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Federal Communications Commission
Washington, D.C. 20554

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In the Matter of)
)
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)

GN Docket No. 07-45

FIFTH REPORT

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By the Commission: Chairman Martin and Commissioners Tate and McDowell issuing separate statements; Commissioners Copps and Adelstein dissenting and issuing separate statements.

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June 30, 2007	

I. INTRODUCTION

1. This is the Commission's Fifth Report examining the availability of advanced telecommunications capability to all Americans, as required by section 706 of the Telecommunications Act of 1996 (1996 Act).¹ Section 706 directs the Commission to encourage the deployment of advanced telecommunications capability to all Americans by using measures that "promote competition in the local telecommunications market."² Further, it requires the Commission to conduct a regular inquiry to determine "whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion."³ In this Report, we find, pursuant to the analytical framework established in prior section 706 reports, that advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion.

II. DEFINITION OF ADVANCED TELECOMMUNICATIONS CAPABILITY

2. Section 706(c) of the 1996 Act describes advanced telecommunications capability as "high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data, graphics, and video telecommunications using any technology."⁴ In previous reports, the Commission defined "broadband" – and, in effect, "advanced telecommunications capability" and "advanced services" – as services and facilities with an upstream (customer-to-provider) and downstream (provider-to-customer) transmission speed of more than 200 kilobits per second (kbps).⁵ As in these previous reports, we use these terms interchangeably for the purposes of this Report, and we describe service speeds with greater specificity where needed.⁶ By contrast, the Commission has used the term "high-speed" to describe services with over 200 kbps capability in at least one direction.⁷

3. In the Commission's *Fourth Report* in 2004, the Commission made clear that 200 kbps service was appropriately considered "first generation" broadband. Also in 2004, the Commission reexamined its Form 477 local competition and broadband data gathering program, and began requiring providers to

¹ 47 U.S.C. § 157 nt.; 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*, GN Docket No. 07-45, Notice of Inquiry, 22 FCC Rcd 7816 (2007) (beginning the fifth inquiry under section 706) (*Fifth Report Notice*). The 1996 Act, Pub. L. 104-104, Feb. 8, 1996, 110 Stat. 56, amended the Communications Act of 1934, codified at 47 U.S.C. § 151 *et seq.* We refer to the Communications Act of 1934, as amended, as the "Communications Act."

² 47 U.S.C. § 157 nt.

³ *Id.*

⁴ *Id.*

⁵ *Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, CC Docket No. 98-146, Report, 14 FCC Rcd 2398, 2406, para. 20 (1999) (*First Report*); *Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, CC Docket No. 98-146, Second Report, 15 FCC Rcd 20913, 20919-21, para. 10 (2000) (*Second Report*); *Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, CC Docket No. 98-146, Third Report, 17 FCC Rcd 2844, 2850, para. 9 (2002) (*Third Report*); *Availability of Advanced Telecommunications Capability in the United States*, GN Docket No. 04-54, Fourth Report to Congress, 19 FCC Rcd 20540, 20551-52 (2004) (*Fourth Report*).

⁶ See *infra* para. 33; Appendix B. We note, however, that some of the third-party studies and reports cited in this Fifth Report may use the term "broadband" differently than it has been defined in our section 706 reports.

⁷ See *Second Report*, 15 FCC Rcd at 20920, para. 11; *Third Report*, 17 FCC Rcd at 2850-51, para. 9; *Fourth Report*, 19 FCC Rcd at 20551.

submit further information about their broadband deployments.⁸ Among other things, the Commission required that filers determine the percentage of their broadband connections that are faster than 200 kbps in both directions and to categorize those connections into five "speed tiers" based on the information transfer rate in the connection's faster direction: (1) greater than 200 kbps but less than 2.5 megabits per second (mbps); (2) greater than or equal to 2.5 mbps but less than 10 mbps; (3) greater than or equal to 10 mbps but less than 25 mbps; (4) greater than or equal to 25 mbps but less than 100 mbps; and (5) greater than or equal to 100 mbps.⁹ As a result of this more refined data collection, the Commission is now able to examine the deployment of broadband capable of providing service in excess of 200 kbps on the basis of speed tiers in this and subsequent reports.

4. Given the conclusion of the *Fourth Report* and the availability of suitable data from the Form 477 program, we find it appropriate to evaluate broadband deployment by monitoring the migration of customers and services to higher speed tiers, beginning at the 200 kbps threshold.¹⁰ By doing so, the Commission can evaluate and track broadband deployment over time against a common benchmark to determine whether it is being deployed in a reasonable and timely manner.¹¹ Thus, in this Report we evaluate broadband deployment by speed tiers for the first time.

5. Variation in services and technologies likewise supports our evaluating broadband deployment over a range of speed tiers. As Connected Nation, the parent company of ConnectKentucky,¹² points out, different broadband technologies have varying capabilities today that may meet particular needs of broadband customers.¹³ Further, consumers currently require different speed services depending upon the

⁸ See *Local Telephone Competition and Broadband Reporting*, WC Docket No. 04-141, Report and Order, 19 FCC Rcd 22340 (2004) (2004 Data Gathering Order).

⁹ See *id.* at 22347-48, para. 14.

¹⁰ See, e.g., NATOA *et al.* Comments at 8-9 ("We suggest one option the Commission consider be some sort of tiered approach in defining 'advanced telecommunications capability,' similar in approach to the manner in which the Commission currently obtains information on deployment. . . . By adopting the data collection tiers into the operational definition of 'advanced telecommunications services,' both quantity and quality of broadband deployment can be measured. As a result, all consumers, regardless of the speed of their selected service, will be counted."); TIA Comments at 7 ("Included in the Commission's January report on Internet access, is a set of 'tiers' of broadband, divided by technologies and the transmission speeds made possible by them. . . . TIA recommends that the Commission, for purposes of assessment, use these tiers to identify what is available to the consuming public and the kinds of capabilities the tiers enable.") (citation omitted); CTIA Comments at 10 (arguing that the baseline definition should be maintained to allow the Commission to compile a full picture of the advanced telecommunications capabilities available to American consumers); Verizon/Verizon Wireless Comments at 32 (arguing that there is no reason to stop tracking entry-level broadband speeds that continue "to provide many consumers access to the applications and services they desire").

¹¹ We thus disagree that we should abandon consideration of information of services at the 200 kbps level. See, e.g., APT Comments at 3 (arguing that the 200 kbps standard has outlived its usefulness); NASUCA Comments at 9 (stating its belief that the current definition of advanced services is out of date); NJ Rate Counsel Comments at 10 (arguing that the current speeds have become irrelevant). But see, e.g., TIA Comments at 5 ("Despite the Commission's definition of broadband as 200 kbps, its deregulatory policies have spurred billions of dollars in investment and the availability of better broadband services. So, even though 200 kbps may not be an appropriate definition of broadband in today's market, it is important to note that the definition itself has done nothing to impede innovation.").

¹² For a discussion of the ConnectKentucky project, see *infra* para. 37.

¹³ Connected Nation Comments at 2-3 (cautioning against the adoption of an inflexible definition of "advanced telecommunications capability" that might exclude particular technologies, such as the fixed wireless technologies that ConnectKentucky has found to be creative and cost effective solutions in some areas); see also, e.g., OPASTCO (continued....)

particular applications or services being used, which can, in part be a function of other technological developments, such as advances in compression technology.¹⁴ For example, in prior section 706 reports, the Commission has noted that at 200 kbps, consumers can enjoy the most popular applications, including web browsing and email, without the delay experienced by dial-up subscribers.¹⁵ Commenters point out that other applications and services work best with higher-capacity broadband.¹⁶ By examining broadband availability across various speed tiers, we can monitor the availability of broadband associated with a full range of technologies and services.

6. For the reasons described above, in this Report we evaluate the status of broadband according to the historical Form 477 data and terminology. In light, however, of the continuing evolution in technology and consumer demand for advanced telecommunications capability, the Commission must continue to evolve its data collection. The Commission is modifying the Form 477 data collection in order to allow the Commission to gather more detailed information about availability of and subscription to broadband services, such as by adding additional broadband speed tiers.¹⁷

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Comments at 11-12 (stating that it may be appropriate for the Commission to consider various speeds of broadband services as part of its section 706 analysis “since technological advancements and marketplace demands will likely render any one speed of broadband inappropriate. In addition, a speed-based definition risks rapid obsolescence, as new applications and compression technology change the dynamics of how consumers will utilize broadband. . . . Changes in marketplace demands and technological capabilities are too unpredictable at this point to make alterations based on pre-determined conditions.”); NRTC Reply at 4 (“[T]he Commission must note the contribution of satellite and other wireless broadband providers that are delivering advanced telecommunications capabilities and take care not to exclude such providers from any benefits that might be derived from a definition that encompasses such lower speeds.”).

¹⁴ See, e.g., OPASTCO Comments at 12.

¹⁵ See *First Report*, 14 FCC Rcd at 2406, para. 20; *Second Report*, 15 FCC Rcd at 20920, para. 10; *Third Report*, 17 FCC Rcd at 2852, para. 11; *Fourth Report*, 19 FCC Rcd at 20551-52. As NATOA *et al.* point out, “the current speed of 200 kbps in each direction, according to the FCC’s own report, ‘permits users to play interactive games, use VoIP applications; listen to on-line music, and watch compressed video clips.’ This functionality – for some – may be sufficient and, because of availability, cost or a combination of these and other factors, these consumers will choose not to upgrade their broadband service. As a result, if the definitional speed is raised higher than 200 kbps, these consumers, even though they have access to broadband, will not be counted. Thus, if we are more interested in getting an accurate assessment of broadband deployment across the country – quantity – we must be careful in not increasing the speed to such an extent that a significant undercount occurs.” NATOA *et al.* Comments at 8 (citation omitted); see also TIA Comments at 6 (“While broadband continues to be offered at increasingly faster speeds and for some applications speeds as high as several megabits per second are necessary, it remains the case that in many circumstances speeds as low as 200 kbps may be appropriate.”).

¹⁶ See, e.g., FTTH Council Comments at 9-10 (citing, for example, the need for capacity ranging from 6 mbps for analog video to 20 mbps for digital, high-definition video, and up to 60 mbps for future “Super HDTV” video, depending upon the compression technology); Consumers Union *et al.* Comments at 15, Fig. 3 (citing different download speeds associated with different applications).

¹⁷ See *Deployment of Nationwide Broadband Data to Evaluate Reasonable and Timely Deployment of Advanced Services to All Americans, Improvement of Wireless Broadband Subscriberhip Data, and Development of Data on Interconnected Voice over Internet Protocol (VoIP) Subscriberhip*, WC Docket No. 07-38, Notice of Proposed Rulemaking, 22 FCC Rcd 7760 (2007) (*2007 Data Gathering Notice*); *Deployment of Nationwide Broadband Data to Evaluate Reasonable and Timely Deployment of Advanced Services to All Americans, Improvement of Wireless Broadband Subscriberhip Data, and Development of Data on Interconnected Voice over Internet Protocol (VoIP) Subscriberhip*, WC Docket No. 07-38, Report and Order and Further Notice of Proposed Rulemaking, FCC 08-89 (rel. Jun. 12, 2008) (*2008 Data Gathering Order*).

III. DEVELOPMENTS IN LAST-MILE TECHNOLOGIES SINCE THE *FOURTH REPORT*

7. There have been considerable changes and advances in the delivery of broadband since the *Fourth Report*. Here, we highlight a few of these advances for different broadband deployment technologies.

A. Cable Technologies

8. Cable modem technologies continue to provide high-speed data services over cable systems, and in many cases, voice services over the Data Over Cable Service Interface Specification (DOCSIS) platform using PacketCable or other voice over Internet Protocol (VoIP) standards. Since the *Fourth Report*, cable operators have continued to upgrade their hybrid fiber coaxial (HFC) networks and are working to deliver new or improved services to residential and, increasingly, business customers through bandwidth increases and savings. The Commission estimates that high-speed cable modem service is available to 96 percent of the households to which cable system operators could provide cable TV service.¹⁸

9. Further, cable companies have continued to upgrade the equipment used to deliver broadband services, including a throughput improvement that allows cable operators to deliver additional and more complex services, including VoIP.¹⁹ On August 7, 2006, CableLabs announced the adoption of the new DOCSIS 3.0 specifications that enable cable operators to offer significantly higher data rates to their broadband customers.²⁰ Specifically, the DOCSIS 3.0 specifications enable downstream data rates of 160 mbps or higher and upstream data rates of 120 mbps or higher.²¹ DOCSIS 3.0 also incorporates support for the Internet Protocol version 6 (IPv6), which is the next generation of the Internet Protocol (IP), and greatly expands the number of Internet addresses that operators may use, allowing them to provide consumers with more IP-based services.²² This new specification promises secure delivery of advanced interactive video that would otherwise require complex engineering in the networks and substantial upgrades to the plant.

10. The transition to DOCSIS 3.0 will take place in two phases. First, the operators must replace the Cable Modem Termination System (CMTS) equipment in the network before offering the service.

¹⁸ See Appendix B, Table 14.

¹⁹ "Throughput" is the actual amount of useful and non-redundant information which is transmitted or processed. See Harry Newton, *Newton's Telecom Dictionary* at 832 (20th ed. 2004).

²⁰ CableLab's DOCSIS continues to be the dominant standard used to provide high-speed Internet service for cable operators. Cable operators previously have deployed DOCSIS 1.0, 1.1, and 2.0 throughout their systems, allowing capacities of up to 30 mbps. DOCSIS 3.0 has fully replaced the cancelled 2.0b specification, which was identified only as an interim solution.

²¹ See Press Release, CableLabs, *CableLabs Issues DOCSIS 3.0 Specification Enabling 160 Mbps* (Aug. 7, 2006), available at http://www.cablelabs.com/news/pr/2006/06_pr_docsis30_080706.html. To achieve these higher data rates, DOCSIS 3.0 specifies a methodology called channel bonding – a load-sharing technique for logically combining multiple DOCSIS channels – in both the upstream and downstream directions. Downstream channel bonding is possible for a minimum of four channels, approximately 38 mbps each, for a total of more than 140 mbps shared throughput. Upstream channel bonding is possible for a minimum of four channels, 10 to 30 mbps each, for a total of 40 to 120 mbps of shared throughput. See John T. Chapman and Shalabh Goel, *The Road to DOCSIS 3.0* (Dec. 1, 2006), available at <http://www.cable360.net/ct/sections/features/20942.html>.

²² See Press Release, CableLabs, *CableLabs Issues DOCSIS 3.0 Specification Enabling 160 Mbps* (Aug. 7, 2006), available at http://www.cablelabs.com/news/pr/2006/06_pr_docsis30_080706.html.

Second, partly by a process of natural replacement over time, the cable modems and set-top boxes in consumers' homes will be replaced with DOCSIS 3.0-compatible equipment.²³ Some cable multiple system operators (MSOs) soon will begin to deploy DOCSIS set-top gateways (DSGs), which support more bandwidth intensive interactive video services and provide easier integration of multi-vendor solutions, in addition to supporting the upcoming OpenCable Application Platform (OCAP).²⁴

11. The cable industry is also continuing work on its Next Generation Network Architecture (NGNA) project to advance cable operators' transition to all-digital networks and to provide an alternative software-based conditional access system that supports cable operators' existing security. The non-profit company Polycipher intends to continue the work NGNA had begun on the downloadable conditional access system (DCAS) software-based security platform.²⁵ Further, NGNA intends to unify cable's IP and moving pictures expert group (MPEG) video infrastructures in an effort to drive down equipment costs, reclaim valuable HFC spectrum, and enable high-value digital services. Fulfilling the NGNA vision requires a new class of Digital IP Cable Edge devices that integrate the functionality of a high-density edge quadrature amplitude modulation (QAM) modulator platform, DOCSIS CMTS, and video processing. Ultimately, IP traffic (data, voice, and video) and MPEG traffic (broadcast and on-demand standard and high-definition video) will flow over a common Gigabit Ethernet backbone to the cable network edge. There, the NGNA edge platform will dynamically route the service to the appropriate customer premises device, whether MPEG set-top, IP set-top, cable modem, or PacketCable electronic message transfer agent (E-MTA).²⁶

B. Copper Technologies

12. Local telephone carriers primarily use digital subscriber line (DSL) service offerings to provide consumers with broadband services where they have not deployed fiber technologies. As of June 2007, there were over 23.3 million broadband DSL connections.²⁷ The variety and speed of DSL service offered continues to increase as carriers more fully realize the potential of copper-based technologies. Next generation network facilities, such as asymmetric DSL 2+ (ADSL2+), are capable of offering customers broadband connections of up to 25 mbps, while very high-speed asymmetrical DSL (VDSL2) can achieve speeds of 100 mbps at distances of a few hundred feet and 25 mbps at around 2,500 feet.²⁸

²³ Press Release, ABI Research, *DOCSIS 3.0 Penetration to Reach 60% by 2011* (Aug. 23, 2006), available at <http://www.abiresearch.com/abiprdisplay.jsp?pressid=710>. Many major cable modem vendors, including BigBand Networks, Arris, and Cisco, participated in a weeklong interoperability event in July 2006, and all companies' downstream channel bonding products were able to interoperate with each other. In addition, the vendors successfully performed limited IPv6 testing.

²⁴ See CableLabs OpenCable Website (visited June 25, 2007), available at <http://www.opencable.com/>. The DSGs have embedded DOCSIS modems for the purpose of migrating traditional cable Out of Band (OOB) messaging from a proprietary to standards-based transport. OOB signals typically include conditional access, system information, electronic programming guide (EPG), and emergency alert system (EAS) data.

²⁵ See Jeff Baumgartner, *Polycipher Key to Cable's Downloadable Conditional Access Effort*, CED Magazine (Aug. 17, 2006), available at <http://www.cedmagazine.com/article.aspx?id=120534>.

²⁶ See Light Reading's Cable Digital News, *Next-Generation Network Architecture (NGNA)* (Oct. 30, 2006), available at http://www.lightreading.com/document.asp?doc_id=109381&site=cdn.

²⁷ See Appendix B, Table 2.

²⁸ See Covad Comments at 3; NuVox/XO Comments at 5; Telecommunications Industry Association, *2007 Technology & Policy Primer* at 32 (visited July 30, 2007), available at <http://www.tiaonline.org/policy/publications/white%5Fpapers/documents/TIA2007Primer.pdf>.

13. In addition to DSL, carriers are using copper-based technologies to provide other services. For instance, copper loops can provide Ethernet services at speeds approximating 50 mbps on loops of up to 12,000 feet.²⁹ Advanced services, like Internet Protocol television (IPTV) and high-definition television (HDTV), are also now available over copper-based networks.³⁰

C. Fiber Technologies

14. Fiber technology deployments have increased dramatically since the *Fourth Report*. Specifically, at the time of the *Fourth Report*, fiber-to-the-home (FTTH) was just beginning to impact the market for advanced telecommunications services, but has since experienced marked growth. For example, Verizon's FiOS FTTH network offers speeds of up to 30 mbps downstream and up to 5 mbps upstream (and even up to 50 mbps downstream and up to 10 mbps upstream in select locations) and is now available to 6.8 million homes and businesses.³¹ Carriers have also deployed other fiber technology offerings such as fiber-to-the-curb (FTTC) and fiber-to-the-node (FTTN), where fiber is deployed from the central office to a location near – but not all the way to – the customer's premises. The fiber is connected to an optical network unit (ONU) or similar electronics at that location, from which copper and, often, coaxial cable are connected to each customer premises.³² For example, AT&T is in the process of deploying its "U-Verse" offering, which will include IP-based video, broadband, and VoIP services, to 18 million households through a combination of FTTN and FTTH by the end of 2008.³³ In addition, many small providers are deploying FTTH networks.³⁴

D. Unlicensed Wireless Technologies

1. Wi-Fi

15. Since the *Fourth Report*, Wireless Fidelity (Wi-Fi) access to the Internet has continued to grow with an ever-increasing number of hotspots, *i.e.*, a place where the public can access Wi-Fi service, either for free or for a fee.³⁵ Also, a number of cities have joined the Wi-Fi expansion with municipal

²⁹ See, *e.g.*, Covad Comments at 4-7; NuVox/XO Comments at 4-5.

³⁰ See NuVox/XO Comments at 5.

³¹ See FTTH Council Comments at 4; Verizon/Verizon Wireless Comments at 1; News Release, Verizon Communications Inc., *Innovation and Telecom Companies' Advanced Networks Power Telecom Future, Seidenberg Tells NXCComm; Broadband, IP and Mobility are Key for Customers; Verizon FiOS All-Fiber Network Now Connected to More Than 1 Million Internet and Nearly 500,000 TV Customers, Seidenberg Say* (June 20, 2007), available at <http://newscenter.verizon.com/press-releases/verizon/2007/innovation-and-telecom.html>.

³² See, *e.g.*, Letter from Glenn Reynolds, Vice President – Federal Regulatory, BellSouth, to Marlene H. Dortch, Secretary, FCC, CC Docket No. 01-338, Att. at 6 (filed Sept. 17, 2003).

³³ See AT&T, Media Kits (visited July 30, 2007), available at <http://www.att.com/gen/press-room?pid=5838>.

³⁴ See FTTH Council and TIA, *FTTH/FTTP UPDATE* at 11-12 (Apr. 1, 2007), available at <http://www.ftthcouncil.org/documents/800832.pdf> (noting that 341 small providers have deployed FTTH).

³⁵ Wi-Fi refers to any device using the 802.11 family of standards developed by the Institute of Electrical and Electronics Engineers (IEEE) for wireless local area networking. The IEEE 802.11 family of standards for Wi-Fi include 802.11a for networking devices using the 5 GHz frequency band at speeds up to 54 mbps; 802.11b for networking devices using the 2.4 GHz frequency band at speeds up to 11 mbps; 802.11g for networking devices using the 2.4 GHz frequency band at speeds up to 54 mbps; and the latest draft standard 802.11n, scheduled to be ratified in 2008, for networking devices using either the 2.4 GHz or 5 GHz frequency band with promises of maximum speeds up to 600 mbps. Although 802.11n is still in draft form, the Wi-Fi Alliance has begun certifying products to this draft standard, which has promoted market availability of pre-802.11n certified products. See

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wireless networks.³⁶ As of August 2007, MuniWireless's website estimates that there are 415 cities and counties in the United States deploying, planning, or running Wi-Fi networks.³⁷ Wi-Fi computer chips are also becoming ubiquitous and are appearing in devices such as memory cards for digital cameras, allowing the camera to send digital photos directly to a Wi-Fi-enabled printer or to any Internet photo processing website.³⁸

16. Where communication between Wi-Fi-enabled devices has generally consisted of data communication from devices such as computers and personal digital assistant devices, Wi-Fi-enabled telephones now allow voice communication over the Internet using VoIP at any Wi-Fi hotspot.³⁹ As more companies, cities, and households develop Wi-Fi networks, Wi-Fi phones are becoming more useful. For example, some wireless carriers are providing or planning to provide dual-mode hybrid mobile phones that use both Wi-Fi and mobile networks.⁴⁰ In addition, some VoIP service providers have partnered with hardware manufacturers to release cell-like mobile phones that can use their services via Wi-Fi

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Marguerite Reardon, *Wi-Fi Alliance to Begin Certifying 802.11n Gear*, News.com (May 16, 2007), available at http://news.zdnet.com/2100-1035_22-6184282.html. Wi-Fi networks operate on an unlicensed basis under Part 15 of the Commission's rules, in the 2.4 and 5 GHz frequency bands. With the latest 802.11n draft standard, Wi-Fi networks can provide multiple data rates over 200 mbps. See Eric Bangeman, *802.11n Specs Moves Closer to Completion*, Ars Technica (Jan. 19, 2007), available at <http://arstechnica.com/news.ars/post/20070119-8662.html>; see also Broadcom White Paper, *802.11n: Next Generation Wireless LAN Technology* (April 2006), available at http://www.broadcom.com/docs/WLAN/802_11n-WP100-R.pdf. A Wi-Fi network is comprised of one or more base stations or Access Points (AP) that enable communication between any Wi-Fi equipped wireless device, such as a personal computer or a mobile telephone, that comes within 300 feet (100 m) of an AP. The range of an 802.11x (a, b, or g) Wi-Fi device is approximately 300 feet (100 m), whereas an 802.11n Wi-Fi device typically can deliver more than twice the range. See David Naskin, *FAQ: 802.11n Wireless Networking*, Computerworld (May 16, 2007), available at <http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=9019472>. Wi-Fi networks often rely on another type of broadband connection for access to the Internet. See *Appropriate Regulatory Treatment for Broadband Access to the Internet Over Wireless Networks*, WT Docket No. 07-53, Declaratory Ruling, 22 FCC Rcd 5901, 5907, para. 15 (2007) (*Wireless Broadband Internet Access Services Order*).

³⁶ According to JiWire, Inc., there are 58,197 hotspots in the United States. See JiWire, Inc. Website (visited Aug. 20, 2007), available at http://www.jiwire.com/hot-spot-directory-browse-by-state.htm?country_id=1&provider_id=0. Further, Wi-Fi networks are demonstrating their importance in homeland security measures as well. See Carol Wilson, *Wi-Fi Fills Cracks*, Telephony Online (Aug. 20, 2007), available at http://telephonyonline.com/home/news/telecom_wifi_fills_cracks/ (noting that the Minneapolis Wi-Fi network aided rescue workers following the collapse of the I-35 bridge).

³⁷ A list of municipal Wi-Fi networks is available at <http://www.muniwireless.com/article/articleview/13/1/24/> (visited Aug. 20, 2007); see also Microsoft, *MetroFi team*, Light Reading (Nov. 15, 2006), available at http://www.lightreading.com/document.asp?doc_id=110669&print=true.

³⁸ See Michael Kanellos, *Wi-Fi Memory Cards Coming to Cameras*, CNET News.com (June 10, 2007), available at http://news.com.com/Wi-Fi+memory+cards+coming+to+cameras/2100-1041_3-6189671.html.

³⁹ Several manufacturers are offering Wi-Fi mobile phones. See Peter Jacobson, *Wi-Fi Phones Buyer's Guide*, Information Week (Feb. 1, 2007), available at <http://www.informationweek.com/story/showArticle.jhtml?articleID=196901394>.

⁴⁰ See, e.g., Amol Sharma, *How Wi-Fi Can Extend T-Mobile Range*, Wall St. J., May 3, 2007, at B3, available at <http://online.wsj.com/article/SB117815938377190497.html>; see also *infra* para. 26 (discussing these dual-mode hybrid mobile phones). These handsets allow the consumer to take advantage of Wi-Fi networks when they are available, and use the mobile networks the rest of the time.

networks.⁴¹ According to Infonetics Research, Wi-Fi phone sales reached \$535 million in 2006, a 327 percent growth from 2005.⁴²

2. WiMAX

17. Worldwide Interoperability for Microwave Access (WiMAX)⁴³ has made large strides in part due to the adoption of the IEEE 802.16e-2005 standard.⁴⁴ Activities on WiMAX deployments in terms of products shipped have accelerated since the end of 2006. Intel Corp. released its WiMAX system-on-chip, the WiMAX Connection 2250, in late 2006, and companies such as Motorola, Alcatel, and Proxim are planning to integrate the Intel chip into their WiMAX system designs.⁴⁵ To date, carrier use of the WiMAX technology has largely come in two areas: as a backhaul service for cellular, operating as an alternative to T1 lines or point-to-point fiber links; or in conjunction with Wi-Fi meshes to provide tiered mesh services in larger metropolitan areas.⁴⁶ However, as mobile WiMAX devices become available,⁴⁷

⁴¹ See *supra* note 39.

⁴² See *Wi-Fi, Mobile Phone Sales Soar in 2006 - Dual-mode Wi-Fi/Cellular VoIP Phones Ramping Up*, Government Technology (Jan. 25 2007), available at <http://www.govtech.com/dc/articles/103532>.

⁴³ WiMAX refers to any device using the IEEE 802.16 standard for wireless metropolitan area networking and operates on the same general principles as Wi-Fi by allowing communication between WiMAX enabled devices and providing them with a gateway to the Internet. A WiMAX system consists of two parts: (1) a WiMAX tower, similar to a cell-phone tower that connects to the Internet using a high-bandwidth wired connection, such as a T3 line; and (2) WiMAX-enabled receivers in mobile devices such as laptop computers or dual mode hybrid mobile phones. A WiMAX tower can connect to another WiMAX tower using a line-of-sight, microwave link, thereby creating a backhaul connection. With its wide range coverage and tower-to-tower connection, WiMAX is capable of delivering last-mile broadband to remote rural areas. Providers tout WiMAX delivery of broadband at 75 mbps, under ideal circumstances, and reach up to 30 miles. See *Fifth Report Notice*, 22 FCC Rcd at 7823, n.30. In contrast, the Wi-Fi/802.11 wireless local area network standard is limited in most cases to only 100-300 feet. WiMAX operates on both licensed and unlicensed frequencies. The 802.16 standard specifies a range of operating frequencies from 2 to 66 GHz. Initial WiMAX products operate in the internationally available 2.3 GHz, 2.5 GHz, 3.3 GHz and 3.4-3.8 GHz licensed bands, and WiMAX computer chips for use in the 5.8 GHz unlicensed bands are becoming available. See WiMAX Forum, *Mobile WiMAX - Part I: A Technical Overview and Performance Evaluation* at 49 (Feb. 21 2006), available at http://www.wimaxforum.org/technology/downloads/Mobile_WiMAX_Part1_Overview_and_Performance.pdf. In the U.S., service providers use the 2.3 GHz (Horizon Wi-Com) and 2.5 GHz (Clearwire Corp. and Sprint Nextel) licensed bands. See WiMAX Forum, *Wavesat Announces Availability of World's First 5.8 GHz WiMAX Mini-PCI Design* (May 30, 2007), available at http://www.wimaxforum.org/news/pr/view?item_key=7e567f8255fcd06753d7129a63ef2dc3e9e4162f. To promote interoperability and compliance with the 802.16 standard among equipment from various manufacturers, trade associations such as the WiMAX Forum provide a certification program, which allows vendors to display a "WiMAX Forum Certified" designation on their products. The WiMAX Forum maintains a product registry of all WiMAX certified products at http://www.wimaxforum.org/kshowcase/view/catalog_search (visited June 24, 2007). To date, there are over two dozens of WiMAX Forum-Certified base stations and subscriber stations.

⁴⁴ IEEE 802.16-2004 standard defines the air interface for fixed WiMAX stations. Mobile WiMAX implementations follow IEEE 802.16e-2005 standard.

⁴⁵ See Colleen Taylor, *Intel Debuts WiMAX Chip*, Electronic News (Oct. 12, 2006), available at <http://www.edn.com/index.asp?layout=articlePrint&articleID=CA6380414>.

⁴⁶ See Loring Werbel, *Pushing Past Trials, WiMAX Footprint Grows*, EETimes (July 17, 2006), available at <http://www.eetimes.com/showArticle.jhtml?articleID=190400387>.

consumer services and applications as well as enterprise network solutions are accelerating WiMAX growth.⁴⁸ Commercial WiMAX deployments are expected to begin by the end of 2007.⁴⁹

3. Wireless Personal Area Network

18. Wireless Personal Area Networks (WPANs) are growing with the advent of wireless USB,⁵⁰ a wireless type of networking using ultra-wideband (UWB) radio technology.⁵¹ Wireless USB uses the unlicensed 3.4-10.6 GHz frequency band for UWB communication devices and aims at eliminating cables to allow computer peripherals and multi-media devices to interconnect.⁵² Wireless USB offers speeds up to 480 mbps over a range of 30-45 feet. In-Stat estimates that by late 2007, computers and high-end multi-media devices will have certified wireless USB devices built into them, replacing the traditional wired USB connection port.⁵³

E. Licensed Wireless Technologies

19. Wireless broadband technologies operating on licensed spectrum allow consumers to access the Internet at high speeds on a mobile, portable, or fixed basis using a mobile phone or a laptop computer with a wireless modem. Since the *Fourth Report*, wireless operators have greatly expanded and upgraded their broadband networks to allow subscribers access to the Internet while mobile via a laptop computer

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⁴⁷ See W. David Gardner, *WiMAX Modems Expected in Late 2007*, Information Week (June 15, 2007), available at <http://www.informationweek.com/shared/printableArticle.jhtml?articleID=199904800>; see also Stephen Lawson, *Mobile WiMAX Gear Lifts Off*, IDG News Service (Apr. 10, 2007), available at http://wireless.itworld.com/4273/070410wimax/page_1.html.

⁴⁸ See Stephen Lawson, *Samsung to Aim WiMAX at SMB Networking*, Wash. Post (May 23, 2007), available at <http://www.washingtonpost.com/wp-dyn/content/article/2007/05/23/AR2007052300054.html>.

⁴⁹ See W. David Gardner, *Mobile WiMAX Commercial Launch Planned for Northeast Region in August*, Information Week (June 29, 2007), available at <http://www.informationweek.com/showArticle.jhtml;jsessionid=KRCV4F3J5HTSSQSNLPCKH0CJUNN2JVN?articleID=200001684&queryText=wimax>; Peter Svensson, *Sprint Sees Growth Beyond Cell Phones*, Associated Press (Aug. 31, 2007), available at http://biz.yahoo.com/ap/070831/market_spotlight_sprint.html?v=1. We note that WiMAX technology can be deployed in both licensed and unlicensed spectrum bands, depending on the particular standard and network architecture employed. See *infra* para. 19.

⁵⁰ Universal Serial Bus (USB) refers to the common plug-and-play, high-speed computer bus used to connect peripheral devices to a computer. There are two versions of USB. USB 1.0, the older version, transfers data at speeds up to 12 mbps. USB 2.0 can achieve data transfer rates up to 480 mbps.

⁵¹ See Cameron Wilnot, *Intel Demonstrates fast new Ultra-Wideband WPAN at IDF Fall Taiwan 2006*, Tweaktown.com (Oct. 17, 2006), available at <http://www.tweaktown.com/articles/968/>. A WPAN is a computer network used for communication among personal devices close to the same person such as between a headset and a personal audio CD or MP3 player, or between a digital camera and a laptop computer. WPAN can be used for communication between the personal devices themselves, or for connecting to a higher-level network, such as a home network between two or more computers, and to the Internet. WPAN uses point-to-point or peer-to-peer technology without the need for a wireless router, thus reducing infrastructure costs. Because the UWB part of WPAN allows for very fast maximum throughput rates of up to 480 mbps at a range of 30 feet or less (the same as Bluetooth), which matches that of wired USB 2.0 (480 mbps), Intel is promoting WPAN as USB without wires. See *id.* UWB operates on an unlicensed basis under Part 15 of the Commission's rules.

⁵² See 47 C.F.R. § 15.517.

⁵³ See *Wireless USB to Soar in 2007*, Test & Measurement World (May 10, 2007), available at <http://www.tmworld.com/article/CA6440967.html>.

or Personal Digital Assistant (PDA) with a wireless modem card, or to download a range of multimedia content and advanced applications on certain mobile handset models. Some Code Division Multiple Access (CDMA) carriers have deployed 1xEV-DO (EV-DO) and EV-DO Revision A (Rev A) network technologies across their networks.⁵⁴ With EV-DO, typical users experience download speeds from 400-700 kbps and upload speeds of 50-70 kbps.⁵⁵ The EV-DO Rev A network upgrade increases these average download speeds to 600 kbps-1.4 mbps and significantly improves average upload speeds to 350-800 kbps.⁵⁶ The Commission estimates that, as of mid-2007, EV-DO/EV-DO Rev A networks had been deployed to approximately 82 percent of the U.S. population.⁵⁷ In addition to the EV-DO deployments by CDMA wireless carriers, some GSM carriers have upgraded portions of their networks with Wideband CDMA/High Speed Downlink Packet Access (WCDMA/HSDPA) technology, which enables mobile broadband access at average user download speeds of 400-700 kbps.⁵⁸ The Commission estimates that, as of mid-2007, WCDMA/HSDPA networks covered approximately 43 percent of the U.S. population.⁵⁹

20. In addition, wireless operators in the 2.5 GHz Broadband Radio Service (BRS) and Educational Broadband Service (EBS) and 2.3 GHz WCS spectrum have begun rolling out, or have announced plans to deploy, wireless broadband services using Orthogonal Frequency Division Multiplexing (OFDM) technologies, including WiMAX and similar technologies.⁶⁰ Because OFDM

⁵⁴ See *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, WT Docket No. 04-111, Ninth Report, 19 FCC Rcd 20597, 20652-53, para. 134 (2004) (*Ninth CMRS Competition Report*); *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, WT Docket No. 06-17, Eleventh Report, 21 FCC Rcd 10947, 10993, para. 112 (2006) (*Eleventh CMRS Competition Report*); News Release, Verizon Wireless, *Verizon Wireless: 100 Percent of Wireless Broadband Network Now Enhanced with Faster Speeds* (June 29, 2007), available at <http://news.vzw.com/news/2007/06/pr2007-06-28h.html> (Verizon Wireless June 29, 2007 News Release).

⁵⁵ See News Release, Sprint Nextel, *Sprint Powers Up Faster Mobile Broadband Network in 10 More Markets, Upgraded Coverage Reaches 60 Million People* (Dec. 12, 2006), available at http://www2.sprint.com/mr/news_dtl.do?id=14680; 3G Americas, *3G Technologies* (visited July 3, 2007), available at http://www.3gamericas.com/English/PDFs/3G_technology_comparison.pdf (3G Americas website). The maximum peak download speed for EV-DO is 2.4 mbps. See 3G Americas website.

⁵⁶ See News Release, Sprint Nextel, *America's Largest and Fastest Mobile Broadband Network Just Got Even Larger – Sprint Customers Can Do More, In More Places, And At Fast Speeds* (June 19, 2007), available at http://www2.sprint.com/mr/news_dtl.do?id=17121 (Sprint Nextel June 19, 2007 News Release); Verizon Wireless June 29, 2007 News Release. The maximum peak download speed for EV-DO is 3.1 mbps. See 3G Americas website.

⁵⁷ Commission estimate based on service area boundary maps provided by American Roamer and census block analysis of population covered.

⁵⁸ See *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, WT Docket No. 05-71, Tenth Report, 20 FCC Rcd 15908, 15953 (2005) (*Tenth CMRS Competition Report*); see also, e.g., News Release, Cingular Wireless, *Cingular Wireless Completes \$86 Million Investment in Las Vegas During 2006 – Delivers Wireless Innovation* (Jan. 30, 2007), available at <http://att.centralcast.net/cingularnewsarchive/Release.aspx?ID=4224>.

⁵⁹ Commission estimate based on service area boundary maps provided by American Roamer and census block analysis of population covered.

⁶⁰ See, e.g., *Eleventh CMRS Competition Report*, 21 FCC Rcd at 10962, para. 32 (noting that several small BRS/EBS licensees offer wireless broadband services in rural areas of the country using technologies that employ OFDM); News Release, Sprint Nextel, *Sprint Nextel Cites WiMAX Network Progress for 2007* (Jan. 8, 2007),

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allows signals to pass through buildings and trees, carriers can use the technology to offer wireless broadband services without a direct line-of-sight between the transmitter and the end user's receiver.⁶¹ Therefore, many of the services offered using OFDM technology allow customers to access the Internet with portable "plug-and-play" modem devices connected to a personal or laptop computer, rather than a fixed antenna mounted on a rooftop, allowing customers to transport these devices to other locations within the carrier's coverage area where a network signal is available and in some cases use them while traveling at high speeds.⁶²

21. As of June 2007, 35.3 million mobile wireless devices capable of accessing the Internet over high-speed lines were in use, versus almost none at the end of 2003.⁶³ In addition, the Commission estimates that, as of mid-2007, providers have deployed mobile broadband networks to areas of the country containing 233 million people, or 82 percent of the U.S. population.⁶⁴

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available at http://www2.sprint.com/mr/news_dtl.do?id=15000; News Release, Horizon Wi-Com, *Horizon Wi-Com Selects Navini for Wireless Deployment* (Jan. 15, 2007), available at http://www.wcai.com/pdf/2007/p_naviniJan12.pdf (Horizon Wi-Com Jan. 15, 2007 News Release); News Release, Clearwire Corporation, *Richmond First in Virginia to Experience Clearwire Wireless Broadband Service* (June 5, 2007), available at http://www.clearwire.com/company/news/06_05_07_b.php; W. David Gardner, *WiMax Networks Go Live in Nine Northeast Cities*, InformationWeek (June 13, 2007), available at <http://www.informationweek.com/showArticle.jhtml;jsessionid=OPFNJOZNUB2LOQSNLQSKH0CJUNN2JVN?articleID=199903928&queryText=WiMax+Networks+Go+Live+in+Nine+Northeast+Cities> (noting that Horizon Wi-Com purchased its WCS licenses from Verizon in 2006); News Release, Sprint Nextel, *Sprint Nextel and Clearwire to Partner to Accelerate and Expand the Deployment of the First Nationwide Mobile Broadband Network Using WiMAX Technology* (July 19, 2007), available at http://www2.sprint.com/mr/news_dtl.do?id=17520; *supra* para. 17 (discussing WiMAX technology). As one of the conditions of the August 2005 merger of Sprint and Nextel, the Commission required the merged company to fulfill its voluntary commitment to provide service in the 2.5 GHz band. The merged company is required to offer service using its BRS/EBS spectrum to at least 15 million Americans by August 2009 and to an additional 15 million Americans by August 2011. See *Applications of Nextel Communications, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, File Nos. 0002031766, *et al.*, WT Docket No. 05-63, Memorandum Opinion and Order, 20 FCC Rcd 13967, 14028-29, para. 165 (2005). In June 2007, the merged company reported that it expected to meet and exceed those requirements. See Howard Buskirk, *Sprint Says It Easily Will Exceed Buildout Requirements*, Comm. Daily at 9 (June 15, 2007). The AT&T/BellSouth merger also resulted in merger commitments by AT&T to offer mobile and fixed wireless broadband service to 25% of the population covered by its WCS licenses (excluding Alaska) by July 21, 2010. See *AT&T Inc. and BellSouth Corporation Application for Transfer of Control*, WC Docket No. 06-74, Memorandum Opinion and Order, 22 FCC Rcd 5662, 5816 (2007). AT&T also agreed to divest its 2.5 GHz BRS/EBS spectrum, and in May 2007, Clearwire completed the acquisition of this spectrum. See News Release, Clearwire Corporation, *Clearwire Completes Acquisition of AT&T Mobile WiMAX Spectrum* (May 31, 2007), available at http://www.clearwire.com/company/news/05_31_07.php.

⁶¹ See *Eleventh CMRS Competition Report*, 21 FCC Rcd at 10995, para. 119.

⁶² See *id.*

⁶³ See Appendix B, Table 1.

⁶⁴ Commission estimate based on service area boundary maps provided by American Roamer and census block analysis of population covered.

F. Broadband over Power Lines Technologies

22. Since the *Fourth Report*, the broadband over power line (BPL) industry continues to evolve.⁶⁵ There are two types of BPL. Access BPL carries broadband to the customer and acts as a last-mile technology.⁶⁶ Access BPL alleviates the need to build broadband infrastructure to every customer because power lines are installed virtually everywhere in the United States.⁶⁷ In-House BPL provides home networking within the customer's premises.⁶⁸ Since a provider can route In-House BPL to any power outlet, it enjoys certain advantages over wireless networks when it comes to penetrating through walls and buildings.

23. New BPL companies and technologies are entering the marketplace and new strategies are emerging. Utility companies have formed strategic partnerships with BPL equipment manufacturers to facilitate deployment.⁶⁹ Utilities are also focusing on using BPL to improve their own services, including

⁶⁵ See *Amendment of Part 15 Regarding New Requirements and Measurement Guidelines for Access Broadband over Power Line Systems; Carrier Current Systems, Including Broadband Over Power Line Systems*, ET Docket Nos. 04-37, 03-104, Report and Order, 19 FCC Rcd 21265, 21266, paras. 1-2 (2005) (*Access BPL Order*), appeal pending, *ARRL v. FCC*, Docket No. 06-1343 (D.C. Cir. filed Oct. 10, 2006); *Amendment of Part 15 Regarding New Requirements and Measurement Guidelines for Access Broadband over Power Line Systems; Carrier Current Systems, including Broadband over Power Line Systems*, ET Docket Nos. 04-37, 03-104, Memorandum Opinion and Order, 21 FCC Rcd 9308 (2006) (*Access BPL Reconsideration Order*), appeal pending, *ARRL v. FCC*, Docket No. 06-1343 (D.C. Cir. filed Oct. 10, 2006); United Power Line Council, *Status of Broadband over Power Line 2007* (visited June 26, 2007), available at http://uplc.utc.org/file_depot/0-10000000/0-10000/7966/comman/2007+BPL+Update.pdf. BPL is the delivery of broadband over the existing medium- and low-voltage electric power distribution network. See *Access BPL Order*, 19 FCC Rcd at 21267-68, para. 5.

⁶⁶ Although several proprietary Access BPL technologies exist, they function similarly by attaching "couplers" to medium voltage power lines, typically at intervals of less than a mile, that process and/or repeat digital signals between the end-user customer premises and the point where the utility network connects to the Internet at its backhaul connection point. See *Access BPL Order*, 19 FCC Rcd at 21267-68, para. 5.

⁶⁷ There are over a dozen Access BPL devices certified under our rules. See FCC, Equipment Authorization System Generic Search (visited July 26, 2007), available at <https://gullfoss2.fcc.gov/oetcf/eas/reports/GenericSearch.cfm> (searching the Commission's database for grants of Access BPL equipment). Because BPL injects radio frequency (RF) energy into unshielded medium voltage lines, the technology creates RF emissions, which raise concerns of potential harmful interference with incumbent users of the spectrum. The American Radio Relay League (ARRL) has filed for judicial review of the *Access BPL Order* and the *Access BPL Reconsideration Order*. See *ARRL v. FCC*, Docket No. 06-1343 (D.C. Cir. filed Oct. 10, 2006) (appealing the Commission's BPL rules on the contention that, among other things, they fundamentally alter the longstanding rights of radio spectrum licensees, including amateur radio operators). The Commission's BPL orders impose specific requirements to minimize this interference, and the BPL industry has responded with second-generation Access BPL equipment in compliance with the new rules. See 47 C.F.R. § 15.601 *et seq.*

⁶⁸ See *Access BPL Order*, 19 FCC Rcd at 21267-68, para. 5.

⁶⁹ For example, ConEdison Company of New York, Duke Energy Corporation, and San Diego Gas & Electric are working with Ambient Corporation for their BPL equipment. See Ambient Corporation Website (visited Aug. 6, 2007), available at www.ambientcorp.com. PPL Telcom, Northeast Utilities System, and Duquesne Light are working with Amperion for their BPL equipment. See Amperion Website (visited Aug. 6, 2007), available at www.amperion.com. PEPSCO, Duke Energy Corporation, Texas Utilities (TXU), and Hawaiian Electric Company (HECO) are working with Current Technologies for their equipment. See Current Technologies Website (visited Aug. 6, 2007), available at www.currenttechnologies.com. Central Virginia Electric Cooperative and South Central Indiana REMC are working with International Broadband Electric Communications (IBEC) for their BPL equipment. See International Broadband Electric Communications, Inc. Website (visited Aug. 6, 2007), available at www.ibec.net.

a variety of utility and energy “smart grid” applications, such as advanced metering for time-of-use pricing, load management, and power outage warning and detection.⁷⁰ There are approximately 36 BPL deployments around the country in both rural and suburban areas, nine of which are commercial deployments and the remaining 27 of which are either pilot or trial deployments.⁷¹ Currently, most BPL systems provide symmetrical speeds upwards of 2 mbps to the customer.

G. Satellite Technologies

24. Satellite-based Internet access services are an option for consumers that live in areas where wireline, cable, or terrestrial wireless Internet access is unavailable.⁷² With a few exceptions, none of the three most widely subscribed satellite-based Internet access services satisfies, however, the Commission’s definition of advanced services, which calls for a minimum transmission speed of in excess of 200 kbps downstream and upstream.⁷³ Satellite services account for only approximately 0.7 percent of the total high-speed lines in the United States.⁷⁴ Satellite technology continues to evolve, however. Recently launched Ka-Band satellites promise improved coverage and higher speeds for upstream and downstream

⁷⁰ See *Access BPL Order*, 19 FCC Rcd at 21267-68, para. 5.

⁷¹ See United Power Line Council, *BPL Deployment Map 2007* (visited June 26, 2007), available at http://uplc.utc.org/file_depot/0-10000000/0-10000/7966/conman/BPL+Deployment+Map+2007.pdf; United Power Line Council, *Status of Broadband over Power Line 2007* (visited June 26, 2007), available at http://uplc.utc.org/file_depot/0-10000000/0-10000/7966/conman/2007+BPL+Update.pdf.

⁷² With the commencement of service by WildBlue Communications in June 2005, there are now three providers of satellite-based high-speed Internet access serving the residential, small office/home office, and small business market segments, including HughesNet, the successor to the DirecWay Service, and Starband, a subsidiary of Gilat Satellite Networks. As of June 2007, all three companies offer a variety of service plans with each requiring installation of satellite equipment. See HughesNet Website (visited June 18, 2007), available at <http://www.hughesnet.com>; Starband Inc. Website (visited June 18, 2007), available at <http://starband.com/services/>; WildBlue Communications Website (visited June 18, 2007), available at <http://www.wildblue.com>.

⁷³ Most satellite services provide downstream speeds in excess of 200 kbps. Upstream speeds, with a few exceptions, are slower. See, e.g., WildBlue Packages (visited Aug. 20, 2007) (describing “Value Pak” service with speeds up to 512 kbps downstream and up to 128 kbps upstream, “Select Pak” services with speeds up to 1 mbps downstream and up to 200 kbps upstream, and “Pro Pak” service with speeds up to 1.5 mbps downstream and up to 256 kbps upstream), available at <http://www.wildblue.com/about/Wildblue/qaa.jsp>.

⁷⁴ See Appendix B, Table 1. Approximately 79% of satellite high-speed lines are for residential use. See *id.*, Tables 1, 3.

service.⁷⁵ Satellite technology is also increasingly being developed and deployed for last-mile Internet connectivity to mobile platforms, such as airplanes, ships and automobiles.⁷⁶

IV. NEW DEVELOPMENTS IN SERVICES, APPLICATIONS AND DEVICES

25. Advances in the delivery of broadband since the *Fourth Report* have been paralleled by advances in broadband-based services and applications, as well as the devices used to run or access such services and applications. These evolving services, applications and devices continue to revolutionize how Americans exchange information.

26. *Voice Developments.* The wireless industry has recently made available mobile devices that connect to both traditional commercial mobile radio service (CMRS) and Wi-Fi networks for voice and data access.⁷⁷ These devices can move seamlessly between the two types of networks without dropping a call. This development exemplifies the convergence of wireless and wireline networks, as home or in-building Wi-Fi hot spots typically rely on technologies such as DSL, cable, fiber, or T-1 lines for access to the Internet.

27. In addition, in light of faster broadband speeds becoming available to consumers and improvements in VoIP technology, more Americans are subscribing to interconnected VoIP services.⁷⁸

⁷⁵ Ka-Band refers to frequencies in the 18 to 40 GHz range. Commercial satellite use of this band is a relatively recent development, focused primarily on the 17.7-20.2 GHz (downlink) and 27.5-30.0 GHz (uplink) frequency bands. In March 2007, WildBlue launched the WildBlue-1 satellite, specifically designed for the provision of high-speed Internet access using Ka-Band frequencies. See Press Release, WildBlue Communications, Inc., *WildBlue High-Speed Internet via Satellite Triples Capacity with New Satellite* (Mar. 20, 2007), available at <http://www.wildblue.com/company/doPressReleaseDetailsAction.do?pressReleaseID=41>. Hughes launched the Ka-Band Spaceway 3 satellite on August 14, 2007, which promises upload speeds as high as 16 mbps and downloads as fast as 30 mbps. See Hughes Spaceway Website (visited Aug. 20, 2007), available at <http://www.spaceway.com/HUGHES/Rooms/DisplayPages/LayoutInitial?Container=com.webridge.entity.Entity%5B0ID%5B1F25CC9CF1479743B2C83A5CF6F811F0%5D%5D>.

⁷⁶ See, e.g., International Bureau Filing System File Nos. SES-LIC-20051028-01494; SES-AMD-20060314-00440; SES-AMD-20070309-00325 (proposal of Viasat to provide an aeronautical mobile service). Ships now have several options concerning high-speed Internet access, including use of C- and Ku-Band under the Commission's earth stations on vessels (ESV) rules. See *infra* para. 53.

⁷⁷ See, e.g., News Release, T-Mobile USA, Inc., *T-Mobile Introduces Unlimited Calling Over Wi-Fi With the National Launch of T-Mobile HotSpot @Home* (June 27, 2007), available at http://www.lbszone.com/index2.php?option=com_content&do_pdf=1&id=2026; AT&T Website, *iPhone - Technical Specs for iPhone* (visited July 10, 2007), available at <http://www.wireless.att.com/cell-phone-service/specials/iPhoneCenter.html>; T-Mobile Website, *T-Mobile Wing* (visited July 10, 2007), available at <http://www.t-mobile.com/shop/phones/Detail.aspx?device=acc8102d-4506-4eaa-bc2f-9c7b8ec1b1e0>.

⁷⁸ See *Universal Service Contribution Methodology*, WC Docket No. 06-122; CC Docket Nos. 96-45, 98-171, 90-571, 92-237; NSD File No. L-00-72; CC Docket Nos. 99-200, 95-116, 98-170; WC Docket No. 04-36, Report and Order and Further Notice of Proposed Rulemaking, 21 FCC Rcd 7518, 7528-29, para. 19 (2006) (*2006 Interim Contribution Methodology Order*) (noting that the number of interconnected VoIP subscribers had grown from 150,000 in 2003 to 4.2 million by the end of 2005); see also Press Release, Infonetics, *VoIP Service Revenue Doubles in North America, Europe, Asia Pacific in 2005* (July 26, 2006), available at <http://www.infonetics.com/resources/purple.shtml?ms06.vip.nr.shtml>; Bear Stearns, *March Broadband Buzz: A Monthly Update on Critical Broadband Issues* at 4 (Mar. 12, 2007); *Cable Telephone Subscriptions Growth Accelerates*, IP Media Monitor (March 12, 2007), available at <http://www.ipmediamonitor.com>. The Commission has defined "interconnected VoIP services" as those that (1) enable real-time, two-way voice communications; (2) require a broadband connection from the user's location; (3) require IP-compatible customer premises

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Many cable operators are currently deploying PacketCable 1.0 and 1.5 architecture to improve support for VoIP services within their cable networks, with PacketCable 2.0 and 3.0 technology promising even greater flexibility and the potential for new services.⁷⁹

28. *Video Developments.* Video services and devices continue to evolve as broadband speeds increase. The growth of new technology in the cable arena will soon allow IP video over cable systems.⁸⁰ CableLab's DOCSIS 3.0 specification will make available speeds of over 100 mbps by logically bonding multiple 6 MHz channels to act as if they were a single channel. Several cable providers recently have launched or soon will begin IPTV trials and pilot projects based on broadband applications.⁸¹

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equipment; and (4) permit users to receive calls from and terminate calls to the public switched telephone network (PSTN). See *IP-Enabled Services; E911 Requirements for IP-Enabled Service Providers*, WC Docket Nos. 04-36, 05-196, First Report and Order and Notice of Proposed Rulemaking, 20 FCC Rcd 10245, 10257-58, para. 24 (2005) (*VoIP 911 Order*) (defining "interconnected VoIP service" as set forth in section 9.3 of the Commission's rules, 47 C.F.R. § 9.3).

⁷⁹ PacketCable 2.0 is an application-agnostic architecture based on a common network core of standard protocols to register clients and establish sessions for voice, video, and text. PacketCable 2.0 will supply quality-of-service (QoS) for all forms of IP-enabled applications and services and allow integration across a single network of cable's voice, video, and data silos. See Jeff Baumgartner, *The Slow Road to PacketCable 2.0*, Light Reading's Cable Digital News (June 7, 2007), available at http://www.lightreading.com/document.asp?doc_id=125943&print=true. This technology has the potential to allow the rapid introduction of new services, such as the integration of the cable network with wireless networks and cross-platform feature integration (e.g., set-top box applications that integrate with a customer's voice service for certain features, including caller ID display on the TV and the ability to forward incoming calls to voicemail or other telephone numbers). See Kevin Johns and Eric Rosenfeld, *PacketCable 2.0-Design Goals, Strategic Drivers and Architecture*, CED Web Extra (Dec. 1, 2006), available at <http://www.cedmagazine.com/article.aspx?id=68204>. PacketCable 3.0 is described *supra* at paras. 9-10.

⁸⁰ Cisco announced the addition of Internet streaming capabilities to its Video on Demand (VOD) Content Delivery System (CDS) while also showing two HD MPEG-4 video streams over a cable modem at the Cable Show in 2007. Motorola is looking to incorporate an IPTV bypass technique for cable modems into CableLabs' specifications. At the ANGA Cable show, BigBand demonstrated HD VOD over DOCSIS 2.0 and delivery of HD Video to an IPTV set-top using DOCSIS 3.0's channel bonding techniques. See Todd Spangler, *Cable Firms Might Pump Video over Fast Modems*, MultiChannel News (May 28, 2007), available at <http://www.multichannel.com/index.asp?layout=article&articleid=CA6446742&industryid=47196>.

⁸¹ In July 2005, Time Warner Cable conducted a six-month pilot project of "Broadband TV" service for roughly 9,000 subscribers. Customers could view the channels through a PC after downloading RealPlayer media player and logging into a specially designated website with their cable account numbers. See Kathryn Balint, *For Television via Internet, Future is Now*, Union-Tribune (July 13, 2005), available at <http://www.signonsandiego.com/news/business/20050713-9999-1b13iptv.html>. In May 2007, Comcast announced plans to conduct an IPTV trial in an undisclosed 50,000 homes when expected DOCSIS 3.0 gear becomes available later this year. The trial will include an IP-video headend and DOCSIS 3.0 set-top boxes built to the operator's Residential Network Gateway requirements. One trial will provide voice, video, and data over a single, high-bandwidth IP connection. The test bed will also include other network-connected devices, such as Sling Media's Slingbox, dual-mode Wi-Fi/cellular phones and mobile handsets capable of playing video. See Todd Spangler, *Comcast to Take IPTV for a Spin*, MultiChannel News (May 4, 2007), available at <http://www.multichannel.com/index.asp?layout=articlePrint&articleID=CA6439264>. Sling Media's Slingbox digitally encodes a signal source, such as the video output of a set-top box, and streams the video over the home network or over the Internet to a personal computer or mobile device, allowing users to effectively take their multichannel video service with them to wherever they can access the Internet. See Sling Media Website (visited June 25, 2007), available at <http://us.slingmedia.com/page/home>.

29. *Data Developments.* There have also been some significant developments in data services, applications, and devices since the *Fourth Report*. BPL technology companies have developed an In-House BPL system known as HomePlug, which allows for broadband speed communications among local devices attached to the power outlets within the premises. In 2005, the HomePlug 1.0 standard was superseded by HomePlug AV, which now offers up to 200 mbps over home electrical wiring, making it capable of streaming multiple high-definition video streams, such as HDTV signals to television sets located in different rooms in a house.⁸²

V. BROADBAND IS BEING DEPLOYED TO ALL AMERICANS

30. The Commission has taken a number of actions designed to promote broadband deployment since the *Fourth Report*, and the evidence indicates that deployment continues to increase. Below we provide an overview of the data regarding deployment of broadband in the United States, and then discuss the steps taken by the Commission to foster broadband deployment.

A. Overview of Broadband Data

31. The Commission's data collection program has required every facilities-based broadband provider to report to the Commission information about its service offerings and types of customers. Since the *Fourth Report*, the Commission updated and improved its data collection program. In November 2004, the Commission released an order that modified the collection requirements and removed the reporting exemption for providers with fewer than 250 high-speed connections in service in a particular state.⁸³ Also in that order, the Commission required providers to report more information about the speeds of their deployed advanced services lines.⁸⁴ These modifications to the Commission's data collection program provide the Commission with further insight into broadband deployment advances.

32. Further, as discussed above, we recognize that broadband services and applications are evolving at a fast rate, and that consumers increasingly demand higher transmission speeds. Thus, with this Report, the Commission for the first time begins reporting with deployment data that are more granular. Additionally, the Commission is adopting an order that updates the Commission's Form 477 data collection to further refine its speed tiers and monitor more precisely the progress of broadband deployment.⁸⁵

33. Since the Commission's *Fourth Report*, broadband deployment has continued to increase steadily.⁸⁶ The number of high-speed lines – those lines with speeds of over 200 kbps in at least one direction – has increased from 27.7 million in December 2003 to 100.9 million in June 2007.⁸⁷ A

⁸² See Eric Bangeman, *HomePlug AV Networking Tech Takes Stage at CeBIT*, Ars Technica (March 16, 2007), available at <http://arstechnica.com/news/ars/post/20070316-homeplug-av-networking-tech-takes-stage-at-cebit.html>.

⁸³ See *2004 Data Gathering Order*, 19 FCC Rcd 22340. Because of this reporting change, we realize that when we compare broadband deployment numbers in this Report to those same numbers from the *Fourth Report*, we are comparing different base sets. Nonetheless, we find evidence that broadband deployments are increasing.

⁸⁴ See *supra* para. 3 (discussing the reporting of various broadband speeds).

⁸⁵ See *supra* para. 6.

⁸⁶ The *Fourth Report* reported Commission data as of December 2003. See *Fourth Report*, 19 FCC Rcd at 20567-69.

⁸⁷ Compare FCC, *High-Speed Services for Internet Access: Status as of December 31, 2006*, Table 1 (Oct. 2007) (*December 2006 High-Speed Services Report*), with Appendix B, Table 1. Although the Commission currently

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granular inspection of the June 2007 high-speed line counts reveals that, in the faster direction, 27.9 million of these lines offer service at speeds greater than 200 kbps but less than 2.5 mbps; 37.7 million of these lines offer service at speeds greater than or equal to 2.5 mbps but less than 10 mbps; 3.8 million of these lines offer speeds greater than or equal to 10 mbps but less than 25 mbps; nearly 92,000 of these lines offer speeds greater than or equal to 25 mbps but less than 100 mbps; and over 21,700 of these lines offer speeds greater than or equal to 100 mbps.⁸⁸ Further, the number of advanced services lines – those lines with speeds of over 200 kbps in each direction – has also increased from 19.9 million in December 2003 to 69.6 million in June 2007, of which 61.1 million are residential advanced service lines.⁸⁹

34. As was true in the Commission's last report, cable modem and ADSL providers continue to provide the majority of advanced service lines. Cable represents 48.8 percent of advanced service lines and ADSL represents 33.6 percent, while SDSL and fiber-to-the-end-user premises represent 1.5 percent and 2 percent, respectively, and other technologies represent the remaining 14.1 percent.⁹⁰ The relative position of cable and ADSL advanced service lines was 77.2 percent and 15.3 percent in December 2003, respectively.⁹¹ Notably, only 11.6 percent of cable modem advanced service lines are provided at speeds of less than 2.5 mbps based on the latest *High Speed Services Report*.⁹² In addition, subscribers to ADSL appear increasingly to subscribe to higher-capacity offerings. In particular, the percentage of ADSL advanced service lines provided at speeds of less than 2.5 mbps declined from approximately 67 percent to 55.7 percent from June 2006 to June 2007.⁹³ Looking more broadly at high-speed lines, the Commission's data indicate that cable modem service represents 34.1 percent of the lines, with ADSL representing 27.3 percent of the lines as of June 2007.⁹⁴ Along with this growth, the number of high-speed providers has increased from 432 in December 2003, to 1,360 in June 2007.⁹⁵

35. With regard to residential subscribers, the Commission's data indicate that the number of high-speed lines increased from 26 million in December 2003 to 65.9 million as of June 2007.⁹⁶ Further,

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collects data on mobile wireless subscribers, the *2007 Data Gathering Notice* seeks comment on whether the Commission should collect more granular information to identify separately mobile wireless customers with broadband Internet access plans. See *2007 Data Gathering Notice*, 20 FCC Rcd at 7766-67, paras. 12-14.

⁸⁸ See Appendix B, Table 5.

⁸⁹ Compare December 2006 *High-Speed Services Report* at Table 2, with Appendix B, Table 2; Appendix B, Table 4.

⁹⁰ See Appendix B, Chart 4.

⁹¹ See December 2006 *High-Speed Services Report* at Table 2.

⁹² See Appendix B, Tables 2, 5. The 200 kbps/2.5 mbps speed tier is the lowest in the Commission's current advanced services data collection. As noted above, the Commission is adopting an order updating the Commission's Form 477 data collection to refine further its speed tiers and more precisely monitor the progress of broadband deployment. See *supra* para. 6.

⁹³ Compare FCC, *High-Speed Services for Internet Access: Status as of June 30, 2006*, Tables 2, 5 (Jan. 2007) (reporting data on advanced services lines as of June 2006), with Appendix B, Tables 2, 5 (providing data on advanced services lines as of June 2007).

⁹⁴ See Appendix B, Chart 2.

⁹⁵ See *id.*, Table 7. As a result, in part, of the Commission removing the exemption for filing Form 477 for providers with less than 250 lines per state, the number of providers of high-speed lines doubled between December 2004 and June 2005. See *id.* Nonetheless, we still find that the number of providers continues to increase over time. See *id.*

⁹⁶ Compare *Fourth Report*, 19 FCC Rcd at 20569, with Appendix B, Table 13. The Commission stopped including small business lines with residential lines after December 2004. See Appendix B, Table 3, note.

as of June 2007, only 0.1 percent of zip codes in the United States reported no high-speed lines, compared to 6.8 percent of zip codes with no reported lines in December 2003.⁹⁷ The percent of zip codes reporting four or more providers of high-speed lines also has increased, from 46.3 percent in December 2003 to 88.5 percent in June 2007.⁹⁸ While we recognize that the presence of reported lines in a zip code does not necessarily mean service is available throughout a zip code, these figures do provide evidence that broadband deployment is increasing over time. Further, the Commission is assessing how to assess geographic broadband deployment on a more granular basis in a current proceeding, and thus we anticipate being able to provide more disaggregated broadband deployment data in future reports.⁹⁹

36. High-speed deployments in rural communities also have continued to increase since the Commission's *Fourth Report*. With respect to the lowest density zip codes – those with fewer than six persons per square mile – there has been a significant increase in subscribership. The percentage of the lowest density zip codes with at least one high-speed subscriber increased from 73.5 percent in December 2003 to 90.5 percent as of June 2007.¹⁰⁰ Further, based on the 2007 NTCA Broadband/Internet Availability Survey Report, 99 percent of the NTCA respondents offer broadband service to some part of their customer base.¹⁰¹ In addition, an OPASTCO membership survey found that on average, respondents make broadband available to over 90 percent of their customer base.¹⁰² Ninety percent of the respondents in that survey reported being able to deliver data speeds of at least one mbps in one direction.¹⁰³ Over 75 percent of the respondents also indicated that they compete against two or more providers in the broadband market.¹⁰⁴

37. States are also taking action to monitor and promote broadband deployment, in some cases through public-private partnerships. For example, ConnectKentucky, a non-profit public-private partnership in Kentucky, developed an initiative that increased broadband penetration to rural communities through data-gathering and work with local communities.¹⁰⁵ ConnectKentucky created a detailed map depicting broadband penetration throughout Kentucky, and then analyzed the map against demographic information such as population density, planned development, and existing public assets to identify possible investment opportunities.¹⁰⁶ ConnectKentucky then established eCommunity Leadership Teams in all of Kentucky's 120 counties "to develop comprehensive technology growth plans

⁹⁷ See Appendix B, Table 15.

⁹⁸ See *id.*

⁹⁹ See *2007 Data Gathering Notice*, 22 FCC Rcd 7760.

¹⁰⁰ Compare *December 2006 High-Speed Services Report* at Table 18, with Appendix B, Table 18.

¹⁰¹ See National Telecommunications Cooperative Association, *NTCA 2007 Broadband/Internet Availability Survey Report* (Sept. 2007), available at <http://www.ntca.org/content/documents/2007NTCABroadbandSurveyReport.pdf>. NTCA members are small carriers that are rural telephone companies. See *id.* at 5. For the purposes of this survey, NTCA defines "broadband" as throughput of 200 kbps in one direction. See *id.* at 6.

¹⁰² See OPASTCO Comments at 3. OPASTCO is a trade association that represents over 520 small incumbent LECs serving rural areas, serving over 3.5 million customers. See *id.* at 1. For the purposes of this survey, OPASTCO defines "broadband" to be those services of at least 200 kbps in at least one direction. See *id.* at 3 n.5.

¹⁰³ See *id.* at 3.

¹⁰⁴ See *id.* at 4.

¹⁰⁵ See Connected Nation Comments at 5 (describing Connect Kentucky's approach to modeling data). Connected Nation, the parent company of ConnectKentucky, is a national non-profit that deals with broadband issues in the United States. See *id.* at 2.

¹⁰⁶ See *id.* at 5-6.

that involve many sectors of the community, including healthcare, education and local government.”¹⁰⁷ Based on this project, companies invested more than \$650 million in private capital in Kentucky’s broadband infrastructure, resulting in broadband availability in Kentucky households increasing from 60 percent to 93 percent since 2004.¹⁰⁸ Lawmakers in other states are also taking steps to introduce similar programs.¹⁰⁹

38. As the GAO has found, however, subscribership to Internet access services (of any speed) by Native American households on tribal lands is largely unknown because no federal survey has been designed to track this information.¹¹⁰ As the GAO noted, the Commission previously asked the Census Bureau to collect data on Internet subscribership on tribal lands as part of its surveys, but “Census Bureau officials told [the GAO] that the bureau’s internal policy is to not include questions on its new survey unless the collection of that data by the Census Bureau is mandated by law.”¹¹¹ While the Commission’s Form 477 data collection does not currently collect information on broadband deployment specifically on tribal lands, our pending NPRM seeks comment on ways that the Commission might track this information.¹¹²

B. Commission Action Since the *Fourth Report* to Facilitate Broadband Deployment

39. We remain committed to adopting measures that encourage broadband deployment. Since the *Fourth Report*, the Commission has taken a number of steps to promote broadband deployment.

¹⁰⁷ ConnectKentucky, *eCommunity Strategies* (visited Sept. 7, 2007), available at <http://www.connectkentucky.org/projects/ecs/>; see also Connected Nation Comments at 8-9.

¹⁰⁸ See Connected Nation Comments at 5-7.

¹⁰⁹ See, e.g., Michael Martinez, *Ohio Governor Eyes Statewide Broadband*, National Journal (Aug. 1, 2007), available at http://www.njtelecomupdate.com/2007/08/ohio_governor_eyes_statewide_b.html (noting broadband deployment programs in Ohio, Rhode Island, and South Carolina); News Release, Verizon Communications Inc., *Verizon Announces Plans to Expand High-Speed Internet Availability for Rural West Virginians; Network Expansion, Partnership with ‘Connected Nation’ to Help Provide Broadband to More West Virginians* (Aug. 15, 2007), available at <http://newscenter.verizon.com/press-releases/verizon/2007/verizon-announces-plans-to.html> (announcing a program similar to Connected Nation’s Kentucky program in West Virginia); Connected Tennessee, Inc. Website (visited Aug. 31, 2007), available at <http://www.connectedtn.org/> (discussing an independent non-profit organization focused on broadband deployment in Tennessee); Testimony of James Winnigham before the Senate Committee on Commerce, Science, and Transportation (Aug. 28, 2008) available at http://commerce.senate.gov/public/index.cfm?FuseAction=Hearings.Testimony&Hearing_ID=1894&Witness_ID=6714 (discussing Connect Arkansas, a “non-profit organization created to centrally manage and support an effort to help make broadband available to every home and organization in Arkansas”).

¹¹⁰ See United States Government Accountability Office, *Challenges to Assessing and Improving Telecommunications for Native Americans on Tribal Lands*, GAO-06-189 at 16 (Jan. 2006), available at <http://www.gao.gov/new.items/d06189.pdf> (*GAO Tribal Lands Report*) (noting that the Census Bureau’s new American Community Survey will provide data on tribal lands but does not include a question on Internet access, and that the monthly survey of households conducted by the Census Bureau for the Bureau of Labor Statistics contains too few tribal lands households to provide reliable estimates). We note that Native Public Media (NPM) states in its comments that “broadband penetration on Indian lands is estimated at 10%.” NPM Comments at 3 (citing Testimony of NCAI President Joe Garcia before the Senate Committee on Commerce, Science, and Transportation at 1-2 (March 7, 2006), available at <http://commerce.senate.gov/pdf/garcia-030706.pdf> (NCAI Senate Testimony)).

¹¹¹ *GAO Tribal Lands Report* at 4.

¹¹² See *2007 Data Gathering Notice*, 22 FCC Rcd at 7771-72, 7774, 7777, paras. 25, 29, 37.

1. Promoting Deployment of Broadband Facilities & Services

40. *Eliminating Regulatory Disincentives to Broadband Deployment.* Since the *Fourth Report*, the Commission has taken multiple steps to promote broadband deployment by reevaluating its legacy regulations. In October 2004, the Commission concluded that FTTC loops should enjoy the same unbundling relief that the Commission previously extended to FTTH loops.¹¹³ By extending this unbundling relief to FTTC loops, the Commission removed powerful regulatory disincentives for broadband deployment by carriers seeking to provide advanced services.¹¹⁴ In addition, to encourage broadband deployment and promote local competition, the Commission forbore from applying the *Triennial Review Order's* independent section 271 unbundling obligations to the broadband elements – including FTTH loops, FTTC loops, the packetized functionality of hybrid loops, and packet switching – that the Commission had previously relieved from unbundling under section 251 of the Communications Act.¹¹⁵

41. Further, the Commission determined that facilities-based wireline broadband Internet access service is an information service, removing outdated regulations in favor of a framework in parity with cable modem service, designed to allow the providers of such services to respond effectively to changing marketplace demands and to spur broadband investment and deployment.¹¹⁶ Specifically, this new framework removed the requirement that facilities-based providers separate out and offer the wireline broadband transmission component as a stand-alone telecommunications service under Title II of the Communications Act, and removed the Bell Operating Company *Computer Inquiry* requirements with respect to wireline broadband Internet access service.¹¹⁷ The Commission later ensured comparable regulatory treatment of BPL-enabled broadband Internet access service and wireless broadband Internet access service by classifying these services as information services under Title I of the Communications

¹¹³ See *Review of Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket Nos. 01-338, 96-98, 98-147, Order on Reconsideration, 19 FCC Rcd 20293, 20293, para. 1 (2004).

¹¹⁴ See *id.* at 20297, para. 9.

¹¹⁵ See *Petition for Forbearance of the Verizon Telephone Companies Pursuant to 47 U.S.C. § 160(c); SBC Communications Inc.'s Petition for Forbearance Under 47 U.S.C. § 160(c); Qwest Communications International Inc. Petition for Forbearance Under 47 U.S.C. § 160(c), BellSouth Telecommunications, Inc. Petition for Forbearance Under 47 U.S.C. § 160(c)*, WC Docket Nos. 01-338, 03-235, 03-260, 04-48, Memorandum Opinion and Order, 19 FCC Rcd 21496 (2004).

¹¹⁶ See *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities; Universal Service Obligations of Broadband Providers; Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services; Computer III Further Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer III and ONA Safeguards and Requirements; Conditional Petition of the Verizon Telephone Companies for Forbearance Under 47 U.S.C. § 160(c) with Regard to Broadband Services Provided Via Fiber to the Premises; Petition of the Verizon Telephone Companies for Declaratory Ruling or, Alternatively, for Interim Waiver with Regard to Broadband Services Provided Via Fiber to the Premises; Consumer Protection in the Broadband Era*, CC Docket Nos. 02-33, 01-337, 95-20, 98-10; WC Docket Nos. 04-242, 05-271, Report and Order and Notice of Proposed Rulemaking, 20 FCC Rcd 14853, 14863, 14865, paras. 14, 17 (2005), *aff'd*, *Time Warner Telecom v. FCC*, No. 05-4769 (and consolidated cases) (3rd Cir. Oct. 16, 2007).

¹¹⁷ See *id.* at 14899-992, paras. 86-107.

Act.¹¹⁸ In reaching these determinations, the Commission provided regulatory certainty regarding the classification of these services, thereby encouraging deployment of broadband Internet access service to consumers.

42. Recognizing the link between the ability to provide a triple play of voice, Internet, and video service and providers' incentives to deploy broadband networks, in March 2007, the Commission adopted an order to facilitate and expedite entry of new competitors in the market for the delivery of video programming. The Commission's order preempted local laws, regulations, and franchise agreement requirements to the extent they imposed greater restrictions on market entry than the rules adopted by the Commission.¹¹⁹ The Commission explained that the operation of the franchising process at that time placed unreasonable demands on competitive applicants that contravened the goal of encouraging broadband deployment.¹²⁰ In turn, the Commission found that its new rules would accelerate broadband deployment.¹²¹

43. On March 1, 2007, the Wireline Competition Bureau (WCB) granted a petition filed by Time Warner Cable requesting that the Commission clarify that wholesale telecommunications carriers are entitled to interconnect with incumbent LECs in order to provide service to the wholesale carriers' customers, including new entrants such as VoIP service providers.¹²² That order helped ensure that new entrants have the ability to interconnect with incumbent LECs, consistent with the text of the Communications Act and Commission precedent. WCB concluded that a contrary decision also would impede the important development of wholesale telecommunications competition, facilities-based VoIP competition, and broadband deployment policies that the Commission had developed and implemented over the last decade by limiting the ability of wholesale carriers to offer service.¹²³

44. *Promotion of New Wireline-Based Broadband Technologies.* In 2004 and 2006, the Commission adopted rules for Access BPL systems to ensure that the development of BPL systems did not pose harmful interference risks for licensed radio services.¹²⁴ Given that power lines reach virtually every residence and business in every community and geographic area in this country, BPL service potentially could be made available nearly everywhere, and compete with cable modem service, DSL, and other broadband services.¹²⁵

¹¹⁸ See *United Power Line Council's Petition for Declaratory Ruling Regarding the Classification of Broadband over Power Line Internet Access Service as an Information Service*, WC Docket No. 06-10, Memorandum Opinion and Order, 21 FCC Rcd 13281 (2006); *Wireless Broadband Internet Access Services Order*, 22 FCC Rcd 5901.

¹¹⁹ See *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, Report and Order and Further Notice of Proposed Rulemaking, 22 FCC Rcd 5101 (2007).

¹²⁰ See *id.* at 5102-03, paras. 1, 3.

¹²¹ See *id.*

¹²² See *Time Warner Cable Request for Declaratory Ruling that Competitive Local Exchange Carriers May Obtain Interconnection Under Section 251 of the Communications Act of 1934, as Amended, to Provide Wholesale Telecommunications Services to VoIP Providers*, WC Docket No. 06-55, Memorandum Opinion and Order, 22 FCC Rcd 3513 (WCB 2007).

¹²³ See *id.* at 3517, para. 8.

¹²⁴ See *Access BPL Order*, 19 FCC Rcd 21265; *Access BPL Reconsideration Order*, 21 FCC Rcd 9308.

¹²⁵ See *Access BPL Order*, 19 FCC Rcd at 21266, para. 1.

45. *Clearing Spectrum for Broadband Technology.* The Commission opened up new opportunities for broadband deployment by clearing spectrum for new commercial use. Since the *Fourth Report*, the Commission has: reallocated twenty megahertz of spectrum in the 1915-1920 MHz and 1995-2000 MHz, and 2020-2025 MHz and 2175-2180 MHz bands; reallocated twenty megahertz of spectrum in the 2155-2175 MHz band; and opened up the 1710-1755 MHz band for new advanced wireless services (AWS) services, including third generation (3G) wireless systems.¹²⁶ Further, the Commission has reassigned spectrum in the 2 GHz Mobile Satellite Service (MSS) band to help promote the provision of broadband services in rural areas.¹²⁷ This spectrum will make possible the introduction of hybrid satellite and terrestrial wireless systems in frequency bands with favorable radiofrequency propagation characteristics.

46. As a part of this spectrum clearing, the Commission completed the AWS auction in the 1.7 and 2.1 GHz bands, and adopted service and technical rules for the 700 MHz band in preparation for the upcoming auction in early 2008.¹²⁸ The AWS auction was the biggest and most successful in the Commission's history, and represented the largest amount of spectrum suitable for deploying wireless broadband ever made available in a single auction.¹²⁹ In total, the auction raised \$13.9 billion in gross

¹²⁶ See *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, ET Docket Nos. 00-258, 95-18, RM-9498, RM-10024, Sixth Report and Order, Third Memorandum Opinion and Order, and Fifth Memorandum Opinion and Order, 19 FCC Rcd 20720 (2004); *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services (AWS), including Third Generation Wireless Systems*, ET Docket No. 00-258, WT Docket No. 02-08, Seventh Report and Order, 19 FCC Rcd 21350 (2004); *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, ET Docket No. 00-258, Eighth Report and Order and Fifth Notice of Proposed Rule Making and Order, 20 FCC Rcd 15866 (2005) (*AWS Eighth R&O*). Advanced wireless systems could provide, for example, a wide range of voice, data, and broadband services over a variety of mobile and fixed networks.

¹²⁷ See *Use of Returned Spectrum in the 2 GHz Mobile Satellite Service Frequency Bands*, IB Docket Nos. 05-220, 05-221, Order, 20 FCC Rcd 19696 (2005).

¹²⁸ The 700 MHz band includes spectrum running from 698-806 MHz and encompasses television channels 52 to 69, which television broadcasters currently use during the digital television transition. Once the transition is completed, scheduled for February 17, 2009, this 108 megahertz of spectrum will become available for other uses. A portion of the spectrum, 24 megahertz, has been set aside for use by state and local public safety agencies. Because the 700 MHz spectrum falls below 1 GHz, it has excellent propagation characteristics that will enable licensees to cover a larger area with fewer cell sites and less network infrastructure, making the spectrum particularly valuable and ideal for serving rural and other hard-to-reach areas.

¹²⁹ AWS spectrum can be used by carriers to provide a wide array of innovative wireless services and technologies, including voice, data, video, and other wireless broadband services. In addition to the 90 megahertz of AWS-1 spectrum, the Commission has taken steps toward licensing an additional 40 megahertz of spectrum available for AWS. The Commission has sought comment on the service and technical rules for 20 megahertz of AWS-2 spectrum in the 1.9 and 2 GHz bands. See *Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, WT Docket Nos. 04-356, 02-353, Notice of Proposed Rulemaking, 19 FCC Rcd 19263 (2004). Further, the Commission has allocated 20 megahertz of spectrum at 2155 to 2175 MHz for AWS use. See *AWS Eighth R&O*, 20 FCC Rcd 15866. In 2006, an application for exclusive use of the spectrum in the 2155-75 MHz band was filed, which was accepted for filing in January 2007; subsequently, other applicants filed similar applications for use of this spectrum. All applications are currently pending. See *Application of M2Z Networks, Inc. for License and Authority to Provide a National Broadband Radio Service in the 2155-2175 MHz Band* (filed May 5, 2006) (M2Z Application); see also *Wireless Telecommunications Bureau Announces that M2Z Networks,*

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winning bids, and the Commission sold 1,087 licenses to 104 bidders.¹³⁰ The winning bidders included a mix of different types of companies, including major wireless carriers looking to enhance coverage or deploy new technologies, small businesses seeking to serve rural areas, and new entrants from other technology sectors, most notably cable providers.

47. In April 2007, the Commission adopted certain service and technical rules for the 700 MHz band spectrum and sought comment on additional issues.¹³¹ Specifically, the Commission ruled that E911 and hearing aid compatibility requirements apply to all CMRS services, regardless of the spectrum band used to provide them; established three different geographic areas of varying sizes to be used for licensing the 700 MHz spectrum – Regional Economic Area Groups (REAGs), Economic Areas (EAs), and Cellular Market Areas (CMAs); and harmonized the power levels for paired spectrum between the Upper and Lower 700 MHz bands, moving toward a power spectral density approach.¹³² The Commission has already licensed a small portion of the commercial spectrum in the 700 MHz band and some licensees have begun to offer service before the end of the DTV transition by coordinating with television broadcasters.

48. On July 31, 2007, the Commission adopted its second order in the 700 MHz proceeding and revised the rules governing the 700 MHz band spectrum.¹³³ The goal of these revisions is to foster new

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Inc.'s Application for License and Authority to Provide a National Broadband Radio Service in the 2155-2175 MHz Band is Accepted for Filing, WT Docket No. 07-16, Public Notice, 22 FCC Rcd 1955 (2007); *Wireless Telecommunications Bureau Sets Pleading Cycle for Application by M2Z Networks, Inc. to Be Licensed in the 2155-2175 MHz Band*, WT Docket No. 07-16, Public Notice, 22 FCC Rcd 4442 (2007).

¹³⁰ See *Auction of Advanced Wireless Services Closes: Winning Bidders Announced for Auction 66*, Report No. AUC-06-66-F, Public Notice, 21 FCC Rcd 10521 (2006). In Auction 66, the Commission made available 1,122 AWS licenses in the 1710-1755 MHz and 2110-2155 MHz bands. The revenue collected from this auction nearly doubled the total revenue transferred to the U.S. Treasury from all previous auctions combined. See News Release, FCC, *Wireless Telecommunications Bureau Completes Review of Applications for Licenses for Advanced Wireless Services* (Apr. 30, 2007).

¹³¹ See *Service Rules for the 698-746, 747-762, and 777-792 MHz Bands; Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems; Section 68.4(a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones; Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services; Former Nextel Communications, Inc. Upper 700 MHz Guard Band Licenses and Revisions to Part 27 of the Commission's Rules; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band; Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communications Requirements Through the Year 2010*, WT Docket Nos. 06-150, 01-309, 03-264, 06-169, 96-98, CC Docket No. 94-102, PS Docket No. 06-229, Report and Order and Further Notice of Proposed Rulemaking, 22 FCC Rcd 8064 (2007) (*700 MHz Service Rules Order*); *id.*, Appendix B (identifying the new rules).

¹³² See *id.* at 8067-68, paras. 6-8.

¹³³ See *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands; Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems; Section 68.4 (a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones; Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services; Former Nextel Communications, Inc. Upper 700 MHz Guard Band Licenses and Revisions to Part 27 of the Commission's Rules; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band; Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State, and Local Public Safety Communications Requirements Through the Year 2010; Declaratory Ruling on Reporting Requirement under Commission's Part 1 Anti-Collusion Rule*, WT Docket Nos. 06-150, 01-309, 03-264, 06-169, 96-98, 07-166, CC

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and innovative wireless broadband services, and to create a nationwide broadband network for public safety. To promote the public safety network, the Commission established a framework that will partner commercial and public spectrum licensees, with the commercial licensees funding the network build-out.¹³⁴ To promote the development of wireless broadband services, the Commission amended the rules so that the spectrum licensees will be required to permit customers, manufacturers, and third-party application developers to use the device or application of their choice on the licensed networks.¹³⁵ The auction for the 700 MHz band closed on March 18, 2006.¹³⁶

49. *Promotion of Unlicensed Wireless-Based Broadband Technologies.* Since the *Fourth Report*, the Commission has adopted a series of orders to encourage the deployment of wireless broadband services. For example, the Commission adopted an order to facilitate the testing and development of ultra-wideband (UWB) devices, which will promote broadband wireless communication.¹³⁷ The Commission also permitted the emissions from UWB transmitters operating in the 3.1-5.03 GHz and 5.65-10.6 GHz bands that employ frequency hopping or stepped frequency modulation techniques, or that gate the transmitted signal, to be measured with the transmitter operating in its normal transmission mode. Further, the Commission issued an order to promote broadband development in the 3650 MHz frequency band.¹³⁸ That order adopted, among other things, a streamlined licensing mechanism with minimal regulatory entry requirements, which will encourage multiple entrants and stimulate the rapid expansion of wireless broadband services – especially in rural America – and will serve as a safeguard to protect incumbent satellite earth stations from harmful interference.¹³⁹

50. In 2007, the Commission adopted an order that took a number of important first steps towards allowing the introduction of new low power devices in the broadcast television spectrum (TV bands) on channels/frequencies that are not being used for authorized services (TV band devices).¹⁴⁰ Specifically, the Commission made initial decisions to permit fixed low power devices to operate on any permissible TV channel, but only at times and locations where other authorized services are not already using the spectrum.¹⁴¹ The adopted final rules will allow the marketing of TV band devices to commence on

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Docket No. 94-102, PS Docket No. 06-229, Second Report and Order, 22 FCC Rcd 15289 (2007) (*700 MHz Band Plan Order*); *id.*, Appendix B (identifying the rule changes).

¹³⁴ See *id.* at 15428-32, paras. 386-402.

¹³⁵ See *id.* at 15361-73, paras. 195-228.

¹³⁶ See News Release, *Statement by FCC Chairman Kevin J. Martin* (rel. Mar. 18, 2008) (announcing the close of Auction 73); see also *Notice and Filing Requirements, Minimum Opening Bids, Reserve Prices, Upfront Payments, and Other Procedures for Auctions 73 and 76*, AU Docket No. 07-157, Public Notice, DA 07-4171, para. 1 (rel. Oct. 5, 2007); 47 U.S.C. § 309(j)(15)(C)(v) (requiring the Commission to conduct the auction for the recovered analog spectrum by commencing the bidding not later than January 28, 2008).

¹³⁷ See *Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group*, ET Docket No. 04-352, Order, 20 FCC Rcd 5528 (2005).

¹³⁸ See *Wireless Operations in the 3650-3700 MHz Band; Rules for Wireless Broadband Services in the 3650-3700 MHz Band*, ET Docket Nos. 04-151, 02-380, 98-237, WT Docket No. 05-96, Report and Order and Memorandum Opinion and Order, 20 FCC Rcd 6502 (2005).

¹³⁹ See *id.*

¹⁴⁰ See *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket Nos. 04-186, 02-380, First Report and Order and Further Notice of Proposed Rule Making, 21 FCC Rcd 12266 (2007).

¹⁴¹ See *id.* at 12272, para. 13.

February 18, 2009, after the completed transition to DTV service and all TV stations are in operation on their permanent DTV channels.¹⁴²

51. Additionally, the Commission sought comment on amending Part 15 of the Commission's rules applicable to transmitters operating on an unlicensed basis in the 57-64 GHz frequency range.¹⁴³ The Commission found that these proposals could promote greater utility for the 60 GHz band to serve the public interest more effectively without potentially increasing interference risks to existing services in the band, while encouraging a more flexible development of products providing broadband data services, and furthering the Commission's objective of making broadband more readily available to all Americans.¹⁴⁴

52. *Promotion of Licensed Wireless Broadband Technologies.* In April 2006, the Commission continued its transformation of the rules governing BRS/EBS.¹⁴⁵ Specifically, the Commission revised the mechanism for licensees to transition from the old to the new band plan by allowing BRS and EBS providers to act as "proponents" and propose market-based transition plans for relocating all of the licenses within the same Basic Trading Area (BTA) to the spectrum assignments of the new band plan.¹⁴⁶ The Commission anticipated that this action would facilitate providers' use the spectrum in the 2496-

¹⁴² See *id.*

¹⁴³ See *Revision of the Commission's Rules Regarding Operation in the 57-64 GHz Band*, ET Docket No. 07-113; RM-11104, Notice of Proposed Rule Making, 22 FCC Rcd 10505 (2007).

¹⁴⁴ See *id.*

¹⁴⁵ See *Amendment of Parts 1, 21, 73, 74, and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational, and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands; Part 1 of the Commission's Rules – Further Competitive Bidding Procedures; Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and the Instructional Television Fixed Service Amendment of Parts 21 and 74 to Engage in Fixed Two-Way Transmissions; Amendment of Parts 21 and 74 of the Commission's Rules with Regard to Licensing in the Multipoint Distribution Service and in the Instructional Television Fixed Service for the Gulf of Mexico; Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands; Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, WT Docket No. 03-66, RM-10586, WT Docket No. 03-67, MM Docket No. 97-217, WT Docket No. 02-68, RM-9718, WT Docket No. 00-230, IB Docket No. 02-364, ET Docket No. 00-258, Order on Reconsideration, Fifth Memorandum Opinion and Order, Third Memorandum Opinion and Order, and Second Report and Order, 21 FCC Rcd 5606, 5609, para. 1 (2006) (*BRS/EBS Transition Order*). Formerly, the BRS and EBS were known as the MDS service and the ITFS service, respectively. See *Amendment of Parts 1, 21, 73, 74, and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational, and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands; Part 1 of the Commission's Rules – Further Competitive Bidding Procedures; Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and the Instructional Television Fixed Service Amendment of Parts 21 and 74 to Engage in Fixed Two-Way Transmissions; Amendment of Parts 21 and 74 of the Commission's Rules with Regard to Licensing in the Multipoint Distribution Service and in the Instructional Television Fixed Service for the Gulf of Mexico; Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, WT Docket No. 03-66, RM-10586, WT Docket No. 03-67, MM Docket No. 97-217, WT Docket No. 02-68, RM-9718, WT Docket No. 00-230, Report and Order and Further Notice of Proposed Rulemaking, 19 FCC Rcd 14165, 14169-70, para. 6 (2004) (creating a new BRS/EBS band plan for the 2496-2690 MHz band that eliminated the use of interleaved channels and created distinct band segments for high power operations, such as one-way video transmission, and low power operations, such as two-way fixed and mobile broadband applications).

¹⁴⁶ See *BRS/EBS Transition Order*, 21 FCC Rcd at 5639, para. 59.