the Commission authorized voluntary use of the ATSC 3.0 transmission standard and found that 3.0 transmissions meet the definition

⁹⁶² *Rules and Policies to Promote New Entry and Ownership Diversity in the Broadcasting Services*, MB Docket No. 17-289, Report and Order, at 1, para. 1 (2018) (*Incubator R&O*).

⁹⁶³ *Incubator R&O* at 2, para 6.

⁹⁶⁴ *Id.* at 2, para 6.

⁹⁶⁵ *Id.*

⁹⁶⁶ *Id.* at 2, para 7.

⁹⁶⁷ *Id.* at 1, para 1.

⁹⁶⁸ *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, 9931-33, para. 2 (*Next Gen TV Order*). The rules adopted in the *Next Gen TV Order* took effect on March 5, 2018, except for rule sections 73.3801, 73.6029, and 74.782, which require OMB approval. *Media Bureau Announces Next Gen TV Order Published in Federal Register*, GN Docket No. 16-142, Public Notice, DA 18-103 (MB Feb. 2, 2018). The rules requiring OMB approval took effect on July 17, 2018. *Next Gen TV Rules Receive OMB Approval*, GN Docket No. 16-142, Public Notice, DA 18-736 (MB July 17, 2018). In the accompanying Further Notice of Proposed Rulemaking, the Commission sought further comment on: (1) issues related to exceptions to and waivers of the local simulcasting requirement, (2) whether the Commission should let full power broadcasters use channels in the television broadcast band that are vacant to facilitate the transition to 3.0, and (3) its tentative conclusion that local simulcasting should not change the significantly viewed status of a station transmitting in ATSC 3.0. *Next Gen TV Order*, 32 FCC Rcd at 9989, paras. 122-31.

⁹⁶⁹ *Authorizing Permissive Use of the "Next Generation" Broadcast Television Standard*, GN Docket No. 16-142, Notice of Proposed Rulemaking, 32 FCC Rcd 1670, 1671, para. 1 (2017).

⁹⁷⁰ *Id.*

of “broadcasting” in the Communications Act.⁹⁷¹ The Order requires broadcasters who transmit in ATSC 3.0 to simulcast the primary video programming stream of their 3.0 channels in an ATSC 1.0 format, so that viewers will continue to receive ATSC 1.0 service.⁹⁷²

318. The Order states that an ATSC 3.0 broadcaster’s ATSC 1.0 signal will retain mandatory carriage rights, but that the station’s 3.0 signal will not have mandatory carriage rights while the Commission requires local simulcasting.⁹⁷³ Thus, MVPDs are required to continue to carry broadcasters’ 1.0 signals but are not required to carry 3.0 signals. The Commission did not adopt new rules to govern carriage of 3.0 signals pursuant to retransmission consent and found that voluntary carriage of 3.0 signals is best left to marketplace negotiations between broadcasters and MVPDs.⁹⁷⁴ Television stations transmitting signals in ATSC 3.0 are subject to the public interest obligations currently applicable to television broadcasters.⁹⁷⁵ In addition, the Commission concluded that it is unnecessary to adopt an ATSC 3.0 tuner mandate for new television receivers.⁹⁷⁶ The Commission requires broadcasters to provide advance on-air notifications to educate consumers about ATSC 3.0 service deployment and simulcasting.⁹⁷⁷ Lastly, the Order adopts specific technical aspects of the ATSC 3.0 standard.⁹⁷⁸

319. *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.⁹⁷⁹ This effort has resulted in the elimination or modification of several requirements, including the following:

- In January 2018, the Commission eliminated the main studio rule, which had long required each television broadcast station to maintain a main studio located in or near its community of license.⁹⁸⁰ The Commission found that the widespread availability of electronic communication enables stations to participate in their communities of license and allows

⁹⁷¹ *Next Gen TV Order*, 32 FCC Rcd at 9934-37, paras. 6-7, 9.

⁹⁷² *Id.* at 9931-33, para. 2. The programming aired on the ATSC 1.0 simulcast channel must be “substantially similar” to the programming aired on the 3.0 channel. This requirement means that the programming must be the same, except for programming features that are based on the enhanced capabilities of ATSC 3.0, advertisements, and promotions for upcoming programs. *Id.* The substantially similar requirement will sunset in five years from its effective date absent further action by the Commission to extend it. *Id.*

⁹⁷³ *Id.* at 9958, para. 61.

⁹⁷⁴ *Id.* at 9969-70, paras. 77-78.

⁹⁷⁵ *Id.* at 9970, para. 79.

⁹⁷⁶ *Id.* at 9973, para. 83.

⁹⁷⁷ *Id.* at 9975, para. 86.

⁹⁷⁸ *Id.* at 9978, para. 94. The Commission incorporates two parts of the ATSC 3.0 “physical layer” standard into its rules: (1) ATSC A/321:2016 “System Discovery & Signaling” (A/321), which is the standard used to communicate the RF signal type that the ATSC 3.0 signal will use, and (2) A/322:2017 “Physical Layer Protocol” (A/322), which is the standard that defines the waveforms that ATSC 3.0 signals may take. *Id.* at 9978, para. 95. The Commission also adopts the service and interference protection rules that were proposed in the *Next Gen TV NPRM*. *Id.* at 9982, para. 105. The Commission also concludes that broadcast television stations may operate ATSC 3.0 Single Frequency Networks (SFNs) pursuant to its current rules authorizing Distributed Transmission Systems (DTS). *Id.* at 9987, para. 115.

⁹⁷⁹ *Commission Launches Modernization of Media Regulation Initiative*, MB Docket No. 17-105, Public Notice, 32 FCC Rcd 4406 (2017).

⁹⁸⁰ *Elimination of Main Studio Rule*, MB Docket No. 17-106, Report and Order, 32 FCC 8158, 8158, para. 1 (2017) (*Main Studio Order*); see also *Elimination of Main Studio Rule*, Notice of Proposed Rulemaking, 32 FCC Rcd 4415 (2017).

members of the community to contact broadcast stations without the need for the physical presence of a local broadcast studio.⁹⁸¹ Likewise, because the Commission adopted online public inspection file requirements for broadcast stations, community members no longer need to visit a television station's main studio to access its public inspection file.⁹⁸² Given these changes, the Commission found the main studio rule to be outdated and unnecessarily burdensome on broadcast licensees.⁹⁸³ The Commission also eliminated the requirement that the main studio have full-time management and staff present during normal business hours as well as the requirement that the studio be capable of originating programming.⁹⁸⁴ Repeal of this rule is expected to give broadcasters cost savings and greater flexibility in their station operations.⁹⁸⁵

- In February 2018, the Commission eliminated rules that required certain broadcast and cable entities to maintain paper copies of the Commission's regulations.⁹⁸⁶
- As initially adopted, Section 73.624(g) of the Commission's rules required DTV broadcast stations to submit an annual report concerning provision of ancillary or supplementary services to the Commission, even if they provided no ancillary or supplementary services⁹⁸⁷ during the relevant reporting period.⁹⁸⁸ In April 2018, the Commission limited this reporting requirement to the small number of broadcast stations that actually provided feeable ancillary

⁹⁸¹ *Main Studio Order*, 32 FCC Rcd at 8163, para. 9.

⁹⁸² *Id.*

⁹⁸³ *Id.* at 8165, para. 13.

⁹⁸⁴ *Id.* at 8168, 8169, paras. 17, 19. Although not codified in regulations, the Commission had held that a main studio must have a "meaningful management and staff presence" to fulfill the main studio's function, which at a minimum required "management and staff presence on a full-time basis during normal business hours." *See Amendment of Sections 73.1125 and 73.1130 of the Commission's Rules, the Main Studio and Program Origination Rules for Radio and Television Broadcast Stations*, Memorandum Opinion and Order, 3 FCC Rcd 5024, 5026, para. 24 (1988) (1988 *Main Studio and Program Origination Reconsideration Order*); *Application for Review of Jones Eastern of the Outer Banks, Inc. Licensee, Radio Station WRSF(FM) Columbia, North Carolina*, Memorandum Opinion and Order, 6 FCC Rcd 3615, 3616, n.2 (1991). Stations were also required to maintain production and transmission facilities. 1988 *Main Studio and Program Origination Reconsideration Order*, 3 FCC Rcd at 5026, para. 24. The Commission found that requiring a main studio to maintain staff sufficient to accommodate visits from community members could not be justified because of current technology. *Main Studio Order* at 8168-69, para. 18.

⁹⁸⁵ *Id.* at 8168, 8169, paras. 17, 19.

⁹⁸⁶ *Amendment of Parts 74, 76 and 78 of the Commission's Rules Regarding Maintenance of Copies of FCC Rules*, Report and Order, 33 FCC Rcd 2425 (2018). The rules required (1) licensees or permittees of low power TV, TV translators, and TV booster stations to maintain "a current copy of Volume I and Volume III of the Commission's rules and (2) licensees and permittees of FM translator and FM booster stations to maintain a current copy of Volumes I (Parts 0, 1, 2 and 17) and III (Parts 73 and 74) of the Commission's rules. *Id.* at 2425-46, para. 2 and ns. 3 & 4 (internal citations omitted).

⁹⁸⁷ *See supra* note 261.

⁹⁸⁸ *Amendment of Section 73.624(g) of the Commission's Rules Regarding Submission of FCC Form 2100, Schedule G, Used to Report TV Stations' Ancillary or Supplementary Services*, MB Docket No. 17-264, Report and Order, FCC 18-41 at para. 3 (Apr. 13, 2018) (citing 47 CFR § 73.624(g)(2)(i)); *Fees for Ancillary or Supplementary Use of Digital Television Spectrum Pursuant to Section 336(e)(1) of the Telecommunications Act of 1996*, Report and Order, 14 FCC Rcd 3259 (1998) (*Ancillary or Supplementary Services Report and Order*), *recon. denied*, Memorandum Opinion and Order, 14 FCC Rcd 19931 (1999).

or supplementary services during the previous twelve months.⁹⁸⁹

- In September 2018, the Commission eliminated FCC Form 325, which collected certain operational information from cable television systems, finding that the form's limited utility was outweighed by the burden placed on cable operators to file, and on the Commission to process, the form.⁹⁹⁰
- In October 2018, the Commission eliminated the requirement that broadcast licensees and permittees file paper copies of certain documents with the Commission.⁹⁹¹

D. The Satellite Market

320. On September 27, 2017, the Commission adopted an updated regulatory framework to facilitate the delivery of broadband services through satellite constellations.⁹⁹² In that Order, the Commission updated, clarified and streamlined the current rules governing NGSO FSS systems to better reflect current technology and promote additional operational flexibility. That action paves the way for greater broadband offerings in the United States, particularly in remote and rural areas. In March 2018, to facilitate the efficient and effective use of spectrum, the Commission approved the first U.S.-licensed satellite constellation to provide broadband services using a new generation of low-Earth orbit satellite technologies in the *SpaceX Authorization Order*.⁹⁹³

321. In addition to SpaceX, the Commission has approved a number of NGSO FSS MEO and LEO systems for operation in the U.S. market that plan to serve a variety of purposes, such as the provision of high-throughput, low-latency broadband services to remote locations, satellite mission extension services, and inter-satellite connectivity. For example, in 2017, the Commission adopted an order granting market access to WorldVu d/b/a OneWeb for its NGSO FSS system of 720 satellites, which OneWeb plans to use to further its goal to “provide high-speed, affordable broadband connectivity to anyone, anywhere” in the United States.⁹⁹⁴ Also, the Commission granted the request of Space Norway AS (Space Norway) to access the U.S. market using a two-satellite NGSO FSS system, in a highly-elliptical orbit, to enable Space Norway to pursue its goal of providing broadband Internet access to currently unserved and underserved communities in the Arctic region of the United States.⁹⁹⁵ The authorization of these and other systems furthers the Commission's efforts to close the digital divide

⁹⁸⁹ *Id.* at para. 1 (citing 47 CFR § 73.624(g)(2); *Amendment of Section 73.624(g) of the Commission's Rules Regarding Submission of FCC Form 2100, Schedule G, Used to Report TV Stations' Ancillary or Supplementary Services et al.*, MB Docket No. 17-264 *et al.*, Notice of Proposed Rulemaking, FCC 17-138 (Oct. 24, 2017)).

⁹⁹⁰ *FCC Form 325 Collection*, MB Docket No. 17-290, Report and Order, FCC 18-136 (Sept. 26, 2018).

⁹⁹¹ *Amendment of Section 73.3613 of the Commission's Rules Regarding Filing of Contracts*, MB Docket No. 18-4, Report and Order, FCC 18-145 (Oct. 23, 2018).

⁹⁹² *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed Satellite Service Systems and Related Matters*, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809 (2017).

⁹⁹³ *Space Exploration Holdings, LLC; Application For Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System; Application For Approval For Orbital Deployment And Operating Authority for the SpaceX NGSO Satellite System Supplement*, Memorandum Opinion, Order and Authorization, 33 FCC 3391 (2018).

⁹⁹⁴ *WorldVu Satellites Limited; Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System*, Order and Declaratory Ruling, 32 FCC Rcd 5366 (2017); *WorldVu Satellites Limited, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb System*, IBFS File No. SAT-LOI-20160428-00041, Narrative at 1 (filed Apr. 28, 2016).

⁹⁹⁵ *Space Norway AS; Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission*, Order and Declaratory Ruling, 32 FCC Rcd 9649, 9649, paras. 1, 22 (2017); *Space Norway AS, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the Arctic Satellite Broadband Mission*, IBFS File No. SAT-PDR-20161115-00111, Narrative at 1, 12-14 (filed Nov. 15, 2016).

across the United States.⁹⁹⁶

322. On November 15, 2018, the Commission adopted a number of Orders granting the applications of NGSO FSS LEO systems for market access. The Commission granted Kepler's request for U.S. market access to offer global connectivity for the Internet of Things using a proposed constellation of 140 NGSO LEO satellites.⁹⁹⁷ The Commission also granted the applications of Telesat Canada and LeoSat for U.S. market access to provide broadband services.⁹⁹⁸ The Commission also granted SpaceX's application to construct, deploy and operate a proposed NGSO satellite system using frequencies in the V-band, which will provide SpaceX with additional flexibility to provide both diverse geographic coverage and the capacity to support a wide range of proposed broadband and communications services in the United States and globally.⁹⁹⁹

323. On April 17, 2018, the Commission proposed revisions to its rules to facilitate deployment of a class of satellites known colloquially as "small satellites."¹⁰⁰⁰ These types of satellites, which have relatively short duration missions, have been advancing scientific research and are increasingly being used for commercial endeavors such as gathering Earth observation data. The proposed rules were designed to lower the regulatory burden involved in licensing small satellites and reduce application processing times, while offering protection for critical communication links and enabling efficient use of spectrum for this dynamic sector.¹⁰⁰¹

324. Finally, on September 27, 2018, the Commission streamlined, consolidated, and harmonized the rules governing earth stations used to provide satellite-based GSO FSS services on ships, airplanes and vehicles.¹⁰⁰² These actions simplify the regulatory approval process for this rapidly growing segment of the satellite communications market and expand the FSS frequency bands where these operations can be conducted.¹⁰⁰³ On November 15, 2018, the Commission proposed similar rules with respect to governing earth stations used to provide satellite-based GSO FSS services on ships, airplanes and vehicles.¹⁰⁰⁴ Finally, on November 15, 2018, the Commission adopted a Notice of Proposed

⁹⁹⁶ See also *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, FCC 18-70 (June 6, 2018), 2018 WL 3046987; *Karousel Satellite LLC; Application for Authority to Launch and Operate a Non-Geostationary Earth Orbit Satellite System in the Fixed Satellite Service*, Memorandum Opinion, Order and Authorization, FCC 18-125 (Aug. 16, 2018).

⁹⁹⁷ *Kepler Communications Inc. Petition for Declaratory Ruling to Grant Access to the U.S. Market for Kepler's NGSO FSS System*, Order and Declaratory Ruling, FCC 18-162 (Nov. 19, 2018).

⁹⁹⁸ *Telesat Canada Petition for Declaratory Ruling to Grant Access to the U.S. Market for Telesat's V-Band NGSO Constellation*, Order and Declaratory Ruling, FCC 18-163 (Nov. 15, 2018); *LeoSat MA, Inc. Petition for Declaratory Ruling Concerning U.S. Market Access for the LeoSat Ka-band Low-Earth Orbit Satellite System*, Order and Declaratory Ruling, FCC 18-163 (Nov. 19, 2018).

⁹⁹⁹ *Space Exploration Holdings, LLC; Application for Approval for Orbital Deployment and Operating Authority for the SpaceX V-band NGSO Satellite System*, Memorandum Opinion, Order and Authorization, FCC 18-161 (rel. Nov. 19, 2018).

¹⁰⁰⁰ See *Small Satellites NPRM*.

¹⁰⁰¹ *Id.* at para. 1.

¹⁰⁰² *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*, Report and Order and Further Notice of Proposed Rulemaking, FCC 18-138 (Sept. 27, 2018), 2018 WL 4678557.

¹⁰⁰³ *Id.*

¹⁰⁰⁴ See *Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, IB Docket No. 18-315, Notice of Proposed Rulemaking, FCC 18-160 (rel. Nov. 16, 2018).

(continued....)

Rulemaking proposing to further streamline the Commission's Part 25 rules governing satellite services, including through consolidated licensing and reporting proposals.¹⁰⁰⁵

IV. COMMISSION AGENDA TO FURTHER ENCOURAGE INVESTMENT, INNOVATION, DEPLOYMENT, AND COMPETITION

325. RAY BAUM'S Act 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. We note that because this is the first Communications Marketplace Report, the Commission did not have the opportunity to describe its agenda in a previous Communications Marketplace Report. This section of the *Report* helps to articulate the Commission's agenda for the next 2-year period.¹⁰⁰⁶

A. The Mobile Wireless Market

326. *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 over the next two years across a range of low-, mid-, and high-band frequencies to ensure a vibrantly competitive mobile wireless services marketplace.

327. *High-band*. The FCC has made auctioning high-band, millimeter-wave spectrum a priority. In the Spectrum Frontiers proceeding, the Commission has proposed rules for facilitating the reconfiguration of existing 39 GHz spectrum holdings into more contiguous license blocks and areas conducive to wireless broadband deployments. To accomplish this reconfiguration, the Commission has proposed an incentive auction and sought comment on a proposal for an optional voucher exchange that will allow incumbent licensees to consolidate their holdings prior to the incentive auction.

328. The 28 GHz auction (Auction 101) began on November 14, 2018. Short forms have been filed for the 24 GHz auction (Auction 102), which will start after Auction 101 is complete. FCC Chairman Ajit Pai has announced his intent to start the auction process for Upper 37 GHz (37.6-38.6 GHz), 39 GHz (38.6-40 GHz), and 47 GHz (47.2-48.2 GHz) in the second half of 2019. With these auctions, the FCC will release almost 5 gigahertz of 5G spectrum into the market—more than all other flexible use bands combined. And we are working to free up additional spectrum for 5G in millimeter wave frequencies, including the 26 and 42 GHz bands.

329. *Mid-band*. Mid-band spectrum is very well-suited for next generation 5G wireless services due to the combination of favorable propagation characteristics (as compared to high bands, like mmW) and the opportunity for additional channel re-use (as compared to low bands).¹⁰⁰⁷ To facilitate additional access to mid-band spectrum the Commission will conduct an auction for Priority Access Licenses (PALs) in the 3.5 GHz band. Separately, in the Mid-Band proceeding, the Commission identifies potential opportunities for additional terrestrial use of 500 megahertz of mid-band spectrum between 3.7-4.2 GHz.¹⁰⁰⁸ The Commission is also seeking comment on potential changes to the

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¹⁰⁰⁵ *Further Streamlining Part 25 Rules Governing Satellite Services*, IB Docket No. 18-314, Notice of Proposed Rulemaking (rel. Nov. 19, 2018).

¹⁰⁰⁶ Section 401 of the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (RAY BAUM'S Act), Pub. L. No. 115-141, 132 Stat. 1087 (codified at 47 U.S.C. § 163) (RAY BAUM's Act).

¹⁰⁰⁷ *Mid-Band Order*, at 3, para. 5.

¹⁰⁰⁸ *See generally Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Order and Notice of Proposed Rulemaking, FCC 18-91, (Jul. 13, 2018) (*Mid-Band Order*).

Commission's rules in the 3.7-4.2 GHz band to promote more efficient and intensive fixed use of the band on a shared basis.¹⁰⁰⁹ With our work on the 2.5 GHz, 3.5 GHz, and 3.7-4.2 GHz bands, we could make up to 844 megahertz available for 5G deployments.¹⁰¹⁰

330. *Low-band.* The FCC is acting to improve use of low-band spectrum (useful for wider coverage) for 5G services, with targeted changes to the 600 MHz, 800 MHz, and 900 MHz bands.¹⁰¹¹

331. *Unlicensed.* Recognizing that unlicensed spectrum will be important for 5G, the Commission recently proposed rules, in the 6 GHz band, that will promote new opportunities for unlicensed use in portions of 1200 megahertz of spectrum while ensuring current licensed services in operation continue to thrive.¹⁰¹² The agency is also creating new opportunities for unlicensed use above 95 GHz.¹⁰¹³

332. *Expanding Wireless Access in Rural Areas.* We will proceed with the Mobility Fund Phase II Auction, a reverse auction of up to \$4.53 billion in funding support for deployment of 4G LTE mobile service where it is currently lacking.

333. *Infrastructure.* 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. 5G can enable increased competition for a range of services—including broadband—support new healthcare and Internet of Things applications, speed the transition to life-saving connected car technologies, and create jobs. Just as we have done in the past two years in reexamining the Commission's rules and procedures for wireless infrastructure deployment, we will continue to look for ways in which we can promote the rapid deployment of advanced wireless broadband services, whether through Commission processes, local and state review, or otherwise. In addition to reexamining our own procedures, we will continue to work with other U.S. government agencies as well as states and local governments, to facilitate the deployment of advanced wireless broadband services.

B. The Fixed Communications Market

334. The Commission's policymaking efforts over the last two years have targeted promoting greater broadband deployment, and the data demonstrate that more Americans have coverage from multiple fixed broadband providers than ever before.¹⁰¹⁴ We are optimistic that competition will continue to flourish as the Commission's recent efforts to increase broadband deployment by breaking down regulatory barriers spurs additional Internet service provider investment. The Commission will continue to monitor the marketplace to encourage broadband deployment and bring the benefits of competition to as many Americans as possible.

335. Over the next two years, the Commission will continue to focus our efforts on creating a regulatory environment that reduces barriers to investment and encourages the private sector to build, maintain, and upgrade next-generation networks so that the benefits of broadband are available to all Americans. The work of the BDAC will also continue to play a crucial role in informing our efforts to streamline broadband deployment and close the digital divide. The recently established Disaster

¹⁰⁰⁹ *Mid-Band Order* at 2, para. 2.

¹⁰¹⁰ *Id.*

¹⁰¹¹ *Id.*

¹⁰¹² *See generally Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Proposed Rulemaking, FCC 18-147 (Oct. 24, 2018) (*6 GHz NPRM*).

¹⁰¹³ *Spectrum Horizons*, Notice of Proposed Rulemaking, 33 FCC Rcd 2438 (2018).

¹⁰¹⁴ *See supra* Section III.D.

Response and Recovery Working Group is already at work exploring additional measures that public and private actors can take before a disaster to improve resiliency of broadband infrastructure, strategies they can use during the response to a disaster to minimize the downtime of broadband networks, and actions they can take to restore broadband infrastructure during disaster recovery.¹⁰¹⁵

336. The Commission will also continue to review outdated regulations that burden incumbent providers and stifle competition. For instance, we will reexamine our rate floor rules for rate-of-return carriers, which artificially inflate prices for rural consumers. The Commission will also work towards removing unnecessary tariffing rules and encouraging carriers' transition of their business data services to light-touch incentive regulation. Where competition warrants it, we will encourage carriers to transition away from ex ante pricing regulation. We will also work to identify and eliminate arbitrage opportunities in our intercarrier compensation system through enforcement proceedings, tariff investigations, and rulemakings as we continue the Commission's longer-term efforts to fully move to a bill-and-keep regime.

337. The Commission will also prioritize proceedings that advance the goals of universal service and target the digital divide. Specifically, we will focus on providing long term funding for restoration and expansion of fixed broadband connectivity in Puerto Rico and the U.S. Virgin Islands through the Universal Service Fund. The Commission will also use its auction authority to continue providing high-speed Internet access to many unserved Americans, including through the Connect American Fund Phase II auction, in which Commission staff will soon conclude reviews of winning bidders' long-form applications so that service providers can begin deploying new networks to serve rural Americans.¹⁰¹⁶ Finally, we will undertake much needed changes to the universal service Rural Health Care Program and explore a "Connected Care Pilot Program" to support the delivery of telehealth services to low-income Americans, with a focus on the delivery of such services to patients beyond the doors of brick-and-mortar health care facilities.

C. The Video and Audio Markets

338. As part of its ongoing *Modernization of Media Regulation Initiative*, the Commission will continue to modernize its regulations affecting media outlets by eliminating or modifying obsolete, burdensome, or outmoded rules, including by completing several previously initiated rulemakings.¹⁰¹⁷ The Commission has commenced a number of rulemaking proceedings as part of this initiative in order to reduce burdens on licensees, while simultaneously enhancing competition and service to the public.¹⁰¹⁸

339. In addition, the Commission is engaged in ongoing efforts to enhance competition and improve public service in the video marketplace in a variety of other ways. For example, the Commission is addressing two issues raised by a remand of the U.S. Court of Appeals for the Sixth Circuit.¹⁰¹⁹ The first concerns the ability of local franchising authorities to regulate non-cable services, such as broadband

¹⁰¹⁵ See *FCC Announces Membership of the Broadband Deployment Advisory Committee's Disaster Response and Recovery Working Group*, GN Docket No. 17-83, Public Notice, DA 18-1121 (Nov. 1, 2018); *FCC Solicits Nominations for New Disaster Response and Recovery Working Group of the Broadband Deployment Advisory Committee*, GN Docket No. 17-83, Public Notice, DA 18-837 (Aug. 9, 2018)

¹⁰¹⁶ FCC Strategic Plan at 6.

¹⁰¹⁷ See *Commission Launches Modernization of Media Regulation Initiative*, MB Docket No. 17-105, Public Notice, 32 FCC Rcd 4406 (2017).

¹⁰¹⁸ See, e.g., *Elimination of Obligation to File Broadcast MidTerm Report (Form 397) Under Section 73.2080(f)(2)*, MB Docket No. 18-23, Notice of Proposed Rulemaking, 33 FCC Rcd 2570 (2018); *Channel Lineup Requirements – Sections 76.1705 and 76.1700(a)(4)*, MB Docket No. 18-92, Notice of Proposed Rulemaking, 33 FCC Rcd 4323 (2018).

¹⁰¹⁹ *Montgomery County, Md. et al. v. FCC*, 863 F.3d 485 (6th Cir. 2017)

Internet access service, and the second relates to the appropriate treatment of cable-related “in kind” contributions.¹⁰²⁰

340. Furthermore, with respect to television broadcast stations, the Commission has authorized 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.¹⁰²¹ The Commission is currently examining several remaining issues to facilitate the introduction of service with the new standard.¹⁰²²

341. The Commission also continues to examine its broadcast ownership regulations. For example the Commission has recently commenced its statutory quadrennial review of the media ownership rules to determine whether they remain “necessary in the public interest as a result of competition.”¹⁰²³ The Commission’s review will consider whether three key structural ownership rules remain in the public interest in light of the current media marketplace or whether, alternatively, the public interest would benefit from modification or elimination of these rules.¹⁰²⁴ Retention, modification, or elimination of these structural ownership rules may impact competition in the video and/or audio marketplace. In addition, a rulemaking proceeding is pending to examine the national television audience reach cap.¹⁰²⁵

342. Also with respect to the audio marketplace, the Commission’s AM revitalization effort aims to “help AM broadcasters better serve the public, thereby advancing the Commission’s fundamental goals of localism, competition, and diversity in broadcast media.”¹⁰²⁶ Pursuant to this effort, the Commission has taken several steps designed to improve AM broadcasting, including opening FM translator filing windows exclusively for AM licensees and permittees, modifying technical rules to ease

¹⁰²⁰ *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, Second Further Notice of Proposed Rulemaking, FCC 18-131, paras. 16, 25 (Sep. 25, 2018)

¹⁰²¹ *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, 9931-33, para. 2.

¹⁰²² Specifically, the Commission will address the remaining pending issues regarding: (1) possible exceptions to and waivers of the local simulcasting requirement, (2) whether the Commission should let full power broadcasters use channels in the television broadcast band that are vacant to facilitate the transition to 3.0, and (3) the Commission’s tentative conclusion that local simulcasting should not change the significantly viewed status of a station transmitting in ATSC 3.0. *Id.* at 9989, paras. 122-31. The Commission will also address pending petitions for reconsideration of the initial order filed by NTCA – The Internet & Television Alliance and American Television Alliance, respectively. Petition for Reconsideration of NTCA – The Internet & Television Alliance, Docket GN 16-142 (filed Mar. 5, 2018); Petition for Reconsideration of American Television Alliance, Docket GN 16-142 (filed Mar. 5, 2018).

¹⁰²³ Telecommunications Act of 1996, Pub. L. No. 104-104, § 202(h), 110 Stat. 56, 111-12 (1996) (1996 Act); Consolidated Appropriations Act, 2004, Pub. L. No. 108-199, § 629, 118 Stat. 3, 99-100 (2004) (Appropriations Act) (amending Sections 202(c) and 202(h) of the 1996 Act). In 2004, Congress revised the then-biennial review requirement to require such reviews quadrennially. *See* Appropriations Act § 629, 118 Stat. at 100.

¹⁰²⁴ In addition, the proceeding will examine several potential pro-diversity initiatives raised in the Commission’s combined 2010/2014 Quadrennial Review proceeding. *See 2014 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. 14-50, Second Report and Order, 31 FCC Rcd 9864, 10006-07, paras. 330-32 (2016).

¹⁰²⁵ *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).

¹⁰²⁶ *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Notice of Proposed Rulemaking, 28 FCC Rcd 15221, 15222, para. 1 (2013).

regulatory burdens, and providing AM licensees with more operational flexibility to improve service to the public.¹⁰²⁷ This effort is ongoing, and the Commission anticipates taking additional steps to enhance and improve the AM service, enhancing the ability of AM broadcasters to compete and serve the public.¹⁰²⁸ In addition, the Commission has commenced a rulemaking proceeding seeking to “streamline the rules relating to interference caused by FM translators and expedite the translator complaint resolution process.”¹⁰²⁹ Adoption of streamlined interference rules may enhance the ability of FM broadcasters to compete in the audio marketplace.

D. The Satellite Market

343. The Commission plans to pursue an agenda over the next two years to further encourage investment and innovation in the provision of satellite services. Those actions will also facilitate the further deployment of satellite services, thereby expanding connectivity in rural, high-cost areas of the country and promoting competitive choices throughout the nation. Specifically, the Commission expects to consider final rules in a number of separate rulemaking proceedings, all of which are designed to promote and protect innovation and investment in the commercial satellite industry.

344. First, the Commission plans to consider final rules to facilitate the deployment of small satellites, which are relatively inexpensive and have demonstrated their utility and capabilities across a wide range of satellite services.¹⁰³⁰ These proposals are designed to lower the regulatory burden involved in licensing small satellites and reduce application processing times. They will also offer protection for critical communication links and enable efficient use of spectrum for this dynamic sector.

345. Second, the Commission plans to further streamline and consolidate the Part 25 rules governing satellite communications, including application and licensing processes for both space and earth stations. For example, the Commission plans to consider consolidated space station and earth station licensing,¹⁰³¹ which would likely facilitate the design of new systems by providing for simultaneous, rather than sequential, planning of space station and gateway earth stations. The Commission also plans to simplify and harmonize rules governing earth stations used to provide satellite-based FSS services on ships, airplanes, and vehicles, a rapidly growing segment of the satellite communications market.¹⁰³²

346. Third, the Commission plans to consider final rules providing FSS with additional capacity for satellite services of millimeter wave band spectrum while permitting substantial terrestrial use. For instance, it has proposed to permit licensing of individual FSS earth stations in the 50.4-51.4

¹⁰²⁷ See *id.*; *Revitalization of the AM Radio Service*, MB Docket No. 13-249, First Report and Order, Further Notice of Proposed Rulemaking, and Notice of Inquiry, 30 FCC Rcd 12145 (2015); *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Second Report and Order, 32 FCC Rcd 1724 (2017); *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Third Report and Order, 32 FCC Rcd 7736 (2017).

¹⁰²⁸ *Revitalization of the AM Radio Service*, MB Docket No. 13-249, Second Further Notice of Proposed Rulemaking, FCC 18-139 (Oct. 5, 2018) (presenting a proposal to modify the protection of Class A AM stations).

¹⁰²⁹ *Amendment of Part 74 of the Commission’s Rules Regarding FM Translator Interference*, MB Docket No. 18-119, Notice of Proposed Rulemaking, FCC 18-60 at 1, para. 1 (May 10, 2018).

¹⁰³⁰ See *Streamlining Licensing Procedures for Small Satellites*, Notice of Proposed Rulemaking, 33 FCC Rcd 4152 (2018).

¹⁰³¹ See *Further Streamlining Part 25 Rules Governing Satellite Services*, IB Docket No. 18-314, Notice of Proposed Rulemaking, FCC 18-165 (rel. Nov. 19, 2018).

¹⁰³² 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*, Report and Order and Further Notice of Proposed Rulemaking, FCC 18-138 (Sept. 27, 2018), 2018 WL 4678557; See *Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, IB Docket No. 18-315, Notice of Proposed Rulemaking, FCC 18-160 (rel. Nov. 16, 2018).

GHz band.¹⁰³³ This proposal is part of an overall strategy to have a balanced approach for sharing between terrestrial and satellite services in V-band, and would build on prior decisions to provide FSS with exclusive access to the 40-42 GHz and 48.2-50.2 GHz bands, as well as shared access to the 37.5-40 GHz and 28 GHz bands. Through these actions, the Commission has sought to provide certainty to satellite providers for them to offer services in shared spectrum bands.

347. Finally, the Commission plans to update its rules and policies regarding orbital debris.¹⁰³⁴ Orbital debris, also known as “space debris” consists of artificial objects orbiting the Earth that are not functional spacecraft, and can be created under a variety of scenarios involving satellite systems.¹⁰³⁵ Orbital debris can affect the cost, reliability, integrity, and capability of new satellite systems and valuable services to the public, and it has the potential to cause physical harm to both people and property.¹⁰³⁶ 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, both of which have the potential to increase the amount of orbital debris.¹⁰³⁷ In these circumstances, continuing to rely on clearly outdated rules and policies increases both risks to continued safe operations in space and the uncertainty surrounding future satellite operations. Mitigating the growth of orbital debris through updated orbital debris rules and policies is more critical than ever to facilitate space commerce investments and innovation. As the Commission has previously found, consideration of orbital debris issues plays an important role in preserving access to space for the long term and in ensuring the safety of persons and property in space and on the surface of the Earth.¹⁰³⁸

¹⁰³³ *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services; Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services*, GN Docket No. 14-177, WT Docket No. 10-112, Third Report and Order, Memorandum Opinion and Order, and Third Further Notice of Proposed Rulemaking, FCC 18-73 (rel. June 8, 2018). We note that Boeing has petitioned for FSS access to 51.4-52.4 GHz. Our proposal applies only to 50.4 - 51.4 GHz, where there currently is an FSS allocation, and does not address Boeing’s petition.

¹⁰³⁴ Additionally, in the future, Hughes and ViaSat will be expanding broadband services in remote areas with funding from the Connect America Fund. *See supra* Chapter III.D.1, note [[x]] (noting that Hughes was awarded funding to serve 76,873 units in New York state, while ViaSat was a winning bidder in 20 states, potentially serving 190,575 locations).

¹⁰³⁵ *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, FCC 18-159, para. 1 (rel. Nov. 19, 2018) (*Orbital Debris NPRM*).

¹⁰³⁶ *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 11575, para. 14 (2004) (*Orbital Debris Order*).

¹⁰³⁷ *Orbital Debris NPRM* at 1.

¹⁰³⁸ *Orbital Debris Order*, 19 FCC Rcd at 11575, para. 14.