

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

In the Matter of

Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of)	
the Commission’s Rules to Improve Wireless)	WT Docket No. 10-4
Coverage Through the Use of Signal Boosters)	

REPORT AND ORDER

Adopted: February 20, 2013

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By the Commission: Chairman Genachowski, Commissioners McDowell, Clyburn, Rosenworcel and Pai
 issuing separate statements.

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I. INTRODUCTION AND SUMMARY

1. The rules and policies we adopt in this *Report and Order* will enhance wireless coverage for consumers, particularly in rural, underserved, and difficult-to-serve areas by broadening the availability of signal boosters while ensuring that boosters do not adversely affect wireless networks. Mobile voice and mobile broadband services are increasingly important to consumers and to our nation’s economy. While nearly the entire U.S. population is served by one or more wireless providers, coverage gaps that exist within and at the edge of service areas can lead to dropped calls, reduced data speeds, or complete loss of service. Robust signal boosters can bridge these gaps and extend coverage at the fringe of service areas. Signal boosters are particularly useful in rural and difficult-to-serve indoor environments, such as hospitals. Signal boosters can also improve public safety communications by enabling the public to connect to 911 in areas where wireless coverage is deficient or where an adequate communications signal is blocked or shielded. In short, because signal boosters represent a cost-effective means of improving our nation’s wireless infrastructure, the rules we adopt today should lead to more robust service for many Americans at home, at work, and on the road.

2. The new regulatory framework for signal boosters we adopt today is one element in a set of initiatives designed to promote deployment of mobile voice and broadband services in the United States. Our rules are technology neutral and can accommodate devices for the cellular systems in use today. In addition, our rules are sufficiently flexible to encourage further technological advances and a robust, competitive market for booster technology. In order to ensure that boosters do not result in degraded performance on commercial, private, and public safety wireless networks, we adopt stringent, industry consensus-based technical rules for Consumer Signal Boosters, which incorporate sufficient safeguards to mitigate interference to wireless networks. Our new technical rules will facilitate vast improvements to the signal boosters on the market today and will allow for technological innovations in the future.

3. In this *Report and Order*, we adopt new technical, operational, and registration

requirements for signal boosters.¹ Our new rules create two classes of signal boosters – Consumer and Industrial – with distinct regulatory requirements outlined below.

4. *Consumer Signal Boosters* are designed to be used “out of the box” by individuals to improve their wireless coverage within a limited area such as a home, car, boat, or recreational vehicle. Consumer Signal Boosters will be authorized under provider licenses subject to certain requirements. Specifically, subscribers must obtain some form of licensee consent to operate the booster; register the booster with their provider; use a booster that meets the Network Protection Standard and is FCC certificated; and operate the booster on a secondary, non-interference basis and shut it down if it causes harmful interference. Consumers may continue to use existing signal boosters provided they (1) have the consent of their provider, and (2) register the booster with that provider. The Commission will conduct consumer outreach to educate consumers, public safety entities, small businesses, and others about our new regulatory framework.

5. *Industrial Signal Boosters* include a wide variety of devices that are designed for installation by licensees or qualified installers. These devices are typically designed to serve multiple users simultaneously and cover larger areas such as stadiums, airports, office buildings, hospitals, tunnels, and educational campuses. Industrial Signal Boosters require an FCC license or express licensee consent to operate, and must be appropriately labeled. This *Report and Order* also revises technical and operational requirements for duly-licensed Part 90 Private Land Mobile Radio (PLMR), non-consumer signal boosters.

6. We establish a two-step transition process for equipment certification for both Consumer and Industrial Signal Boosters sold and marketed in the United States. First, on the release date of this *Report and Order*, we will no longer accept applications for equipment certification of Consumer or Industrial Signal Boosters that do not comply with our new rules and will cease certification of devices which do not comply with our new rules. Second, on or after March 1, 2014, all Consumer and Industrial Signal Boosters sold and marketed in the United States must meet our new requirements.

II. SIGNAL BOOSTERS IN SUBSCRIBER-BASED SERVICES

A. Background

7. Signal boosters serve the public interest by enabling consumers to improve their wireless coverage in rural, underserved, and difficult-to-serve areas. By some estimates, there are more than 2 million signal boosters in use today.² The increased coverage provided by a signal booster is demonstrated by a test conducted near the rural, mountainous town of Enterprise, Utah,³ where use of a signal booster provided a three times coverage area increase for both voice and data service as compared

¹ Our use of the term “signal booster” in this *Report and Order* is intended to include all manner of amplifiers, repeaters, boosters, distributed antenna systems, and in-building radiation systems that serve to amplify signals between a device and a wireless network. Our use of the term “signal booster” does not include femtocells. Femtocells are different from signal boosters. Femtocells are similar to small base stations inside homes or offices and only work in a provider’s licensed area. The connection between the handset and the femtocell is typically wireless using licensed frequencies or Wi-Fi, which uses unlicensed frequencies. Unlike signal boosters, which connect to a wireless network using licensed frequencies, femtocells connect to a wireless network using broadband Internet access in a home or office. Femtocells are not covered by the rules adopted in this *Report and Order*. Additional background information on signal boosters can be found in Appendix B.

² See Petition for Rulemaking of Wilson Electronics, Inc., at 4, WT Docket No. 10-4 (filed Nov. 3, 2009).

³ Enterprise, Utah is a community of approximately 1,700 residents located in the southernmost part of the Great Basin. The nearest city, St. George (population 72,897), is located 40 miles to the south. See <http://www.enterpriseutah.org/> (last visited Oct. 3, 2012).

to coverage without a booster.⁴ At the fringe of existing coverage, the signal booster was able to extend a cell phone's connectivity to the cell site by up to 8 miles.⁵ Use of the booster expanded the coverage of the existing cell site to include Modena, Utah, a rural town previously unserved by the cell site.⁶ Some rural providers rely on signal boosters to provide adequate communications coverage for their subscribers. Copper Valley Wireless, which serves remote South Central Alaska, notes that signal boosters are "vital" to "provide safe and reliable telecommunications services" in remote areas where due to geography and population size, towers are few and far between.⁷ Signal boosters can also address coverage gaps in urban environments, such as buildings, tunnels, and garages. Signal boosters can benefit consumers by improving wireless coverage in office buildings where they work, in health care facilities, where doctors and health care providers need reliable communications, and on educational campuses where students want access to the latest wireless applications.

8. When used properly, signal boosters also provide public safety benefits.⁸ In areas where wireless coverage is deficient or where a signal is blocked or shielded, signal boosters enable the public to connect to 911 in an emergency.⁹ In addition, both rural and metropolitan police departments rely on signal boosters to extend land mobile coverage in areas of limited service.¹⁰ First responders, including

⁴ *Ex Parte* Letter from Russell D. Lukas, Counsel, Wilson Electronics, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission (Mar. 1, 2012) at 2.

⁵ *Id.* at Fig. 2.

⁶ *Id.*

⁷ *Ex Parte* Letter from Sarah Jorgenson, Wireless Tech Support Clerk, Copper Valley Wireless (July 13, 2012) at 1.

⁸ *See, e.g.*, Public Knowledge and The New America Foundation Comments at 3 (noting that enhanced access to 911 would serve the public interest); *Ex Parte* Letter from Russell D. Lukas, Counsel to Wilson Electronics, Inc., and John T. Scott, III, Counsel to Verizon Wireless, to Marlene H. Dortch, Secretary, Federal Communications Commission (July 25, 2011) (Joint Proposal); Blooston Comments at 2 ("The proper use of signal booster technology will provide public safety benefits"); *Ex Parte* Letter from Bruce A. Olcott, Counsel, Cellphone-Mate, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, Attachment (Jan. 10, 2012) at 10 ("Signal boosters enable consumers to complete E911 calls that might not have been possible at the edge of network coverage"); *Ex Parte* Letter from William Wilhelm, Counsel, Nextivity, to Moslem Sawez, Wireless Telecommunications Bureau, Federal Communications Commission (Mar. 8, 2012) (Nextivity Mar. 8, 2012 *Ex Parte* Letter) at 1 (stating that greater signal booster use will improve the availability and delivery of emergency services to end users); TIA Comments at 2 (noting that signal boosters can benefit public safety by expanding the area within which emergency calls can be placed over commercial networks).

⁹ In May 2009, the National Transportation Safety Board recommended that until wireless capacity is extended along highly traveled rural roads, motor coaches traveling in rural areas without wireless telephone coverage should carry mobile cellular amplifiers or satellite-based devices to communicate during emergency events. NTSB Safety Recommendation, H-09-9, at 4-5 (May 29, 2009), *available at* http://www.nts.gov/doclib/reletters/2009/H09_9.pdf (lasted visited Jan. 29, 2013). *Ex Parte* Letter from Russell D. Lukas, Counsel to Wilson Electronics, Inc., to Hon. Julius Genachowski, Chairman, Federal Communications Commission (Mar. 30, 2011) (Wilson Mar. 30, 2011 *Ex Parte* Letter) at 2 (describing how use of signal boosters will improve E911 connectivity and accuracy).

¹⁰ *See, e.g.*, *Ex Parte* Letter from Russell D. Lukas, Counsel to Wilson Electronics, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (Dec. 15, 2010) (Wilson Dec. 15, 2010 *Ex Parte* Letter) at Attachment 1 (describing the need for signal boosters by Sheriff's office in rural Washington County, Utah, because many areas of the county lack two-way radio signal coverage due to challenging geography and terrain); Orange County Sheriff-Coroner Department PN Comments at 1 (bi-directional amplifier systems "supplement in-building two way public safety radio communications coverage where it wouldn't otherwise exist or would be unreliable"); Cobb County E-911 PN Comments at 1 ("great and positive" benefits of signal boosters include "ability to provide critical or important communications where there is limited or none"). *See also* New York City Transit Authority (NYCTA) Reply PN Comments at 2 (NYCTA uses fixed boosters for police, fire and EMS operations in New (continued....))

emergency medical personnel, also use signal boosters to improve communications during disasters and other emergencies.¹¹

9. Malfunctioning, improperly-installed, or technically-deficient signal boosters, however, may cause harmful interference to commercial and public safety wireless networks. Such interference might disrupt cellular service, including 911 emergency assistance calls. The record before us reflects that wireless service providers and public safety communications officials sometimes expend significant time and resources to locate and eliminate signal booster related interference.¹² The new regulatory framework we adopt today will allow consumers to realize the benefits of using signal boosters while preventing, controlling, and, if necessary, resolving interference to wireless networks.

10. *Procedural History.* On November 2, 2007, CTIA filed a Petition for Declaratory Ruling regarding the use of signal boosters in the Commercial Mobile Radio Service (CMRS) bands.¹³ The Wireless Telecommunications Bureau placed the CTIA Petition on Public Notice for comment on January 6, 2010.¹⁴ On April 6, 2011, the Commission released the *NPRM* in this proceeding.¹⁵ Comments and reply comments on the *NPRM* were due on July 25 and August 24, 2011 respectively.¹⁶

(Continued from previous page) _____

York's underground subway system); Joint Council on Transit Wireless Communications PN Comments at 1-2 (signal boosters are "essential components" to most transport operators to enable "vital communications" within tunnels, underground facilities, and buildings); TIA Comments at 2 (noting that signal boosters can benefit public safety by improving the coverage of public safety wireless systems). Comments received in response to the *Public Notice* in this proceeding are referred to herein as "PN Comments" or "PN Reply Comments." See *infra* n.14.

¹¹ See, e.g., APCO PN Comments at 1 ("signal boosters are extremely valuable to public safety networks"); Wilson Dec. 15, 2010 *Ex Parte* Letter at Attachment 1 (Christopher Andrews, Wilson County Emergency Management, Tennessee noting the need for signal boosters in emergency response vehicles in order to serve rural areas; Karen Kempert, Emergency Manager/911 Systems Coordinator, Langdon, ND describing the use of a signal booster to facilitate communications on a search and rescue operation in an area of challenging terrain; John Thompson, Flagstaff, AZ, stating that "[s]ignal amplifiers are essential for rural emergency responders and rural residents" both on and off Navajo reservations).

¹² See, e.g., Massachusetts State Police PN Comments at 1; King County, Washington Regional Communications Board PN Comments at 1-3; San Bernardino PN County Comments at 1; AT&T PN Reply Comments at 10; Verizon Wireless PN Comments at 6-8; U.S. Cellular PN Comments at 5-6; Sprint Nextel PN Comments at 4. See also *Ex Parte* Letter from William L. Roughton, Jr., General Attorney, AT&T, to Marlene H. Dortch, Secretary, Federal Communications Commission (Sept. 25, 2012) at 1 (describing interference from a signal booster in an apartment building in Miami, Florida, which resulted in interference to 20 sectors on 12 AT&T cell sites).

¹³ See Petition for Declaratory Ruling of CTIA – The Wireless Association, WT Docket No. 10-4 (filed Nov. 2, 2007) (CTIA Petition). We note that the CTIA Petition also addresses the use of signal jamming devices, but we do not address the use of such devices in this proceeding. *Id.* at 6-10.

¹⁴ Wireless Telecommunications Bureau Seeks Comment on Petitions Regarding the Use of Signal Boosters and Other Signal Amplification Techniques Used With Wireless Services, *Public Notice*, 25 FCC Rcd 68 (Jan. 6, 2010) (*Signal Boosters PN*).

¹⁵ Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, *Notice of Proposed Rulemaking*, 26 FCC Rcd 5490, 5527, ¶ 106 (2011) (*NPRM*) (granting in part and denying in part the three petitions for rulemaking). The Commission initiated this proceeding in January 2010 by issuing a Public Notice seeking comment on a number of petitions that sought changes to our rules for signal boosters. *Signal Boosters PN*, 25 FCC Rcd 68.

¹⁶ Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, *Order*, 26 FCC Rcd 8578 (2011) (extending deadlines for filing comments and reply comments).

11. On July 25, 2011, Verizon Wireless, Wilson Electronics, and V-COMM submitted a solution (Joint Proposal) for the design and operation of signal boosters.¹⁷ The Joint Proposal set forth technical specifications for consumer-targeted boosters “designed to enable signal boosters to be installed by consumers and operated without causing harm to wireless networks.”¹⁸ Subsequently, Verizon Wireless, Wilson Electronics, T-Mobile, Nextivity, and V-COMM submitted a combined proposal (Consolidated Proposal) consisting of a set of proposed rules that would apply to all consumer-targeted boosters, including two separate “Safe Harbors” for provider-specific (“Safe Harbor 1”) and wideband boosters (“Safe Harbor 2”).¹⁹

B. Classification

12. We find that different categories of signal boosters merit distinct regulatory treatment.²⁰ As commenters aptly recognize, different types of signal boosters have different uses and different potential for causing interference.²¹ In addition, the record reflects that there has been some confusion regarding permissible uses of signal boosters. CTIA, for example, states that some signal booster manufacturers “misrepresent to customers that these devices may legally be operated on exclusive use spectrum without licensee authorization.”²² We believe that consumers and others who choose to use signal boosters to improve their wireless coverage will benefit from clear classification of the types of boosters that are available on the market and of their legal, permissible uses. To this end we classify signal boosters into two distinct, straight-forward categories: Consumer Signal Boosters and Industrial Signal Boosters.²³

1. Consumer Signal Boosters

13. We define Consumer Signal Boosters as devices that are marketed to and sold for personal use by individuals. These devices allow an individual within a limited area such as a home, car, boat or RV, to improve wireless coverage. Consumer Signal Boosters are designed to be used “out-of-the-box” and do not need fine tuning or other technical adjustments. Individuals should be able to install Consumer Signal Boosters without third party, professional assistance. These devices thus require tight regulatory controls to mitigate their potential for interference. Accordingly, as discussed further below, Consumer Signal Boosters must include specific technical features that will protect against interference,²⁴

¹⁷ Joint Proposal at 1.

¹⁸ *Id.* at 2.

¹⁹ See *Ex Parte* Letter from Michiel Lotter, Nextivity, Sean Haynberg, V-COMM, L.L.C., Russell D. Lukas, Counsel to Wilson Electronics, Inc., Steve Sharkey, Chief, Engineering and Technology Policy, T-Mobile, USA, and John T. Scott, Verizon Wireless, to Marlene H. Dortch, Secretary, Federal Communications Commission (June 8, 2012) (Consolidated Proposal).

²⁰ In the *NPRM*, we proposed to distinguish between fixed and mobile signal boosters. *NPRM*, 26 FCC Rcd at 5507-09, ¶¶ 47-54. The rules we adopt today in this *Report and Order* distinguish between Industrial and Consumer Signal Boosters, which we find is a logical outgrowth of the distinction between fixed and mobile boosters.

²¹ Verizon Wireless Comments at 4. See also Joint Proposal at Attachment A, Attachment B.

²² CTIA Comments at 13. See also Sprint PN Comments at 9.

²³ We note that the Joint Proposal separated signal boosters into three categories: Consumer Boosters; Certified Engineered and Operated Boosters (“CEO Boosters”); and Carrier Installed Boosters. Joint Proposal at 1. While we incorporate elements of the Joint Proposal classifications, we find this tripartite distinction unnecessary and decline to adopt it here. Instead, we include CEO Boosters and Carrier Installed Boosters within our classification of Industrial Signal Boosters.

²⁴ See Verizon Wireless Comments at 4 (consumer boosters “must be carefully designed to protect against in-band and adjacent band emissions and noise, in-band receiver overload, and oscillation”). See also *infra* ¶¶ 57-69.

be appropriately labeled,²⁵ have some form of provider consent prior to consumer use,²⁶ and be accurately registered with the consumer's wireless provider.²⁷

14. As discussed further below, Consumer Signal Boosters can be designed to cover multiple wireless providers (Wideband Consumer Signal Boosters) or a single provider (Provider-Specific Consumer Signal Booster). Both Wideband and Provider-Specific Consumer Signal Boosters can be either fixed or mobile. We define a fixed Consumer Signal Booster as a Consumer Signal Booster designed to operate in a fixed location in a building. We define a mobile Consumer Signal Booster as a Consumer Signal Booster designed to operate while moving, *e.g.*, in a vehicle or boat, where both uplink and downlink transmitting antennas are at least 20 cm from the user or any other person.

2. Industrial Signal Boosters

15. We define Industrial Signal Boosters as all signal boosters other than Consumer Signal Boosters. The classification of Industrial Signal Boosters thus covers a wide variety of devices that are designed for installation by licensees or qualified installers. Industrial Signal Boosters may be fixed or mobile.²⁸ These devices are extensively and successfully in use today and we do not seek to curtail their use in the future. Because these devices may be installed only with explicit licensee consent and close licensee coordination, they are not and will not be required to incorporate particular interference protection features. In addition, these devices must be appropriately labeled.

16. Industrial Signal Boosters include large, high powered devices intended for professional or enterprise use.²⁹ These devices tend to have more expansive functionality than Consumer Signal Boosters. For example, unlike Consumer Signal Boosters, many Industrial Signal Boosters incorporate remote monitoring capability to allow the operator to use a graphical user interface to control the device's functions, including remote power control, turn-on, and turn-off.³⁰ The output power and gain for Industrial Signal Boosters are typically multiple times the power and gain of Consumer Signal Boosters. These devices are designed to serve multiple users simultaneously and cover larger areas such as stadiums, shopping malls, office buildings, tunnels, and campuses.³¹ An Industrial Signal Booster installation may support a single wireless provider or multiple wireless providers.³² In addition, such an installation may utilize a greater number of antennas, amplifiers, and other components, compared to Consumer Signal Boosters.³³

²⁵ See *infra* ¶¶ 119-124.

²⁶ See *infra* ¶¶ 24-34.

²⁷ See *infra* ¶¶ 95-103.

²⁸ Unlike Consumer Signal Boosters, we do not distinguish between wideband and provider-specific industrial signal boosters used in the CMRS bands. As discussed further below, however, boosters used in Part 90 spectrum are classified as either Class A (narrowband) or Class B (wideband).

²⁹ See Joint Proposal at 1.

³⁰ See *Ex Parte* Letter from D. Zachary Champ, Government Affairs Counsel to PCIA, to Marlene Dortch, Secretary, Federal Communications Commission (Feb. 6, 2012) (DAS Forum Feb. 6, 2012 *Ex Parte* Letter) at 1. The DAS Forum explains that a Consumer Signal Booster is only perceived by the wireless network as another mobile device. *Id.* at 1-2.

³¹ Joint Proposal at 2. See also *Ex Parte* Letter from Bruce A. Olcott, Counsel to Cellphone-Mate, Inc., to Marlene Dortch, Secretary, Federal Communications Commission (July 24, 2012) (Cellphone-Mate July 24, 2012 *Ex Parte* Letter) at 4 (noting that industrial signal boosters can be used in large and small retail establishments, factories, and other locations where people congregate).

³² Joint Proposal at 2.

³³ See Verizon Wireless Comments at 4.

17. The DAS Forum states that wireless providers treat these large Industrial Signal Boosters as network elements that are a part of their overall wireless networks.³⁴ According to the DAS Forum, Industrial Signal Boosters incorporated with a distributed antenna system (DAS) installation are fine-tuned to the provider's frequencies and specifications.³⁵ The DAS Forum further explains that Industrial Signal Boosters are "network aware, alarmed, and geographically tied to particular provider base stations."³⁶ The larger scope and scale of these devices requires installation to be coordinated by the installer with the wireless provider(s) being served by the booster in order to avoid interference with wireless networks.³⁷

18. Our definition of Industrial Signal Boosters also includes devices that are tailored to serve individual subscribers. Sprint maintains that wireless providers should have the flexibility to use boosters that may not fully comply with the Consumer Signal Booster requirements.³⁸ Sprint explains that it "might be willing to permit [its] customers to use higher-powered mobile boosters...if [Sprint] could limit the location of those boosters or if the boosters were designed to determine that they are sufficiently distant from all cell sites to avoid interference."³⁹ We agree that providers should continue to be allowed to use all types of signal boosters to serve their subscribers' needs. We caution, however, that if a provider allows an individual subscriber to operate a signal booster that does not meet our Consumer Signal Boosters requirements, *i.e.*, the device does not include the required interference safeguards, the provider must install and configure such a device for its subscriber.

19. In addition, we define the category of Industrial Signal Boosters to include signal boosters deployed in the private land mobile bands by PLMR licensees or those with the consent of PLMR licensees.⁴⁰

20. With respect to Industrial Signal Boosters, wireless providers and entities working in close cooperation with wireless providers are in the best position to determine the appropriate equipment to serve subscriber and business needs and can properly install and configure such devices to ensure that they do not cause harmful interference. We are wary, however, that consumers may erroneously purchase Industrial Signal Boosters and unwittingly cause interference to wireless networks because these devices do not contain sufficient, consumer-targeted safeguards. We thus require that Industrial Signal Boosters be labeled to notify consumers that operation of the device requires an FCC license or express (*i.e.*, individualized) consent of the licensee whose signals are intended to be amplified by the device.⁴¹

³⁴ DAS Forum Feb. 6, 2012 *Ex Parte* Letter at 1.

³⁵ *Id.* at 2.

³⁶ *Id.* at 1.

³⁷ *Id.*

³⁸ *Ex Parte* Letter from Richard B. Engelman, Director, Spectrum Resources, Sprint Nextel Corporation, to Marlene Dortch, Secretary, Federal Communications Commission (Mar. 14, 2012) (Sprint Mar. 14, 2012 *Ex Parte* Letter) at 1.

³⁹ *Id.* at 1-2.

⁴⁰ *See infra* ¶ 149.

⁴¹ *See infra* ¶¶ 119-124, 188. Note that in contrast to the express consent requirement for Industrial Signal Boosters, the consent requirement for Consumer Signal Boosters may be satisfied, for example, by purchase of a signal booster to which a carrier has categorically consented.

C. Consumer Signal Boosters**1. Authorization for Consumer Signal Boosters**

21. As noted above, we seek to provide consumers with ready access to well-designed signal boosters that do not harm wireless networks. After a thorough review of the substantial record in this proceeding, we find that Consumer Signal Boosters should be authorized under provider licenses as subscriber equipment subject to certain requirements. In order to use a Consumer Signal Booster, a consumer must:

- Have some form of consent from his/her wireless provider to operate the Consumer Signal Booster. We note that Verizon Wireless, T-Mobile, Sprint, AT&T, and the RTG member companies have made voluntary commitments to consent to all Consumer Signal Boosters that meet the Network Protection Standard.⁴² Therefore, we expect that subscribers of these companies will not need to specifically seek consent from these providers, or other providers who make similar “blanket” consent commitments, for Consumer Signal Boosters that meet the Network Protection Standard.
- Register the Consumer Signal Booster consistent with the procedures of his/her wireless provider.
- Operate the Consumer Signal Booster only on certain frequencies used for the provision of subscriber-based services.
- Operate a Consumer Signal Booster on a secondary, non-interference basis and must shut down the booster if it is causing harmful interference.
- Use a Consumer Signal Booster that meets the Network Protection Standard and has been certified consistent with our new rules.
- Use a Consumer Signal Booster which is appropriately labeled consistent with the rules we adopt today and use the device only with manufacturer-specified antennas, cables, and/or couplings.
- Not deactivate any features of the Consumer Signal Booster which are designed to mitigate harmful interference to wireless networks.

All of these prongs of the authorization process must be satisfied for use of Consumer Signal Boosters to stay in compliance with our rules.

a. Blanket Authorization Under Provider Licenses

22. We find that it is in the public interest to authorize Consumer Signal Boosters as subscriber equipment under provider licenses. At this time, we find that a blanket licensing framework will best facilitate the rapid introduction of Consumer Signal Boosters, provide a streamlined process for authorization of device operation, and enable wireless operators to maintain sufficient control of their networks.

23. In the *NPRM*, we tentatively proposed to license the use of signal boosters by rule under Section 307(e) of the Communications Act.⁴³ Specifically, we proposed to establish a Signal Booster Radio Service under Part 95 of the Commission’s Rules, defining it as a Citizens Band Radio Service pursuant to the Commission’s authority under Sections 307(e)(1) and (e)(3).⁴⁴ In addition, we sought

⁴² See *infra* ¶ 57.

⁴³ *NPRM*, 26 FCC Rcd at 5501-02, ¶¶ 29-32; 47 U.S.C. § 307(e).

⁴⁴ *NPRM*, 26 FCC Rcd at 5501-02, ¶¶ 29-32.

public comment on alternative regulatory approaches for the authorization of signal boosters.⁴⁵

24. *Discussion.* Section 301 of the Communications Act requires a valid FCC license to operate a radio frequency transmitting device, such as a signal booster.⁴⁶ This statutory requirement is reflected in the Commission’s rules and policies which require an FCC license or licensee consent to operate a station in the Wireless Radio Services.⁴⁷ Based on the record in this proceeding, we find that Consumer Signal Boosters, used in the manner provided herein, can be operated as subscriber equipment under provider licenses. And to conform the rules to this finding, we amend Part 20 of our rules to provide that the authority for subscribers to operate Consumer Signal Boosters is “included in the authorization held by the licensee providing service to them”⁴⁸ subject to certain requirements.

25. Under the regulatory framework we adopt today, a subscriber must have the consent of a wireless provider to operate a Consumer Signal Booster. Subscribers may obtain provider consent in a variety of ways. For example, all four nationwide wireless providers – Verizon Wireless,⁴⁹ T-Mobile,⁵⁰ Sprint,⁵¹ and AT&T⁵² – and the member companies of RTG,⁵³ have voluntarily committed to allow their

⁴⁵ *Id.* at 5502, ¶ 32.

⁴⁶ 47 U.S.C. § 301.

⁴⁷ Our rules afford CMRS licensees blanket authority to operate an array of transmitters, including signal boosters, on their licensed spectrum without prior Commission approval. *See, e.g.*, 47 C.F.R. § 22.165 (providing that “[a] licensee may operate additional transmitters at additional locations on the same channel or channel block as its existing system without obtaining prior Commission approval”); 47 C.F.R. § 22.383 (authorizing licensees to “install and operate in-building radiation systems without applying for authorization or notifying the FCC, provided that the locations of the in-building radiation systems are within the protected service area of the licensee’s authorized transmitter(s) on the same channel or channel block”); 47 C.F.R. § 1.903(c) (providing that a subscriber’s authority “to operate mobile or fixed stations in the Wireless Radio Services...is included in the authorization held by the licensee providing service to them”).

⁴⁸ *See* Appendix A, § 20.21(a).

⁴⁹ *Ex Parte* Letter from Andre J. Lachance, Assistant General Counsel, Verizon, to Marlene Dortch, Secretary, Federal Communications Commission (Jan. 29, 2013) (Verizon Jan. 29, 2013 *Ex Parte* Letter) at 1. Specifically, Verizon states that it intends to “voluntarily...authorize customers to operate consumer signal boosters on the Verizon Wireless network provided that the consumer boosters meet one of the consumer booster safe harbor protection standards [in the Consolidated Proposal].” Verizon further states that its consent is subject to the following conditions: (1) customer registration with Verizon Wireless prior to operation; (2) compliance with the Commission’s signal booster rules; and (3) the customer must cease using the booster immediately upon being notified that the device is causing interference. In addition, Verizon reserves the right to withdraw its authorization for any booster that causes harmful interference or fails to operate properly. *Id.*

⁵⁰ *Ex Parte* Letter from Steve Sharkey, Chief, Engineering and Technology Policy, T-Mobile, USA, to Marlene H. Dortch, Secretary, Federal Communications Commission (Jan. 30, 2013) (T-Mobile Jan. 30, 2013 *Ex Parte* Letter) at 1-2. T-Mobile states that it expects to be able to “voluntarily authorize” the deployment of signal boosters on its network provided: “(i) the boosters meet technical criteria designed to prevent interference; and (ii) consumers are required to obtain the consent of their Commercial Mobile Radio Service provider via a notification process prior to the deployment of boosters.” In addition, T-Mobile states that it reserves the right to prohibit the deployment of signal boosters that “develop a track record of interference, or are otherwise demonstrated to be incompatible with the operation of T-Mobile’s network,” until the interference issues can be properly addressed. *Id.* at 2.

⁵¹ *Ex Parte* Letter from Richard B. Engelman, Director, Spectrum Resources, Sprint Nextel Corporation, to Marlene Dortch, Secretary, Federal Communications Commission (Feb. 8, 2013) (Sprint Feb. 8, 2013 *Ex Parte* Letter) at 2. Specifically, Sprint states that it “anticipates consenting to our customers’ use of signal boosters that have received FCC equipment authorization” pursuant to the requirements that (1) the Commission’s technical specifications protect against harmful interference; (2) there is an effective enforcement and education program; and (3) there is a path for future improvements. In addition, Sprint reserves the right to withhold or withdraw its consent if a Consumer Signal Booster “is found to cause interference or be incompatible with Sprint’s network.” *Id.*

subscribers to use properly certificated Consumer Signal Boosters on their networks; this voluntary “blanket” commitment constitutes sufficient licensee consent for a subscriber to operate a Consumer Signal Booster on that provider’s network.⁵⁴ Thus, once a Consumer Signal Booster has been certificated under our new rules,⁵⁵ Verizon, T-Mobile, Sprint, AT&T, and RTG member subscribers need only register their Consumer Signal Boosters prior to operation; subscribers generally need not seek further consent from their wireless provider. In addition, the Competitive Carrier Association (CCA),⁵⁶ states that many of its carrier members will consider voluntarily authorizing their subscribers to use properly certificated Consumer Signal Boosters on their networks.⁵⁷ CCA also notes that a signal booster manufacturer could seek authorization for use of a particular booster model on behalf of all subscribers of individual providers.⁵⁸

26. We are persuaded that blanket authorization under provider licenses is the appropriate regulatory approach at this time. As commenters recognize, Consumer Signal Boosters readily fit within the blanket licensing framework for mobile handsets.⁵⁹ T-Mobile asserts that Consumer Signal Boosters should be treated like other third-party devices that operate on a provider’s network.⁶⁰ T-Mobile states that, like handsets, Consumer Signal Boosters should be under a provider’s operational control and if the device causes harmful interference or is otherwise not operated in accordance with applicable rules and

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⁵² *Ex Parte* Letter from Jeanine Poltronieri, AT&T, to Marlene H. Dortch, Secretary, Federal Communications Commission (Feb. 13, 2013) (AT&T Feb. 13, 2013 *Ex Parte* Letter) at 1. Specifically, AT&T “affirms that it will voluntarily consent to the operation of all signal booster models certified by the Commission to comply with the technical rules” in the Consolidated Proposal. In addition, AT&T reserves the right to withdraw its consent for any signal booster causing harmful interference. *Id.*

⁵³ *Ex Parte* Letter from Caressa D. Bennet, General Counsel, RTG, to Marlene H. Dortch, Secretary, Federal Communications Commission (Feb. 13, 2013) (RTG Feb. 13, 2013 *Ex Parte* Letter) at 1. RTG states that so long as the Commission “adopts rules that protect against harmful interference, RTG’s members anticipate the voluntary authorization of signal boosters by their respective subscribers.” RTG also states that “any signal booster that causes harmful interference or negatively impacts wireless network operations” must be shut down. *Id.* RTG is a trade association representing rural wireless carriers who each serve less than 100,000 subscribers. *See* <http://ruraltelecomgroup.org/about-rtg/> (last visited Feb. 19, 2013).

⁵⁴ *See Ex Parte* Letter from Rebecca Murphy Thompson, General Counsel, Competitive Carriers Association, to Marlene Dortch, Secretary, Federal Communications Commission (Nov. 7, 2012) (CCA Nov. 7, 2012 *Ex Parte* Letter) at 2 (noting that carriers may issue “blanket consent” for all signal boosters meeting the Joint Proposal Safe Harbors).

⁵⁵ Devices may receive FCC certification prior to March 1, 2014.

⁵⁶ CCA, formerly known as RCA – The Competitive Carriers Association, represents over 100 wireless carriers, including Sprint, T-Mobile, and MetroPCS.

⁵⁷ *Ex Parte* Letter from Rebecca Murphy Thompson, General Counsel, Competitive Carriers Association, to Marlene Dortch, Secretary, Federal Communications Commission (Feb. 18, 2013) (CCA Feb. 18, 2013 *Ex Parte* Letter) at 2. CCA states that any voluntary carrier authorization would be subject to conditions, including: booster registration; booster operation in accordance with technical specifications; providers’ ability to withdraw consent if a booster is found to cause interference; a consumer must immediately turn off a booster upon notification of an interference event by a provider; providers may enforce interference determinations through an FCC-developed process; and FCC consideration of activation and remote shut-down requirements for boosters in the future. *Id.*

⁵⁸ *See* CCA Nov. 7, 2012 *Ex Parte* Letter at 2.

⁵⁹ *See* T-Mobile Comments at 3-4; The Blooston Licensees Comments at 8. *See also* TIA Comments at 4-5 (supporting blanket authorization for signal boosters); U.S. Cellular Reply Comments at 2-3 (stating that signal boosters must remain under carrier control).

⁶⁰ T-Mobile Comments at 5.

regulations, it should be denied access to the network.⁶¹ Similarly, Verizon Wireless explains that “wireless licensee knowledge, control and consent are critical to ensuring that signal boosters do not interfere [with wireless networks], or if they do, to resolving that interference.”⁶² We agree that this is the correct approach at this time.

27. Some commenters raise concerns that a consent requirement would allow providers to block consumer access to signal boosters.⁶³ The record, however, reflects provider support for, not opposition to, consumer access to signal boosters. In fact, all four nationwide wireless providers, Verizon Wireless, T-Mobile, Sprint, and AT&T, as well as RTG’s member companies have committed to allow all Consumer Signal Boosters, which comply with our newly adopted Network Protection Standard, to be operated by consumers on their networks.⁶⁴ In addition, CCA states that many of its carrier members will consider voluntarily authorizing their subscribers to use properly certificated Consumer Signal Boosters on their networks.⁶⁵

28. Because Consumer Signal Boosters will be authorized under providers’ licenses, we are mindful that providers must retain sufficient control over these devices in order to avoid a violation of Section 310(d) of the Communications Act.⁶⁶ As the Commission explained previously, “a non-licensee’s

⁶¹ T-Mobile Comments at 5, *citing* Amendment of Sections of Part 21 (now Part 22) of the Commission’s Rules to Modify Individual Radio Licensing Procedures in the Domestic Public Radio Services (now Public Mobile Radio Services), *Report and Order*, 77 FCC 2d 84 (1980).

⁶² Verizon Wireless Comments at v.

⁶³ *See, e.g., Ex Parte* Letter from Caressa D. Bennet, General Counsel, RTG, to Marlene H. Dortch, Secretary, Federal Communications Commission (Aug. 1, 2012) (RTG Aug. 1, 2012 *Ex Parte* Letter) at 2 (arguing that large providers could use consent requirement to deny consumer access to signal boosters); *Ex Parte* Letter from Bruce A. Olcott, Counsel to Cellphone-Mate, to Marlene H. Dortch, Secretary, Federal Communications Commission, (Feb. 11, 2013) at 2, 3 (stating that major providers often object to the sale and installation of signal booster systems by independent companies and arguing that large providers have the incentive to withhold consent to wideband signal boosters in order to disadvantage smaller providers); *Ex Parte* Letter from Michael Calabrese, Director, Wireless Future Project, Open Technology Institute, New America Foundation, to Marlene H. Dortch, Secretary, Federal Communications Commission (Feb. 11, 2013) at 3 (arguing that carrier consent requirement would permit anti-competitive behavior where providers can enter into exclusive arrangements with booster manufacturers).

⁶⁴ Verizon Jan. 29, 2013 *Ex Parte* Letter at 1; T-Mobile Jan. 30, 2013 *Ex Parte* Letter at 1-2; Sprint Feb. 8, 2013 *Ex Parte* Letter at 2; AT&T Feb. 13, 2013 *Ex Parte* Letter at 1; RTG Feb. 13, 2013 *Ex Parte* Letter at 1.

⁶⁵ CCA Feb. 18, 2013 *Ex Parte* Letter at 2. Thus, many CCA members will consider joining the four nationwide carriers and the RTG member companies in voluntarily authorizing Consumer Signal Boosters. Regarding the balance of CCA carrier members, we note that CCA previously stated that its members will “independently engage in good faith efforts to test signal boosters, on a commercially reasonable timeframe, to determine whether the subject booster is appropriate for use on a providers’ exclusively licensed spectrum.” CCA Nov. 7, 2012 *Ex Parte* Letter at 2. Further, CCA stated that it “is not aware of its carrier members intending to use a carrier consent requirement to effect a blanket ban policy on signal boosters.” *Id.* Separately, MetroPCS states that it “would likely test any signal boosters which it was presented with for testing and would decide whether to proceed with authorizing such signal boosters based on the test results” and “such testing could be accomplished in a relatively short period of time.” *Ex Parte* Letter from Carl W. Northrop, Counsel to MetroPCS, to Marlene H. Dortch, Secretary, Federal Communications Commission (Sept. 13, 2012) (MetroPCS Sept. 13, 2012 *Ex Parte* Letter) at 2.

⁶⁶ 47 U.S.C. § 310(d) (“No construction permit or station license, or any rights thereunder, shall be transferred, assigned, or disposed of in any manner, voluntarily or involuntarily, directly or indirectly, or by transfer of control of any corporation holding such permit or license, to any person except upon application to the Commission and upon finding by the Commission that the public interest, convenience, and necessity will be served thereby. No construction permit or station license, or any rights thereunder, shall be transferred, assigned, or disposed of in any manner, voluntarily or involuntarily, directly or indirectly, or by transfer of control of any corporation holding such (continued....)”)

mere use of licensed spectrum does not necessarily imply that the licensee has transferred, assigned, or disposed of the license or any license rights.”⁶⁷ Rather, “[i]f the licensee continues to hold a sufficient degree of control over the non-licensee’s use, there has been no transfer, assignment, or disposition.”⁶⁸ The Commission illustrated this point with the example of a subscriber’s use of a mobile handset. The Commission explained that “the licensee has authorized the subscriber to use the spectrum [without licensee supervision] on a daily basis” and noted that “[b]ecause the licensee continues to exercise a sufficient degree of control over such use...Section 310(d) is not implicated.”⁶⁹

29. Under the framework we adopt today, we find that wireless licensees will have “a sufficient degree of control”⁷⁰ over Consumer Signal Boosters.⁷¹ Specifically, operation of a Consumer Signal Booster requires licensee consent. In addition, subscribers are required to register a Consumer Signal Booster with their provider prior to operation. Further, if a Consumer Signal Booster causes actual harmful interference, once the subscriber is notified of the interference event by a wireless provider or the Commission, the subscriber must shut down the device immediately or as soon as practicable. We note too, that a wireless provider can shut off a subscriber’s service if the subscriber refuses to shut down a signal booster that causes harmful interference. Our blanket licensing approach ensures that subscribers operate signal boosters with their providers’ knowledge and under their providers’ control. We conclude that the combination of these factors constitutes a sufficient degree of control over Consumer Signal Boosters.

30. In addition, we are confident that under this regulatory framework, wireless providers will support consumers by voluntarily committing to allow Consumer Signal Boosters that meet our newly adopted technical requirements to be operated on their networks or expressly consenting to their use. As of the date of this *Report and Order*, all four nationwide wireless provider, Verizon Wireless, T-Mobile, Sprint, and AT&T, as well as RTG’s member companies have made such voluntary commitments.⁷² In addition, CCA states that many of its carrier members will consider voluntarily authorizing their subscribers to use properly certificated Consumer Signal Boosters on their networks.⁷³ Because these nationwide providers have committed to allow subscribers to operate Consumer Signal Boosters on their networks and others appear willing to consider similar use, we see no reason to treat signal boosters any differently than handsets – both types of devices will be operated under the blanket of a provider’s license.

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permit or license, to any person except upon application to the Commission and upon finding by the Commission that the public interest, convenience, and necessity will be served thereby.”).

⁶⁷ Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, *Report and Order and Further Notice of Proposed Rulemaking*, 18 FCC Rcd 20604, 20640, ¶ 77 (2003).

⁶⁸ *Id.*

⁶⁹ *Id.*

⁷⁰ *Id.*

⁷¹ In the event a provider withdraws consent to the use of a Consumer Signal Booster, any further operation would be unauthorized in violation of Section 301 of the Communications Act.

⁷² Verizon Jan. 29, 2013 *Ex Parte* Letter at 1 and *supra* n.49; T-Mobile Jan. 30, 2013 *Ex Parte* Letter and *supra* n.50; Sprint Feb. 8, 2013 *Ex Parte* Letter at 2 and *supra* n.51; AT&T Feb. 13, 2013 *Ex Parte* Letter at 1 and *supra* n.52; RTG Feb. 13, 2013 *Ex Parte* Letter at 1 and *supra* n.53.

⁷³ CCA Feb. 18, 2013 *Ex Parte* Letter at 2.

31. We find that adoption of a license-by-rule framework is not warranted at this time. Commenters have mixed views on the appropriateness of a license-by-rule approach in this proceeding.⁷⁴ Our goal in this proceeding is to ensure that consumers and others have access to safe, reliable signal boosters, which do not harm wireless networks. Based on the record in this proceeding, we conclude that a blanket license framework, rather than a license-by-rule framework is the best approach for achieving this goal. The blanket license framework encourages providers and manufacturers to work collaboratively to develop safe, effective signal boosters, much in the same way handsets are successfully developed today. Similarly, consumers are well acquainted with a provider consent-based blanket licensing framework, which is the same method by which handsets are licensed today. The blanket licensing framework coupled with most providers' voluntary commitment to permit subscribers to operate Consumer Signal Boosters on their networks⁷⁵ ensures that many consumers will have access to safe signal boosters and the coverage-enhancing benefits that they can provide.

32. While we are encouraged by statements in the record regarding providers' willingness to consent to, test, and consider Consumer Signal Boosters for use on their networks, we believe it is appropriate to monitor licensee behavior with respect to signal boosters. As suggested by CCA,⁷⁶ in the event we observe that providers are refusing to give timely and reasonable consideration to signal booster consent requests, we will take appropriate action as it is needed, including measures such as vigorous investigation of individual complaints or revisiting our authorization mechanism for Consumer Signal Boosters and considering alternate approaches within our authority, including a license-by-rule approach.⁷⁷ In the NPRM, we tentatively concluded that we had the authority to pursue a license-by-rule approach, indicating that "[o]ur authority to license new services by rule under Section 307 is well-established."⁷⁸ A number of parties submitted comments into the record disputing that conclusion.⁷⁹ Were we to shift to a license-by-rule approach, we would address those arguments at that time.

⁷⁴ Some commenters support the license-by-rule approach. *See, e.g.*, RTG Aug. 1, 2012 *Ex Parte* Letter at 2; Cellphone-Mate July 24, 2012 *Ex Parte* Letter at 2; Wilson Electronics, Inc. Reply Comments at 2, 8-10; Public Knowledge and the New America Foundation Comments at 2; CellAntenna Reply Comments at 4-5; Wi-Ex Reply Comments at 3; CelLynx Comments at 2. Other commenters disagree with the license-by-rule framework. *See, e.g.*, Smart Booster Comments at 14; WCAI Comments at 6-7; *Ex Parte* Letter from Carl W. Northrop, Metro PCS, to Marlene Dortch, Secretary, Federal Communications Commission (Mar. 16, 2012) at 2; CCA Nov. 7, 2012 *Ex Parte* Letter at 1; APCO Comments at 2; U.S. Cellular Reply Comments at 1.

⁷⁵ Verizon Jan. 29, 2013 *Ex Parte* Letter at 1 and *supra* n.49; T-Mobile Jan. 30, 2013 *Ex Parte* Letter and *supra* n.50; Sprint Feb. 8, 2013 *Ex Parte* Letter at 2 and *supra* n.51; AT&T Feb. 13, 2013 *Ex Parte* Letter at 1 and *supra* n.52; RTG Feb. 13, 2013 *Ex Parte* Letter at 1 and *supra* n.53. *See also* CCA Feb. 18, 2013 *Ex Parte* Letter at 2 (stating that many of CCA's carrier members will consider voluntarily authorizing their subscribers to use properly certificated Consumer Signal Boosters on their networks).

⁷⁶ *Id.* *See also* MetroPCS Sept. 13, 2012 *Ex Parte* Letter at 2 (Commission can monitor carrier behavior and revisit consent requirement if carriers refuse to give consent requests due consideration).

⁷⁷ The Commission's authority to license new services by rule under Section 307 is well established. *See, e.g.*, Amendment of Parts 1 and 95 of the Commission's Rules to Eliminate Individual Station Licenses in the Remote Control (R/C) Radio Service and the Citizens Band (CB) Radio Service, *Report and Order*, 48 Fed. Reg. 24884, ¶ 25 (1983); Amendment of Parts 2 and 95 of the Commission's Rules to Create a Wireless Medical Telemetry Service, *Report and Order*, 15 FCC Rcd 11206, at 11216, ¶ 27 (2000) (adopting rules to license the wireless medical telemetry service by rule under Part 95); Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, *Notice of Proposed Rulemaking and Order*, 27 FCC Rcd 15594 (2012) (proposing to create a shared Citizens Broadband Service in the 3550-3650 MHz Band).

⁷⁸ *NPRM*, 26 FCC Rcd at 5502, ¶ 30.

⁷⁹ *See, e.g.*, Verizon Comments at 18-21; CTIA Comments at 9-10.

33. Based on the extensive array of voluntary commitments to allow use of boosters made by a broad cross-section of wireless providers, we expect that non-approval of boosters that meet the Network Protection Standard will be a rare and unusual occurrence. Nevertheless, to the extent that providers do opt not to consent to the use of a particular signal booster model on their network, we anticipate they will do so only for the purpose of preventing a demonstrated risk of harmful interference, for example, due to field observation of devices not complying with the network protection standard.

34. In order to facilitate our review of providers' behavior regarding Consumer Signal Boosters, we will require all nationwide wireless service providers⁸⁰ to make public certain information regarding their consent for their subscribers to use Consumer Signal Boosters. Specifically, on March 1, 2015 and March 1, 2016, all nationwide wireless providers must publicly indicate their status regarding consent for each Consumer Signal Booster that has received FCC certification as listed in a Public Notice to be released by the Wireless Telecommunications Bureau 30 days prior to each reporting date. For each listed Consumer Signal Booster, wireless providers should publicly indicate whether they (1) consent to use of the device; (2) do not consent to use of the device; or (3) are still considering whether or not they will consent to the use of the device. Our reporting requirement will provide the Commission with valuable information regarding providers' treatment of Consumer Signal Boosters, including the level of consumer access. This information will inform our decision whether it is necessary to revisit our Consumer Signal Booster authorization mechanism.

b. Registration

35. In addition to seeking provider consent to operate a Consumer Signal Booster, we also require subscribers to register their devices with their wireless providers. As discussed in more detail below, registration is a key element in providers' ability to control the devices that operate on their network.⁸¹ Registration is also one way for subscribers to obtain and demonstrate that they have provider consent. Further, registration will assist providers in locating problematic boosters in the event interference occurs and will facilitate consumer outreach. We find that the benefits associated with a provider-based registration system (*e.g.*, provider control of devices, rapid interference resolution, ease of consumer outreach) outweigh the costs of such a system. For these reasons, we find that the public interest will be served by requiring subscribers to register their Consumer Signal Boosters with their wireless providers prior to operation and as a condition of authorization.

c. Spectrum Limitations

36. Based on our review of the record in this proceeding, we find that the public interest will be served by enabling the use of Consumer Signal Boosters in the wireless radio service spectrum bands used for the provision of subscriber-based services under parts 22 (Cellular), 24 (Broadband PCS), 27 (AWS-1, 700 MHz Lower A-E Blocks, and 700 MHz Upper C Block), and 90 (Specialized Mobile Radio) of this chapter.⁸² Consistent with current practice, we are not limiting the use of Industrial Signal Boosters to specific spectrum bands; such boosters are typically professionally installed and closely coordinated with affected licensees, thereby limiting the potential for interference even in bands undergoing reconfiguration or in areas where the deployment of multiple technologies and services may be the norm. Consumer boosters, by contrast, may be installed by individuals with no technical expertise

⁸⁰ A nationwide network covers a sufficiently large percentage of the population such that it would be inappropriate to categorize it as a regional network. Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services, *Fifteenth Report*, 26 FCC Rcd 9664, 9694, n.54 (2011).

⁸¹ See *infra* ¶ 96.

⁸² Operation on Part 90 (Specialized Mobile Radio) frequencies is permitted upon the Commission's release of a Public Notice announcing the date Consumer Signal Boosters may be used in the band. See *infra* ¶ 40.

and are highly portable, favoring their use in select bands for the reasons stated below. We note that subscriber-based services may be offered in additional bands in the future. As consumer demand for signal boosters in these bands arises, we can seek comment on how best to expand our signal booster framework to accommodate such additional bands.

37. *Cellular, Broadband PCS, and AWS-1 Bands.* Commenting parties overwhelmingly support the use of Consumer Signal Boosters in the Cellular, Broadband PCS, and AWS-1 bands. No party opposes the use of Consumer Signal Boosters in these bands. On the basis of the record before us, we therefore determine that these bands should be eligible for Consumer Signal Booster use.

38. *700 MHz Band.* WCAI argues that Consumer Signal Boosters should not be permitted in the 700 MHz Band because the band's flexible service rules permit licensees to deploy multiple technologies, including some with different power requirements (broadcast and mobile broadband, for example).⁸³ WCAI also argues against the use of Consumer Signal Boosters in the 700 MHz Band because the band was only "recently" transitioned from television broadcast to a fixed and mobile allocation.⁸⁴ We disagree. Our decision is guided not by when the Commission established the 700 MHz band plan,⁸⁵ but by whether consumers are likely to benefit from the prospective use of boosters in the band. And we agree with Verizon—which holds considerable spectrum in the 700 MHz band—that consumers will benefit from the use of boosters in the band. The fact that a range of technologies can be deployed in the band does not undermine our conclusion. Indeed, the use of well-designed and technically compliant boosters in the band will help extend the reach of new and innovative services, including 4G LTE broadband technologies, to the public.

39. *800 MHz Specialized Mobile Radio Service Band.* We find that the public interest will be served by permitting the use of Consumer Signal Boosters in the 800 MHz Specialized Mobile Radio (SMR) band, once nationwide reconfiguration of the band is substantially completed.⁸⁶ APCO, Sprint, Verizon Wireless, and Wilson Electronics all support the use of Consumer Signal Boosters in the 800 MHz SMR band (817-824 MHz and 862-869 MHz) upon completion of the band's reconfiguration.⁸⁷ Sprint supports the use of Consumer Signal Boosters in regions where reconfiguration has been completed even though nationwide reconfiguration has yet to be completed.⁸⁸ We believe, however, that

⁸³ WCAI Reply Comments at 6.

⁸⁴ *Id.*

⁸⁵ The Commission established the Upper 700 MHz Band plan and the Lower 700 MHz Band plan in two separate proceedings in 2000 and 2001. See Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, *First Report and Order*, 15 FCC Rcd 476 (2000); Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59), *Report and Order*, 17 FCC Rcd 1022 (2002). The Commission revised the entire 700 MHz Band plan in 2007. See Service Rules for the 698-746, 747-762 and 777-792 MHz Band, *Second Report and Order*, 22 FCC Rcd 15289 (2007).

⁸⁶ Additional information regarding reconfiguration of the 800 MHz band is available at <http://transition.fcc.gov/pshs/public-safety-spectrum/800-MHz/reconfiguration-overview.html> (last visited Jan. 29, 2013).

⁸⁷ Joint Proposal at 1; *Ex Parte* Letter from Richard B. Engelman, Director – Spectrum Resources, Government Affairs, Sprint Nextel Corporation, to Marlene H. Dortch, Secretary, Federal Communications Commission (March 8, 2012) (Sprint Mar. 8, 2012 *Ex Parte* Letter) at 3; APCO Comments at 5 ("consumer use of mobile boosters should not be allowed below 824/869 MHz until such time as the 800 MHz rebanding process has been completed throughout all regions of the nation, at which point public safety and ESMR operations will be in separate portions of the band"). *But cf.* WCAI Reply Comments at 1-2 (generally opposing the use of Consumer Signal Boosters in the 800 MHz SMR Service bands).

⁸⁸ Sprint Mar. 14, 2012 *Ex Parte* Letter at 1-2 (Sprint would consider allowing these boosters provided it maintains control over these types of boosters to ensure they will not be used outside of the reconfigured region).

the benefits of using Consumer Signal Boosters in those areas are outweighed by the risk that some boosters could be diverted for use in an area still undergoing band reconfiguration and therefore possibly interfere with public safety operations.⁸⁹

40. We therefore find that the public interest is served by permitting the use of Consumer Signal Boosters in the 800 MHz SMR band only once nationwide band reconfiguration is substantially completed. And we hereby direct the Public Safety and Homeland Security and Wireless Telecommunications Bureaus to determine when the nationwide reconfiguration is sufficiently complete to permit the use of Consumer Signal Boosters in the 800 MHz SMR band, and to issue a Public Notice announcing the date Consumer Signal Boosters may be used in the band.

41. *Broadband Radio Service and Educational Broadcast Service 2.5 GHz Band.* We will not permit the use of Consumer Signal Boosters in the BRS/EBS 2.5 GHz band at this time. Sprint maintains that it is in the public interest to allow signal boosters in the 2.5 GHz band.⁹⁰ WCAI, however, opposes the use of Consumer Signal Boosters use in the 2.5 GHz band.⁹¹ We generally agree with WCAI that the 2.5 GHz band should be exempt from Consumer Signal Boosters, at least at this time, because of the historical license uses that have been grandfathered in the 2.5 GHz band.⁹² Specifically, the 2.5 GHz band contains legacy educational and commercial video systems that would not be compatible with the use of signal boosters.⁹³ In view of the forgoing, we will not permit the use of Consumer Signal Boosters in the BRS/EBS 2.5 GHz band at this time.

d. Secondary, Non-interfering Operations

42. In the *NPRM*, we proposed that operation of a Consumer Signal Booster would be on “a secondary, non-interference basis to the primary services licensed for the frequency bands on which they transmit, and to primary services licensed for the adjacent frequency bands that might be affected by their transmission.”⁹⁴ We explained that the technical specifications we proposed would facilitate the development and deployment of robust signal boosters that did not harm wireless networks.⁹⁵ However, we determined that secondary status provided an additional safeguard in the event harmful interference occurred despite the technical protections.⁹⁶ The commenters who address the issue of secondary regulatory status are supportive.⁹⁷

⁸⁹ We note that Sprint and other licensees are of course free to install Industrial Signal Boosters in the band today.

⁹⁰ Sprint Feb. 8, 2013 *Ex Parte* Letter at 3. Sprint, however, provides no argument in support of its assertion. As noted above, we can seek comment on how best to expand our signal booster framework to accommodate additional bands, such as 2.5 GHz, as circumstances warrant. *See supra* ¶ 36.

⁹¹ WCAI Reply Comments at 1-2.

⁹² *Id.* at 5.

⁹³ In the Middle Band Segment of the 2.5 GHz band, high-power video systems are allowed throughout the country. *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, *Report and Order and Further Notice of Proposed Rulemaking*, 19 FCC Rcd 14165, 14185-14186, ¶ 44 (2004). In the remainder of the band, some Multichannel Video Programming Distributors have received waivers to continue operating high-power video systems throughout the band. *See id.* at 14199-14200, ¶ 77.

⁹⁴ *NPRM*, 26 FCC Rcd 5490 at Appendix A; *see also id.* at 5507, ¶ 46.

⁹⁵ *Id.* at 5507, ¶ 46.

⁹⁶ *Id.*

⁹⁷ *See, e.g.*, CellAntenna Reply Comments at 5-6; Public Knowledge and the New America Foundation Reply Comments at 4.

43. We find that the additional safeguard of limiting Consumer Signal Booster operations to secondary status is warranted and will serve the public interest. We seek a solution that will both provide consumers with effective tools to serve their telecommunications requirements and enable wireless providers to provide high-quality, interference-free service. In the event a Consumer Signal Booster causes harmful interference, once the Consumer Signal Booster operator is informed of such interference by the Commission or a wireless provider, the operator must cease signal booster operation. While we believe that the more stringent technical requirements we adopt today will substantially limit the potential for Consumer Signal Boosters to cause harm to wireless networks, in the event that harmful interference does occur, this safeguard will require the signal booster operator to deactivate the signal booster immediately or as soon as practicable. Finally, we find that the benefits associated with secondary operation to consumers and wireless service providers (*e.g.*, protecting wireless networks from interference) outweigh the costs associated with shutting down interfering boosters.

e. Network Protection Standard

44. A consumer's authorization to use a Consumer Signal Booster is also contingent on use of a device that meets all aspects of our Network Protection Standard. As explained more fully below, the Network Protection Standard is a series of technical safeguards designed to minimize the potential for Consumer Signal Boosters to cause interference to wireless networks.⁹⁸ Throughout this proceeding, we seek to balance the need to empower consumers to meet their wireless coverage requirements with the need to protect wireless networks from harmful interference. We thus require consumers to use devices which comply with our Network Protection Standard as a condition of their authorization under provider licenses.

f. Labeling and the Use of Approved Antennas, Cables and/or Coupling Devices

45. In order to receive authorization to operate a Consumer Signal Booster, subscribers must also use a device that is appropriately labeled consistent with our rules. Specifically, all Consumer Signal Boosters must be labeled to reflect that they (1) are suitable for consumer use; (2) must be registered with and authorized by the operator's wireless provider; (3) must be used with manufacturer-specified antenna, cables, and/or coupling devices; (4) must be shut down if causing interference; and (5) may affect location accuracy of E911 calls. As discussed further below, proper labeling ensures that consumers are well aware of the specific requirements that attach to their use of a Consumer Signal Booster.⁹⁹ Accordingly, we find that it is in the public interest to require subscribers to use appropriately labeled Consumer Signal Boosters in order to receive blanket authorization.

46. The Consolidated Proposal includes a provision that consumers may operate Consumer Signal Boosters only with approved antennas, cables, and/or coupling devices (collectively "special accessories") as specified by the manufacturer of the Consumer Signal Booster.¹⁰⁰ Altering the gain of the antenna used with a signal booster will affect the device's Effective Radiated Power (ERP) and its corresponding potential for interference and radiofrequency (RF) exposure to individuals. In order to protect wireless networks from interference and to protect consumers from levels of RF exposure in excess of our RF exposure guidelines, a consumer should operate a Consumer Signal Boosters only with approved special accessories as specified by the manufacturer of the Consumer Signal Booster. Accordingly, a consumer is authorized to use a Consumer Signal Booster only with the antennas, cables, and/or coupling devices specified by the booster manufacturer in order to meet the

⁹⁸ See *infra* ¶¶ 49-76.

⁹⁹ See *infra* ¶¶ 119-124.

¹⁰⁰ See Consolidated Proposal at § 20.16(c).

Network Protection Standard.¹⁰¹

g. Safeguards Must be Enabled and Operating

47. The cornerstone of our new framework for authorization of signal boosters is the use of devices that incorporate the technical safeguards established in the Network Protection Standard. The Network Protection Standard requires that manufacturers design devices where these safeguards cannot be easily defeated. Equally important, signal booster operators must ensure that the safeguards are enabled and operating. Thus, a subscriber's Consumer Signal Booster authorization is also contingent on use of a device with all safeguards enabled and operating. If a subscriber disables or deactivates any safeguard incorporated in the Consumer Signal Booster, it will void the subscriber's authorization to operate the device.¹⁰²

h. De Minimis, Third-Party Use

48. In some instances, a subscriber may be authorized to operate a Consumer Signal Booster to connect to his/her wireless provider and a third party may also wish to use the booster occasionally to connect to the third party's wireless provider. Examples include a visitor in a home or guest in a vehicle. We view these occasional, incidental uses as *de minimis* and authorize them under the license of the third-party user's serving provider. The Commission may modify any station license or construction permit if, in its judgment, such action will promote the public interest, convenience, and necessity.¹⁰³ Such modification may appropriately be accomplished through notice and comment rulemaking.¹⁰⁴ We conclude that the public interest is best served if consumers have a variety of choices to meet their individual communications needs. We seek to empower consumers with these choices, but recognize that wideband Consumer Signal Booster use will not necessarily be limited to the purchaser of the device. Thus, we find it in the public interest to authorize *de minimis, i.e.*, occasional, incidental use of a Consumer Signal Booster by a third party under the license of the third party's wireless provider and hereby modify providers' licenses to permit such use. We do not expect that the *de minimis* authorization

¹⁰¹ Our antenna kitting rules (*see* Appendix A § 20.21(a)(3)) require a manufacturer to sell Consumer Signal Boosters (fixed and mobile) together with all necessary antennas, cables, and/or coupling devices. This requirement is not intended to preclude equipment options, such as upgraded antennas or other equipment options, to be offered with the Consumer Signal Booster purchase or with an after purchase upgrade, but all equipment options and features must be tested to ensure the Network Protection Standard is met. This requirement ensures that consumers have the appropriate special accessories when they purchase a Consumer Signal Booster and that after purchase upgrades still comply with the necessary requirements. We do not require consumers to use Consumer Signal Boosters only with these manufacturer-provided special accessories to allow for future replacement due to damage, loss, upgrade, etc. Consumers must nonetheless use any Consumer Signal Booster with manufacturer-*specified* special accessories.

¹⁰² In the event Commission staff direct a consumer to cease operation of a Consumer Signal Booster, any further operation would be unauthorized in violation of Section 301 of the Communications Act.

¹⁰³ *See* Revision of Rules and Policies for the Direct Broadcast Satellite Service, *Report and Order*, 11 FCC Rcd 9712, 9766, n.272 (1995), *citing* *Committee for Effective Cellular Rules v. FCC*, 53 F.3d 1309, 1316 (D.C. Cir. 1995) (Commission properly acted within its rulemaking authority in adopting changes in cellular geographic service areas even though they will result in modification of existing licenses). *See also* Spectrum and Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big LEO Bands, Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands, *Second Order on Reconsideration, Second Report and Order, and Notice of Proposed Rulemaking*, 22 FCC Rcd 19733, 19743-44, ¶ 23 (2007), *citing* *WBEN, Inc. v. United States*, 396 F.2d 601, 617-20 (2d Cir. 1968), *cert. denied*, 393 U.S. 914 (1968).

¹⁰⁴ *Id.* The Commission specifically invited comment in the *NPRM* on authorizing all signal boosters pursuant to existing carrier licenses. *NPRM*, 26 FCC Rcd at 5502, ¶ 32. The license revisions we adopt here are a logical outgrowth of the *NPRM*.

would extend to routine, continued use of the signal booster by a third party (*e.g.*, housemates or family members with different wireless providers). If a third party intends to use a Consumer Signal Booster on a regular, sustained basis, the third party must seek its provider's consent to do so.¹⁰⁵ We find that the benefits associated with authorizing such occasional, incidental uses for consumers outweigh the costs of such use.

2. Network Protection Standard

49. The Network Protection Standard we adopt today is a flexible set of requirements for the design and manufacture of Consumer Signal Boosters. We also adopt two sets of technical parameters, which we deem to satisfy the Network Protection Standard – one for Wideband Consumer Signal Boosters and a second for Provider-Specific Consumer Signal Boosters. Finally, for manufacturers who design signal boosters that do not meet all of the Network Protection Standard requirements, we provide a process to demonstrate compliance with the Network Protection Standard through equivalent protections. This multipronged approach provides manufacturers with certainty regarding the technical specifications that meet our Network Protection Standard as well as sufficient flexibility to develop innovative ways to design signal boosters that do not harm wireless networks. We believe the benefits derived from more technically sophisticated signal boosters to consumers and wireless service providers (*i.e.*, expanded coverage with less interference) outweigh the costs associated with producing and obtaining such equipment.

50. As we recognized in the NPRM, poorly-designed, improperly-installed or malfunctioning signal boosters can produce noise, in the form of adjacent channel interference, oscillation, or base station overload, which may cause interference to commercial and public safety networks.¹⁰⁶ We also acknowledged the substantial benefits that signal boosters could provide to wireless subscribers, particularly rural subscribers, by extending the range of wireless coverage. We thus proposed a series of technical safeguards that could be integrated into signal boosters with the goal of preventing interference to wireless networks.¹⁰⁷ Specifically, we proposed that going forward signal boosters must (1) comply with existing technical parameters for the applicable spectrum band of operation and existing RF exposure requirements; (2) automatically self-monitor operations and shut down if not in compliance with our technical rules or if the device is in oscillation; and (3) power down or shut down automatically when a device is not needed, such as when the device approaches the base station with which it is communicating.¹⁰⁸ Our goal in the NPRM was to “create appropriate incentives for carriers and manufacturers to collaboratively develop robust signal boosters that do not harm wireless networks.”¹⁰⁹ We also invited commenters to suggest other technical parameters which might further enhance interference safeguards and provide additional protection to wireless networks.¹¹⁰

51. *Comments.* The majority of commenters support the adoption of network protection safeguards for signal boosters.¹¹¹ CellAntenna, for example, states that “the adoption of and compliance

¹⁰⁵ For example, two housemates or family members with different wireless providers intending to use a single Wideband Consumer Signal Booster would each seek consent from their wireless provider.

¹⁰⁶ NPRM, 26 FCC Rcd at 5496, ¶ 14.

¹⁰⁷ *Id.* at 5502-05, 5509, ¶¶ 34-41, 53-54.

¹⁰⁸ *Id.*

¹⁰⁹ *Id.* at 5491, ¶ 2.

¹¹⁰ *Id.* at 5512-13, ¶ 61.

¹¹¹ Blooston Licensees Comments at 7 (supporting signal boosters that are well-designed and not likely to cause harmful interference); Cellphone-Mate Comments at 3, 13 (supporting a set of rules based primarily on the Commission's proposal supplemented by transmit power limits); CommScope Comments at 2 (supporting the (continued....))

with signal booster-specific technical criteria will effectively eradicate any interference from signal boosters.”¹¹² TIA comments that in order to minimize harm to wireless networks, “signal boosters must be required to incorporate technology designed to eliminate interference caused by adjacent channel noise, oscillation, and base station receiver overload.”¹¹³ Public Knowledge and the New America Foundation maintain that “[t]he proposed device certification requirements strike the appropriate balance between the interests of consumers, licensees and third-party device makers and marketers.”¹¹⁴

52. As contemplated in the *NPRM*, key industry stakeholders worked collaboratively to develop an industry-driven proposal for regulating consumer-targeted signal boosters, which incorporates and builds upon the Commission’s proposal. On July 25, 2011, Verizon Wireless, Wilson Electronics, and V-COMM submitted the Joint Proposal.¹¹⁵ The Joint Proposal set forth technical specifications for consumer-targeted boosters “designed to enable signal boosters to be installed by consumers and operated without causing harm to CMRS networks.”¹¹⁶ The Joint Proposal garnered substantial support from providers, manufacturers, and industry associations¹¹⁷ and was followed by additional proposals and suggested modifications.¹¹⁸

53. Most recently, Verizon Wireless, Wilson Electronics, T-Mobile, Nextivity, and V-COMM submitted the Consolidated Proposal consisting of a set of proposed rules that would apply to all consumer-targeted boosters, including two separate “Safe Harbors” for provider-specific (Safe Harbor 1) and wideband boosters (Safe Harbor 2).¹¹⁹ The signatories to the Consolidated Proposal, which include two of the largest nationwide providers – Verizon Wireless and T-Mobile – as well as two of the leading

(Continued from previous page) _____
proposed technical requirements); CTIA Comments at 14 (supporting technical standards that would mitigate harmful interference); Public Knowledge and New America Foundation Comments at 3 (supporting the proposed network safety standards to limit interference); T-Mobile Comments at 10 (supporting requirements that will minimize interference); TIA Comments at 3 (supporting “strict technical standards to avoid interference”); Wi-Ex Comments at 7 (supporting technical safeguards).

¹¹² CellAntenna Reply Comments at 2.

¹¹³ TIA Comments at 3.

¹¹⁴ Public Knowledge and New America Foundation Comments at 4.

¹¹⁵ Joint Proposal at 1.

¹¹⁶ *Id.* at 2.

¹¹⁷ *See, e.g.*, Cincinnati Bell Wireless Reply Comments at 2 (generally supporting technical specifications); CTIA Reply Comments at 4-6 (stating that Joint Proposal significantly advances the discussion of the proper requirements for signal boosters); NENA Reply Comments at 1 (“the joint proposal adequately balances the interests of the electronics manufacturing community, wireless carriers, and public safety agencies by improving access to communications networks, minimizing the likelihood of harmful interference, and minimizing the cost of signal boosters in areas where such devices can be beneficial”); Sprint Reply Comments at 3 (generally supporting Joint Proposal); Wireless Extenders Reply Comments at 4-7 (same).

¹¹⁸ *Ex Parte* Letter from Steve Sharkey, Chief, Engineering and Technology Policy, T-Mobile, USA, to Marlene H. Dortch, Secretary, Federal Communications Commission (Nov. 18, 2011) (submitting a separate proposal based on existing FCC rules and internationally recognized technical standards); Sprint Mar. 8, 2012 *Ex Parte* Letter at 1-4 (generally endorsing both the Joint Proposal and the T-Mobile proposal); *Ex Parte* Letter from Jeanine Poltronieri, AT&T, to Marlene H. Dortch, Secretary, Federal Communications Commission (Apr. 3, 2012) (AT&T Apr. 3, 2012 *Ex Parte* Letter) at 1 (attempting to “synthesiz[e] the best elements of the proposals already in the record” in an effort to develop a proposal “that will allow well-designed, non- interfering consumer boosters to be deployed”); *Ex Parte* Letter from John T. Scott, Verizon Wireless, and Russell D. Lukas, Counsel to Wilson Electronics, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (Mar. 14, 2012) (Verizon/Wilson Mar. 14, 2012 *Ex Parte* Letter) (modifying Joint Proposal to accommodate suggestions made by both Sprint and T-Mobile).

¹¹⁹ *See* Consolidated Proposal.

manufacturers of signal boosters – Wilson Electronics and Nextivity, state that each is “comfortable that consumer boosters that meet these standards, if operating properly and in accordance with all of the requirements of the protection standards, will not cause harmful interference to either the serving provider or adjacent wireless networks.”¹²⁰ The Consolidated Proposal, including the Safe Harbors for provider-specific and wideband signal boosters, are incorporated in the Network Protection Standard below.

54. The Consolidated Proposal is endorsed by AT&T, Sprint, and more than 90 small rural providers. RTG¹²¹ and Wireless Extenders (Wi-Ex) support the Consolidated Proposal without modification.¹²² CCA states that it supports many elements of the Consolidated Proposal and “affirmatively supports” Safe Harbor 2.¹²³ AT&T states that “many of the operational requirements, interference safeguards, and technical standards contained in the Safe Harbors provide a good foundation for future Commission rules or industry standards.”¹²⁴ AT&T requests that Safe Harbors 1 and 2 be modified to require that Consumer Signal Boosters may only be operated with original manufacturer-provided equipment (e.g., antennas and cables).¹²⁵ AT&T maintains that use of non-standard equipment significantly increases the risk of mis-installation and interference.¹²⁶ AT&T also asks that Safe Harbor 1 be revised to require provider consent prior to operation.¹²⁷

55. Sprint supports the Consolidated Proposal with a few qualifications and states that, as modified, it “would likely reduce the incidence of harmful interference from signal boosters compliant with such rules in comparison to those available to consumers from third parties today.”¹²⁸ Sprint asks that the proposed rules explicitly state that consumer signal boosters cannot amplify signals received outside the frequency bands enumerated in the rule for the provision of subscriber-based CMRS service.¹²⁹

¹²⁰ *Id.* at 1.

¹²¹ RTG’s 90 member companies are rural wireless carriers throughout the United States to the west of the Mississippi River. All of these rural wireless carriers serve fewer than 100,000 subscribers and most of them serve fewer than 10,000 subscribers.

¹²² RTG Aug. 1, 2012 *Ex Parte* Letter at 2 (stating that RTG “is satisfied that there are sufficient safeguards built into the ‘safe harbor’ provisions, as presented that make explicit carrier consent unnecessary”); *Ex Parte* Letter from Devendra T. Kumar, Counsel, Wireless Extenders, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (July 30, 2012) at 2. Wi-Ex does not support a registration requirement, however. *Id.*

¹²³ CCA Nov. 7, 2012 *Ex Parte* Letter at 1.

¹²⁴ *Ex Parte* Letter from Jeanine Poltronieri, AT&T, to Marlene H. Dortch, Secretary, Federal Communications Commission (July 20, 2012) (AT&T July 20, 2012 *Ex Parte* Letter) at 1.

¹²⁵ *Id.* at 3.

¹²⁶ *Id.*

¹²⁷ *Id.* We note that this modification is not a technical specification; rather it is an authorization issue, which is addressed elsewhere in this *Report and Order*. See *supra* ¶¶ 24-34. In addition, AT&T asks the Commission to adopt an electronic registration process and require manufacturers to fund a centralized database. AT&T July 20, 2012 *Ex Parte* Letter at 3. We address the registration requirement below. See *infra* ¶¶ 95-109. Finally, AT&T asks that we adopt enhanced enforcement procedures. AT&T July 20, 2012 *Ex Parte* Letter at 3. These issues are addressed below as well. See *infra* ¶¶ 138-140.

¹²⁸ *Ex Parte* Letter from Richard B. Engelman, Director – Spectrum Resources, Government Affairs, Sprint Nextel Corporation, to Marlene H. Dortch, Secretary, Federal Communications Commission (July 27, 2012) (Sprint July 27, 2012 *Ex Parte* Letter) at 2.

¹²⁹ *Id.* at 1-2. Sprint maintains that such language is necessary to prevent harmful interference to public safety and commercial communications in adjacent bands.

56. Two commenters raise concerns about the Consolidated Proposal. Smart Booster states that the Safe Harbors “do not adequately prevent or minimize the interference from cellular boosters.”¹³⁰ Smart Booster maintains that the proposed output power level in the Consolidated Proposal will both render a signal booster ineffective in rural areas and create an increased risk for interference in urban areas.¹³¹ Cellphone-Mate states that the Consolidated Proposal is a “workable safe harbor proposal that meets the needs of consumers, manufacturers, and carriers,” but suggests that the proposed intermodulation limit is unnecessary.¹³²

a. Network Protection Standard Requirements

57. We find that the public interest will be served by requiring all Consumer Signal Boosters to comply with a Network Protection Standard, generally based upon the Consolidated Proposal described above. The Network Protection Standard is a flexible set of requirements that will facilitate the development of safe, economical signal boosters today, while encouraging technological booster innovation going forward. Under the Network Protection Standard, all Consumer Signal Booster must: (1) comply with existing technical parameters for the applicable spectrum band of operation; (2) automatically self-monitor certain operations and shut down if not in compliance with our new technical rules; (3) automatically detect and mitigate oscillations in the uplink and downlink bands; (4) power down or shut down automatically when a device is not needed, such as when the device approaches the base station with which it is communicating; (5) be designed so that these features cannot be easily defeated; and (6) incorporate interference avoidance for wireless subsystems. Importantly, we note that all of these requirements are included within the Consolidated Proposal set forth by Verizon, T-Mobile, Wilson, and Nextivity¹³³ and endorsed by AT&T,¹³⁴ Sprint,¹³⁵ RTG,¹³⁶ and CCA.¹³⁷

58. We recognize that these technological advancements and new requirements may, at least initially, increase the cost of Consumer Signal Boosters available for sale, particularly for those boosters which today contain no or minimal safeguards.¹³⁸ We find these technical safeguards are vital, however, to the development of signal boosters that significantly expand coverage for consumers and do not harm wireless networks. The record reflects that some existing boosters, particularly those that do not provide built-in safeguards, have caused substantial interference to both commercial and public safety

¹³⁰ *Ex Parte* Letter from Jeremy K. Raines, Smart Booster, to Marlene H. Dortch, Secretary, Federal Communications Commission (July 13, 2012) (Smart Booster July 13, 2012 *Ex Parte* Letter) at 2.

¹³¹ *Ex Parte* Letter from Jeremy K. Raines, Smart Booster, to Marlene H. Dortch, Secretary, Federal Communications Commission (May 16, 2012) (Smart Booster May 16, 2012 *Ex Parte* Letter) at 6-7, 10-11. Smart Booster further contends that, under the Consolidated Proposal, future wireless networks with increased receiver sensitivities will be compromised. *Id.* at 4.

¹³² Cellphone-Mate July 24, 2012 *Ex Parte* Letter at 1-2. Cellphone-Mate maintains that the -19 dBm limit on intermodulation may double the cost of a consumer signal booster without appreciably improving the device’s interference potential. *Id.* at 1. In the alternative, Cellphone-Mate suggests that intermodulation limits be imposed on wireless base stations. *Id.* at 2.

¹³³ *See generally* Consolidated Proposal.

¹³⁴ AT&T July 20, 2012 *Ex Parte* Letter at 1.

¹³⁵ Sprint July 27, 2012 *Ex Parte* Letter at 1.

¹³⁶ RTG Aug. 1, 2012 *Ex Parte* Letter at 2.

¹³⁷ CCA Nov. 7, 2012 *Ex Parte* Letter at 1.

¹³⁸ By some estimates, Consumer Signal Boosters which incorporate significant safeguards are expected to be in the \$100-\$300 range for mobile boosters and \$200-\$500 range for fixed boosters. Joint Proposal at 2.

networks.¹³⁹ As discussed in more detail below, the rules we adopt today will permit continued operation of those signal boosters that do not meet the Network Protection Standard requirements, in cases in which the operators of those signal boosters have obtained licensee consent. However, our rules are intended to quickly phase out the availability of these “legacy” devices to consumers and replace them with more technically sophisticated signal booster choices that are designed to expand coverage for consumers and mitigate harmful interference to wireless networks. Consumer boosters that meet the new requirements will significantly improve voice and broadband coverage and data transmission in rural and in-building areas.¹⁴⁰ Our rules encourage the development of better, safer boosters and we anticipate that, over time, market forces will decrease the price of these devices. We believe the benefits associated with more technically sophisticated signal boosters to consumers and wireless service providers outweigh the costs to consumers and the payback on consumer’s investment is estimated to be high.¹⁴¹

59. *Existing Technical Parameters.* We adopt the requirement proposed in the *NPRM* that all Consumer Signal Boosters must meet all applicable technical specifications for the relevant band(s) of operation as they apply to mobile units (*i.e.*, not base station technical specifications).¹⁴² Commenting parties who chose to address this parameter are generally supportive.¹⁴³

60. As we explained in the *NPRM*, Parts 22, 24, and 27 of our rules do not provide specific technical requirements for designing signal boosters; however, in order to obtain certification and thus enter the market, all RF devices must meet certain technical specifications designed to protect against interference.¹⁴⁴ In addition, Part 90 specifies technical parameters for certain signal boosters and signal

¹³⁹ See *supra* at ¶ 9.

¹⁴⁰ See *Ex Parte* Letter from Catherine Wang, Counsel to Nextivity, to Marlene H. Dortch, Secretary, Federal Communications Commission (Apr. 17, 2012) at 2 (“for every Cel-Fi system that is provided to a household, approximately 20% new broadband data connections are made”).

¹⁴¹ See *id.* (“the return on investment for a consumer booster like the Nextivity product is in excess of \$2 for every \$1 spent”).

¹⁴² The applicable rules are § 22.355, Public Mobile Services frequency tolerance; § 22.913, Cellular effective radiated power limits; § 22.917, Emission limitation for cellular equipment; § 24.232, PCS power and antenna height limits; § 24.238, Emission limitations for Broadband PCS equipment; § 27.50, Miscellaneous Wireless Communications Services power and antenna height limits; § 27.53, Miscellaneous Wireless Communications Services emission limits; § 90.205, Private Land Mobile Radio Services power and antenna height limits; § 90.210, Private Land Mobile Radio Services emission masks; and § 90.247, Private Land Mobile Radio Services mobile repeater stations.

¹⁴³ Cellphone-Mate Reply Comments at 13. See also CommScope Comments at 2; Public Knowledge and New America Foundation Comments at 4; *Ex Parte* Letter from Steve Sharkey, Chief, Engineering and Technology Policy, T-Mobile, USA, to Marlene H. Dortch, Secretary, Federal Communications Commission (Feb. 17, 2012) (T-Mobile Feb. 17, 2012 *Ex Parte* Letter), Attachment at 11.

¹⁴⁴ *NPRM*, 26 FCC Rcd at 5502-03, ¶ 34. For example, all certified devices must comply with the specified power levels for their applicable rule parts. See, e.g., 47 C.F.R. § 22.913(a)(2) (maximum power level for cellular devices can be no greater than 7 watts ERP); 47 C.F.R. § 24.232(c) (maximum power level for PCS devices can be no greater than 2 watts EIRP); 47 C.F.R. § 27.50(d)(2) (maximum power level for AWS devices can be no greater than 1 watt EIRP). Likewise, certified devices must comply with specified out-of-band emissions (OOBE) limits. See, e.g., OOBE limits for Cellular, 47 C.F.R. § 22.917(a) (the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB); OOBE limits for PCS, 47 C.F.R. § 24.238(a) (the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB); OOBE limits for AWS, 47 C.F.R. § 27.53(h) (the power of any emission outside a licensee’s frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10\log_{10}(P)$ dB). In addition, Part 22 devices are subject to frequency tolerance limits. 47 C.F.R. § 22.355 (the carrier frequency of each transmitter must be maintained within the tolerances given in Table C-1 of § 22.355).

repeaters.¹⁴⁵ Requiring signal boosters to be manufactured to meet our newly adopted, rigorous technical requirements is the cornerstone of promoting access to such devices while minimizing the potential for harmful interference. Our existing technical rules set the “ceiling” for parameters such as power level, emission limitations, and frequency tolerance; Consumer Signal Boosters which meet the Network Protection Standard cannot exceed the power, emissions, and frequency tolerance levels set forth in our existing rules. We anticipate, however, that many Consumer Signal Boosters will need to incorporate power, emissions, and frequency tolerance levels that are more restrictive than existing levels in order to meet the Network Protection Standard.¹⁴⁶

61. *Anti-Oscillation and Automatic Self-Monitoring Features.* Consistent with our proposal in the *NPRM*, we require Consumer Signal Boosters to detect and mitigate oscillation in the uplink and downlink bands (such as may result from insufficient isolation between the device’s antennas). In addition, we modify slightly our proposal to require automatic self-monitoring in Consumer Signal Boosters. These built-in technological safeguards will substantially minimize the potential for harmful interference to wireless networks. Commenters widely support requiring Consumer Signal Boosters to incorporate self-monitoring features.¹⁴⁷

62. As explained in Appendix B, malfunctioning, poorly-designed or improperly-installed signal boosters have the potential to create substantial interference to wireless networks. For example, if a device is improperly installed,¹⁴⁸ it may oscillate and disrupt communications between nearby mobile devices and a base station. Accordingly, we require all Consumer Signal Boosters to detect and mitigate oscillation (such as may result from insufficient isolation between the antennas) in both the uplink and downlink bands. This safeguard is particularly important for a consumer-targeted device where installation will be undertaken by individuals without the technical expertise to identify and correct faulty installation. Under the Network Protection Standard, an improperly installed Consumer Signal Booster that goes into oscillation will either stop the oscillation or shut down before it can cause harmful interference to nearby wireless networks.¹⁴⁹

63. In conjunction with an anti-oscillation feature, we find that Consumer Signal Booster safeguards will be enhanced by adding certain self-monitoring features. We thus require all Consumer

¹⁴⁵ See, e.g., 47 C.F.R. § 90.219(b) (narrowband (Class A) signal boosters must be equipped with automatic gain control circuitry, which will limit the total effective radiated power (ERP) of the unit to a maximum of 5 watts and wideband (Class B) signal boosters must be limited to 5 watts ERP for each authorized frequency that the booster is designed to amplify); 47 C.F.R. § 90.210 (Part 90 narrowband boosters must meet the OOB limits listed in this part for each narrowband channel that the booster is designed to amplify); 47 C.F.R. § 90.219 (Class B signal boosters must meet the emission limits listed in this part for frequencies outside of the booster’s designed passband); 47 C.F.R. § 90.247 (mobile repeater stations limited to a maximum output power limit of 6 watts).

¹⁴⁶ For example, the Wideband Consumer Signal Booster specification we adopt today limits power levels to 1 watt, while Part 22 permits mobile devices up to 7 watts and Part 24 permits mobile devices up to 2 watts. See 47 C.F.R. §§ 22.913 and 24.232.

¹⁴⁷ See, e.g., CellLynx Comments at 5 (“signal boosters, by design, should self-monitor and respond appropriately to developing power and out-of-band emission issues”); CommScope Comments at 4; CTIA Comments at 17; T-Mobile Comments at 12; TIA Comments at 3; Joint Proposal at 2; AT&T Apr. 3, 2012 *Ex Parte* Letter at 1; Wi-Ex Comments at 9 (boosters “must self-monitor for maximum output power and oscillation and make adjustments or shutdown as necessary to avoid generating interference”); Cellphone-Mate Comments at 4 (the ability to detect and mitigate oscillation is a “reasonable and manageable technical requirement intended to address a legitimate potential interference concern”).

¹⁴⁸ For example, if there is insufficient isolation between the signal booster’s transmit and receive antennas.

¹⁴⁹ Specific parameters for achieving this safeguard for Provider-Specific and Wideband Consumer Signal Boosters are set forth in our Final Rules. See Appendix A.

Signal Boosters to monitor the device's compliance with applicable noise and gain limits.¹⁵⁰ If it is determined that the device is operating outside of these technical parameters, the device must be capable of self-correcting or shutting itself down automatically. These features, when combined with the additional safeguards we adopt today, will substantially minimize the interference potential of Consumer Signal Boosters.

64. We note that this safeguard departs slightly from what we proposed in the *NPRM*. In the *NPRM*, we proposed to require self-monitoring of all technical operating parameters.¹⁵¹ In this proceeding, we seek to adopt a robust set of safeguards while simultaneously limiting our regulations to only those necessary to safeguard wireless networks from harmful interference. As Cellphone-Mate aptly states, safeguards must be “reasonable and manageable technical requirement[s] intended to address a legitimate potential interference concern.”¹⁵² After careful study and collaboration, the signatories to the Consolidated Proposal propose two technical parameters to be self-monitored – noise and gain limits.¹⁵³ We agree that limiting our safeguards to monitoring and correcting noise and gain limits strikes an appropriate balance between protecting wireless networks and limiting our regulations to those reasonably necessary to minimize the potential for harmful interference. This, in turn, will allow manufacturers to develop affordable consumer devices. We thus limit our self-monitoring requirements to those identified in the Consolidated Proposal – noise and gain limits. Consumer Signal Boosters must automatically self-monitor their operations to ensure compliance with applicable noise and gain limits and self-correct or shut down automatically if operating in violation of those rules.¹⁵⁴

65. *Power/Shut Down When Approaching Any Affected Base Station.* Signal boosters pose the greatest potential for interference when they are operating at full power near a wireless network base station. We thus proposed in the *NPRM* to require a signal booster operating in a mobile environment to power down or shut down as the device approaches the base station with which it is communicating. We also queried whether this power down function should apply to any base station in order to prevent the “near-far problem.”¹⁵⁵ Commenters generally support a power/shut down capability in Consumer Signal Boosters both in relation to the base station with which the booster is communicating as well as any other nearby base station.¹⁵⁶

¹⁵⁰ In the *NPRM*, we noted that the base station technical limits are not applicable because they would allow significantly higher power levels, which are not warranted for this service. See *NPRM*, 26 FCC Rcd at 5504, ¶ 37.

¹⁵¹ *Id.*

¹⁵² Cellphone-Mate Comments at 4.

¹⁵³ See Consolidated Proposal at Safe Harbor 1 § 3(viii); Safe Harbor 2 § 3(ix).

¹⁵⁴ Specific parameters for achieving this safeguard for Provider-Specific and Wideband Consumer Signal Boosters are set forth in our Final Rules. See Appendix A.

¹⁵⁵ *NPRM*, 26 FCC Rcd at 5509, ¶ 54. The “near-far problem” occurs when a signal booster communicating with Provider “A,” far from provider A’s base station may be near Provider “B’s” base station and introduces excessive noise to Provider B.

¹⁵⁶ See, e.g., CTIA Comments at 16 (stating that “it is absolutely critical to ensure that boosters monitor the power levels of all base stations and automatically modify the gain to protect the operations of wireless carriers”); CelLynx Comments at 7 (stating that “[a]utomatic gain control is the best way that a mobile signal booster can prevent noise generation with the base stations which it is not communicating (‘the near-far problem’)”); Cellphone-Mate Comments at 5 (stating that power down requirement “may also pose a reasonable and only moderately burdensome requirement for signal booster equipment”); GTECH Comments a 6 (arguing that power down requirement should also apply to fixed signal boosters in lieu of a coordination requirement); Smart Booster Comments at 5 (noting that a Smart Booster signal booster would deactivate itself upon entering areas in which the device was not needed).

66. We conclude that harmful interference from Consumer Signal Boosters can be greatly minimized if the devices operate only when they are needed to provide an adequate signal and cease operations when they are unnecessary. We thus require a Consumer Signal Booster operating in a mobile environment to power down¹⁵⁷ or shut down as the device approaches the base station with which it is communicating. Further, because signal boosters operating at full power pose a substantial interference risk to any nearby base station, not just the base station with which the booster is communicating, we also require Consumer Signal Boosters to automatically power down or shut down as they approach any affected base station.¹⁵⁸ When implemented in Consumer Signal Boosters, this safeguard will protect wireless networks by mitigating excess noise to base stations from signal boosters operating at full power within close proximity.

67. *Safeguards Cannot be Easily Defeated.* In the rules we proposed in the *NPRM*, we specified that signal booster operators were prohibited from deactivating any interference-mitigating features in Consumer Signal Boosters and that such features must be enabled and operating at all times the signal booster is in use.¹⁵⁹ We find that in addition to requiring Consumer Signal Boosters to incorporate technical safeguards, it is equally important that these features remain enabled and operating whenever the device is in use. Thus, each application for certification of a Consumer Signal Booster must contain an explanation of all measures taken to ensure that the technical safeguards designed to inhibit harmful interference and protect wireless networks cannot be deactivated by the user.¹⁶⁰ For example, Consumer Signal Boosters should not have user-accessible controls (*e.g.*, buttons, knobs, switches, codes), which would allow a consumer to deactivate the device's safeguards. Further, if a Consumer Signal Booster casing is opened, an individual with basic technical skills should not be able to defeat the device's safeguards by re-soldering a connection, clipping a wire, or moving a switch. Alternatively, a manufacturer could prevent a consumer from tampering with a device by coating it with epoxy or using tamper-proof screws for assembly.¹⁶¹

68. In addition, each applicant must certify that it has taken measures to ensure that these safeguards cannot be easily defeated.¹⁶² This requirement will minimize the opportunity for consumers to unwittingly (or intentionally) disable the safeguards that are necessary to mitigate interference. We believe this feature is integral to the development of Consumer Signal Boosters which will not cause harmful interference.

69. *Additional Safeguards.* We also invited commenters to suggest other technical parameters which might further enhance interference safeguards and provide additional protection to wireless networks.¹⁶³ The Consolidated Proposal proposes one additional interference safeguard for Consumer Signal Boosters which they term "Interference Avoidance for Wireless Subsystems."¹⁶⁴

¹⁵⁷ For example, current cell phones are equipped with dynamic power control, which allows the phone to operate at the minimum power necessary to achieve communications.

¹⁵⁸ Specific parameters for achieving this safeguard for Provider-Specific and Wideband Consumer Signal Boosters are set forth in our Final Rules. See Appendix A.

¹⁵⁹ *NPRM*, 26 FCC Rcd 5490 at Appendix A (proposed § 95.1623).

¹⁶⁰ See, *e.g.*, Amendment of the Commission's Rules to Establish New Personal Communications Services, *Memorandum Opinion and Order*, 9 FCC Rcd 4957, 5041 at ¶ 222 (1994) (adopting rules requiring technical safeguards on unlicensed devices in the PCS bands that could not be easily defeated).

¹⁶¹ This list is illustrative and not intended to be exhaustive.

¹⁶² The certification must comply with Section 1.16 of our rules. 47 C.F.R. § 1.16 (Unsworn declarations under penalty of perjury in lieu of affidavits).

¹⁶³ *NPRM*, 26 FCC Rcd at 5512-13, ¶ 61.

¹⁶⁴ Consolidated Proposal at Safe Harbor 1 § 4(iii); Safe Harbor 2 § 4(iii).

Pursuant to this safeguard, consumer boosters using unlicensed, *e.g.*, Part 15, or other frequency bands, for wireless transmissions between donor and server subsystems for their internal operations must employ interference avoidance methods to prevent interference from being transmitted into authorized spectrum bands.¹⁶⁵ We believe this safeguard will further serve to mitigate the potential for harmful interference from Consumer Signal Boosters and thus require all Consumer Signal Boosters to incorporate this feature.

b. Specifications to Satisfy the Network Protection Standard Requirements

70. The Network Protection Standard is a set of requirements which are intended to ensure that consumer-targeted signal boosters are designed and manufactured with sufficient safeguards to protect wireless networks from harmful interference. The Network Protection Standard defines the types of safeguards that must be incorporated in Consumer Signal Boosters, but does not dictate the means by which manufacturers must achieve these features. Thus, these requirements provide manufacturers with sufficient flexibility to design innovative products to meet consumer needs. While we seek to promote innovation through flexible rules, we also want to provide manufacturers with sufficient certainty to enable them to design products which they will be confident will satisfy our rules. Accordingly, we adopt technical specifications for two types of boosters -- Wideband Consumer Signal Boosters and Provider-Specific Consumer Signal Boosters. These technical specifications are derived from the Consolidated Proposal. We find that these two approaches satisfy the requirements of the Network Protection Standard and will result in safe, economical Consumer Signal Boosters which do not harm wireless networks.

71. The Consolidated Proposal, which forms the basis for the two technical specifications, received overwhelming record support. We recognize that some commenters in the record disagree with certain aspects of the Consolidated Proposal.¹⁶⁶ These concerns, however, are juxtaposed against support for the Consolidated Proposal by the four largest nationwide providers – AT&T, Sprint, T-Mobile, and Verizon Wireless – as well as over 90 small rural providers represented by RTG and CCA’s 100 member companies.¹⁶⁷ These providers collectively employ all of the major air interfaces in use today. Moreover, as experts regarding the operation of their networks, these providers are well-qualified to determine what devices are appropriate for use on their networks and whether such devices may cause interference and negatively affect service quality. Based on the record in this proceeding, we believe that the Consolidated Proposal appropriately balances the need to protect wireless networks with the need to provide consumers with affordable signal booster options. Accordingly, we adopt Safe Harbors 1 and 2 as described in the Consolidated Proposal.

72. *Wideband Consumer Signal Boosters.* The Consolidated Proposal includes two separate consumer booster protections specifications – one for Wideband Consumer Signal Boosters and a second for Provider-Specific Consumer Signal Boosters, discussed below. We define Wideband Consumer Signal Boosters as boosters that may operate on the frequencies and in the market areas of multiple licensees. Because Wideband Consumer Signal Boosters operate across multiple bands and in spectrum licensed to multiple wireless providers, these devices require tight technical specifications to ensure they do not cause harmful interference in adjacent bands.

¹⁶⁵ *Id.*

¹⁶⁶ For example, Smart Booster maintains that the proposed output power level in the Consolidated Proposal will create an increased risk for interference in urban areas. Smart Booster May 16, 2012 *Ex Parte* Letter at 6-7, 10-11. Cellphone-Mate states that the -19 dBm limit on intermodulation will not appreciably improve a signal booster’s interference potential, but may double the cost of the device. Cellphone-Mate July 24, 2012 *Ex Parte* Letter at 1.

¹⁶⁷ Verizon Wireless and T-Mobile put forward the Consolidated Proposal, which was endorsed without qualification by RTG. AT&T, Sprint, and CCA each support the Consolidated Proposal with certain qualifications. These qualifications are largely addressed in the Network Protection Standard we adopt today.

73. The Consolidated Proposal contains detailed technical specifications relating to noise limits, bidirectional capability, booster gain limits, power limits, out of band emissions limits, intermodulation limits, antenna kitting, transmit power off mode, and uplink inactivity for Wideband Consumer Signal Boosters. The Wideband Consumer Signal Booster technical specifications also address anti-oscillation, gain control, and interference avoidance for wireless subsystems.¹⁶⁸ These technical specifications are endorsed by the four largest nationwide providers, CCA's 100 members, and over 90 small rural providers across the United States, who conclude that signal boosters meeting these specifications will not cause harmful interference to wireless networks. We agree and find that these technical specifications meet the requirements of the Network Protection Standard.

74. *Provider-Specific Consumer Signal Boosters.* We define Provider-Specific Consumer Signal Boosters as boosters that can only operate on the frequencies and in the market areas of the licensee(s) specified during the certification of the device. These devices are designed to operate only on a particular licensee(s)'s frequencies and in that licensee(s)'s market areas. Thus, Provider-Specific Consumer Signal Boosters may be certificated and operated only with the consent of the licensee(s) whose frequencies are being amplified by the device. Accordingly, any application for certification of a Provider-Specific Consumer Signal Booster must include a certification, made under penalty of perjury,¹⁶⁹ that the applicant has received the consent of the relevant licensee(s) to manufacture the device. Absent this certification, we will not approve an application under our Provider-Specific Consumer Signal Booster technical specifications. Further, the detailed technical specifications in the Consolidated Proposal include noise limits, bidirectional capability, booster gain limits, power limits, out of band emissions limits, intermodulation limits, antenna kitting, transmit power off mode, and uplink inactivity for Provider-Specific Consumer Signal Boosters.¹⁷⁰ The Provider-Specific Consumer Signal Booster technical specifications also address anti-oscillation, gain control, and interference avoidance for wireless subsystems.¹⁷¹ These technical specifications are endorsed by the four largest nationwide providers, CCA's 100 members, and over 90 small rural providers across the United States, who conclude that signal boosters meeting these specifications will not cause harmful interference to wireless networks. We agree and find that these technical specifications meet the requirements of the Network Protection Standard.

75. *Equivalent Protections.* In adopting the Network Protection Standard, we do not seek to dictate the specific means by which manufacturers choose to satisfy our requirements. Instead, our rules provide manufacturers with the flexibility to develop effective and innovative ways to incorporate appropriate safeguards and design Consumer Signal Boosters which do not harm wireless networks. The technical rules we adopt today reflect industry consensus on the safeguards necessary to protect wireless networks from potential interference from Consumer Signal Boosters. These safeguards reflect existing technologies, which can be rapidly developed into products that will be available to consumers in the near term. We recognize, however, that signal booster technology will continue to evolve and we seek to adopt rules which foster future product innovation. Smart Booster, for example, proposes to develop an "intelligent" signal booster which pairs GPS technology with a memory card to control where the booster operates and on which frequencies.¹⁷² While the Smart Booster proposal may not satisfy each tenet of the Provider-Specific Consumer Signal Booster technical specifications, these features may nonetheless be sufficient to meet the underlying goals of the Network Protection Standard. Accordingly, any Consumer

¹⁶⁸ See generally Consolidated Proposal.

¹⁶⁹ See 47 C.F.R. § 1.16.

¹⁷⁰ See generally Consolidated Proposal.

¹⁷¹ *Id.*

¹⁷² Smart Booster Comments at 25.

Signal Booster which does not meet the technical parameters enumerated in our rules can still satisfy the Network Protection Standard if the manufacturer can demonstrate that the booster provides equivalent protections.

76. Any entity seeking to certify a Consumer Signal Booster which does not meet the enumerated safeguards contained in the Network Protection Standard may request a determination of “equivalent protection” from the Wireless Telecommunications Bureau. Such requests will be placed on Public Notice and interested parties will have an opportunity to comment. If the Wireless Telecommunications Bureau determines that the proponent has shown equivalent protection that satisfies the Network Protection Standard, the proponent may then seek equipment certification from the Office of Engineering and Technology.

c. Future Signal Booster Capabilities

77. Commenters suggest a few additional features that may prove beneficial for Consumer Signal Boosters in the future. Sprint acknowledges that “some of the requirements proposed by commenters in this proceeding, while highly desirable, may not be achievable in the near future.”¹⁷³ Sprint suggests that the Commission initiate a proceeding to develop, over the next 24 months, additional rules to improve consumer signal booster performance. Specifically, Sprint asks that boosters marketed 24 months after adoption of new rules include the capability for (1) automatic registration prior to operation; (2) transmission of the booster’s location and owner contact information directly to the wireless network operator; and (3) remote booster deactivation by a network operator if a booster is causing interference or operating out of compliance with the Commission’s rules.¹⁷⁴ Similarly, AT&T proposes that a consumer-targeted signal booster should (1) be remotely activated by a provider; (2) continuously identify itself to a provider’s network; and (3) be subject to remote shutdown.¹⁷⁵ Smart Booster proposes that all consumer signal boosters be required to “have a minimum amount of intelligence so that they know where to amplify, how much to amplify, and within which spectrum blocks to amplify.”¹⁷⁶ These comments suggest additional and improved signal booster safeguards may be beneficial in the future. Based on the current record, however, we have insufficient information to determine whether such safeguards are warranted given their relative costs and benefits, or whether they are even technologically feasible.

78. We believe it would be beneficial to assess the state of technological advancements after signal booster manufacturers have had an opportunity to develop devices under our new rules. Accordingly, we direct the Wireless Telecommunications Bureau to release a *Public Notice* no later than March 1, 2016, seeking comment on additional technologies that may enhance the interference-mitigating features of signal boosters already required by our rules. Issues to be addressed in the *Public Notice* should include, but are not limited to, the performance and effectiveness of new Consumer Signal Boosters and whether additional safeguards can be implemented using existing network infrastructure, or whether these features require modifications to wireless network operations, the effectiveness of the registration system, and the effectiveness of the FCC’s enforcement efforts. The *Public Notice* will serve as a starting point for issues that will inform whether further action in this area is warranted.

¹⁷³ Sprint July 27, 2012 *Ex Parte* Letter at 3.

¹⁷⁴ *Id.*

¹⁷⁵ See *Ex Parte* Letter from Jeanine Poltronieri, Assistant Vice President, External Affairs, AT&T Services Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (May 18, 2012) (AT&T May 18, 2012 *Ex Parte* Letter) at 1. CommScope also supports remote control and monitoring of signal boosters. CommScope Comments at 5.

¹⁷⁶ Smart Booster Comments at 37.

3. Enhanced 911

79. Well-designed signal boosters can improve public safety by expanding wireless coverage and enabling the public to connect to first responders in areas where service might otherwise be unavailable. In certain circumstances, however, using a signal booster to complete an Enhanced 911 (E911) call can affect location accuracy. Thus, the rules adopted in this *Report and Order* serve to substantially minimize the locations at which such inaccuracies might occur and greatly reduce the potential for interference that might prevent an emergency call from being completed.

80. In the *NPRM*, we sought comment on challenges presented by signal boosters on certain network-based E911 systems and whether signal boosters may lead to inaccurate location estimates.¹⁷⁷ The majority of commenters agree with the Commission that the deployment of well-designed signal boosters can improve the safety of wireless consumers by expanding coverage and enabling the public to connect to 911 in an emergency.¹⁷⁸

81. *Signal Boosters and E911 Systems.* The Commission's rules require wireless providers to provide location information for a 911 caller to the appropriate Public Safety Answering Point (PSAP); this information must be accurate within 50-300 meters for a certain percentage of the calls, depending upon the type of location technology used by the provider.¹⁷⁹ Some wireless providers generate the location of a 911 caller through GPS or similar technology installed in the caller's handset (handset-based E911 solution). Other providers use positioning technologies to determine a mobile phone's location by comparing the times at which a cell signal reaches multiple Location Measurement Units (LMUs) installed at the operator's base stations (network-based E911 solution).¹⁸⁰ The LMUs are highly sensitive receivers that allow providers to measure the Time Difference of Arrival (TDOA) of uplink signals using the cell sites surrounding the mobile device to be located.¹⁸¹

82. Signal boosters do not affect all E911 location technologies. Signal boosters neither impede nor amplify GPS signals. Therefore, a signal booster will not affect the accuracy of an E911 call placed on a wireless network which uses a handset-based solution.¹⁸² As described below, signal boosters can affect network-based E911 solutions in some instances.

83. *"Delay" issue.* Signal boosters can introduce delay that alters the measured time-of-arrival used by network-based E911 systems and cause a potential error.¹⁸³ When a mobile device uses a

¹⁷⁷ See *NPRM*, 26 FCC Rcd at 5498, ¶ 19.

¹⁷⁸ See *id.* at 5490, 5495, ¶¶ 1, 12; see Blooston Comments at iii, 2; *Ex Parte* Letter from Bruce A. Olcott, Counsel to Cellphone-Mate, to Marlene H. Dortch, Secretary, Federal Communications Commission, (May 9, 2012) at 3; Nextivity Mar. 8, 2012 *Ex Parte* Letter at 1; TIA Comments at 2-3, 8; Wilson Comments at 8-9 (citing *NPRM*, 26 FCC Rcd at 5502, ¶ 31); *Ex Parte* Letter from Russell D. Lukas, Counsel to Wilson Electronics, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, Attachment *Consumer Booster Improvement of Cell Site Coverage* (Mar. 2, 2012) at 5.

¹⁷⁹ 47 C.F.R. § 20.18(h). The FCC's wireless E911 rules seek to improve the effectiveness and reliability of wireless 911 services by providing 911 dispatchers with additional location-specific information on wireless 911 calls. Location accuracy requirements are less stringent for network-based solutions. *Id.*

¹⁸⁰ See *NPRM*, 26 FCC Rcd at 5498, ¶ 19; TruePosition Comments at 2.

¹⁸¹ See TruePosition Comments at 2; *Ex Parte* Letter from John E. Logan, Counsel to TruePosition, to Marlene H. Dortch, Secretary, Federal Communications Commission (Dec. 23, 2011) (TruePosition Dec. 23, 2011 *Ex Parte* Letter), Attachment *Analysis of the Affects [sic] of Signal Boosters on U-TDOA Performance* at 3.

¹⁸² See Verizon Wireless Comments at 11-12.

¹⁸³ See Blooston Comments at iii, 6-7; CTIA Comments at 4; TIA Comments at 6; TruePosition Comments at 2-6; Verizon Wireless Comments at 12; See *Ex Parte* Letter from Devendra T. Kumar, Counsel, Wireless Extenders, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (May 1, 2012) (Wi-Ex May 1, 2012 *Ex* (continued....))

signal booster, there are actually two signals transmitted – one by the mobile and another amplified signal from the signal booster.¹⁸⁴ Because LMUs are designed with very sensitive receivers, some LMUs will detect the signal from the mobile, while other, more distant LMUs, will only be able to detect the amplified and delayed signal from the booster.¹⁸⁵ This disparity creates ambiguous TDOA measurements, where the amount of degradation depends on a number of factors, including the delay through the signal booster, the relative signal levels, and the geometry of the surrounding cell sites.¹⁸⁶

84. “Noise” issue. Poorly designed, improperly installed, or malfunctioning signal boosters can cause interference to both commercial and public safety wireless networks.¹⁸⁷ Signal boosters can produce “noise,” which has the potential to interfere with wireless networks.¹⁸⁸ This “noise” can take the form of adjacent channel interference, oscillation, or base station receiver overload.¹⁸⁹ The effect of “noise” on location accuracy depends on factors including gain, channel assignment, the number of sites at which signal boosters are active, and the geometry of the affected sites.¹⁹⁰ Such interference may prevent an emergency call from being completed or result in dropped calls.¹⁹¹

85. *Discussion.* We adopt network protection requirements in this *Report and Order*, which serve to substantially minimize the locations at which signal boosters might affect E911 location accuracy. Specifically, under the Network Protection Standard, Consumer Signal Boosters must power down or turn off when near a cell site, both near the cell sites of the signal booster operator’s provider as well as the sites of other wireless providers.¹⁹² As a result, signal boosters will not operate in densely populated urban areas that are well covered by multiple providers and their networks. Instead, signal boosters will operate only in areas where wireless coverage is weak or non-existent (*i.e.*, rural areas and indoors), where emergency calls might not be completed but for the use of a signal booster.

86. In addition, our new Network Protection Standard greatly reduces the potential for interference (“noise”), which might prevent an emergency call from being completed. Under the Network Protection Standard, Consumer Signal Boosters must turn off when oscillating and operate only for the duration of a call.¹⁹³ Oscillation can interfere with both the signal from the base station and the signal from the mobile device.¹⁹⁴ Requiring oscillation detection and shutdown features will minimize harmful interference that could affect the completion of a wireless call, including a 911 call. As a result, we would expect a decline in dropped 911 calls due to signal boosters.

(Continued from previous page) _____

Parte Letter) at 2 (stating that the signal boosters’ filters are the biggest contributor to delay).

¹⁸⁴ TruePosition Comments at 3.

¹⁸⁵ *Id.*

¹⁸⁶ *Id.* at 2-3.

¹⁸⁷ *NPRM*, 26 FCC Rcd at 5496-97, ¶¶ 14-17; *see also* Appendix B.

¹⁸⁸ *Id.*, 26 FCC Rcd at 5496, ¶ 14; *see also* TruePosition comments at 2 (noting that signal boosters can act as interferers when locating a mobile device for E911 purposes); CTIA Comments at 10 (noting that interference will result in dropped calls, including calls to 911).

¹⁸⁹ *See* Appendix B.

¹⁹⁰ TruePosition Dec. 23, 2011 *Ex Parte* Letter, Attachment *Analysis of the Effects [sic] of Signal Boosters on U-TDOA Performance* at 8.

¹⁹¹ *NPRM*, 26 FCC Rcd at 5495-96, ¶ 13.

¹⁹² *See supra* ¶¶ 65-66.

¹⁹³ *See supra* ¶¶ 61-64.

¹⁹⁴ *See* Appendix B.

87. The record shows that existing signal boosters have not prevented providers from meeting their E911 regulatory obligations.¹⁹⁵ Wilson Electronics, for example, found that its signal boosters can cause additional signal delay ranging from 63.2-173.2 nanoseconds, depending on the type of signal booster. This delay results in location error ranging from 18.9-51.9 meters.¹⁹⁶ Wireless providers using a network-based E911 solution must provide location accuracy within 100-300 meters.¹⁹⁷ The Wilson Electronics' test suggests that existing signal boosters should not impede providers' ability to comply with the Commission's E911 regulations. We would expect that the additional safeguards we adopt today would further limit the opportunity for new Consumer Signal Boosters, manufactured consistent with our Network Protection Standard, to affect E911 location accuracy.

88. TruePosition also tested the effect of signal boosters on E911 location accuracy. TruePosition conducted its test on AT&T's network using various signal booster models with different gain and delay characteristics.¹⁹⁸ TruePosition's test involved three scenarios: (1) locating a mobile device with no signal booster (control scenario); (2) locating a mobile device which was using a signal booster; and (3) locating a mobile device that was *not* using a signal booster, but where there was a signal booster in constant operation near one cell site.¹⁹⁹ Under the control scenario, TruePosition was able to determine the location of a mobile device within approximately 40 meters, 67 percent of the time.²⁰⁰ In the second scenario, locating a mobile device that was using a signal booster, TruePosition was able to determine the location of the caller within 59.1 meters, 67 percent of the time. In the third scenario, placing a signal booster in constant operation near one cell site, TruePosition was able to determine the location of the mobile device within 43.4 meters, 67 percent of the time.²⁰¹ Therefore, the TruePosition test also suggests that providers should be able to comply with the Commission's current E911 regulations even with the location error introduced by a signal booster.

89. In addition, the record reflects that numerous signal booster manufacturers currently include features in their devices designed to mitigate the impact on E911 location accuracy.²⁰² Wilson, for example, states that "since modern boosters disable themselves when they are close to cell sites, there is no degradation of E911 accuracy in those situations."²⁰³ Nextivity states that minimizing signal booster delay is one of the company's key design parameters.²⁰⁴ Wi-Ex states that it specifically considered delay and the potential effect on E911 location in the design and development of wideband boosters.²⁰⁵ We expect that the Network Protection Standard will encourage manufacturers to continue to improve upon these efforts.

¹⁹⁵ The allowable accuracy for network-based technology in E911 positioning is 300 meters for 90 percent of calls and 100 meters for 67 percent of calls. 47 C.F.R. § 20.18(h)(1).

¹⁹⁶ Wilson Mar. 30, 2011 *Ex Parte* Letter at 2.

¹⁹⁷ 47 C.F.R. § 20.18(h)(1).

¹⁹⁸ TruePosition Dec. 23, 2011 *Ex Parte* Letter, Attachment *Analysis of the Affects [sic] of Signal Boosters on U-TDOA Performance* at i.

¹⁹⁹ *Id.* at 6-11.

²⁰⁰ *Id.* at 13. We note that the 67 percent TruePosition uses in its test is relevant, as the allowable accuracy for network-based technology in E911 positioning is 100 meters for 67 percent of calls. *See* 47 C.F.R. § 20.18(h).

²⁰¹ TruePosition Dec. 23, 2011 *Ex Parte* Letter at 13.

²⁰² *See* Wilson Mar. 30, 2011 *Ex Parte* Letter at 3; TruePosition Dec. 23, 2011 *Ex Parte* Letter, Attachment *Analysis of the Affects [sic] of Signal Boosters on U-TDOA Performance* at 17.

²⁰³ Wilson Mar. 30, 2011 *Ex Parte* Letter at 3.

²⁰⁴ Nextivity *Response to Request for Information* at 2.

²⁰⁵ *See* Wi-Ex May 1, 2012 *Ex Parte* Letter at 2.

90. On balance, we find that well-designed, well-made signal boosters will serve the public interest by promoting public safety. We recognize that signal boosters can affect E911 location accuracy for network-based E911 solutions in certain limited circumstances. We believe, however, that the Network Protection Standard will reduce these instances by limiting the use of signal boosters to areas with limited or no coverage, such as rural areas and dead zones within covered areas and indoors.²⁰⁶ We conclude that consumers benefit from using signal boosters to place and complete their emergency calls in rural areas and indoors, even if the location accuracy is affected in some cases, because absent a booster, consumers would lack any access to emergency services in these areas.

91. *Labeling.* Some commenters recommend that manufacturers label signal boosters to notify consumers that accurate E911 location information may not be provided on calls served by signal boosters.²⁰⁷ We agree that consumers should be notified and we address this issue in our labeling requirements.²⁰⁸ We seek to provide consumers with sufficient information to make considered choices about whether to use a signal booster. Armed with knowledge that signal boosters may affect the accuracy of E911 location information, consumers can determine whether a signal booster is an appropriate choice for their individual circumstances. Accordingly, all consumer signal boosters must be labeled with the following language:²⁰⁹

WARNING. E911 location information may not be provided or may be inaccurate for calls served by using this device.

92. *Liability.* Some commenters propose that licensees should not be held liable for E911 location accuracy when those capabilities are affected by signal booster use.²¹⁰ We decline to adopt any form of limited liability or exemption here. Based on the record, it is unclear whether commenters seek an exemption from the Commission's E911 accuracy regulations or seek general liability relief from tort law or both. To the extent commenters request relief from the Commission's E911 location accuracy regulations, we find that such relief is not warranted. The record reflects that even when signal booster use is taken into consideration on wireless networks, providers can meet our E911 location accuracy

²⁰⁶ We note that in Multiple Dwelling Units (MDUs) a resident may place an E911 call that is amplified by another resident's signal booster without the caller knowing that a signal booster is used or its effect on location accuracy. Because MDUs house a large number of residents in close proximity, a greater degree of accuracy may be required to find the location of the caller, and a signal booster's effect on location accuracy may be more pronounced. We note that our existing E911 location accuracy requirements do not apply to calls placed indoors, where we expect the vast majority of MDU calls will be placed. However, in a separate, on-going proceeding, the Commission sought comment on how location information and accuracy can be improved in challenging environments, including indoor settings. That docket is a more appropriate proceeding in which to address concerns related to the use of signal boosters in MDUs and the effect on E911 location accuracy compliance. While we will examine indoor location accuracy requirements in that proceeding, here we find that it is in the public interest for 911 calls from MDUs to be delivered to PSAPs, even if the signal booster affects location accuracy. See *Wireless E911 Location Accuracy Requirements; E911 Requirements for IP-Enabled Service Providers, Further Notice of Proposed Rulemaking and Notice of Inquiry*, 25 FCC Rcd 18957, 18966, ¶ 22 (2010). See also Public Notice, Public Safety and Homeland Security Bureau Seeks Comment on Multiline Telephone Systems Pursuant to the Next Generation 911 Advancement Act of 2012, *Public Notice*, 27 FCC Rcd 5329 (PSHSB 2012).

²⁰⁷ See AT&T Apr. 3, 2012 *Ex Parte* Letter at 2; Joint Proposal Attachment A *Consumer Booster Specifications for CMRS Spectrum Bands* at 7; Verizon/Wilson Mar. 14, 2012 *Ex Parte* Letter at 4.

²⁰⁸ See *infra* ¶¶ 119-124.

²⁰⁹ This language was recommended in the Consolidated Proposal.

²¹⁰ See AT&T Apr. 3, 2012 *Ex Parte* Letter at 2; T-Mobile Comments at 10; T-Mobile Feb. 17, 2012 *Ex Parte* Letter, Attachment *Improving Wireless Coverage Through the Use of Signal Boosters* at 9; CCA Nov. 7, 2012 *Ex Parte* Letter at 2.

requirements.²¹¹ Therefore, licensees must continue to comply with current E911 location accuracy regulations. To the extent commenters seek liability protection under tort law, we believe that this issue would be more appropriately addressed in a separate, on-going proceeding where the Commission is addressing E911 accuracy and reliability.²¹²

4. Registration

93. For the reasons below, we find it in the public interest to require Consumer Signal Booster operators to register all new and existing Consumer Signal Boosters with the operator's serving wireless provider. We require providers to develop a registration mechanism to allow Consumer Signal Booster operators to register their devices. The majority of commenters support a registration requirement as a tool to maintain licensees' control of their networks, hasten interference resolution, and facilitate consumer outreach without creating an unnecessary burden on consumers. Below, we describe the registration requirement and outline the registration procedure.

a. Registration Requirement

94. In the *NPRM*, we sought comment on whether signal booster operators should be required to register their devices prior to operation and whether grandfathered devices should also be subject to such a requirement.²¹³ Specifically, we asked whether operators should be required to register with a national signal booster clearinghouse, how such a clearinghouse should be structured, and whether there are technical or programmatic features that could aid in compliance with a registration requirement.²¹⁴ We also asked commenters to address the costs and benefits of a registration requirement.²¹⁵ Further, we sought comment on practical measures we might adopt to minimize or eliminate consumer burdens, whether registration requirements should be limited to fixed boosters, and whether registration would be effective in helping to identify and to mitigate interference from signal boosters.²¹⁶ Similarly, in the *NPRM*, the Commission cited the Public Safety Department of St. Lucie County, Florida, as supporting a requirement that signal booster operators register their signal boosters with licensees.²¹⁷

95. *Discussion.* We find it in the public interest to require all Consumer Signal Booster operators to register their boosters with their serving providers. The majority of commenters support some form of a registration requirement for all new and existing Consumer Signal Boosters.²¹⁸ While we

²¹¹ See *supra* ¶¶ 87-88. TruePosition Dec. 23, 2011 *Ex Parte* Letter, Attachment *Analysis of the Affects* [sic] of *Signal Boosters on U-TDOA Performance*; Wilson Mar. 30, 2011 *Ex Parte* Letter at 2.

²¹² See Amending the Definition of Interconnected VoIP Service in Section 9.3 of the Commission's Rules; Wireless E911 Location Accuracy Requirements; E911 Requirements for IP-Enabled Service Providers, *Third Report and Order, Second Further Notice of Proposed Rulemaking, and Notice of Proposed Rulemaking*, 26 FCC Rcd 10074 (2011). See generally, Facilitating the Deployment of Text-to-911 and Other Next Generation 911 Applications Framework for Next Generation 911 Deployment, PS Docket No. 11-153, PS Docket No, 10-255, *Further Notice of Proposed Rulemaking*, 2012 WL 6468876, ¶ 167 (rel. Dec. 13, 2012) (seeking comment on the issue of liability protection for, inter alia, CMRS providers).

²¹³ *NPRM*, 26 FCC Rcd at 5513, 5514, ¶¶ 62, 65-66.

²¹⁴ *Id.* at 5514, ¶ 65.

²¹⁵ *Id.*

²¹⁶ *Id.* at 5514, ¶ 66.

²¹⁷ *Id.* at 5513-14, ¶ 64.

²¹⁸ See Association of Public-Safety Communications Officials (APCO) Comments at 2; Bird Technologies Group (BTG) Comments at 7-8; CellAntenna Reply Comments at 6; Cincinnati Bell Wireless Reply Comments at 5; DAS Forum Comments at 11; *Ex Parte* Letter from Carl W. Northrop, Counsel to Metro PCS, to Marlene H. Dortch, (continued....)

recognize that our registration requirement imposes some burden upon providers to develop and maintain a registration system, we find that this burden is outweighed by the substantial benefits of provider-based registration. As discussed further below, a provider-based registration requirement will facilitate licensee control over Consumer Signal Boosters, help providers rapidly resolve interference issues, and assist in consumer outreach. We thus require operators of all Consumer Signal Boosters, both fixed and mobile, to register their devices with their serving providers.

96. Our registration requirement will facilitate provider control over Consumer Signal Boosters consistent with existing practices with respect to consumer handsets and devices. Under Section 310(d) of the Communications Act, a provider must maintain a sufficient degree of control over RF transmitting devices which operate under the provider's license.²¹⁹ We find that registration of Consumer Signal Boosters provides one indicia of control over these devices. As Verizon Wireless aptly notes, a registration requirement will "enable the boosters to be operated pursuant to the licensee's authority and...enable licensees to exert operational control over the consumer boosters operating on each licensee's network."²²⁰ Further, this is consistent with the way consumers contact their providers to initiate service for handsets and other devices. Thus, a provider-based registration system is preferable to a manufacturer-based system as proposed by some commenters.²²¹

97. In addition, a provider-based registration requirement will facilitate rapid resolution of interference, if it occurs. Many commenters observe that signal booster interference is complicated by the lack of information about precisely where the devices are located.²²² T-Mobile states that a registration requirement will "improve the ability of licensees to identify potential sources of interference, and more quickly locate signal boosters that cause interference."²²³ A provider-based registration requirement ensures that providers – the entities involved in resolving interference – have access to the necessary information. If a wireless provider identifies interference on its network that might be attributable to a signal booster, the provider can use the registration information as a ready resource for identifying nearby signal boosters and associated points of contacts.²²⁴ Using this information, licensees can contact the operator of an interfering booster and swiftly address the problem. Registration information will also assist in the Commission's investigations of interference events. We expect that providers will make

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Secretary, Federal Communications Commission (Aug. 14, 2012) (MetroPCS Aug. 14, 2012 *Ex Parte* Letter) at n.37, 9; *Ex Parte* Letter from Michael Millard and Jeremy K. Raines, Smart Booster, to Marlene H. Dortch, Secretary, Federal Communications Commission, (Aug. 14, 2012) (Smart Booster Aug. 14, 2012 *Ex Parte* Letter) at 7; Sprint Nextel Reply Comments at 2; T-Mobile Comments at 8; T-Mobile Reply Comments at 4; USA Mobility Comments at 9; Verizon Wireless Comments at 12.

²¹⁹ 47 U.S.C. § 301(d).

²²⁰ Verizon Wireless Comments at 7.

²²¹ AT&T, MetroPCS, and CCA propose that signal booster manufacturers should manage and fund a central, electronically available signal booster database. AT&T July 20, 2012 *Ex Parte* Letter at 5; MetroPCS Aug. 14, 2012 *Ex Parte* Letter at 9; CCA Nov. 7, 2012 *Ex Parte* Letter at 2.

²²² See Sprint Nextel Comments at 8 (noting that "network teams" must drive around using sophisticated and costly radio frequency monitoring equipment to locate the interference source); CTIA Reply Comments at 7, 13 (noting the difficulty providers face in "identifying the location and operator of the offending booster"); Gregory T. Bunting Comments at 1 (emphasizing the importance of documenting the location of signal boosters in the event a device malfunctions and causes interference); Bird Technologies Petition at 6 ("since there are few records of where consumers have installed signal boosters, it is extremely difficult for licensees to locate oscillating signal boosters or to identify or contact the party responsible for correcting the problem").

²²³ T-Mobile Comments at 8.

²²⁴ *NPRM*, 26 FCC Rcd at 5514, ¶ 65. See DAS Forum Comments at 8-9; T-Mobile Comments 9-10; Joint Proposal at 5.

registration information available to the Commission upon request.

98. A registration requirement will also facilitate consumer outreach. Providers could use the registration information to develop a database of signal booster operators so that they can quickly communicate with a particular registered user or group of users regarding their signal boosters. For example, licensees could use this information to identify signal booster models that have a high incidence of interference issues, as well as certain environments that appear especially susceptible to interference.²²⁵ This benefit of registration will be useful for both fixed and mobile devices.

99. We decline to adopt a requirement that signal boosters must be designed so that they cannot operate until they have been registered.²²⁶ While a number of commenters suggest that such a feature would be desirable, there is no evidence in the record that such a feature is currently achievable. A provider-based registration system can be rapidly implemented thus providing consumers with a ready means of registering their devices. We expect that the Wireless Telecommunications Bureau will examine the achievability of an electronic registration system when the Bureau reviews the state of signal booster technological advancements.

100. As discussed above, a provider-based registration requirement will facilitate licensee control over Consumer Signal Boosters, help licensees rapidly resolve interference issues, and assist in consumer outreach. Given that providers derive a number of benefits from subscriber registration, and in order to encourage consumer compliance with our registration requirement, we conclude that providers may not charge a registration fee. A fee-based registration system could discourage subscribers from registering their boosters and might dissuade some consumers from using these beneficial devices at all.

101. A registration requirement should not be overly burdensome to consumers. While some commenters contend that registration would create an unnecessary burden to consumers,²²⁷ we expect providers to develop a simple registration process that requires minimal information from each consumer. T-Mobile notes that many consumer products today require registration, such as iPods, cell phones, and security software.²²⁸ We find that any minimal burden created by the registration process is greatly outweighed by the benefit of ensuring that licensees retain control of their networks and are able to identify and locate signal boosters that cause interference. Cellphone-Mate maintains that a registration requirement will be difficult to enforce.²²⁹ In our view, proper labeling coupled with a free, simple registration procedure will promote substantial consumer compliance without the need for heavy-handed enforcement. We disagree with Smart Booster's assertion that a registration requirement for mobile

²²⁵ See T-Mobile Comments at 9-10.

²²⁶ See, e.g., AT&T May 18, 2012 *Ex Parte* Letter at 1; AT&T July 20, 2012 *Ex Parte* Letter at 5 (stating that signal boosters should be designed in such a manner that prevents operation until booster is registered in a manufacturer-funded central database); Cincinnati Bell Wireless Reply Comments at 3; Smart Booster Aug. 14, 2012 *Ex Parte* Letter at 7 (proposing a requirement that all intelligent boosters have a provision to guarantee they are registered). In a preceding filing, Smart Booster argued that a clearinghouse is not necessary for intelligent boosters because these devices are location aware. See Smart Booster Comments at 6, 33; T-Mobile Comments at 8; Joint Proposal at 8.

²²⁷ See Cellphone-Mate Comments at 8; Public Knowledge and New America Foundation Comments at 4; Public Knowledge and New America Foundation Reply Comments at 2-4.

²²⁸ T-Mobile Comments at 9. Carriers and manufacturers require registration for other consumer devices, including cell phones, laptops, security software, and Microsoft Office®. This registration information typically includes the user's name, the user's contact information, and the product name or product type. Some registration processes may seek more specific information, such as the product serial number and information about where and how the product will be used.

²²⁹ Cellphone-Mate Comments at 8.

signal boosters is of little value.²³⁰ At a minimum, mobile booster registration will provide a useful starting point for licensees investigating interference events.

102. Further, we conclude that the benefits of a provider-based registration system outweigh the costs of such a system. While we recognize that providers must bear the cost of creating and maintaining a signal booster registration system, there are substantial benefits to be gained by a provider-based system. First, provider-based registration gives providers some control over devices that are authorized under the blanket of their licenses. Second, provider-based registration will allow providers to rapidly identify sources of interference should they occur. Finally, provider-based registration will facilitate consumer outreach in the event that providers need to communicate with a particular registered user or group of users regarding their signal boosters. We thus conclude that the benefits of a provider-based registration system outweigh the costs of such a system.

103. For these reasons, all Consumer Signal Booster operators must register their devices as set forth in this *Report & Order*. Our requirement applies to operators of all Consumer Signal Boosters—new and existing, fixed and mobile.²³¹

b. Registration Procedure and Access to Registration Information

104. *Registration Procedure.* Based on the record in this proceeding, we find it is in the public interest to require Consumer Signal Booster operators to register directly with their serving provider prior to operating their devices.²³² In addition, if a consumer purchases a Consumer Signal Booster for use in a location where subscribers of multiple serving providers will access the device regularly, each such subscriber must register the device with their provider.²³³ Further, consumers who purchase wireless service from resellers must also register their boosters. Wireless providers must therefore establish a process for these consumers to register either directly with the serving provider (*i.e.*, the underlying facilities-based provider) or with the applicable reseller.

105. We find that direct registration with the serving provider, rather than a third-party or the Commission, will enhance the ability of licensees to retain control of their networks. Direct registration also provides a convenient opportunity for consumers to obtain licensee consent prior to operation; a completed Consumer Signal Booster registration provides evidence of licensee consent to operation of the registered booster.²³⁴ Finally, providers' access to registration information should vastly improve the ability to locate these devices in the case of interference.

106. By March 1, 2014, all providers who voluntarily consent to the use of Consumer Signal Boosters on their networks must establish a free registration mechanism for their subscribers. In order to promote the availability of Consumer Signal Boosters for consumers with wireless coverage needs, providers may not charge a fee for registration. At a minimum, providers must collect (1) the name of the Consumer Signal Booster owner and/or operator, if different individuals; (2) the make, model, and serial number of the device; (3) the location of the device; and (4) the date of initial operation. Wireless providers may determine how to collect such information²³⁵ and how to keep it up-to-date. While we

²³⁰ See Smart Booster Comments at 33.

²³¹ We note that existing signal boosters currently operated by consumers will not be grandfathered unless registered. See *infra* ¶¶ 128-198.

²³² In the event a consumer switches service providers, it must obtain consent from and register with the new provider or else cease operations.

²³³ See *supra* ¶ 48.

²³⁴ Providers may also choose to provide consent in other ways as described above. See *supra* ¶ 25.

²³⁵ For example, providers could allow registration via their websites or toll-free numbers.

otherwise permit providers to develop their own registration processes to facilitate provider control and interference resolution, providers should collect only such information that is reasonably related to achieving these dual goals. We believe this approach adequately balances our regulatory requirements with industry flexibility to implement them. Providers that have not consented to the use of Consumer Signal Boosters by March 1, 2014, must establish a free registration mechanism for their subscribers within 90 days of consenting to such use.

107. In the *NPRM* we queried whether to create a national signal booster clearinghouse to consolidate the registration process.²³⁶ While some commenters support use of a national clearinghouse,²³⁷ the majority of commenters state that a clearinghouse is premature or unnecessary.²³⁸ We agree with commenters that a clearinghouse is unnecessary. Requiring providers to pass registration information to a third party clearinghouse would create unnecessary industry regulation and raise significant privacy concerns.²³⁹ The benefits of registration – maintaining licensee control over signal boosters and resolving interference – can be achieved via direct registration with serving providers. We thus see no need to require the establishment of a national clearinghouse at this time. We note, however, that the flexible registration framework we adopt herein does not prevent wireless providers from consolidating their information collection, storage, and access capabilities in order to efficiently manage registration data and rapidly address interference.

108. *Access to Registration Information.* As discussed above, registration information is a valuable resource to aid in resolution of interference incidents. The Commission encourages providers to share registration information as necessary to address and remedy cases of interference. While we encourage provider cooperation to address interference, we must ensure that consumer privacy is protected when registration information is shared, as it is likely to include signal booster operators' personally identifiable information. To the extent providers share signal booster registration information to address interference issues, they must protect the confidentiality of proprietary information and comply with Customer Proprietary Network Information (CPNI) requirements, as necessary.²⁴⁰ In addition, because this information is proprietary, only those with a legitimate need for the registration information may have access to it. Therefore, a provider may share registration information with another licensed wireless provider solely for the purpose of mitigating network interference caused by Consumer Signal Boosters, including the ability to locate interfering boosters and perform associated outreach.

109. Registration information will also help the Commission resolve interference issues that are brought to the Commission's attention. Accordingly we require wireless licensees to share registration information with the Commission upon request. As is the case with respect to wireless providers' compliance with CPNI requirements, the Commission will take all steps necessary to maintain consumer privacy.

²³⁶ *NPRM*, 26 FCC Rcd at 5514, ¶ 65.

²³⁷ See AT&T May 18, 2012 *Ex Parte* Letter at 1; Cincinnati Bell Wireless Reply Comments at 5; T-Mobile Comments at 9-10.

²³⁸ See CellAntenna Reply Comments at 7; CelLynx Comments at 8-9; Public Knowledge and New America Foundation Comments at 4; Smart Booster Comments at 33; Verizon Wireless Comments at 12.

²³⁹ See CelLynx Comments at 9.

²⁴⁰ The registration information collected by providers may fall within the definition of CPNI. See 47 U.S.C. § 222(h)(1)(A) (requiring telecommunications carriers to protect "customer proprietary network information." The statute defines CPNI as "information that relates to the quantity, technical configuration, type, destination, location, and amount of use of a telecommunications service subscribed to by any customer of a telecommunications carrier, and that is made available to the carrier by the customer solely by virtue of the carrier-customer relationship..."); 47 C.F.R. § 64.2001 *et. seq.*

D. Industrial Signal Boosters

110. We find that the public interest will be best served by maintaining the current authorization framework for Industrial Signal Boosters.²⁴¹ Specifically, operation of Industrial Signal Boosters will continue to require a valid FCC license or licensee consent. In addition, going forward, manufacturers of Industrial Signal Boosters must comply with new labeling requirements. This authorization process will ensure that these devices are operated only by licensees or with licensee consent and are adequately labeled to avoid misuse by consumers.

111. *Discussion.* The record reflects that consumers benefit when providers and others are able to tailor coverage solutions to address specific needs. In some cases, solving a coverage gap may require a large scale, complex installation of signal boosters; in other instances, a provider may need to address the specific coverage needs of a single subscriber. In both instances, however, providers must be directly involved and explicitly consent to the proposed installation to ensure that coverage needs are met and the installations do not cause harmful interference to their networks. Thus, based on the record in this proceeding, we find no reason to alter our existing framework for authorizing Industrial Signal Boosters. We remind manufacturers, however, that Industrial Signal Boosters must meet our current RF exposure requirements.

112. Numerous commenters indicate that established industry practices effectively strike an adequate balance between licensees' need to manage their networks and third parties' ability to install Industrial Signal Boosters where they are deemed necessary.²⁴² As the DAS Forum states, "[a]s a matter of routine business practices, DAS providers coordinate the use of fixed boosters with the licensee whose signal they then retransmit."²⁴³ The DAS Forum also notes that licensee participation in the consent process can go so far as to include licensee selection of a particular booster to be incorporated in the DAS as well as licensee installation of the booster.²⁴⁴ Accordingly, we conclude that we will continue to require Industrial Signal Booster operators to have a valid FCC license or express licensee consent prior to operating an Industrial Signal Booster and explicitly codify this requirement in our rules. We note that express licensee consent may be reflected, for example, by "a letter, email or other record sent from a licensee or agent of a licensee to an operator, owner, or installer of [an Industrial Signal Booster] acknowledging that the [Industrial Signal Booster] will retransmit the specified frequency bands of the licensee."²⁴⁵

113. We also find that the coordination process between the Industrial Signal Booster operator and wireless licensees provides licensees with sufficient control over these devices to comply with the requirements of Section 310(d) of the Act. Industrial Signal Booster operators must have express licensee consent prior to operating a signal booster. In addition, Industrial Signal Boosters will only be authorized on a secondary, non-interference basis and thus must be shut down in the event the device causes harmful interference to the communications of any primary licensed service. As the DAS Forum aptly explains,

²⁴¹ Public safety and PLMR signal boosters operated under Part 90 are addressed in Section III.

²⁴² See, e.g., DAS Forum Reply Comments at 5 (stating that "it is standard procedure for neutral host providers and other professional providers, installers, and operators to coordinate with the wireless carriers"); *Ex Parte* Letter from Jeanine Poltronieri, AT&T, to Marlene H. Dortch, Secretary, Federal Communications Commission (May 28, 2010) at 7 (AT&T "anticipates DAS providers will continue to seek licensee consent prior to initiation of service as they have in the past"); ACUTA Reply Comments at 5 (noting that DAS operators must collaborate with carriers); Sprint Reply Comments at 3 (recommending that all 800 MHz signal booster systems be "properly designed, installed, and fully coordinated with all public safety and commercial networks in the band").

²⁴³ DAS Forum Reply Comments at 5.

²⁴⁴ DAS Forum Comments at 4.

²⁴⁵ DAS Forum Reply Comments at 5.

the information exchanged as part of the established industry coordination process facilitates cooperation between signal booster operators and wireless licensees and, using this information, any instance of interference can be addressed.²⁴⁶ We find that our authorization requirements, coupled with existing industry practices, provide sufficient licensee control over Industrial Signal Boosters.

114. While we leave the existing authorization process for Industrial Signal Boosters largely unchanged, we find that the public interest will be served if manufacturers are required to appropriately label Industrial Signal Boosters. As discussed further below, this labeling will inform prospective purchasers that operation of an Industrial Signal Booster requires an FCC license or express consent of the licensee whose signals are intended to be amplified by the device.²⁴⁷ This minimal additional regulatory burden will ensure that providers and other entities continue to have access to the wide array of signal boosters necessary to address coverage issues, while minimizing the risk that such boosters are inappropriately purchased by consumers who lack the expertise to properly install these technically sophisticated devices.

115. We do not find justification in the record to impose additional regulatory requirements on Industrial Signal Boosters at this time.²⁴⁸ The record indicates that existing, market-driven coordination processes to obtain licensee consent for Industrial Signal Booster installations are largely effective and have resulted in a robust and competitive market.²⁴⁹ Where market-based practices prove effective, we generally refrain from imposing regulations which may unfairly shift market power to one market participant over another.²⁵⁰ While we decline to impose specific timelines within which licensees must respond to requests for consent to install Industrial Signal Boosters, including Part 90 PLMR signal boosters, we expect licensees to act in good faith when responding to such requests and process such requests expeditiously.

116. In the Joint Proposal, Verizon and Wilson ask the Commission to require certification for technicians who install larger, more powerful signal boosters.²⁵¹ We believe that licensees who work directly with technicians, and who are responsible for and have an economic interest in maintaining the proper operation of their systems, are in the best position to determine the appropriate qualifications for technical personnel.²⁵² We have had similar installer certification requirements in the past; however, the Commission determines on a case-by-case basis whether such certification requirements are needed.²⁵³ In

²⁴⁶ *Id.* at 6.

²⁴⁷ Labeling must also reflect that Industrial Signal Boosters operate on a secondary basis.

²⁴⁸ Some commenters ask that we impose a substantial number of new regulations on Industrial Signal Boosters. *See, e.g.*, Joint Proposal at Attachment B (proposing Industrial Signal Boosters standards, installer certification, database of installations, on-site testing before activation); Jack Daniel Reply Comments at 10 (supporting installer certification); NAM/MRFAC Comments at 4 (same).

²⁴⁹ *See supra* ¶ 112.

²⁵⁰ Some commenters voice concern that additional regulatory requirements for Industrial Signal Booster installations may give wireless carriers an unfair competitive advantage over independent installers. *See, e.g.*, DAS Forum Reply Comments at 6-8; ACUTA Reply Comments at 7-8.

²⁵¹ Joint Proposal at 3. The Joint Proposal suggests that installers should pass an industry-certified test compliance program, coordinate with existing licensees as necessary, and maintain a database of information. *Id.* at 4-6.

²⁵² Members of the wireless industry are free to develop standards for technician certification programs, if they so choose.

²⁵³ *See generally* Requirements for Licensed Operators in Various Radio Services, *Report and Order*, 96 FCC 2d 1123 (1984). *See also* Amendment of Parts 13 and 80 of the Commission's Rules Concerning Maritime Communications, *Second Report and Order*, *Sixth Report and Order*, and *Second Further Notice of Proposed* (continued....)

this instance, we conclude that technician certification requirements are not warranted and decline to adopt them here.²⁵⁴

E. Equipment

117. We also address a number of rules, requirements, and policies which apply to both Consumer and Industrial Signal Boosters, specifically: labeling; RF exposure requirements; treatment of existing boosters; equipment certification; and revocation of equipment authorization.²⁵⁵

1. Labeling

118. In the *NPRM*, we proposed to require that all signal boosters be labeled and marketed to consumers with clear information specifying the legal use for the device.²⁵⁶ We acknowledged that labeling and marketing requirements would remind signal booster operators of their legal responsibilities, facilitate coordination with providers, and assist in interference prevention.²⁵⁷ Specifically, we proposed that labels and marketing materials include a prominently placed “consumer disclosure” notifying consumers that signal boosters may only be operated consistent with our rules.²⁵⁸ In addition, we proposed to require the consumer disclosure (1) in any marketing materials, (2) in the owner’s manual, (3) on the outside packaging of the device, and (4) on a label affixed to the device.²⁵⁹ We also sought comment on whether to require manufacturers, retailers, and other entities marketing or selling signal boosters to display the consumer disclosure language conspicuously at the point-of-sale and on their websites.²⁶⁰

119. *Discussion.* In the *NPRM*, we presented a framework for signal booster regulation that included consumer-driven compliance aided by labeling and marketing requirements.²⁶¹ Our review of the record indicates that labeling and marketing requirements are the best method to inform consumers about which devices are appropriate for their use and how to comply with our rules.²⁶² We believe that appropriately crafted labeling and marketing requirements will lead to increased compliance with our rules and decreased interference to wireless networks.

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Rulemaking, 19 FCC Rcd 3120, 3128-29, ¶ 13 (2004) (declining to adopt mandatory training and testing of recreational boaters in the use of digital selective calling equipment).

²⁵⁴ ACUTA, Cellphone-Mate, and the DAS Forum oppose requiring signal booster installers to meet training and certification benchmarks as requested in the Joint Proposal. ACUTA Reply Comments at 5 (noting that there are no similar requirements for technicians who install full cell sites and that such requirements will limit the available options for those who wish to have CEO boosters installed); Cellphone-Mate Reply Comments at 12-13 (stating that installer certification is unnecessary when professionally installed systems are not the primary source of interference complaints); DAS Forum Reply Comments at 4.

²⁵⁵ Public safety and Private Land Mobile Radio signal boosters operated under Part 90 are addressed in Section III.

²⁵⁶ *NPRM*, 26 FCC Rcd at 5505-06, ¶¶ 42-44.

²⁵⁷ *Id.* at 5505-06, ¶ 42.

²⁵⁸ *Id.* at 5506, ¶ 43.

²⁵⁹ *Id.*

²⁶⁰ *Id.* at 5507, ¶ 45.

²⁶¹ *Id.* at 5505-06, ¶42.

²⁶² Commenters widely support the marketing and labeling requirements proposed in the *NPRM*. See, e.g., DAS Forum Comments at 2 (labeling will enhance coordination); Verizon Wireless Comments at iv; CelLynx Comments at 7; Public Knowledge and the New America Foundation Reply Comments at 4; Sprint Nextel Reply Comments at 4.

120. The Commission consistently has adopted labeling requirements to avoid consumer confusion and provide consumers with needed information. In prior proceedings, the Commission required the labeling of Part 15 unlicensed devices, DTV equipment, and cordless telephones.²⁶³ We find that labeling and marketing requirements are particularly beneficial in this proceeding where we have classified signal boosters into two distinct categories – Consumer and Industrial – with substantially different uses, characteristics, and capabilities.²⁶⁴ A prominently displayed label on a device’s packaging will immediately inform consumers whether the device is suitable for personal use in a home or vehicle setting or whether a device is designed for large-scale commercial uses. Providing appropriate consumer disclosures on signal booster labels and in product manuals and on-line marketing materials²⁶⁵ will educate consumers about which boosters to purchase, their registration requirements, and their obligation to turn off the booster if it is causing interference. Despite WCAI’s concerns,²⁶⁶ we find that these requirements will aid, not decrease, compliance with our rules. Further, we disagree with CellAntenna’s argument that labeling requirements are unnecessary so long as a device has been properly tested and received FCC approval.²⁶⁷ Absent an appropriate label, a consumer will be unable to distinguish between a Consumer Signal Booster, which is appropriate for their use, and an Industrial Signal Booster, which is inappropriate for their use.

121. In addition, we require manufacturers to inform consumers about the impact of signal boosters on E911 calls.²⁶⁸ Signal boosters can affect the location accuracy of an E911 call if the call is placed on a network using a network-based E911 location protocol.²⁶⁹ Network-based E911 solutions determine the location of a caller based on the times at which a cell signal reaches Locations Measurement Units installed at the operator’s base stations. Signal boosters can create delays, which may alter these calculations and thus affect location accuracy. While signal boosters provide substantial public safety benefits and can facilitate emergency communications where they might otherwise be unavailable, consumers should be advised that signal boosters could affect location accuracy if a provider employs a network-based E911 solution. Such information arms consumers with the tools they need to make

²⁶³ Modifications of Parts 2 and 15 of the Commission’s Rules for Unlicensed Devices and Equipment Approval, *Second Report and Order*, 22 FCC Rcd 8028 (2007); Compatibility Between Cable Systems and Consumer Electronics Equipment, *Report and Order*, 15 FCC Rcd 17568, 17577-78 (2000) (“these considerations—avoiding consumer confusion and helping speed up the digital transition—lead us to take an additional step in labeling requirements”); Amendment of Part 15 to Add New Interim Provisions for Cordless Telephones, *Second Report and Order*, 100 FCC 2d 1128, 1131-32 (1985) (“we believe the public interest would be served by adopting the proposed labeling requirement . . . with this information, consumers will be able to make an informed choice”).

²⁶⁴ See *supra* ¶¶ 12-20.

²⁶⁵ Our goal in requiring signal booster labeling is to ensure that consumers have sufficient information when purchasing a signal booster. When a consumer purchases a signal booster in a brick-and-mortar store, he or she can read the label on the packaging. When a consumer purchases a signal booster on-line, the label should be viewable to the consumer at least once before they purchase the product.

²⁶⁶ WCAI maintains that the proposed language does not sufficiently inform consumers about their responsibilities, places too high a burden on consumers to research our rules, and thus will inhibit compliance. WCAI Comments at 7.

²⁶⁷ CellAntenna Comments at 3.

²⁶⁸ Verizon Wireless Comments at 15; AT&T Apr. 3, 2012 *Ex Parte* Letter at 2; Joint Proposal, Attachment A *Consumer Booster Specifications for CMRS Spectrum Bands* at 7; Verizon/Wilson Mar. 14, 2012 *Ex Parte* Letter at 4.

²⁶⁹ See *supra* ¶¶ 83-84. We note that signal boosters neither impede nor amplify GPS signals used by handset-based E911 solutions. Therefore, use of a signal booster will not affect the accuracy of an E911 call placed on a wireless network that uses a handset-based solution. See Verizon Wireless Comments at 11-12.

informed choices about their telecommunications services. We therefore find it in the public interest to require the consumer disclosure to include information about how signal boosters may affect E911 calls.

122. Some commenters propose that if a signal booster is designed to pass through satellite GPS signals with no interference to commercial wireless or GPS operations, (e.g., direct connected or device-coupled boosters) the device should be excluded from the E911 consumer notification requirement.²⁷⁰ We agree. If a device will have no effect on E911 communications, a consumer notification is unnecessary.²⁷¹

123. Accordingly, all signal boosters marketed on or after March 1, 2014, must include the following advisories (1) in on-line point-of-sale marketing materials, (2) in any print or on-line owner's manual and installation instructions, (3) on the outside packaging of the device, and (4) on a label affixed to the device:

For all Consumer Signal Boosters:

This is a CONSUMER device.

BEFORE USE, you MUST REGISTER THIS DEVICE with your wireless provider and have your provider's consent. Most wireless providers consent to the use of signal boosters. Some providers may not consent to the use of this device on their network. If you are unsure, contact your provider.

You MUST operate this device with approved antennas and cables as specified by the manufacturer. Antennas MUST be installed at least 20 cm (8 inches) from any person.

You MUST cease operating this device immediately if requested by the FCC or a licensed wireless service provider.

WARNING. E911 location information may not be provided or may be inaccurate for calls served by using this device.

For Industrial Signal Boosters:²⁷²

WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

A Consumer Signal Booster label may contain an acknowledgement that particular provider(s) have given their consent for all consumers to use the device. Such an acknowledgement would be inserted prior to, "Some wireless providers may not consent to the use of this device on their

²⁷⁰ AT&T Apr. 3, 2012 *Ex Parte* Letter at 2; Joint Proposal, Attachment A *Consumer Booster Specifications for CMRS Spectrum Bands* at 7; Verizon/Wilson Mar. 14, 2012 *Ex Parte* Letter at 4.

²⁷¹ If an applicant seeking equipment certification maintains that its device will have no effect on E911 communications, it must so certify, under penalty of perjury, during the equipment certification process.

²⁷² Industrial Signal Boosters to be used in the Part 90 services require a different label. *See infra* ¶ 188.

network. If you are unsure, contact your provider.” The remaining language of the advisory shall remain the same.

124. We recognize that our labeling requirement imposes additional costs on entities which manufacturer signal boosters. On balance, however, we find that such costs are outweighed by the benefits of ensuring that consumers purchase appropriate devices. Our newly adopted labeling requirements will help consumers determine which signal boosters are appropriate for their use (Consumer Signal Boosters) and which are not (Industrial Signal Boosters). Clear labels will also inform consumers about registration and use requirements, which will facilitate resolution of interference events should they occur. We thus conclude that the costs of labeling are outweighed by the benefits of such a requirement.

2. RF Exposure Requirements

125. In the *NPRM*, the Commission invited comment on how to apply its existing RF exposure requirements to signal boosters, and on adopting rule revisions to make clear that the existing RF exposure requirements apply to those signal boosters.²⁷³ Our existing RF exposure rules have thus far proven effective in ensuring compliance with our current RF exposure guidelines for the deployment and use of signal boosters, and thus we see no reason to change them here. Although commenting parties are largely silent on this requirement, T-Mobile supports application of our RF exposure rules to Consumer Signal Booster devices,²⁷⁴ and the Consolidated Proposal would require compliance with existing RF rules for Consumer Signal Boosters.²⁷⁵ Nevertheless, with the establishment of our Consumer/Industrial signal booster delineation, we believe our RF exposure rules would benefit from clarifications on how the RF exposure rules apply to various signal booster operations. Accordingly, as discussed below, we continue to require all signal boosters – both Consumer and Industrial – to comply with our current RF exposure rules, and we adopt a new rule, 47 C.F.R. § 20.2, to cross-reference the RF exposure requirements in Sections 1.1307, 2.1091, and 2.1093 of the Commission’s rules.²⁷⁶

126. All signal boosters – fixed and mobile – must comply with our RF exposure rules.²⁷⁷ We note that modification of a signal booster’s antenna configuration can substantially alter the RF effects of a device. For example, using an antenna with higher gain than is specified by the manufacturer will increase the effective radiated power of the device which may, in addition to potentially causing interference to wireless networks, cause RF exposure in excess of our limits. Accordingly, we require all Consumer Signal Boosters to be sold together with antennas, cables, and/or coupling devices that meet the requirements of this section.²⁷⁸ Further, all Consumer Signal Boosters must be sold with user manuals which specify the special accessories that meet the requirements of this section and must be labeled to indicate that the device may only be operated using approved special accessories as specified by the

²⁷³ *NPRM*, 26 FCC Rcd at 5505, ¶¶ 40-41.

²⁷⁴ T-Mobile Feb. 17, 2012 *Ex Parte* Letter, Attachment at 10.

²⁷⁵ Consolidated Proposal at § 20.16(i).

²⁷⁶ Any mobile booster that can operate within 20 centimeters of the body will have to demonstrate specific absorption rate (SAR) compliance under all possible usage configurations with appropriate mobile devices. *See* 47 C.F.R. § 2.1091(d)(4).

²⁷⁷ The RF exposure rules in Sections 1.1307, 2.1091, and 2.1093 outline exposure limits, equipment authorization requirements, and other regulatory requirements that are based on the type of device, how it is deployed or used, the power of its transmissions, and the proximity of its antenna and radiating structures to a person’s body. *See* 47 C.F.R. §§ 1.1307(b), 2.1091, and 2.1093.

²⁷⁸ *See supra* ¶ 46.

manufacturer of the Consumer Signal Booster.²⁷⁹ We note that, since Consumer Signal Boosters operating in fixed-mounted configurations are generally deployed similarly to subscriber transceiver antennas,²⁸⁰ the labeling requirements for subscriber transceiver antennas in Table 1 of Section 1.1307(b)(1) also apply to these types of signal boosters.

3. Treatment of Existing Signal Boosters

127. In the *NPRM*, we requested comment on how best to address the use of signal boosters currently operated by consumers that do not conform to the technical requirements we adopt today.²⁸¹ We asked whether we should prohibit or grandfather their use under certain conditions, including requiring their registration.²⁸² We received a broad range of comments regarding the treatment of existing signal boosters. Based on our review of the record and for the reasons stated below, we will permit consumers to operate existing (nonconforming) signal boosters provided they (1) have the consent of their serving provider, and (2) register their booster with that provider.

128. *Discussion.* Some commenters oppose the continued use (or grandfathering) of existing boosters and argue that their use could impede network performance.²⁸³ After careful review of the record in this proceeding, we find that, on balance, the public interest will be best served by permitting consumers to operate existing signal boosters provided they (1) have the consent of their serving provider, and (2) register their booster with that provider. Our regulatory treatment of existing boosters is consistent with our determination above that a subscriber must have the consent of their wireless provider to operate a Consumer Signal Booster.²⁸⁴ A subscriber must obtain its provider's consent, by phone or email for example, to use an existing signal booster on its provider's network. If a consumer does not have the consent of its service provider to use an existing booster, he or she must immediately cease operation until consent is obtained. While we agree that market forces may eventually curtail the use of existing signal boosters,²⁸⁵ because existing devices do not contain the full complement of interference safeguards we adopt today, consumers and others may operate such devices only with the consent of their wireless providers. And we emphasize that our Enforcement Bureau stands ready to rigorously investigate any complaint of harmful interference associated with unauthorized signal booster use.

129. In addition to requiring licensee consent in order to operate an existing booster, we agree that registration of existing boosters will be beneficial.²⁸⁶ Thus, where a signal booster operator has

²⁷⁹ See Consolidated Proposal at § 20.16(c).

²⁸⁰ For example, fixed consumer transmitting antennas typically are installed on home rooftops where access would be occasional but not controlled.

²⁸¹ *NPRM*, 26 FCC Rcd at 5513, ¶¶ 62-63.

²⁸² *Id.* at 5513, ¶ 62.

²⁸³ See, e.g., Blooston Comments at 11; (grandfathering existing boosters could perpetuate interference problems and confuse the public regarding the potential risks of operating such devices); CTIA Comments at 11; Smart Booster Reply Comments at 22.

²⁸⁴ See *supra* ¶¶ 24-25.

²⁸⁵ See, e.g., Wilson Comments at 9; Wireless Extenders Reply Comments at 9-10 (noting that manufacturers will aggressively market new devices to consumers, hastening the migration to new booster technologies); Cellphone-Mate Comments at 16-17 (stating that signal boosters have a limited lifespan and consumers will replace them to take advantage of innovative 4G technologies). Those who support grandfathering the use of existing boosters argue that there are many well-designed signal boosters currently in use that do not harm wireless networks, and therefore prohibiting their use is unwarranted. See, e.g., Wilson Comments at 8; T-Mobile Comments at 14 (supporting grandfathering on a noninterference basis).

²⁸⁶ Verizon supports a registration requirement for nonconforming boosters. Verizon Comments at 16. See also Cincinnati Bell Reply Comments at 5.

consent to operate the device, the operator must also register the booster with their service provider. Wireless providers who choose to consent to Consumer Signal Booster use have until March 1, 2014, to establish a free registration mechanism for their subscribers.²⁸⁷ And after establishing a registration mechanism, providers will need to advise subscribers of their registration process.²⁸⁸ Accordingly, we require consumers to register their existing boosters within 90 days of being notified by their service provider of the registration process. Registration of existing boosters will ensure that service providers and the Commission can efficiently identify, investigate, and resolve interference complaints should they arise.

130. Further, we confirm that wireless providers are not required to consent to the use of any existing signal booster. Because existing boosters do not incorporate the interference-mitigating safeguards we adopt today, wireless providers may determine whether the continued use of such devices is warranted. In addition, wireless providers retain the right to shut down any signal booster causing harmful interference to their operations or network performance.

131. We decline to adopt Verizon's proposal to require all consumers to replace their existing signal boosters within one year²⁸⁹ or to implement AT&T's proposed equipment exchange program.²⁹⁰ No licensee is obligated to consent to the use of an existing signal booster on its network. However, where a licensee does consent to the use of an existing signal booster, the licensee can determine whether such use should continue. A one-year equipment "replacement deadline," as urged by Verizon and Cincinnati Bell Wireless, is arbitrary and should not be forced on consumers and wireless providers. We apply the same reasoning to AT&T's proposed equipment exchange program and will leave to providers the decision whether to permit existing signal boosters to be operated on their networks.

4. Equipment Certification

132. In the *NPRM*, we sought comment on a timeline to encourage manufactures to quickly transition to devices that meet our new technical specifications and labeling requirements for signal boosters.²⁹¹ We proposed the following two-step approach – beginning 30 days after the effective date of the adopted rules, equipment applications must demonstrate that the device meets the new rules and six months after the effective date of the adopted rules, all signal boosters marketed or sold in the United States must meet the adopted rules.²⁹²

133. *Discussion.* We find it in the public interest to establish a two-step transition process similar to the one proposed in the *NPRM*. We agree that this two-step process "strike[s] an appropriate balance between the need to transition quickly to boosters that meet the new design parameters and allowing manufacturers and booster sales outlets a reasonable period of time to comply with the new rules."²⁹³ Specifically, on the release date of this *Report and Order*, the Commission²⁹⁴ will no longer

²⁸⁷ See *supra* ¶ 106. Providers that have not consented to the use of Consumer Signal Boosters by March 1, 2014, must establish a free registration mechanism for their subscribers within 90 days of consenting to such use. *Id.*

²⁸⁸ Providers may choose to notify their customers by billing insert or text message, for example.

²⁸⁹ Verizon Comments at 16-17.

²⁹⁰ AT&T asks that the Commission implement an "exchange program" to remove non-compliant boosters from the market. AT&T July 20, 2012 *Ex Parte* Letter at 2, 6-7.

²⁹¹ *NPRM*, 26 FCC Rcd at 5513, ¶ 63.

²⁹² *Id.*

²⁹³ Verizon Wireless Comments at 16.

²⁹⁴ We conclude that initially, as manufacturers implement our new technical specifications, Consumer Signal Boosters should be certified by the Commission. We anticipate that as manufacturers become more familiar with the new rules, the certification process will transition primarily to Telecommunications Certification Bodies. We (continued....)

accept applications for equipment certification of Consumer or Industrial Signal Boosters that do not comply with our new rules and will cease certification of devices that do not comply with our new rules.²⁹⁵ Further, on or after March 1, 2014, all Consumer and Industrial Signal Boosters sold and marketed in the United States must meet our new requirements.²⁹⁶ We believe this is a reasonable timeframe to allow manufacturers to develop and the Commission to certify devices that meet the new rules and will result in an orderly transition to better signal boosters.²⁹⁷

134. AT&T asks that once the Commission adopts new rules governing Consumer Signal Boosters, the sale and marketing of non-compliant signal boosters should be illegal.²⁹⁸ We decline to immediately prohibit the sale of existing signal boosters even though these devices do not comply with our new rules. The record reflects that individual consumers, public safety entities, building owners, and many others, currently need signal boosters to meet their communications needs, particularly in rural areas. No signal boosters on the market today, however, meet our new requirements. While we conclude above that these non-compliant devices should not be grandfathered permanently, we see a need to provide near-term equipment options for licensees and consumers while manufacturers come into compliance with our new rules. Thus, manufacturers and retailers may no longer sell non-conforming signal boosters on or after March 1, 2014. We caution, however, that consumers and others may use non-conforming signal boosters only with the consent of their wireless provider.²⁹⁹

135. We also decline to expand our certification requirements as suggested by some commenters. Some commenters ask that we adopt a multi-party, multi-step process for signal booster certification.³⁰⁰ This process would require equipment certification by the FCC, conformance with an industry-driven certification process, and approval from the individual spectrum licensee that a device is compliant.³⁰¹ We see no reason to adopt extensive new certification regulations by codifying the existing industry practice for certifying devices. Rather, once the Commission has certified a Consumer Signal

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note, however, that any request to comply with the Network Protection Standard by demonstrating equivalent protections must be filed with the Wireless Telecommunications Bureau.

²⁹⁵ This includes permissive changes to previously certificated boosters. Thus, any entity seeking to make changes to a previously certificated, consumer-targeted signal booster must ensure that such changes comply with the Network Protection Standard.

²⁹⁶ The Consolidated Proposal includes a provision that would prohibit the marketing or sale of non-compliant Consumer Signal Boosters any time after six months after the effective date of new rules. Consolidated Proposal at 20.16(j). *See also* Sprint July 27, 2012 *Ex Parte* Letter at 2 (supporting six month transition period).

²⁹⁷ The rules include new types of technical requirements for which there is no precedent. Manufacturers will first need to design boosters to meet the new technical rules. In parallel, the FCC Lab will review and process initial applications for equipment certification, and where appropriate, request and test samples of the new products that are designed to comply with the new rules. This will enable the FCC Lab to gain the experience that is necessary for developing appropriate testing procedures. The Lab will then communicate these testing procedures to test labs and Telecommunications Certification Bodies (TCBs) who review equipment certification applications on behalf of the Commission and provide an opportunity for feedback prior to TCBs taking action on certification requests. Based on our experience in implementing new technical requirements for various types of equipment we anticipate that this will take until late fall. Manufacturers will then need time to produce the new equipment, import and/or ship products to vendors through the retail chain before the March 1, 2014, transition date after which products may not be sold unless they have been certificated to show that they are compliant with the new rules.

²⁹⁸ AT&T July 20, 2012 *Ex Parte* Letter at 6.

²⁹⁹ *See supra* ¶¶ 24-25.

³⁰⁰ Blooston Licensees Comments at 10; CTIA Comments at 2, 17; T-Mobile Comments at 4, 6-7; Telecommunications Industry Association Comments at 4.

³⁰¹ *See, e.g.*, CTIA Comments at 17.

Booster for operation, wireless providers may determine what additional measures are necessary to ensure that a device complies with the requirements of the individual wireless provider's network.

5. Revocation of Equipment Authorization

136. Some commenters ask that the Commission promptly revoke the equipment authorization of any Consumer Signal Booster found to have caused multiple incidents of harmful interference.³⁰² Specifically, AT&T asks that where the Commission “documents a pattern of harmful interference involving a particular signal booster model, the Commission should revoke that model’s device certification.”³⁰³ Alternatively, AT&T proposes that we create a complaint process to enable providers to file a complaint against a signal booster manufacturer – rather than the booster operator – where a particular signal booster model causes multiple interference events.³⁰⁴ AT&T argues that such a complaint process would enable providers to prevent the source of interference at the device level, rather than react to individual interference events.³⁰⁵

137. The Commission has a well-established process for revocation of equipment authorization. Specifically, Section 2.939 of our rules enumerates the circumstances under which the Commission may revoke any equipment authorization.³⁰⁶ Section 2.939(b) further provides that “[r]evocation of an equipment authorization shall be made in the same manner as revocation of radio station licenses.”³⁰⁷ In response to complaints and following appropriate investigation, the Commission has availed itself of this process on numerous occasions to revoke the equipment authorizations of devices such as learned-mode remote control transmitters,³⁰⁸ General Mobile Radio Service radios,³⁰⁹ and wireless microphones.³¹⁰ At this time, we see no reason to create a new procedure to specifically address complaints regarding signal boosters. We are mindful, however, that malfunctioning boosters present the potential of harmful interference to wireless networks. Accordingly, we will closely monitor any complaints involving new Consumer Signal Boosters,³¹¹ particularly repeated complaints regarding a

³⁰² Sprint July 27, 2012 *Ex Parte* Letter at 3; AT&T July 20, 2012 *Ex Parte* Letter at 7.

³⁰³ AT&T July 20, 2012 *Ex Parte* Letter at 7.

³⁰⁴ *Id.*

³⁰⁵ *Id.*

³⁰⁶ 47 C.F.R. § 2.939. Section 2.939(a) states that “the Commission may revoke any equipment authorization: (1) For false statements or representations made either in the application or in materials or response submitted in connection therewith or in records required to be kept by Sec. 2.938. (2) If upon subsequent inspection or operation it is determined that the equipment does not conform to the pertinent technical requirements or to the representations made in the original application. (3) If it is determined that changes have been made in the equipment other than those authorized by the rules or otherwise expressly authorized by the Commission. (4) Because of conditions coming to the attention of the Commission which would warrant it in refusing to grant an original application.”

³⁰⁷ 47 C.F.R. § 2.939(b). Revocation of radio station licenses is governed by Sections 1.91 and 1.92 of the Commission's rules. 47 C.F.R. §§ 1.91, 1.92.

³⁰⁸ Tung Shih Technology Co., LTD.; Grantee of Equipment Authorization for Learned Mode Remote Control Transmitter Devices, FCC ID Nos. MMORC0196N and MMORMC575, 20 FCC Rcd 7801 (EB 2005) (revoking equipment authorization for certain learned mode remote control transmitters).

³⁰⁹ J Communications Co., LTD.; Grantee of Equipment Authorization for General Mobile Radio Service Radios, FCC ID # OAJFR1-GPS, 19 FCC Rcd 10643 (EB 2004) (revoking equipment authorization for certain General Mobile Radio Service radios).

³¹⁰ *See, e.g.*, Hosiden Electronics Co., Ltd. 4-33 Kitakyuhoji, 1-Chome, Yao-Shi Osaka, 581, Japan Order to Show Cause why the type approval for Model No. FTM-13EA wireless microphone should not be withdrawn, 70 FCC 2d 1881 (1979) (revoking equipment authorization for certain wireless microphones).

³¹¹ *See infra* ¶ 138.

single Consumer Signal Booster model, and will take appropriate action, including, where warranted, revocation of equipment authorization.

F. Other Issues

138. *Enforcement Issues.* AT&T asks the Commission to adopt a comprehensive enforcement plan in connection with the adoption of new rules for signal boosters.³¹² To this end, AT&T suggests specific categories of information that should be collected regarding signal boosters involved in an interference event. While we agree that comprehensive enforcement protocols are beneficial in this area, the Enforcement Bureau's current procedures are sufficient to address the issues raised by AT&T. As a result, we see no reason to formally change the investigation procedures already in place regarding signal booster interference investigations. The Enforcement Bureau investigates, tracks, and resolves complaints of signal booster interference, has taken enforcement action where warranted, and will continue to do so. To the extent additional information may be necessary to track and identify patterns of interference involving particular booster manufacturers or models affecting multiple wireless provider networks, the Enforcement Bureau will continue to leverage the expertise of the Commission's field engineers to obtain the relevant data. Accordingly, we will closely monitor any complaints involving new Consumer Signal Boosters, and will take appropriate enforcement action against operators, retailers, manufacturers, or other entities that violate the signal booster rules.³¹³

139. AT&T also asks the Commission to adopt an accelerated docket procedure to address complaints from providers against manufacturers of equipment responsible for multiple interference events.³¹⁴ AT&T argues that an accelerated process directed at manufacturers – versus providers reacting to individual interference complaints – will stop the repeated interference caused by particular devices in a reasonable, fixed timeframe.³¹⁵ CTIA and WCAI support AT&T's accelerated docket proposal.³¹⁶ Wilson maintains that in order to adopt such an adjudicatory process, the Commission must initiate a notice-and-comment rulemaking.³¹⁷

³¹² AT&T May 18, 2012 *Ex Parte* Letter at 1-2.

³¹³ As a general matter, the Commission can exercise discretion in its enforcement of the rules, and has a variety of mechanisms by which it can ensure compliance. *See* 47 C.F.R. § 1.80(b)(4), Note (“...The Commission and its staff retain the discretion to issue a higher or lower forfeiture than provided in the guidelines, to issue no forfeiture at all, or to apply alternative or additional sanctions as permitted by the statute...”). Accordingly, we intend to exercise the discretion allowed by our rules and direct the Enforcement Bureau in this limited context to provide a consumer that has not registered a booster and/or obtained consent from a carrier a warning and an opportunity to shut down the booster before proposing a forfeiture, provided that he or she has not previously been warned about failing to register and/or obtain consent. Consumers receiving a warning must promptly remedy violations; otherwise, they may be subject to forfeitures. The warning requirement for consumers would not apply to egregious violations (*e.g.*, a case where a consumer is intentionally causing widespread interference). We also note that such treatment would not apply to non-consumer violators of the signal booster rules. We further note that this warning requirement will expire in two years unless expressly renewed in the Public Notice referenced in paragraph 78 above.

³¹⁴ AT&T PN Comments at 35; *see also* AT&T Apr. 3, 2012 *Ex Parte* Letter at 3 (AT&T reiterates its desire for an accelerated docket process against manufacturers of boosters that cause repeated interference).

³¹⁵ AT&T PN Comments at 33. AT&T proposes an accelerated Section 208-type process under which a carrier may file a complaint against a manufacturer whose product has caused multiple interference events and the Commission would be required to resolve the complaint within 60 days. *Id.* at 35.

³¹⁶ *Ex Parte* Letter from Brian M. Josef, CTIA-The Wireless Association, to Marlene H. Dortch, Secretary, Federal Communications Commission (June 3, 2010) at 3-4; *see also* CTIA PN Reply Comments at 14 (reiterating support for accelerated docket); and WCAI Comments at 20 (supporting and accelerated docket procedure).

³¹⁷ *Ex Parte* Letter from Russell D. Lukas, Counsel to Wilson Electronics, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission (June 28, 2010) at 1-2.

140. We conclude that an accelerated docket procedure is not warranted at this time. In this *Report and Order* we adopt a new framework for certifying and authorizing signal boosters. Under this framework, we adopt technical rules specifically designed to create Consumer Signal Boosters which do not harm wireless networks. We also expressly codify that Consumer and Industrial Signal Boosters may only be operated with a license or the consent of the relevant licensee. We expect that these rules, working in concert, will substantially reduce the instances of harmful interference generated by signal boosters. Accordingly, we conclude that it would be premature to expend Commission resources on an accelerated process that may be unnecessary in view of our newly-adopted signal booster framework. Going forward under our new framework, we will monitor the number and types of signal booster complaints and may revisit the need for an accelerated docket process should the circumstances warrant it.

141. *Consumer Outreach.* AT&T asks the Commission to conduct an outreach campaign to increase consumer awareness of our new rules for Consumer Signal Boosters. Specifically, AT&T asks that we issue a Public Notice informing the public about our regulations governing the marketing, sale and use of unauthorized signal boosters.³¹⁸ AT&T also proposes that we require signal booster manufacturers to engage in outreach to educate their customers regarding the use of legacy devices, including notices distributed to on-line and brick and mortar retailers of signal boosters.³¹⁹

142. We agree that consumer outreach can serve a vital role in educating consumers, public safety entities, small businesses, and others regarding the benefits of signal boosters and their legal, authorized uses. The rules we adopt today create a new framework for the manufacture, sale, and authorization of signal boosters and an aggressive consumer outreach campaign will promote compliance with these new rules. Accordingly, we direct the Consumer and Governmental Affairs Bureau, in connection with the Wireless Telecommunications Bureau, to conduct a consumer outreach campaign regarding our new regulatory regime for signal boosters. In addition, we direct the Consumer and Governmental Affairs Bureau to issue a Consumer Advisory regarding our new booster rules. This Advisory, among other things, will indicate that subscribers must turn off a booster if they receive a request to do so from the FCC or any wireless provider.

143. *CTIA Petition for Declaratory Ruling.* On November 2, 2007, CTIA filed a Petition for Declaratory Ruling regarding the use of signal boosters in the Commercial Mobile Radio Service (CMRS) bands.³²⁰ CTIA requests that we declare that an FCC license or licensee consent is required to operate a signal booster.³²¹ In addition, CTIA requests that we declare that the sale and marketing of signal boosters to members of the public, who do not have a spectrum license or the consent of the applicable licensee(s), violates the Communications Act and Commission rules.³²² In this *Report and Order*, we adopt a new framework for certifying and authorizing Consumer and Industrial Signal Boosters. This new framework obviates the need for the Commission to clarify our prior signal booster rules. Accordingly, we dismiss the CTIA Petition as it relates to signal boosters as moot.

³¹⁸ AT&T July 20, 2012 *Ex Parte* Letter at 7.

³¹⁹ *Id.* AT&T also recommends that outreach extend to publications and organizations of communities with significant signal booster usage, such as boating publications and boating trade associations. *Id.*

³²⁰ We note that the CTIA Petition also addresses the use of signal jamming devices, but we do not address the use of such devices in this proceeding. *See* CTIA Petition at 6-10.

³²¹ *Id.* at 2.

³²² *Id.*

III. SIGNAL BOOSTERS FOR PUBLIC SAFETY AND PRIVATE LAND MOBILE RADIO SERVICE OPERATIONS UNDER PART 90

144. Our discussion above sets forth a new regulatory framework for the use of Consumer and Industrial Signal Boosters in subscriber-based services. Below, we address our Part 90 rules concerning the use of signal boosters in the Private Land Mobile Radio Services (PLMRS) and Public Safety Radio Services (PSRS).³²³ The majority of licensees regulated under this rule part are companies, local governments, and other organizations which do not offer telecommunications services to the public. Instead, these licensees operate PLMR systems to facilitate their business needs or public safety functions, *e.g.*, emergency response communications and two-way radio dispatch.³²⁴ Part 90 PLMR licensees typically obtain authorizations for individual narrowband channels or groups of channels to satisfy their own communication needs. Moreover, many Part 90 channels are interleaved and a licensee's channels may not be adjacent to one another, which presents unique considerations for signal boosters used with Part 90 PLMR services. Because signal boosters used for PLMRS and PSRS are not intended for consumer use, we classify these boosters as Industrial Boosters.³²⁵

145. There are significant technical and regulatory differences between the subscriber-based operations discussed above and PLMR operations. The main technical difference between subscriber-based services and PLMR services is that the subscriber-based systems have a cellular architecture composed of densely deployed, low elevation towers to increase frequency reuse, while PLMR systems typically deploy a traditional base-mobile architecture composed of few towers at high elevations to maximize range at the expense of frequency reuse. As a result, these systems have different design considerations and goals that must be considered when deploying signal boosters or other transmitters that may operate on their system.³²⁶ From a regulatory perspective, subscriber-based services typically operate on large blocks of spectrum that are authorized over large, defined geographic areas. By contrast, PLMR services are assigned individual narrowband channels at specific locations with an operating radius that is coordinated through frequency coordination bodies. In light of these technical and regulatory differences, we adopt separate, specific rules for PLMR signal boosters in Part 90.

146. The record reflects that the deployment of Part 90 PLMR signal boosters has generated substantial benefits, albeit with some instances of interference. We seek to support the continued use of well-designed, properly installed signal boosters and believe the actions we take in this proceeding, in conjunction with the Commission's rebanding of the 800 MHz band, will further reduce the potential for harmful interference caused by signal boosters.³²⁷ While we leave much of our regulatory framework for

³²³ For brevity, we generally refer to both PLMRS and PSRS operations as Private Land Mobile Radio (PLMR) operations below.

³²⁴ With the exception of Enhanced Specialized Mobile Radio (ESMR), 220-222 MHz services, and Multilateration Location Monitoring Service (M-LMS) licensees, most Part 90 radios are used by the licensee directly and not subscribers. Part 90 PLMR licensees include public safety agencies, utilities, railroads, manufacturers and other businesses.

³²⁵ *See supra* ¶¶ 15-20. There are no Consumer Signal Boosters in the Private Land Mobile or Public Safety Radio Services because licensees in these services do not offer communications service for hire to customers or subscribers. Rather these licensees (unlike the wireless "carriers" in the Commercial Mobile Radio Services) use their radio systems internally to coordinate mobile units and personnel to increase the efficiency of their operations (*e.g.*, two-way voice dispatch, fleet calling, paging and data).

³²⁶ These considerations include power control, noise management, and control of undesired emissions.

³²⁷ Several comments indicate that many instances of interference involving signal boosters were the result of interleaving of PLMRS and PSRS channels with subscriber-based CMRS channels. *See, e.g.*, Sprint Reply Comments at 3; Joint Reply Comments filed by the Metropolitan Washington Airports Authority (MWAA), the City of Cambridge, Massachusetts, the Maryland Counties of Anne Arundel and Montgomery, and the Virginia Counties of Arlington and Fairfax, together with the City of Ontario, California, (collectively "Public Safety Licensees") at 2; (continued....)

Part 90 PLMR signal boosters unchanged,³²⁸ we take the following actions:

- Clarify our rules to make it clear that non-licensees who seek to operate signal boosters must obtain the consent of the licensee[s] whose signals they intend to amplify;
- Adopt a registration requirement for existing and future Class B signal booster installations;
- Permit Part 90 licensees to deploy Class A (narrowband) signal boosters in both fixed and mobile environments provided that they do not cause interference to other licensed services in the band. We prohibit mobile deployment of Class B (wideband) signal boosters, but allow fixed deployment of Class B signal boosters;
- Require system integrators and installers to consider the potential adverse effects of the increased noise floor on PLMR systems and establish additional emission limits to reduce the interference potential of signal boosters;
- Update our equipment authorization process to differentiate between Class A and Class B signal boosters and testing procedures;
- Establish labeling requirements to promote compliance with our rules; and
- Clarify certain definitions and power requirements.

147. *Background.* In 1996, the Commission adopted Part 90 signal booster rules, defining two classes of signal boosters for Part 90 operations and establishing section 90.219 to allow their use.³²⁹ Part 90 defines a “signal booster” as a device at a fixed location which automatically receives, amplifies and retransmits, on a one-way or two-way basis, the signals received from base, fixed, mobile, and portable stations, with no change in frequency or authorized bandwidth.³³⁰ Part 90 classifies two types of signal boosters – Class A narrowband, where the booster employs a narrow passband that amplifies only those discrete frequencies intended to be retransmitted, and Class B wideband, where all signals within a wider passband of the signal booster are amplified.³³¹ Under section 90.219, licensees authorized to operate stations that transmit in frequency bands above 150 MHz may employ signal boosters at fixed locations, subject to certain power and emission limits. Licensees may not, however, use a signal booster to extend their service area(s).³³² In addition, Class B boosters may be operated only in confined areas and licensees are required to eliminate harmful interference should it occur.³³³ We note that the Commission did not discuss the mobile use of signal boosters when it adopted the Part 90 signal booster framework in 1996, and the definition of signal boosters refers to operation at “fixed” locations.

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TriPower Group Comments at 10. This interleaving problem will soon be resolved. *See* Improving Public Safety Communications in the 800 MHz Band, *Report and Order*, 19 FCC Rcd 14969 (2004).

³²⁸ For example, we retain the method of authorization for PLMR signal boosters, the classification of boosters as Class A or Class B, and the 5 Watt ERP power limit.

³²⁹ *See* Amendment of Parts 22, 90, and 94 of the Commission’s Rules to Permit Routine Use of Signal Boosters, *Report and Order*, 11 FCC Rcd 16621 (1996) (*Signal Boosters Report and Order*); *Memorandum Opinion and Order*, 12 FCC Rcd 6896 (1997) (*Signal Boosters Memorandum Opinion and Order*); 47 C.F.R. § 90.219.

³³⁰ 47 C.F.R. § 90.7.

³³¹ *Id.*

³³² 47 C.F.R. § 90.219.

³³³ *Id.*

A. Authorization for Part 90 Signal Boosters

148. In the *NPRM*, we proposed to largely retain the existing authorization mechanism for Part 90 PLMR signal boosters. Specifically, we proposed to continue to permit licensees to deploy signal boosters without additional licensing requirements if the deployment would not extend the boundary of their service area.³³⁴ In addition, we sought comment on how to facilitate non-licensee use of Part 90 PLMR signal boosters for in-building emergency communications, including whether the proposed Consumer Signal Booster license-by-rule approach would be appropriate for PLMR signal booster deployments.³³⁵ Further, we asked whether additional safeguards were necessary to control interference from in-building signal booster systems.

149. *Discussion.* Commenters generally oppose a license-by-rule framework for Part 90 PLMR signal boosters.³³⁶ Based on our review of the record, we see no need to substantially alter our existing authorization framework for Part 90 PLMR signal boosters. These devices are Industrial Signal Boosters operated by Part 90 licensees or with their consent. As discussed above in the context of subscriber-based services, licensees benefit when they are able to customize their coverage solutions to address their particular communications needs. Where coverage solutions are implemented by third parties, however, licensees must be directly involved and explicitly consent to the proposed installation to ensure that coverage needs are met and the installations do not cause harmful interference.³³⁷ Thus, operation of a Part 90 PLMR signal booster will continue to require a license or licensee consent.³³⁸

150. Our review of the record in this proceeding indicates that, in general, the existing Part 90 signal booster rules have effectively allowed PLMR licensees to deploy signal boosters to address coverage issues. The Metropolitan Washington Airports Authority (MWAA), the City of Cambridge, Massachusetts, the Maryland Counties of Anne Arundel and Montgomery, and the Virginia Counties of Arlington and Fairfax, together with the City of Ontario, California (collectively, “Public Safety Licensees”), for example, emphasize the importance of Class B signal booster deployments to facilitate critical public safety communications in airport terminals.³³⁹ The National Association of Manufacturers (NAM) and MRFAC, Inc. (MRFAC) outline the importance of signal boosters in mines, tunnels and large manufacturing complexes to improve the safety and efficiency of American businesses.³⁴⁰ We agree that signal boosters are a valuable tool for addressing the communication needs of PLMR licensees. Thus, consistent with existing Section 90.219, these licensees may continue to operate signal boosters within their authorized service area.³⁴¹

³³⁴ *NPRM*, 26 FCC Rcd at 5516, ¶ 70.

³³⁵ *Id.* at 5519-20, ¶ 79.

³³⁶ *See, e.g.*, APCO Comments at 2; DAS Forum Comments at 8 (license-by-rule framework would be onerous for Industrial Signal Boosters installed by the DAS industry). *See also*, Public Safety Licensees Comments at 1.

³³⁷ *See* APCO Comments at 2 (PLMR signal boosters should be operated only by licensees, or those authorized by licensees, to ensure proper use and installation); BTG Reply Comments at 2-3 (signal boosters should be installed only by or in coordination with the licensee); Motorola Comments at 3 (Part 90 signal boosters are subject to unique coordination and deployment challenges that necessitate that all relevant licensees directly control signal boosters).

³³⁸ Consent may be obtained, for example, via the existing informal coordination practice between installers and licensees and may be evidenced by a letter, email, or other record sent from a licensee to an operator, owner or installer of a fixed signal booster. DAS Forum Reply Comments at 5. Or, as TIA suggests, non-licensees may deploy signal boosters with the express written consent of a licensee. TIA Comments at 7.

³³⁹ Public Safety Licensees Comments at 3-4.

³⁴⁰ NAM/MRFAC Comments at 2.

³⁴¹ 47 C.F.R. § 90.219.

151. We also seek to address concerns raised in the record regarding installation and operation of PLMR signal boosters by third parties, particularly for public safety uses. Signal booster systems play a crucial role in allowing public safety first responders to communicate in buildings, tunnels and other areas where signals would normally be blocked. In many instances, however, these signal booster systems are not deployed or operated by licensees. Instead, they are installed by DAS professionals for building owners, often to comply with local building codes that require them to enable public safety communications.³⁴² The Public Safety Licensees argue that by implication, Section 90.219 requires licensee consent for these “private placement[s]”³⁴³ of PLMR signal boosters.³⁴⁴ We conclude that this requirement should be made explicit and we amend Section 90.219 accordingly.³⁴⁵ We find that allowing third parties to operate signal boosters with express licensee consent serves the public interest by promoting reliable communications, particularly reliable public safety communications.

152. In addition, we recognize that state of the art PLMR radios use digitally modulated narrowband emissions, but the passband of a Class A signal booster has design constraints requiring that it be wider than the individual PLMR channel(s) being amplified.³⁴⁶ As a result, today’s Class A signal boosters may unintentionally amplify signals of other licensees on adjacent channels in addition to the signals on the licensee’s channel(s) that are intended to be amplified. We consider it impractical and unnecessarily burdensome, however, to require licensees or third parties to seek consent from all licensees within a device’s passband and there is no indication in the record that such a practice is currently taking place for existing signal booster deployments. Instead, we will maintain our current authorization structure for Part 90 PLMR signal boosters and simultaneously adopt new safeguards that will reduce the potential for harmful interference from signal boosters.³⁴⁷ We conclude that the public interest is best served if Part 90 PLMR licensees and others with licensee consent continue to be able to install and operate Part 90 PLMR signal boosters to meet their communications needs, particularly where the devices facilitate public safety communications. Accordingly, PLMR signal boosters may be operated in the Part 90 bands so long as the operator has a license or the consent of the licensee whose signals are intended to be amplified.

³⁴² See, e.g., Jack Daniel Comments at 11.

³⁴³ We interpret “private placement” to mean deployment of signal boosters by non-licensees.

³⁴⁴ Public Safety Licensees Comments at 2, 5 (arguing that such coordination is implied by Section 90.219, *i.e.*, Section 90.219 allows licensees to operate signal boosters and implies that they remain responsible for such operations even if installed by others).

³⁴⁵ As noted above, express licensee consent may be reflected, for example, by “a letter, email or other record sent from a licensee or agent of a licensee to an operator, owner, or installer of [a Part 90 PLMR signal booster] acknowledging that the [Part 90 PLMR signal booster] will retransmit the specified frequency bands of the licensee.” DAS Forum Reply Comments at 5.

³⁴⁶ As discussed below, Part 90 PLMR signal boosters have design constraints that result in passbands that are wider than individual PLMR/PSRS channel widths. Therefore, a Class A signal booster designed for a single 12.5 kHz channel may actually amplify all channels within a 75 kHz passband. See *infra* ¶¶ 155-165.

³⁴⁷ Specifically, we adopt new emission limits to address spurious emissions and increases in noise created by signal booster operations. See *infra* ¶¶ 175-178. In addition, we require all Class B signal booster installations to be registered in an FCC signal booster registration database. Thus, in the event a Class B signal booster causes interference, the operator of the device can be located and asked to shut down the interfering device. See *infra* ¶¶ 161-166. Further, we clarify that signal boosters may only operate on a non-interference basis to the primary services licensed for the frequency bands on which they transmit, and to primary services licensed for the adjacent frequency bands that might be affected by their transmission. See Appendix A, 47 C.F.R. § 90.219(c).

153. So long as licensees meet the requirements we adopt today,³⁴⁸ we do not find justification in the record to impose additional licensing requirements or formal frequency coordination for Part 90 PLMR licensees wishing to deploy signal boosters within their service area.³⁴⁹ The record indicates that the current industry-driven installation and informal coordination processes for Part 90 PLMR signal boosters are largely effective.³⁵⁰ Additional licensing or formal coordination through a frequency coordinator would add unnecessary financial burden and delay to the existing, effective process.³⁵¹ Further, signal boosters authorized through 90.219 are limited to 5 Watts ERP transmitting power and pose a lower potential for interference than higher powered operations that typically require formal coordination and licensing. We note that our formal frequency coordination and licensing processes are designed to identify channels in areas that can be authorized for new use.³⁵² In contrast, our signal booster rules are intended to allow licensees to address coverage gaps on authorized channels within a licensee's existing service area. Accordingly, our revisions to Section 90.219 are intended to clarify the authorization process for signal boosters without fundamental changes to existing practices.

B. Part 90 Signal Booster Classifications and Operational Restrictions

154. In the *NPRM*, we proposed to maintain the Class A and Class B distinctions for signal boosters in Part 90.³⁵³ We also sought comment on further distinctions, definition changes, or operational requirements for Class A and Class B signal boosters to ensure they are properly deployed and operated. In particular, we proposed to continue to limit deployment of Class B signal boosters to confined areas such as buildings, tunnels, parking garages, or other structures where the amplified signal would be largely contained.³⁵⁴ We also proposed, however, to allow Class B signal booster operators to pair enclosed Class B signal boosters with external antennas in order to provide an improved return path to the licensee's base or repeater station.³⁵⁵ Further, we asked how to address coordination and deployment for the return link of Class B signal boosters that cover frequency ranges containing signals from multiple licensees.³⁵⁶ In addition, we proposed to remove the language "or in remote areas"³⁵⁷ from Section

³⁴⁸ See Appendix A, 47 C.F.R. § 90.219.

³⁴⁹ See, e.g., APCO comments at 3-4 (proposing frequency coordination and individual licensing for certain Class A signal boosters); Motorola Comments at 2 (proposing licensing of fixed PLMR signal booster antennas that are more than 20 feet above ground); Jack Daniel Reply Comments at 8 (supporting formal coordination through Part 90 frequency coordinators for signal booster installations where the device transmits at a power level that exceeds 5 watts ERP per channel); NAM/MRFAC Comments at 4 (proposing frequency coordination for signal boosters used to provide fill-in coverage in remote areas).

³⁵⁰ DAS Forum Comments at 8-9; BTG Reply Comments at 3.

³⁵¹ Jack Daniel Reply Comments at 8.

³⁵² Signal boosters may only be used to improve signal coverage within a licensee's coverage area; they may not be used to expand the coverage area. Thus, the use of a signal booster should not affect a frequency coordinator's determinations regarding the availability of channels for assignment.

³⁵³ *NPRM*, 26 FCC Rcd at 5517-18, ¶ 74.

³⁵⁴ *Id.* at 5519, ¶ 78.

³⁵⁵ *Id.* at 5519-20, ¶ 79.

³⁵⁶ *Id.*

³⁵⁷ In 1996, when the Commission adopted section 90.219 to allow Part 90 Class B signal boosters, the Commission sought to address interference concerns raised by wideband signal boosters amplifying signals not assigned to the licensee. *Signal Boosters Report and Order*, 11 FCC Rcd at 16628, ¶ 17. The Commission thus restricted Class B booster use "to areas that are confined or enclosed such as tunnels, underground parking garages, and within buildings (*i.e.*, areas where there is little or no risk of interference to others)." *Id.* The Federal Register Summary for this item, however, erroneously added the phrase "or in remote areas" to the end of that clause. See 61 Fed. Reg. (continued....)

90.219(d) to clarify where Class B signal boosters may operate.³⁵⁸ We also proposed to clarify that Class B boosters can be deployed in both urban and rural areas so long as they are installed in a confined area.³⁵⁹ Finally, we sought comment on how to structure a reasonable transition process for existing Class B signal boosters that do not meet our proposed rules.³⁶⁰

1. Part 90 Signal Booster Classifications

155. *Discussion.* We find that it is in the public interest to maintain both classes of signal boosters. Although some commenters argue that Class B signal boosters should be eliminated³⁶¹ and that there is little distinction between Class A and Class B signal boosters,³⁶² we believe there is a sufficient distinction between wideband signal boosters and those that can be adjusted to amplify a narrow bandwidth.³⁶³ We find that the record demonstrates a need for both wideband and narrowband signal booster solutions to meet different deployment scenarios.³⁶⁴ For example, a single licensee may need a Class A solution to address coverage problems for a few channels in its service area. A Class B solution can address the needs of multiple licensees, or a licensee with multiple channels, to allow communications in tunnels or other venues where a Class A solution may not be viable.³⁶⁵ The record reflects that properly designed Class A and Class B signal boosters can be effectively deployed without a

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31051. On reconsideration, TX/RX Systems, Inc. (TX/RX) sought clarification of the meaning of the term “remote areas” as included in the Federal Register Summary of the rules. *See* TX/RX Petition for Reconsideration, WT Docket No. 95-70, filed July 19, 1996. Apparently unaware of the erroneous language added in the Federal Register, the Commission declined to make such a clarification explaining that the adopting Order did not include any reference allowing signal boosters in “remote areas.” *See Signal Boosters Memorandum Opinion and Order*, 12 FCC Rcd at 6899, ¶ 8. *See also* Canam Comments at 5.

³⁵⁸ *NPRM*, 26 FCC Rcd at 5519, ¶ 78.

³⁵⁹ *Id.*

³⁶⁰ *Id.* at 5494, ¶ 7.

³⁶¹ Motorola Comments at 2, 9 (Class B boosters should be eliminated because Class A boosters are a superior solution with less risk of interference and the price of Class A boosters is decreasing); NPSTC Reply Comments at 3 (noting that Class B boosters become less desirable as demand for channels increases).

³⁶² *See, e.g.*, Jack Daniel Reply Comments at 5-7 (noting there is little distinction between Class A and Class B signal boosters because today’s Class A signal boosters have passbands that are wider than a narrowband channel). *See also* TriPower Comments at 11 (arguing that group delay makes it impractical to design a signal booster that only amplifies individual Part 90 channels).

³⁶³ Jack Daniel Reply Comments at 7.

³⁶⁴ APCO Comments at 3 (supporting retaining both classes of signal boosters); *Ex Parte* Comments from Dick Abbott (Aug. 17, 2012) (Dick Abbott Aug. 17, 2012 *Ex Parte* Comments) at 2 (supporting retaining both Class A and Class B booster categories without separate licensing requirements because there are design circumstances where they are needed without additional licensing burdens). Dick Abbott also recommends establishing a new class of signal booster that permits passbands wider than the occupied bandwidth of a licensed channel, and limits emissions within and outside of the authorized bandwidth. This new class should be used instead of allowing Class B transmissions on the return link or in unconfined areas and the new class would be frequency coordinated and licensed so others are aware of their operation. *Id.*

³⁶⁵ For example, a large metropolitan airport with an underground rail system may need a signal booster system that can accommodate the communications needs of local police, fire, airport maintenance, airport security and other entities. In this instance, a Class B solution would likely be more economical for the variety of licensees that may need to communicate in the tunnel. *See also* Jack Daniel Comments at 7 (noting that Class B signal boosters can be used by multiple public safety entities when responding to a significant event without having to reprogram radios or to cover the entire 700 MHz public safety band).

significant increased potential for harmful interference.³⁶⁶

156. In defining the criteria for Class A signal boosters, some commenters suggest a mask or filter response curve for Class A determination,³⁶⁷ or specifying a maximum group delay that will be permitted for a Class A booster.³⁶⁸ While these proposals have merit, we believe a bright line test will be best to reduce confusion and allow for a wide variety of channel configurations that could occur under the Part 90 rules. Specifically, we amend our rules to reflect that a Class A signal booster must have a passband per channel no larger than 75 kHz.³⁶⁹ This bright line test will reduce confusion in the marketplace as to whether a particular signal booster is a Class A or Class B device. We believe that a 75 kHz passband per channel is sufficient to accommodate the group delay issue associated with Class A signal boosters. In the equipment authorization process, we will distinguish whether signal booster equipment types can meet this passband requirement to determine whether they qualify as Class A or Class B signal boosters.

157. Further, we agree that the definitions of Class A and Class B signal boosters should be revised to reflect that certain DAS and signal booster installations can be complex systems which could incorporate a combination of Class A and Class B signal boosters and amplifiers.³⁷⁰ While we may classify individual pieces of equipment as Class A or Class B signal boosters in the equipment authorization process, it is ultimately how these devices are deployed and operated that dictates many of their regulatory requirements. That is, a DAS in a subway or large building could have a variety of components such as bi-directional amplifiers, antennas and devices that hold an equipment certification as a Class A or Class B signal booster, but the overall system may function as a Class A signal booster system and will be treated as such a system under our rules. We thus modify our definitions of these classifications to reflect such configurations. We also adopt a definition to distinguish signal boosters from signal amplifiers as suggested by commenters.³⁷¹ These definitions are outlined in our final rules in Appendix A.

2. Part 90 Signal Booster Operational Restrictions

158. *Discussion.* Commenters are divided on the issue of whether we should maintain the current operational restriction limiting deployment of Class B signal boosters to confined or indoor areas, as proposed. NAM/MRFAC notes that businesses have successfully deployed Class B signal boosters in

³⁶⁶ See, e.g., BTG Reply Comments at 3 (stating that when properly deployed, neither type of signal booster should cause interference); Jack Daniel Comments at 5 (noting that over two million Class B signal boosters have been installed and very few have caused interference); TriPower Comments at 11.

³⁶⁷ See, e.g., *Ex Parte* Comments from TriPower (Aug. 14, 2012) (TriPower Aug. 14, 2012 *Ex Parte* Comments) at 21.

³⁶⁸ See *Ex Parte* Comments from BTG (Aug. 31, 2012) (BTG Aug. 31, 2012 *Ex Parte* Comments) at 7. BTG states that the Class A emission bandwidth of 60 kHz with rejection of greater than 60 dB at ± 75 kHz, or other specific parameters, would be difficult to implement because the necessary passband slope varies for different modulation schemes and applications. BTG explains that because the amount of group delay that different modulation schemes and applications can tolerate varies, Class A passbands should simply be limited to the minimum that is technically feasible, given the modulation type and system delay requirements. BTG Comments at 7.

³⁶⁹ Commenters suggest a range of passband widths that may be appropriate for Class A signal boosters. See, e.g., Canam PN Comments at 7 (suggesting maximum 60 kHz (+/- 3dB) passband); Jack Daniel Comments at 15-17 (suggesting a range of 12.5 kHz – 100 kHz or 10 MHz, depending on the licensee's authorized frequency range); TriPower Comments at 11 (noting that current Class A passbands cover almost 75 kHz).

³⁷⁰ Dick Abbott Comments at 5 (proposing modification of signal booster definitions to account for the fact that many signal booster systems include a combination of Class A and Class B signal booster components).

³⁷¹ Jack Daniel Comments at 20; California Public-Safety Radio Association Comments at 2.

parts of their outdoor facilities, such as in railroad marshaling yards and on plant complexes, using professional installation with negligible risk of interference.³⁷² APCO opposes outdoor use of Class B signal boosters arguing that such use may cause interference to a wide range of frequencies that are being transmitted.³⁷³ We are persuaded that Class B signal boosters are an important tool for Part 90 PLMR licensees to address their signal coverage needs and that these devices can be effectively deployed outdoors without causing harmful interference.³⁷⁴ Thus, we will modify our current rule to allow Part 90 licensees and those operating with licensee consent to deploy Class B signal boosters both in confined areas and outdoors, while prohibiting mobile deployment of Class B boosters as discussed below.³⁷⁵ The record also reflects that eliminating Class B signal boosters or substantially restricting their use could harm U.S. manufacturers and public safety entities that rely on these devices in both enclosed and outdoor environments.³⁷⁶

159. We note, however, if Class B signal boosters malfunction or are improperly installed, these devices may affect a wide range of channels and licensees.³⁷⁷ Accordingly, as discussed further below, we will require licensees and those operating with licensee consent to register all Class B signal boosters with the Part 90 PLMR signal booster database that the Commission will develop in the near future.³⁷⁸ Our registration requirement, coupled with our adoption of good engineering practice in the deployment of signal boosters, strikes the appropriate balance between providing Part 90 licensees with sufficient flexibility to deploy effective signal booster systems with the need to identify sources of interference should they occur. Because we are not restricting Class B booster operation to enclosed areas, we need not address the issue of Class B booster amplification on the return link from enclosed areas.

160. We leave unchanged our existing operational requirements for Class A signal boosters.³⁷⁹ Licensees and others with licensee consent may continue to use Class A signal boosters to meet their communications needs.

3. Part 90 Signal Booster Registration

161. In the *NPRM*, we sought comment on whether Part 90 PLMR signal booster installations should be subject to the same registration process that we proposed for consumer signal booster operators.³⁸⁰ We reasoned that a centralized clearinghouse of signal booster operators would provide Part

³⁷² NAM/MRFAC Comments at 3.

³⁷³ APCO Comments at 3.

³⁷⁴ NAM/MRFAC Comments at 3.

³⁷⁵ See *infra* ¶¶ 167-174.

³⁷⁶ Public Safety Licensees Reply Comments at 2 (Class B signal boosters should be permitted in unconfined areas so long as they do not cause interference); NAM/MRFAC Comments at 3 (noting that it is expensive and difficult to replace this type of Class B system with Class A signal boosters and that the proposed rule change is unnecessary and would unduly burden businesses); CelLynx Comments at 9 (noting the need for Class B signal boosters in rural or remote areas, especially for 911 services).

³⁷⁷ APCO Comments at 3; Dick Abbott Comments at 2 (opposing wideband amplification of the return link from a Class B signal booster system because it can retransmit a significant amount of wideband noise that degrades the sensitivity of receivers in the proximity of the installation); Motorola Comments at 9 (Class B signal booster use should be limited to enclosed areas).

³⁷⁸ We discuss the details of this database and the registration process below. See *infra* ¶¶ 162-166.

³⁷⁹ See Appendix A, 47 C.F.R. § 90.219(d).

³⁸⁰ *NPRM*, 26 FCC Rcd at 5524, ¶ 92.

90 licensees with a ready resource for identifying and rectifying the source of the interference should it occur.³⁸¹ We also sought comment on whether to apply a registration requirement to fixed, mobile, or both types of signal boosters.³⁸²

162. *Discussion.* We adopt a registration requirement for all existing and future Class B signal booster installations. We believe Class B signal booster registration will be a valuable tool to help resolve interference should it occur and it will impose only a minimal burden on the operators of signal boosters.³⁸³ Most of the commenters who chose to address a registration requirement for Part 90 PLMR operations are supportive.³⁸⁴ Although, the record indicates that many licensees are currently operating non-confined signal boosters on Part 90 PLMR frequencies with little or no interference, we find that a registration requirement will provide an additional source of information and control for licensees. By creating a permanent record of all Class B signal booster installations in a searchable database, licensees will be able to electronically search for signal booster installations if they experience interference or other degradations to their system. This will allow licensees to identify and shut down devices causing harmful interference as necessary. We note that Part 90 PLMR licensees are well acquainted with the interference resolution process as these licensees operate on shared frequencies. A registration database is thus particularly well suited for operators in Part 90 PLMR frequencies.

163. The Part 90 PLMR signal booster registration database should allow licensees experiencing interference to identify Class B signal boosters that have been deployed in the area and provide a point of contact for each deployment to investigate interference. Thus, at a minimum, registration information shall include the following: (1) operating range of the Class B signal booster; (2) the physical location of the signal booster; and (3) contact information for the individual(s) responsible for the signal booster's operation. We delegate authority to the Wireless Telecommunications Bureau to design and manage the online registration tool, including the ability to seek additional information or add features that the Bureau may deem necessary.³⁸⁵

164. While we concluded above that wireless providers would be required to develop and maintain a registration system for their subscribers, we find that the Commission should maintain the Part 90 PLMR registration database. Wireless providers have an established relationship with their subscribers and are well-accustomed to obtaining, retaining, and managing information from their subscribers. Subscribers are familiar with the process of contacting their providers regarding their wireless devices, *e.g.*, initializing and upgrading handsets. Further, a provider-based system places necessary information in the hands of wireless providers who are responsible for resolving interference on their networks. Thus, a provider-based registration process is appropriate and facilitates compliance with our rules for Consumer Signal Boosters. By contrast, Part 90 PLMR licensees are well-accustomed to using the Commission's databases to provide the Commission with information about their service areas, tower locations, contact information, etc. Class B signal booster registration would employ a similar process. Further, an FCC-based system provides licensees with access to information necessary to

³⁸¹ *Id.*

³⁸² *Id.*

³⁸³ Jack Daniel Reply Comments at 8 (registration can be accomplished via a simple on-line tool). *But cf.* CellLynx Comments at 9 (opposing registration because costs outweigh benefits).

³⁸⁴ *See e.g.*, Jack Daniel Reply Comments at 8 (registration will help trace any suspected interference from a signal booster); APCO Comments at 2 (mandatory registration for signal boosters will help licensees locate interference caused by signal boosters); DAS Forum Comments at 11 (supporting registration as an alternative to overly restrictive manufacturing or operational requirements for signal boosters).

³⁸⁵ For example, the Bureau may later determine that a signal booster's FCC ID number is useful in identifying problematic signal boosters.

resolve interference; a licensee-based system would not sufficiently aggregate such information. An FCC-based registration process is thus appropriate for Part 90 PLMR licensees.

165. The Wireless Telecommunications Bureau will perform outreach regarding this registration requirement, including releasing a Public Notice detailing the specifics of the registration process once it is available. We require licensees and signal booster operators to register existing Class B signal booster installations with the Commission by November 1, 2014. We believe this period will allow sufficient time for public outreach, website development, and regulatory approval of this process. After November 1, 2014, operation of an existing, unregistered Class B signal booster will be unauthorized and subject to enforcement action. We note that any new Class B signal booster installed after November 1, 2014 must be registered prior to operation. To encourage compliance with this new requirement, registration will be free of cost to the operator and/or licensee.³⁸⁶ In addition, we ask signal booster manufacturers and Part 90 licensees to assist in informing all relevant parties of our new registration requirements.

166. We do not require operators to register Class A signal boosters at this time. We conclude that the power limits on signal boosters coupled with the relatively narrow passband of Class A devices reduces their potential for interference. In addition, fewer Part 90 licensees are potentially affected by the operation of Class A boosters. We also believe that identification of an interfering Class A booster is easier because each device amplifies a narrow set of channels, allowing the interfering licensee to be identified in ULS. We will closely monitor interference events associated with signal boosters. In the event that a pattern of Class A signal booster interference is established, we may revisit a registration requirement for these devices.

4. Part 90 Mobile Signal Boosters

167. In the *NPRM*, we proposed to amend our rules to explicitly permit Part 90 licensees to use mobile Class A signal boosters on their assigned frequencies and sought comment on how to control interference on interleaved Part 90 channels where a number of different licensees could be affected by such devices.³⁸⁷ We also sought comment on how mobile signal boosters affect operations in different bands including SMR licensees and 700 MHz public safety broadband licensees.³⁸⁸ Further, we asked if additional safeguards or requirements could allow Class B signal boosters to operate in a mobile environment without increased interference.³⁸⁹

168. We also took the opportunity in the *NPRM* to address the difference between a mobile amplifier and a mobile signal booster. We explained that mobile amplifiers are treated as Part 90 transmitters for PLMR public safety and business/industrial pool licensees and are allowed, provided that they do not result in the device operating outside of Part 90 technical rules.³⁹⁰ We sought comment on whether any restrictions should be placed on these devices, including any technical limits, such as separate power limits, automatic gain control, or other features to ensure these devices do not cause interference.³⁹¹

³⁸⁶ 47 U.S.C. § 158(d)(2) (“The Commission may waive or defer payment of an [application fee] [sic] in any specific instance for good cause shown, where such action would promote the public interest”).

³⁸⁷ *NPRM*, 26 FCC Rcd at 5520, ¶ 81.

³⁸⁸ *Id.*

³⁸⁹ *Id.*

³⁹⁰ *Id.* at 5520-21, ¶ 82. Such devices allow land mobile licensees to dock lower powered hand-held devices or attach a hand-held radio to an external antenna to achieve sufficient mobile power levels when in poor signal areas.

³⁹¹ *Id.*

169. *Discussion.* We will permit Part 90 licensees to deploy Class A signal boosters in a mobile environment provided that they do not cause interference to other licensed services. If a Class A signal booster causes interference, it must be shut down. While all signal boosters have the potential to cause interference if they are poorly made, poorly installed, or malfunction, Class A boosters have a lower potential to cause interference because of their narrow passbands. That is, if a signal booster is improperly installed and causes interference, the Class A device will affect fewer channels than the Class B device. In addition, it may be easier to identify the operating licensee of a Class A device by comparing the operating range of the device (using test equipment) to a list of licensees in that area over the relevant channel range.

170. The record reflects that mobile Class A signal boosters are a necessary complement to other signal amplification technologies used for public safety and other Part 90 communications purposes.³⁹² As noted by Motorola, vehicular repeaters are used by many public safety entities to ensure adequate communications signals.³⁹³ Due to challenges surrounding channel availability for vehicular repeaters, however, first responders often rely on mobile Class A signal boosters to meet their essential communications needs.³⁹⁴ Accordingly, we find that it is in the public interest to allow Part 90 licensees to deploy mobile Class A signal boosters provided that they do not cause interference to other licensed services.

171. We do not reach the same conclusion regarding mobile Class B signal boosters. Because Class B signal boosters present a potential for interference across a wider swath of spectrum,³⁹⁵ we conclude that Class B signal boosters may not be deployed in a mobile environment on Part 90 PLMR frequencies and clarify our rules to reflect this. A Class B device operating in a mobile environment has the potential to affect hundreds of other licensees' channels. While the record indicates that some entities have deployed Class B signal boosters in vehicles, we find the potential for interference outweighs the benefits of such devices, especially because there are alternatives, such as Class A boosters and vehicular repeaters that pose less potential for interference.

172. We recognize, however, that some licensees currently operate mobile Class B signal boosters. We believe it is appropriate to provide these licensees with an opportunity to transition their operations to alternate devices.³⁹⁶ Accordingly, licensees who are currently operating mobile Class B signal boosters must transition their operations to alternate, permissible devices by November 1, 2014. We remind licensees that under our rules, any signal booster causing harmful interference must cease operation immediately.

³⁹² See, e.g., APCO Comments at 6.

³⁹³ Motorola Comments at 6-7. See also APCO Comments at 6 (supporting Part 90 licensee use of mobile Class A signal boosters on their licensed frequencies and within their licensed area of operation).

³⁹⁴ Licensees wishing to deploy a vehicular repeater must first coordinate and obtain the authorization for additional channel[s] because vehicular repeaters retransmit on a different channel than they receive. Pyramid notes that channel availability can be a problem in some areas. See Pyramid Communications PN Comments at 3.

³⁹⁵ Motorola Comments at 6-7 (Class B mobile signal boosters should be prohibited on Part 90 frequencies due to their potential to cause interference; vehicular repeater systems are the best solution for public safety); Public Safety Licensees Comments at 5 (opposing mobile Class B signal boosters due to interference potential). *But cf.* CellLynx Comments at 9-10 (supporting mobile Class B signal boosters for both consumers and public safety applications if interference from the device is "substantially limited").

³⁹⁶ Motorola Comments at 6-7 (proposing transition strategies to allow continued use of Class B mobile boosters when interference is not present).

173. In addition, we agree that our rules should distinguish between signal boosters and signal amplifiers.³⁹⁷ As commenters note, signal boosters and signal amplifiers are configured in two distinct ways.³⁹⁸ A signal amplifier is often employed in a mobile environment where the device is physically attached at one end to a radio and at the other to an external antenna to achieve higher power, whereas a signal booster is not physically attached to the radio unit. Accordingly, we adopt separate definitions for these two types of devices.³⁹⁹

174. In reaching our decision, we weighed the costs versus the benefits of allowing mobile applications of signal boosters and considered what conditions should be applied to such operations. In this analysis, we concluded that mobile amplification is needed by PLMR licensees for certain applications, including public safety signal amplification in poor signal areas, but we concluded this need can be met through Class A signal boosters, mobile amplifiers, and mobile vehicular repeaters, which have a lower potential for interference than mobile Class B signal boosters. We also concluded that the benefit of additional regulatory requirements such as coordination and licensing are outweighed by the burden of such requirements and, in any event, they may not be effective for mobile deployments.

5. Technical and Other Issues for Part 90 PLMR Signal Boosters

175. *Emission Limits for Part 90 Signal Boosters.* In the *NPRM*, we explored what emission limits should apply to Class A and B signal boosters. In particular, we sought comment on how to address the effect of group delay on Class A signal boosters designed to amplify narrowband digitally modulated signals,⁴⁰⁰ including whether to relax the emission limits for Class A signal boosters.⁴⁰¹ We also sought comment on the appropriate technical specifications to verify the linearity and performance characteristics of a Class A signal booster to ensure that the out-of-band emissions of boosted signals are not degraded by intermodulation products or spurious emissions.⁴⁰² In addition, we sought comment on the appropriate emission limits for Class B signal boosters,⁴⁰³ including what emission limits might be necessary to address 800 MHz rebanding.⁴⁰⁴ We asked whether Class B signal boosters could be programmable so that the roll off characteristics could be adjusted to apply to the upper and lower spectrum boundaries of the licensee's desired spectrum range.⁴⁰⁵

³⁹⁷ See, e.g., Jack Daniel Comments at 20; APCO Comments at 6; California Public-Safety Radio Association Comments at 2.

³⁹⁸ See, e.g., Jack Daniel Comments at 20; APCO Comments at 6; California Public-Safety Radio Association Comments at 2.

³⁹⁹ See Appendix A.

⁴⁰⁰ Class A signal boosters that use narrowband filters are not able to boost digital signals without causing group delay (a form of distortion in the timing of the signal) that could cause intermittent problems with the receiver's performance. See *NPRM*, 26 FCC Rcd at 5521, ¶ 83.

⁴⁰¹ *Id.*

⁴⁰² *Id.* Intermodulation or intermodulation interference—the modulation products attributable to the components of a complex wave that on injection into a nonlinear circuit produces interference on the desired signal. IEEE Standard Dictionary of Electrical and Electronic Terms, IEEE Std. 100-1972.

⁴⁰³ *NPRM*, 26 FCC Rcd at 5522, ¶ 87.

⁴⁰⁴ *Id.* at 5524, ¶ 94.

⁴⁰⁵ *Id.*

176. *Discussion.* We agree with commenters that the relevant emission limits in Section 90.210 should apply to the retransmitted signals of the signal booster.⁴⁰⁶ We find, however, that we should also adopt some emission limits that would apply to the passband of Class A and Class B signal boosters.⁴⁰⁷ Specifically, we require both Class A and Class B signal boosters to suppress spurious emissions such that they do not exceed -13 dBm within any 100 kHz measurement bandwidth. This level of suppression is consistent with out-of-band emission limits used for other Part 90 transmitters and should reduce the level of spurious emissions generated by signal booster devices. We also limit the noise figure of a signal booster so that it does not exceed 9 dB in either direction.

177. We also find support in the record for requiring Part 90 PLMR signal boosters to suppress emissions outside of the service band for which the operator is authorized and to deploy signal boosters with the minimum passband necessary to achieve the desired communications.⁴⁰⁸ While Part 90 signal booster deployments need some allowance for passbands that are wider than a narrowband land mobile channel, we amend our rules to make it clear that operators may not amplify service bands where they do not have a license or licensee consent. We also prohibit a single Class B signal booster device from amplifying both commercial services (such as Enhanced Specialized Mobile Radio (ESMR) and Cellular Radiotelephone) and Part 90 Land Mobile and Public Safety Services.⁴⁰⁹ This new requirement should address the situation in the 800 MHz spectrum where both subscriber-based systems and PLMR systems operate on adjacent bands, and the same signal booster is used to amplify both. Because signal boosters amplify thermal noise, as well as the desired signals (and add random noise of their own), we believe that limiting the passband of devices to the intended service band of the licensee will further limit the interference potential of the device. This does not apply to DAS systems because they involve a higher level of design and implementation to address the needs of each service. While this requirement may make it difficult for a licensee to install one device in an enclosed structure capable of boosting a wide range of operators, we believe it is needed to reduce the risk of interfering with licensees in other services.

178. In addition, we conclude that it would be beneficial for system integrators and installers to consider the potential adverse effects of increased noise floor on PLMR systems. However, because of the wide range of deployment scenarios in congested and uncongested areas, we find it would be difficult to adopt a uniform noise limit for all Part 90 bands. Instead, we adopt a rule requiring “good engineering practice” to be used when installing signal boosters.⁴¹⁰ We provide examples in the rule regarding maximum ERP levels for noise and intermodulation as submitted by TriPower and other commenters.⁴¹¹

⁴⁰⁶ Dick Abbott Comments at 3 (arguing that retransmitted signals are band-limited by the originating radio to meet the requirements of Section 90.210, so the signal booster should have to ensure only that signals or noise outside of the bandwidth of interest are attenuated).

⁴⁰⁷ Dick Abbott Aug. 17, 2012 *Ex Parte* Comments 5 (out-of-band emission limit formula to account for variations in frequency bands should be $-177.4 \text{ dBm/Hz} + 20 \log(F)$; where F is the frequency in megahertz); TriPower Aug. 14, 2012 *Ex Parte* Comments at 11-15; BTG Aug. 31, 2012 *Ex Parte* Comments at 4-5.

⁴⁰⁸ BTG Reply Comments at 3 (signal boosters should reject frequencies 1 MHz above and below the frequency band for which the licensee is authorized by at least 35 dB); Jack Daniel Reply Comments at 9 (Class B signal boosters should meet a minimum suppression of 30 dB for frequencies 1 MHz above and below the passband); Motorola Comments at 5 (emission limits for Class B signal boosters should be the minimum practical width necessary to transmit the licensee’s authorized frequencies and the out-of-band emissions of the booster should be no greater than the device being boosted).

⁴⁰⁹ TriPower Aug. 14, 2012 *Ex Parte* Comments at 5, 8-9.

⁴¹⁰ This flexible approach will allow installers to consider the spectral environment of each deployment to determine whether an increased noise floor could interfere with nearby noise-limited services.

⁴¹¹ TriPower Aug. 14, 2012 *Ex Parte* Comments at 10-17; Dick Abbott Aug. 17, 2012 *Ex Parte* Comments at 4-5; BTG Aug. 31, 2012 *Ex Parte* Comments at 5.

Compliance with these levels will be deemed satisfaction of the good engineering practice requirement. Specifically, we note that, in a 10 kHz measurement bandwidth: (1) the ERP of intermodulation products within the signal booster passband should not exceed -30 dBm; (2) the ERP of noise within the signal booster passband should not exceed -43 dBm; and (3) the ERP of noise on spectrum more than 1 MHz outside of the signal booster passband should not exceed -70 dBm.⁴¹²

179. *Signal booster power limits.* We also sought comment in the *NPRM* on various proposals to change the power limits for Part 90 signal boosters.⁴¹³ Further, we sought comment on whether we need to clarify our rules regarding the amount of power permitted for Class A versus Class B boosters.⁴¹⁴

180. *Discussion.* We find that the limit of 5 watts ERP per channel continues to be appropriate for both classes of signal boosters used on Part 90 PLMR channels,⁴¹⁵ particularly because we do not adopt additional licensing requirements for these operations.⁴¹⁶ We also apply the 5 watts ERP limit to each channel for which the signal booster is designed to amplify, regardless of whether it is a Class A or Class B signal booster.⁴¹⁷ We note that handheld Part 90 PLMR units typically operate at or below 5 watts and we believe 5 watts ERP per channel is sufficient for signal boosters in most, if not all, cases to address poor signal coverage in enclosed areas or to fill gaps in coverage. We will limit signal booster operations to only the power necessary to achieve the intended communications. This is a common practice by professionals that install signal booster systems and we believe it is beneficial to codify it in our rules. We also note that if licensees need more than 5 watts ERP per channel for a particular deployment, they can use other allowances in Part 90, including obtaining an additional authorization for a repeater or base station.

181. In allowing the 5 watt ERP power limit to apply to each channel a signal booster retransmits, the total aggregate power can be substantially higher than 5 watts.⁴¹⁸ We note that all signal booster installations must comply with the Commission's RF exposure requirements, irrespective of the otherwise permissible maximum power. Multiple channels transmitting at 5 W ERP each can introduce RF exposure compliance issues if an antenna is installed (indoors vs. outdoors) in a location that has the potential to be close to people (*e.g.*, in a car or the hallway in a building). Because Part 90 PLMR signal boosters are typically deployed by professionals that ensure overpowered operations do not occur, we do not believe it is necessary to adopt different power limits for Part 90 PLMR signal boosters based on how

⁴¹² These values could be measured "off the air" relative to a known signal booster carrier power, using a spectrum analyzer.

⁴¹³ *NPRM*, 26 FCC Rcd at 5522-23, ¶¶ 88-90.

⁴¹⁴ *Id.*

⁴¹⁵ NAM/MRFAC Comments at 5 (supporting 5 watt ERP limit to reduce the interference potential of signal boosters and to account for RF hazard concerns); BTG Comments at 2-3 (noting that increased signal booster power (1) makes achieving proper antenna isolation more difficult; (2) makes oscillation more likely; and (3) can lead to generation of passive intermodulation (PIM) products which cannot be filtered out of the signal booster distribution system); Motorola Comments at 5 (supporting 5 watts ERP for Class B signal boosters, but arguing that more power should be allowed for Class A boosters, which is consistent with Part 90 mobile transmitter power limits).

⁴¹⁶ Motorola Comments at 5 (proposing that Class A boosters should be site-licensed to allow for coordination or easy identification if interference occurs).

⁴¹⁷ We note that most Class B signal boosters are linear devices that are not designed to provide different levels of amplification to different signals within their passband, so a power limit of 5 watts ERP per channel may not be possible with this particular design, but we do not wish to preclude Class B signal boosters with the capability to amplify and optimize different signals within their passband separately through digital signal processing techniques.

⁴¹⁸ The total aggregate power will depend on the number of channels and PLMR frequency bands that the signal booster transmits on simultaneously.

they are deployed. Nonetheless, all PLMR signal boosters are required to comply with the RF exposure requirements of Sections 1.1307, 2.1091, and 2.1093 for fixed and mobile exposure conditions. We note that many Part 90 mobile radios could otherwise qualify for the higher occupational exposure limits, but we will require that all signal boosters comply with the more restrictive general population exposure limits given that they may commonly be in locations proximate to the general public who would be unaware of their exposure.

182. *Other design requirements.* In the *NPRM*, we sought comment on whether Part 90 PLMR signal boosters, including 700 MHz public safety broadband (non-consumer) devices, should be required to implement some or all of the safeguards proposed for consumer signal boosters, such as automatic monitoring and shut-down capabilities.⁴¹⁹

183. *Discussion.* We find that it is not necessary to mandate monitoring and shut-down features for Part 90 PLMR signal boosters. While a few commenters support a requirement for automatic monitoring and shut-down capability for signal boosters as an additional measure to protect against oscillation and interference,⁴²⁰ most commenters addressing automatic shut-down requirements argue that they should not be applied to public safety operations.⁴²¹ In addition, we conclude that these requirements are not necessary in light of the other safeguards we adopt here. Part 90 PLMR signal boosters will be installed by the licensee or with the licensee's consent and Class B devices will be registered in the Commission's signal booster database to aid in interference identification. Further, the operators of Part 90 PLMR signal boosters employ qualified individuals to install their equipment, so additional safeguards do not need to be mandated. However, we encourage industry standards groups, manufacturers, and operators of Part 90 PLMR signal boosters to further investigate whether features such as automatic shut-down and advanced monitoring would result in more efficient and safe radio use.

184. Regarding automatic gain control (AGC), we do not find it necessary to mandate the use of AGC in all Part 90 signal boosters.⁴²² Although AGC can be used to prevent over powered operation, in a proper installation under normal operating conditions, the signal booster should have sufficient headroom to ensure that amplification of signals is maintained in a linear mode. When AGC is activated to limit power, the resulting gain compression may compromise linearity to the point that many intermodulation products result. We believe that it is best to leave design tradeoffs to the signal booster designer.

6. Equipment Authorization and Labeling for Part 90 Signal Boosters

185. In the *NPRM*, we sought comment on our equipment authorization process for signal boosters in light of the difficulty in approving a device when it is unclear how the device will be installed or operated.⁴²³ We noted that our equipment authorization database reflects that signal boosters have been certified with a wide range of signal booster power levels, including many well in excess of 5 watts

⁴¹⁹ *NPRM*, 26 FCC Rcd at 5524, ¶ 93.

⁴²⁰ NAM/MRFAC Comments at 5. The Public Safety Licensees state that registration, monitoring and automatic shut-down features may prove useful for privately placed signal boosters, but these requirements should not be placed on public safety signal boosters. Public Safety Licensees Comments at 5.

⁴²¹ See, e.g., BTG Reply Comments at 4; TIA Reply Comments at 1; Jack Daniel Reply Comments at 11-13 (opposing shut-down features for public safety signal boosters and contending that only professionally designed systems will optimize dynamic gain control).

⁴²² APCO Comments at 5 (current rules mistakenly require AGC for Class A instead of Class B signal boosters, however, Class B signal boosters should be equipped with AGC circuitry to limit the total ERP of the unit to a maximum of 5 watts under all conditions); NPSTC Reply Comments at 1 (new Class B boosters should incorporate AGC).

⁴²³ *NPRM*, 26 FCC Rcd at 5523-24, ¶ 91.

transmitter output power.⁴²⁴ We believe this anomaly results because, during the equipment authorization process, the testing authority does not know how the device will be installed, how much signal will be lost in cables to outside antennas, or the type of antenna that will be used. Further, the testing authority does not know if the device will be installed as a signal booster subject to power limits in Section 90.219 or as an amplifier that will be connected directly to a radio and not subject to the 5 watt ERP limit. We asked in the *NPRM* if the existing equipment authorization process was sufficient to ensure signal boosters are approved in such a way that their operation is consistent with our rules and queried whether we should require documentation or labeling on signal amplification devices to describe how the device is to be used.⁴²⁵ We also asked if we should change our methods for evaluating signal boosters during the equipment authorization process to better differentiate between Class A and Class B signal boosters and between a signal booster and an amplifier designed to connect directly to a radio.⁴²⁶

186. *Discussion.* We agree with commenters that the equipment certification process should be modified to reflect the particular requirements of Part 90 signal boosters.⁴²⁷ We conclude that it is necessary to test signal booster devices with multiple signals to ensure they function properly under a variety of conditions that could occur in deployment by PLMR entities.⁴²⁸ Accordingly, we direct the Office of Engineering and Technology to update its Knowledge Database⁴²⁹ to reflect the testing procedure suggestions offered by commenters to ensure that approved devices meet the technical requirements we adopt in this proceeding. In addition, devices submitted for equipment authorization should be properly categorized as Class A, Class B, or amplifier. Our actions in this proceeding are not intended to hinder the industry-developed standards process,⁴³⁰ but to update our rules and practices to be consistent with how signal boosters are deployed and operated by the PLMR community. We encourage industry efforts to continually improve the quality of telecommunications equipment, standards and testing procedures via the standards setting process and to work with the Commission to update our compliance testing as needed. Further, parties can submit alternative test procedures when necessary to demonstrate compliance.

187. As discussed above, we establish a two-step process for equipment authorization to allow time for manufacturers to design and obtain equipment authorization for signal boosters that meet the requirements we adopt here.⁴³¹ Specifically, as of the release date of this *Report and Order*, the

⁴²⁴ *Id.*

⁴²⁵ *Id.*

⁴²⁶ *Id.*

⁴²⁷ BTG Comments at 4 (noting that FCC equipment certification process treats signal boosters as amplifiers or “non-broadcast” transmitters and should be updated to clearly define the certification of signal boosters).

⁴²⁸ Motorola Comments at 6 (signal boosters should be tested using a single carrier to set the maximum power output per channel and with multiple input signals to set the maximum composite power output to ensure the out-of-band emissions for multiple carriers is not exceeded); APCO Comments at 7 (Class B signal boosters should be tested with multiple signals on the input to ensure that the output signal remains constant when multiple signals are present); Motorola Comments at 6 (testing of Class B devices should be conducted for out-of-band emissions compliance for the original signal within the passband and for filter limits at the edge of the wide passband).

⁴²⁹ The OET Equipment Authorization Knowledge Database can be accessed at <https://apps.fcc.gov/oetcf/kdb/index.cfm>.

⁴³⁰ Motorola Comments at 6 (testing and equipment authorization procedures for signal boosters should be based on industry standards, such as those developed by TIA); TIA Reply Comments at 4 (TIA’s existing voluntary, consensus-based standards process has already produced a collection of signal booster standards and further standards efforts should not be discouraged).

⁴³¹ *See supra* ¶¶ 133-135.

Commission will no longer accept applications for equipment certification of Industrial Signal Boosters, including Part 90 signal boosters, that do not comply with our new rules and will cease certification of devices that do not comply with our new rules. Further, starting on March 1, 2014, all Part 90 signal boosters sold and marketed in the United States must meet our new requirements. We believe this is a reasonable timeframe to allow manufacturers to develop and the Commission to certify devices that meet the new rules and will result in an orderly transition to better signal boosters.

188. *Labeling Requirements.* We agree with the California Public-Safety Radio Association that a labeling requirement is appropriate for Part 90 signal boosters.⁴³² Like the Consumer Signal Booster labeling requirements discussed above, equipment labels and information in operating manuals will increase rule compliance and remind signal booster operators about proper implementation of the devices.⁴³³ Thus, all Part 90 signal boosters marketed or sold on or after March 1, 2014, must include the following language:

WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

189. In addition, we require signal booster labels and operating manuals to indicate whether the booster is a Class A or Class B device. These disclosures must be included: (1) in on-line point-of-sale marketing materials, (2) in any print or on-line owner's manual and installation instructions, (3) on the outside packaging of the device, and (4) on a label affixed to the device.

7. 800 MHz Rebanding

190. In the *NPRM*, we sought comment on how best to address the impact of the ongoing 800 MHz rebanding requirement on signal boosters.⁴³⁴ We noted that once rebanding is complete, the separation of commercial SMR frequencies from Part 90 PLMR channels will facilitate the deployment of signal boosters with fewer complications, including fewer instances of interference.⁴³⁵ We also noted, however, that there would be problems with signal boosters that were designed to amplify signals of licensees that had moved to other channels.⁴³⁶ We thus sought comment on the impact of rebanding on existing and future uses of Part 90 signal boosters.⁴³⁷

191. *Discussion.* The record indicates that many signal booster interference incidents are related to the interleaving of PLMR channels with channels used by enhanced SMR (ESMR) providers

⁴³² California Public-Safety Radio Association Comments at 4.

⁴³³ See *supra* ¶¶ 119-124.

⁴³⁴ The goal of the rebanding process is to resolve interference issues related to a mix of interleaved commercial, private, and public safety channels. See *Improving Public Safety Communications in the 800 MHz Band, Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order*, 19 FCC Rcd 14969, 15021-45, 15069, ¶¶ 88-141, 189 (2004); *Supplemental Order and Order on Reconsideration*, 19 FCC Rcd 25120 (2004); *Memorandum Opinion and Order*, 20 FCC Rcd 16015 (2005); *Second Memorandum Opinion and Order*, 22 FCC Rcd 10467 (2007); *Third Memorandum Opinion and Order*, 22 FCC Rcd 17209 (2007).

⁴³⁵ *NPRM*, 26 FCC Rcd at 5524, ¶ 94.

⁴³⁶ *Id.*

⁴³⁷ *Id.*

who offer subscriber-based service over a system employing a high density cellular architecture.⁴³⁸ The 800 MHz band is in the process of rebanding which will eliminate all instances of channel interleaving between ESMR providers and PLMR licensees.⁴³⁹ As discussed above, under our new rules, signal boosters may only operate within the service bands for which they are authorized and we will not issue equipment certification for a single signal booster that amplifies both commercial services (*e.g.*, ESMR, Cellular Radiotelephone) and Part 90 Land Mobile and Public Safety Services.⁴⁴⁰ As a result, once rebanding is complete, a single wideband signal booster will no longer be able to amplify both subscriber-based ESMR and public safety frequencies within the same passband.⁴⁴¹ We anticipate that our changes to the technical requirements for Class B signal boosters, coupled with registration and rebanding, will reduce the instances of signal booster interference going forward.

192. We recognize that when rebanding is complete, there may be existing devices which amplify the “wrong” channels, *i.e.*, channels that have been rebanded to new frequencies.⁴⁴² We encourage Sprint and PLMR licensees going through the rebanding process to address these existing devices as necessary. We find it would be impractical to establish a sunset for existing Class B signal boosters which amplify both public safety and commercial bands because it is not clear when rebanding will be completed in various regions and there is no record of where signal boosters are deployed.⁴⁴³ Instead, we will rely on the existing non-interference requirement, public outreach, and the rebanding process where radio equipment will be modified or swapped out, including signal boosters, to address problematic installations.⁴⁴⁴ Further, as discussed above, new signal booster equipment will be designed and deployed to reflect a post-rebanding channel plan.

193. We find the approach we adopt here is an appropriate balance between allowing signal booster operation now and in the future, without creating a formal licensing and coordination process to address signal booster operations in bands where public safety and non-public safety entities operate in adjacent spectrum. In making this decision, we considered all the alternatives presented in the record, including prohibiting signal booster operations until rebanding is complete and phasing out all 800 MHz signal boosters. However, we believe our approach will be less costly to licensees and manufacturers of signal boosters. While, there may be some costs associated with our new requirement to limit the passband of devices to the service band for which the licensee is authorized (*i.e.*, the ESMR or non-

⁴³⁸ See, *e.g.*, BTG Reply Comments at 3; Sprint Comments at 3 (noting that its engineers have spent many hours tracking down interference caused by public safety signal boosters, which also amplified Sprint’s 800 MHz signals); TriPower Group Comments at 4, 10 (stating that much of the interference caused to 800 MHz public safety communications is from signal boosters intended to amplify 800 MHz Part 22 cellular services and Part 90 SMR operations in the 850 MHz range).

⁴³⁹ See 47 C.F.R. § 90.614 (prohibiting operation of 800 MHz high density cellular systems in the lower segment of the band).

⁴⁴⁰ See *supra* ¶ 177.

⁴⁴¹ DAS systems, which have a higher level of design to address the system requirements of the different services, may continue to offer this dual service functionality.

⁴⁴² NAM/MRFAC Comments at 5 (expressing concern that existing Class B boosters may boost the wrong frequencies post-rebanding).

⁴⁴³ NAM/MRFAC Comments at 5 (proposing a sunset date for Part 90 Class B boosters in the 800 MHz band, *e.g.*, 12 months after completion of rebanding in each NPSPAC region); APCO Comments at 7 (proposing 24-month sunset date for Part 90 Class B boosters in the 800 MHz band).

⁴⁴⁴ See, *e.g.*, APCO Comments at 7 (suggesting outreach programs to encourage manufacturers to provide incentives to retire non-complying devices). We thus decline to impose additional regulatory requirements as suggested by some commenters. See, *e.g.*, TriPower Comments at 10 (recommending Part 90 signal booster coordination until rebanding is complete); Sprint Comments at 3-4 (same); Public Safety Licensees Comments at 6 (same).

ESMR segment of the 800 MHz band), we believe most signal booster devices are already designed this way, so the costs should be minimal.

8. Treatment of Existing Part 90 Signal Boosters

194. *Discussion.* After careful review of the record in this proceeding, we find that, on balance, the public interest will be best served by permitting the continued use of existing Part 90 signal boosters provided operators: (1) have a license or the consent of the licensee whose signals are intended to be amplified by the device, and (2) Class B signal boosters are registered with the Commission.⁴⁴⁵ Our regulatory treatment of existing Part 90 boosters is consistent with our determination above that a subscriber must have the consent of their wireless provider to operate a Consumer Signal Booster.⁴⁴⁶ If a Part 90 signal booster operator does not have consent to use an existing booster, it may not do so. In addition, we emphasize that our Enforcement Bureau stands ready to rigorously investigate any complaint of harmful interference associated with unauthorized signal booster use.

195. As discussed above, we establish a sunset date for the mobile operation of Class B signal boosters, effective November 1, 2014. However, we decline to sunset the use of Part 90 PLMR fixed Class B and mobile Class A signal boosters so long as they do not cause interference and comply with applicable consent and registration requirements.⁴⁴⁷ While the record notes instances of interference caused by Part 90 signal boosters, it does not reflect widespread interference from the use of these devices. Moreover, the record reflects that licensees and others rely on Part 90 signal boosters to provide reliable communications, particularly for public safety purposes.⁴⁴⁸ We do not want to disrupt these beneficial uses of Part 90 signal boosters. We note that our new registration requirement will enable licensees to identify Class B signal boosters if they are problematic. Further, any booster that is found to be causing harmful interference must be shut down. Finally, we anticipate that due to improvements in technology, existing Part 90 signal boosters will be upgraded over time.

9. Request for Forbearance on Conflicting Regulations to Local Zoning Laws

196. In the *NPRM*, we noted Jack Daniel's request that the Commission forbear from adopting any regulations that would hinder local zoning decisions that require the installation of signal boosters in buildings to facilitate communications by public safety first responders.⁴⁴⁹ APCO supports the ability of local communities to adopt ordinances that require signal boosters to be installed in certain buildings to ensure first responders have reliable communications. APCO also supports the Commission's view that such signal boosters must still comply with relevant FCC regulations.⁴⁵⁰

197. As stated in the *NPRM*, our intent in this proceeding is to facilitate the development of well-designed signal boosters to enhance communications without harming networks or licensee operations.⁴⁵¹ We do not seek to preempt local governments' authority to require the installation of signal boosters pursuant to fire or other building codes in the context of this proceeding. Any such installations,

⁴⁴⁵ See *supra* ¶¶ 149-132, 162-166.

⁴⁴⁶ See *supra* ¶¶ 24-29.

⁴⁴⁷ APCO Comments at 5 (proposing 10-year sunset for Class B signal boosters deployed in non-confined areas); NPSTC Reply Comments at 1 (same).

⁴⁴⁸ See *supra* ¶¶ 150, 158.

⁴⁴⁹ *NPRM*, 26 FCC Rcd at 5524, ¶ 94. Jack Daniel contends that the National Fire Protection Association and the International Code Council support these local fire code requirements regarding the installation of signal boosters. Jack Daniel Petition at 9.

⁴⁵⁰ APCO Comments at 8.

⁴⁵¹ *NPRM*, 26 FCC Rcd at 5490-92, 5525, ¶¶ 1-3, 96.

however, must comply with all rules applicable to signal boosters including the new rules we adopt today.

IV. PROCEDURAL MATTERS

A. Final Regulatory Flexibility Analysis

198. The Regulatory Flexibility Act (RFA)⁴⁵² requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that “the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities.”⁴⁵³ Accordingly, we have prepared a Final Regulatory Flexibility Analysis concerning the possible impact of the rule changes contained in the *Report and Order* on small entities. The Final Regulatory Flexibility Analysis is set forth in Appendix C.

B. Final Paperwork Reduction Act Analysis

199. This document contains modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies are invited to comment on the new or modified information collection requirements contained in this proceeding. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

200. In this present document, we assessed the effects of the policies adopted in this *Report and Order* with regard to information collection burdens on small business concerns, and find that these policies will benefit many companies with fewer than 25 employees because the rules we adopt should provide small entities with access to the coverage enhancing benefits of signal boosters that do not harm wireless networks. In addition, we have described impacts that might affect small businesses, which includes most businesses with fewer than 25 employees, in the FRFA in Appendix C.

V. ORDERING CLAUSES

201. Accordingly, IT IS ORDERED, pursuant to Sections 1, 4(i), 4(j), 301, 302, 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 301, 302, 303(f), and 303(r), that this *Report and Order* IS HEREBY ADOPTED.

202. IT IS FURTHER ORDERED that Parts 1, 2, 20, 22, 24, 27, and 90 of the Commission’s rules ARE AMENDED as set forth in Appendix A, effective 30 days after publication in the Federal Register except as otherwise provided herein.

203. IT IS FURTHER ORDERED that the amendments, adopted above and specified in Appendix A, to sections 1.1307, 20.21, 22.9, 24.9, 27.9, 90.219 of the Commission’s rules, 47 C.F.R. §§ 1.1307, 20.21, 22.9, 24.9, 27.9, 90.219, which contain new or modified information collection requirements that require approval by the Office of Management and Budget (OMB) under the Paperwork Reduction Act (PRA), WILL BECOME EFFECTIVE after the Commission publishes a notice in the *Federal Register* announcing such approval and the relevant effective date.

204. IT IS FURTHER ORDERED that the Petition for Declaratory Ruling filed on November 7, 2007 by CTIA - The Wireless Association IS DISMISSED AS MOOT to the extent provided herein.

⁴⁵² *See* 5 U.S.C. § 601–612. The RFA has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

⁴⁵³ 5 U.S.C. § 605(b).

205. IT IS FURTHER ORDERED that the Commission's Consumer & Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this *Report and Order*, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

206. IT IS FURTHER ORDERED that the Commission will send a copy of this *Report and Order* to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Final Rules

Parts 1, 2, 20, 22, 24, 27, and 90 of Title 47 of the Code of Federal Regulations are amended as follows:

Part 1 – PRACTICE AND PROCEDURE

1. The authority citation for Part 1 continues to read as follows:

AUTHORITY: 15 U.S.C. 79 *et seq.*; 47 U.S.C. 151, 154(j), 160, 201, 225 and 303.

2. Section 1.1307 is amended by adding a new row to Table 1 below the existing row for Experimental Radio Services and above the existing row for Paging and Radiotelephone Service, and by revising paragraph (b)(2) as follows:

§ 1.1307 Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.

* * * * *

(b) * * *

(1) * * *

TABLE 1 – TRANSMITTERS, FACILITIES AND OPERATIONS SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

Service (title 47 CFR rule part)	Evaluation required if:
<p>* * * * *</p> <p>Commercial Mobile Radio Services (part 20)</p> <p>* * * * *</p>	<p>* * * * *</p> <p>Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and power > 1000 W ERP (1640 W EIRP). Building-mounted antennas: power > 1000 W ERP (1640 W EIRP). The Commercial Mobile Radio Services provisions in part 20 shall apply only if a label is affixed to the transmitting antenna that:</p> <p style="padding-left: 40px;">(1) provides adequate notice regarding potential radiofrequency safety hazards, <i>e.g.</i>, information regarding the safe minimum separation distance required between users and transmitting antennas; and</p> <p style="padding-left: 40px;">(2) references the applicable FCC-adopted limits for radiofrequency exposure specified in §1.1310.</p> <p>* * * * *</p>

(2) Mobile devices that operate in the Commercial Mobile Radio Services pursuant to part 20 of this chapter; the Cellular Radiotelephone Service pursuant to part 22 of this chapter; the Personal Communications Services pursuant to part 24 of this chapter; the Satellite Communications Services pursuant to part 25 of this chapter; the Miscellaneous Wireless Communications Services pursuant to part 27 of this chapter; the Maritime Services (ship earth station devices only) pursuant to part 80 of this

chapter; and the Specialized Mobile Radio Service, and the 3650 MHz Wireless Broadband Service pursuant to part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use, as specified in §§ 2.1091 and 2.1093 of this chapter. * * *

* * * * *

Part 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

3. The authority citation for Part 2 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302A, 303, and 336, unless otherwise noted.

4. Section 2.1091 is amended by revising paragraph (c) to read as follows:

§ 2.1091 Radiofrequency radiation exposure evaluation: mobile devices.

* * * * *

(c) Mobile devices that operate in the Commercial Mobile Radio Services pursuant to part 20 of this chapter; the Cellular Radiotelephone Service pursuant to part 22 of this chapter; the Personal Communications Services pursuant to part 24 of this chapter; the Satellite Communications Services pursuant to part 25 of this chapter; the Miscellaneous Wireless Communications Services pursuant to part 27 of this chapter; the Maritime Services (ship earth station devices only) pursuant to part 80 of this chapter; and the Specialized Mobile Radio Service, and the 3650 MHz Wireless Broadband Service pursuant to part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if they operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more. * * *

* * * * *

5. Section 2.1093 is amended by revising paragraph (c) to read as follows:

§ 2.1093 Radiofrequency radiation exposure evaluation: portable devices.

* * * * *

(c) Portable devices that operate in the Commercial Mobile Radio Services pursuant to part 20 of this chapter; the Cellular Radiotelephone Service pursuant to part 22 of this chapter; the Personal Communications Services pursuant to part 24 of this chapter; the Satellite Communications Services pursuant to part 25 of this chapter; the Miscellaneous Wireless Communications Services pursuant to part 27 of this chapter; the Maritime Services (ship earth station devices only) pursuant to part 80 of this chapter; and the Specialized Mobile Radio Service, the 4.9 GHz Band Service, and the 3650 MHz Wireless Broadband Service pursuant to part 90 of this chapter; the Wireless Medical Telemetry Service (WMTS) and the Medical Device Radiocommunication Service (MedRadio), pursuant to subparts H and I of part 95 of this chapter, respectively; and unlicensed personal communication service, unlicensed NII devices and millimeter wave devices authorized under 15.253(f), 15.255(g), 15.257(g), 15.319(i), and 15.407(f) of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use. * * *

* * * * *

PART 20—COMMERCIAL MOBILE RADIO SERVICES

6. The authority citation for Part 20 is amended to read as follows:

AUTHORITY: 47 U.S.C. 154, 160, 201, 251-254, 301-303 and 332 unless otherwise noted.

7. Add new § 20.2 to read as follows:

§ 20.2 Other applicable rule parts.

Other FCC rule parts applicable to licensees in the commercial mobile radio services include the following:

(a) *Part 1.* This part includes rules of practice and procedure for license applications, adjudicatory proceedings, procedures for reconsideration and review of the Commission's actions; provisions concerning violation notices and forfeiture proceedings; competitive bidding procedures; and the environmental requirements that, together with the procedures specified in § 17.4(c) of this chapter, if applicable, must be complied with prior to the initiation of construction. Subpart F includes the rules for the Wireless Telecommunications Services and the procedures for filing electronically via the ULS.

(b) *Part 2.* This part contains the Table of Frequency Allocations and special requirements in international regulations, recommendations, agreements, and treaties. This part also contains standards and procedures concerning the marketing and importation of radio frequency devices, and for obtaining equipment authorization.

8. Section 20.3 is revised by adding definitions to read as follows:

§ 20.3 Definitions.

Consumer Signal Booster. A bi-directional signal booster that is marketed and sold to the general public for use without modification.

Fixed Consumer Signal Booster. A Consumer Signal Booster designed to be operated in a fixed location in a building.

Industrial Signal Booster. All signal boosters other than Consumer Signal Boosters.

Mobile Consumer Signal Booster. A Consumer Signal Booster designed to operate in a moving vehicle where both uplink and downlink transmitting antennas are at least 20 cm from the user or any other person.

Non-individual. A non-individual is a partnership and each partner is eighteen years of age or older; a corporation; an association; a state, territorial, or local government unit; or a legal entity.

Provider-Specific Consumer Signal Boosters. Provider-Specific Consumer Signal Boosters may only operate on the frequencies and in the market areas of the specified licensee(s). Provider-Specific Consumer Signal Boosters may only be certificated and operated with the consent of the licensee(s) whose frequencies are being amplified by the device.

Signal booster. A device that automatically receives, amplifies, and retransmits on a bi- or unidirectional

basis, the signals received from base, fixed, mobile, or portable stations, with no change in frequency or authorized bandwidth.

Signal booster operator. The signal booster operator is the person or persons with control over the functioning of the signal booster, or the person or persons with the ability to deactivate it in the event of technical malfunctioning or harmful interference to a primary radio service.

Wideband Consumer Signal Boosters. Wideband Consumer Signal Boosters may operate on the frequencies and in the market areas of multiple licensees.

9. Add new § 20.21 to read as follows:

§ 20.21 Signal boosters.

(a) *Operation of Consumer Signal Boosters.* A subscriber in good standing of a commercial mobile radio service system may operate a Consumer Signal Booster for personal use under the authorization held by the licensee providing service to the subscriber provided that the subscriber complies with paragraphs (a)(1) through (a)(6) below. Failure to comply with all applicable rules in this section and all applicable technical rules for the frequency band(s) of operation voids the authority to operate the Consumer Signal Booster.

(1) Prior to operation, the subscriber obtains the consent of the licensee providing service to the subscriber;

(2) Prior to operation, the subscriber registers the Consumer Signal Booster with the licensee providing service to the subscriber;

(3) The subscriber only operates the Consumer Signal Booster with approved antennas, cables, and/or coupling devices as specified by the manufacturer of the Consumer Signal Booster;

(4) The subscriber operates the Consumer Signal Booster on frequencies used for the provision of subscriber-based services under parts 22 (Cellular), 24 (Broadband PCS), 27 (AWS-1, 700 MHz Lower A-E Blocks, and 700 MHz Upper C Block), and 90 (Specialized Mobile Radio) of this chapter. Operation on Part 90 (Specialized Mobile Radio) frequencies is permitted upon the Commission's release of a Public Notice announcing the date Consumer Signal Boosters may be used in the band;

(5) The Consumer Signal Booster complies with paragraphs (e), (f), (g), and (h) of this section and section 2.907 of this chapter; and

(6) The subscriber may not deactivate any features of the Consumer Signal Booster which are designed to prevent harmful interference to wireless networks. These features must be enabled and operating at all times the signal booster is in use.

(b) *De minimis operation of Consumer Signal Boosters.* A third party's incidental use of a subscriber's Consumer Signal Booster operated under this subparagraph is *de minimis* and shall be authorized under the authorization held by the licensee providing service to the third party.

(c) *Operation of Industrial Signal Boosters.* An individual or non-individual, other than a representative of a foreign government, may operate an Industrial Signal Booster provided that the individual or non-individual:

(1) Has an FCC license or obtains the express consent of the licensee(s) whose frequencies are being retransmitted by the device on a regular basis, and

(2) Uses an Industrial Signal Booster which complies with paragraph (f) of this section.

(d) *Operation on a secondary, non-interference basis.* Operation of signal boosters under this section is on a secondary, non-interference basis to primary services licensed for the frequency bands on which they transmit, and to primary services licensed for the adjacent frequency bands that might be affected by their transmissions.

(1) The operation of signal boosters must not cause harmful interference to the communications of any primary licensed service.

(2) Upon request of an FCC representative or a licensee experiencing harmful interference, a signal booster operator must (i) cooperate in determining the source of the interference and (ii) if necessary, deactivate the signal booster immediately, or as soon as practicable, if immediate deactivation is not possible.

(e) *Consumer Signal Booster Network Protection Standard.*

(1) All Consumer Signal Boosters must incorporate features to prevent harmful interference to wireless networks including but not limited to those enumerated in this section.

(2) *Certification requirements.* (i) A Consumer Signal Booster can only be certificated and operated if it complies with all applicable rules in this subpart and all applicable technical rules for the frequency band(s) of operation including, but not limited to: § 22.355, Public Mobile Services, frequency tolerance; § 22.913, Cellular Radiotelephone Service effective radiated power limits; §22.917, Cellular Radiotelephone Service, emission limitations for cellular equipment; § 24.232, Broadband Personal Communications Service, power and antenna height limits; § 24.238, Broadband Personal Communications Service, emission limitations for Broadband PCS equipment; § 27.50, Miscellaneous Wireless Communications Services, power and antenna height limits; § 27.53, Miscellaneous Wireless Communications Services, emission limits; § 90.205, Private Land Mobile Radio Services, power and antenna height limits; § 90.210, Private Land Mobile Radio Services, emission masks; and § 90.247, Private Land Mobile Radio Services, mobile repeater stations.

(ii) In case of any conflict between the rules set forth in this section and the rules set forth in Parts 22, 24, 27, and 90 of title 47, chapter I of the Code of Federal Regulations, the rules in this section shall govern.

(iii) The application for certification must satisfy the Commission that the Consumer Signal Boosters' features designed to prevent harmful interference and protect wireless networks cannot be easily defeated and must be enabled at all times.

(3) *Frequency Bands.* Consumer Signal Boosters must be designed and manufactured such that they only operate on the frequencies used for the provision of subscriber-based services under parts 22 (Cellular), 24 (Broadband PCS), 27 (AWS-1, 700 MHz Lower A-E Blocks, and 700 MHz Upper C Block), and 90 (Specialized Mobile Radio) of this chapter. The Commission will not certificate any Consumer Signal Boosters for operation on Part 90 (Specialized Mobile Radio) frequencies until the Commission releases a Public Notice announcing the date Consumer Signal Boosters may be used in the band.

(4) *Self-monitoring.* Consumer Signal Boosters must automatically self-monitor their operation

to ensure compliance with applicable noise and gain limits and either self-correct or shut down automatically if their operation exceeds those parameters.

(5) *Anti-oscillation.* Consumer Signal Boosters must be able to detect and mitigate any unintended oscillations in uplink and downlink bands (such as may result from insufficient isolation between the antennas).

(6) *Power Down.* Consumer Signal Boosters must automatically power down or cease amplification as they approach any affected base station.

(7) *Interference Avoidance for Wireless Subsystems.* Consumer Signal Boosters using unlicensed (Part 15) or other frequency bands for wireless transmissions between donor and server subsystems for their internal operations must employ interference avoidance methods to prevent interference transmitted into authorized CMRS spectrum bands.

(8) *Wideband Consumer Signal Boosters.* A Wideband Consumer Signal Booster will meet the Consumer Signal Booster Network Protection Standard if it complies with paragraphs (e)(1) – (e)(7) above and the following :

(i) *Technical Requirements.*

(A) *Noise Limits.*

(1) The transmitted noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed -103 dBm/MHz - RSSI.

Where RSSI (received signal strength indication) is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation. RSSI is expressed in negative dB units relative to 1 mW.

(2) The transmitted maximum noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed the following limits:

(i) Fixed booster maximum noise power shall not exceed $-102.5 \text{ dBm/MHz} + 20 \text{ Log}_{10}(\text{Frequency})$, where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

(ii) Mobile booster maximum noise power shall not exceed - 59 dBm/MHz.

(iii) Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

(B) *Bidirectional Capability.* Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (*i.e.*, uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering may be used provided the uplink filter attenuation is not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

(C) *Booster Gain Limits.*

(1) The uplink gain in dB of a consumer booster referenced to its input and output ports shall not

exceed $-34 \text{ dB} - \text{RSSI} + \text{MSCL}$.

Where RSSI is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation. RSSI is expressed in negative dB units relative to 1 mW.

Where MSCL (Mobile Station Coupling Loss) is the minimum coupling loss in dB between the wireless device and input port of the consumer booster. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

(2) The uplink and downlink maximum gain of a Consumer Booster referenced to its input and output ports shall not exceed the following limits:

(i) Fixed Booster maximum gain shall not exceed $6.5 \text{ dB} + 20 \text{ Log}_{10}(\text{Frequency})$

(ii) Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

(iii) Mobile Booster maximum gain shall not exceed 50 dB when using an inside antenna (e.g., inside a vehicle), 23 dB when using direct contact coupling (e.g., cradle-type boosters), or 15 dB when directly connected (e.g., boosters with a physical connection to the phone).

(D) *Power Limits.* A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Composite downlink power shall not exceed 0.05 watt (17 dBm) conducted and EIRP for each band of operation. Compliance with power limits will use instrumentation calibrated in terms of RMS equivalent voltage.

(E) *Out of Band Emission Limits.* Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

(F) *Intermodulation Limits.* The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm for the supported bands of operation. Compliance with intermodulation limits will use boosters operating at maximum gain and maximum rated output power, with two continuous wave (CW) input signals spaced 600 kHz apart and centered in the pass band of the booster, and with a 3 kHz measurement bandwidth.

(G) *Booster Antenna Kitting.* All consumer boosters must be sold with user manuals specifying all antennas and cables that meet the requirements of this section. All consumer boosters must be sold together with antennas, cables, and/or coupling devices that meet the requirements of this section. The grantee is required to submit a technical document with the application for FCC equipment authorization that shows compliance of all antennas, cables and/or coupling devices with the requirements of this section, including any antenna or equipment upgrade options that may be available at initial purchase or as a subsequent upgrade.

(H) *Transmit Power Off Mode.* When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power OFF Mode." In this mode of operation, the uplink and downlink noise power shall not exceed -70 dBm/MHz and uplink gain shall not exceed the lesser of 23 dB or MSCL.

(I) *Uplink Inactivity.* When a consumer booster is not serving an active device connection after 5 minutes the uplink noise power shall not exceed -70 dBm/MHz.

(ii) *Interference Safeguards.* Consumer boosters must include features to prevent harmful interference including, at a minimum, those enumerated in this subsection. These features may not be deactivated by the operator and must be enabled and operating at all times the signal booster is in use.

(A) *Anti-Oscillation.* Consumer boosters must be able to detect and mitigate (*i.e.*, by automatic gain reduction or shut down), any oscillations in uplink and downlink bands. Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.

(B) *Gain Control.* Consumer boosters must have automatic limiting control to protect against excessive input signals that would cause output power and emissions in excess of that authorized by the Commission.

(C) *Interference Avoidance for Wireless Subsystems.* Consumer boosters using unlicensed (Part 15) or other frequency bands for wireless transmissions between donor and server subsystems for its internal operations must employ interference avoidance methods to prevent interference transmitted into authorized CMRS spectrum bands and must meet applicable limits for radiofrequency exposure.

(9) *Provider-Specific Consumer Signal Boosters.* A Provider-Specific Consumer Signal Booster will meet the Consumer Signal Booster Network Protection Standard if it complies with paragraphs (e)(1) – (e)(7) above and the following:

(i) *Technical Requirements.*

(A) *Noise Limits.* The transmitted noise power in dBm/MHz of frequency selective consumer boosters outside the licensee's spectrum blocks at their uplink and downlink ports shall not exceed the following limits:

(1) $-103 \text{ dBm/MHz} - \text{RSSI}$

(i) Where RSSI is the downlink composite signal power received in dBm for frequencies in the band of operation outside the licensee's spectrum block as measured after spectrum block filtering is applied and is referenced to the booster's donor port for each band of operation. RSSI is expressed in negative dB units relative to 1 mW.

(ii) Boosters with MSCL less than 40 dB, shall reduce the Noise output in (A) by $40 \text{ dB} - \text{MSCL}$, where MSCL is the minimum coupling loss in dB between the wireless device and booster's server port. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

(2) Maximum downlink noise power shall not exceed $-102.5 \text{ dBm/MHz} + 20 \text{ Log}_{10}(\text{Frequency})$, where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

(B) *Bidirectional Capability.* Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (*i.e.*, uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering used must provide uplink filter attenuation not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

(C) *Booster Gain Limits.* The gain of the frequency selective consumer booster shall meet the limits below.

(1) The uplink and downlink gain in dB of a frequency selective consumer booster referenced to its input and output ports shall not exceed $BSCL - 28 \text{ dB} - (40 \text{ dB} - MSCL)$.

Where BSCL is the coupling loss between the booster's donor port and the base station's input port, and MSCL is the minimum coupling loss in dB between the wireless device and the booster's server port. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

In order of preference, BSCL is determined as follows: (1) determine path loss between the base station and the booster; such measurement shall be based on measuring the received forward pilot/control channel power at the booster and reading the pilot/control channel transmit power from the base station as defined in the system information messages sent by the base station, (2) estimate BSCL by assuming that the base station is transmitting at a level of +25 dBm per channel (assume a small, lightly loaded cell) and measuring the total received signal power level within the channel in dBm (RPCH) received at the booster input port. BSCL is then calculated as $25 - RPCH$, or (3) assume that the BSCL is 70 dB without performing any measurement.

(2) The uplink and downlink maximum gain of a frequency selective consumer booster referenced to its input and output ports shall not exceed $19.5 \text{ dB} + 20 \text{ Log}(\text{Frequency})$, or 100 dB for systems having automatic gain adjustment based on isolation measurements between booster donor and server antennas.

Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

(D) *Power Limits.* A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Downlink power shall not exceed 0.05 watt (17 dBm) composite and 10 dBm per channel conducted and EIRP for each band of operation. Compliance with power limits will use instrumentation calibrated in terms of RMS equivalent voltage.

(E) *Out of Band Gain Limits.* A frequency selective booster shall have the following minimum attenuation referenced to the gain in the center of the pass band of the booster:

(1) -20 dB at the band edge, where band edge is the end of the licensee's allocated spectrum,

(2) -30 dB at 1 MHz offset from band edge,

(3) -40 dB at 5 MHz offset from band edge.

A frequency selective booster having maximum gain greater than 80 dB (referenced to the center of the pass band) shall limit the out of band gain to 60 dB at 0.2 MHz offset from the band edge, and 45 dB at 1 MHz offset from the band edge, where band edge is the end of the licensee's allocated spectrum.

(F) *Out of Band Emission Limits.* Booster out of band emissions (OOBE) shall meet the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

(G) *Intermodulation Limits.* The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm for the supported bands of operation. Compliance with intermodulation limits will use boosters operating at maximum gain and maximum rated output power, with two continuous wave (CW) input signals spaced 600 kHz apart and centered in the pass band of the booster, and with a 3 kHz measurement bandwidth.

(H) *Booster Antenna Kitting.* All consumer boosters must be sold with user manuals specifying all antennas and cables that meet the requirements of this section. Mobile consumer boosters must be sold together with antennas, cables, and/or coupling devices that meet the requirements of this section. The grantee is required to submit a technical document with the application for FCC equipment authorization that shows compliance of all antennas, cables, and/or coupling devices with the requirements of this section, including any antenna or equipment upgrade options that may be available at initial purchase or as a subsequent upgrade.

(I) *Transmit Power Off Mode.* When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power OFF Mode." In this mode of operation, the uplink and downlink noise power shall not exceed -70 dBm/MHz and uplink gain shall not exceed the lesser of 23 dB or MSCL.

(J) *Uplink Inactivity.* When a consumer booster is not serving an active device connection after 5 seconds the uplink noise power shall not exceed -70 dBm/MHz.

(ii) *Interference Safeguards.* Consumer boosters must include features to prevent harmful interference including, at a minimum, those enumerated in this subsection. These features may not be deactivated by the operator and must be enabled and operating at all times the signal booster is in use.

(A) *Anti-Oscillation.* Consumer boosters must be able to detect and mitigate (*i.e.*, by automatic gain reduction or shut down), any oscillations in uplink and downlink bands. Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.

(B) *Gain Control.* Consumer boosters must have automatic limiting control to protect against excessive input signals that would cause output power and emissions in excess of that authorized by the Commission.

(C) *Interference Avoidance for Wireless Subsystems.* Consumer boosters using unlicensed (Part 15) or other frequency bands for wireless transmissions between donor and server subsystems for its internal operations must employ interference avoidance methods to prevent interference transmitted into authorized CMRS spectrum bands.

(10) *Equivalent Protections.* Consumer Signal Boosters which do not meet the technical specifications enumerated in paragraphs (e)(1) – (e)(9) above may also meet the Network Protection Standard if they provide equivalent protections as determined by the Wireless Telecommunications Bureau.

(f) *Signal booster labeling requirements.* Signal booster manufacturers, distributors, and retailers must ensure that all signal boosters marketed on or after March 1, 2014 include the following advisories (1) in on-line, point-of-sale marketing materials, (2) in any print or on-line owner’s manual and installation instructions, (3) on the outside packaging of the device, and (4) on a label affixed to the device:

For Consumer Signal Boosters:

This is a CONSUMER device.

BEFORE USE, you MUST REGISTER THIS DEVICE with your wireless provider and have your provider’s consent. Most wireless providers consent to the use of signal boosters. Some providers may not consent to the use of this device on their network. If you are unsure, contact your provider.

You MUST operate this device with approved antennas and cables as specified by the manufacturer. Antennas MUST be installed at least 20 cm (8 inches) from any person.

You MUST cease operating this device immediately if requested by the FCC or a licensed wireless service provider.

WARNING. E911 location information may not be provided or may be inaccurate for calls served by using this device.

For Industrial Signal Boosters:

WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

A Consumer Signal Booster label may contain an acknowledgement that particular provider(s) have given their consent for all consumers to use the device. Such an acknowledgement would be inserted prior to, “Some wireless providers may not consent to the use of this device on their network. If you are unsure, contact your provider.” The remaining language of the advisory shall remain the same.

(g) *Marketing and sale of signal boosters.* Except as provided in § 2.803 of this chapter, no person, manufacturer, distributor, or retailer may market, distribute or offer for sale or lease any Consumer Signal Booster that does not comply with the requirements of this section to any person in the United States or to any person intending to operate the Consumer Signal Booster within the United States at any time on or after March 1, 2014. Consumer Signal Boosters may only be sold to members of the general public for their personal use.

(h) *Registration.* Each licensee consenting to the operation of a Consumer Signal Booster must establish

a free registration mechanism for subscribers and register all Consumer Signal Boosters to which it consents. A licensee must establish a registration mechanism by the later of March 1, 2014 or within 90 days of consenting to the operation of a Consumer Signal Booster. At a minimum, a licensee must collect (1) the name of the Consumer Signal Booster owner and/or operator, if different individuals; (2) the make, model, and serial number of the device; (3) the location of the device; and (4) the date of initial operation. Licensee consent is voluntary and may be withdrawn at the licensee's discretion.

PART 22—PUBLIC MOBILE SERVICES

10. The authority citation for Part 22 is amended to read as follows:

AUTHORITY: 47 U.S.C. 154, 222, 301, 302, 303, 309, and 332.

11. Add new § 22.9 to read as follows:

§ 22.9 Operation of certificated signal boosters.

Individuals and non-individuals may operate certificated Consumer Signal Boosters on frequencies regulated under this part provided that such operation complies with all applicable rules under this part and section 20.21 of this chapter. Failure to comply with all applicable rules voids the authority to operate a signal booster.

PART 24—PERSONAL COMMUNICATION SERVICES

12. The authority citation for Part 24 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 301, 302, 303, 309, and 332.

13. Add new § 24.9 to read as follows:

§ 24.9 Operation of certificated signal boosters.

Individuals and non-individuals may operate certificated Consumer Signal Boosters on frequencies regulated under this part provided that such operation complies with all applicable rules under this part and section 20.21 of this chapter. Failure to comply with all applicable rules voids the authority to operate a signal booster.

PART 27—MISCELLANEOUS WIRELESS COMMUNICATION SERVICES

14. The authority citation for Part 27 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 301, 302, 303, 307, 309, 332, 336, and 337 unless otherwise noted.

15. Add new § 27.9 to read as follows:

§ 27.9 Operation of certificated signal boosters.

Individuals and non-individuals may operate certificated Consumer Signal Boosters on frequencies regulated under this part provided that such operation complies with all applicable rules under this part and section 20.21 of this chapter. Failure to comply with all applicable rules voids the authority to operate a signal booster.

PART 90 – PRIVATE LAND MOBILE RADIO SERVICES

16. The authority citation for Part 90 is amended to read as follows:

AUTHORITY: Sections 4(i), 11, 301, 303(g), 303(r), and 332(c)(7) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 161, 301, 303(g), 303(r), 332(c)(7).

17. Section 90.7 is amended by revising the definition for “Signal Boosters” as follows:

§ 90.7 Definitions.

* * * *

Signal amplifier. A device that amplifies radio frequency signals and is connected to a mobile radio transceiver, portable or handset, typically to the antenna connector. Note that a signal amplifier is not the same thing as a signal booster.

Signal booster. See § 90.219.

* * * * *

18. Section 90.203 is revised to add a new paragraph (q), to read as follows:

§ 90.203 Certification required.

* * * * *

(q) Certification requirements for signal boosters are set forth in § 90.219.

19. Section 90.219 is revised in its entirety, to read as follows:

§ 90.219 Use of signal boosters.

This section contains technical and operational rules allowing the use of signal boosters in the Private Land Mobile Radio Services (PLMRS). Rules for signal booster operation in the Commercial Mobile Radio Services under Part 90 are found in § 20.21 of this chapter.

(a) *Definitions.* The definitions in this paragraph apply only to the rules in this section.

Distributed Antenna System (DAS). A network of spatially separated antenna nodes connected to a common source via a transport medium that provides wireless service within a geographic area or structure.

Signal booster. A device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas and other locations where these signals would otherwise be too weak for reliable communications. Signal booster systems may contain both Class A and Class B signal boosters as components.

Class A signal booster. A signal booster designed to retransmit signals on one or more specific channels. A signal booster is deemed to be a Class A signal booster if none of its passbands exceed 75 kHz.

Class B signal booster. A signal booster designed to retransmit any signals within a wide frequency band. A signal booster is deemed to be a Class B signal booster if it has a passband that exceeds 75 kHz.

Deploy a signal booster. Install and/or initially adjust a signal booster.

Operate a signal booster. Maintain operational control over, and responsibility for the proper functioning

of, a signal booster.

Coverage area of a PLMRS station. All locations within the normal reliable operating range (service contour) of a PLMRS station.

(b) *Authority to operate.* PLMRS licensees for stations operating on assigned channels higher than 150 MHz may operate signal boosters, limited to the service band for which they are authorized, as needed anywhere within the PLMRS stations' service contour, but may not extend the stations' service contour.

(1) PLMRS licensees may also consent to operation of signal boosters by non-licensees (such as a building owner or a signal booster installation contractor) within their service contour and across their applicable frequencies, but must maintain a reasonable level of control over these operations in order to resolve interference problems.

(i) Non-licensees seeking to operate signal boosters must obtain the express consent of the licensee(s) of the frequencies for which the device or system is intended to amplify. The consent must be maintained in a recordable format that can be presented to an FCC representative or other relevant licensee investigating interference.

(ii) Consent is not required from third party (unintended) licensees whose signals are incidentally retransmitted. However, signal booster operation is on a non-interference basis and operations may be required to cease or alter the operating parameters due to a request from an FCC representative or a licensee's request to resolve interference.

(c) *Licensee responsibility; interference.* PLMRS licensees that operate signal boosters are responsible for their proper operation, and are responsible for correcting any harmful interference that signal booster operation may cause to other licensed communications services. Normal co-channel transmissions are not considered to be harmful interference. Licensees are required to resolve interference problems pursuant to § 90.173(b). Licensees shall act in good faith regarding the operation of signal boosters and in the resolution of interference due to signal booster operation. Licensees who are unable to determine the location or cause of signal booster interference may seek assistance from the FCC to resolve such problems.

(d) *Deployment rules.* Deployment of signal boosters must be carried out in accordance with the rules in this paragraph.

(1) Signal boosters may be used to improve coverage in weak signal areas only.

(2) Signal boosters must not be used to extend PLMRS stations' normal operating range.

(3) Signal boosters must be deployed such that the radiated power of the each retransmitted channel, on the forward link and on the reverse link, does not exceed 5 Watts effective radiated power (ERP).

(4) Class B signal boosters may be deployed only at fixed locations; mobile operation of Class B signal boosters is prohibited after November 1, 2014.

(5) Class B signal booster installations must be registered in the FCC signal booster database that can be accessed at the following URL: www.fcc.gov/signal-boosters/registration.

(6) Good engineering practice must be used in regard to the radiation of intermodulation products and noise, such that interference to licensed communications systems is avoided. In the event of harmful interference caused by any given deployment, the FCC may require additional attenuation or filtering of the emissions and/or noise from signal boosters or signal booster systems, as necessary to eliminate the interference.

(i) In general, the ERP of intermodulation products should not exceed -30 dBm in 10 kHz measurement bandwidth.

(ii) In general, the ERP of noise within the passband should not exceed -43 dBm in 10 kHz measurement bandwidth.

(iii) In general, the ERP of noise on spectrum more than 1 MHz outside of the passband should not exceed -70 dBm in a 10 kHz measurement bandwidth.

(7) Signal booster passbands are limited to the service band or bands for which the operator is authorized. In general, signal boosters should utilize the minimum passband that is sufficient to accomplish the purpose. Except for distributed antenna systems (DAS) installed in buildings, the passband of a Class B booster should not encompass both commercial services (such as ESMR and Cellular Radiotelephone) and Part 90 Land Mobile and Public Safety Services.

(e) *Device Specifications.* In addition to the general rules for equipment certification in § 90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

(2) The noise figure of a signal booster must not exceed 9 dB in either direction.

(3) Spurious emissions from a signal booster must not exceed -13 dBm within any 100 kHz measurement bandwidth.

(4) A signal booster must be designed such that all signals that it retransmits meet the following requirements:

(i) The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, *provided that* the retransmitted signals meet the requirements of § 90.213.

(ii) There is no change in the occupied bandwidth of the retransmitted signals.

(iii) The retransmitted signals continue to meet the unwanted emissions limits of § 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

(5) On or after March 1, 2014, a signal booster must be labeled to indicate whether it is a Class A or Class B device, and the label must include the following advisory (1) in on-line point-of-sale marketing materials, (2) in any print or on-line owner's manual and installation instructions, (3) on the outside packaging of the device, and (4) on a label affixed to the device:

“WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.”

APPENDIX B

Signal Boosters Terminology and Concepts

1. *Signal Booster Basics.* Signal boosters are signal amplifiers that can be deployed in many different configurations to improve the wireless connection between a mobile device and the wireless network. Signal boosters are often used to amplify and distribute wireless signals to areas with poor signal coverage and can expand the area of reliable service to unserved or weak signal areas, including garages, underground transportation systems, and large buildings. Two key variables affect the quality of a wireless connection. The first variable is distance to the nearest cell site or base station. In general, the farther away a cell phone is moved from a cell site, the weaker the signal. The second variable is any physical obstacle between the cell phone and the base station. Natural and man-made obstacles, including terrain and buildings, can block the radio frequency waves, which form the communications link between a cell phone and a base station. In addition, metal, glass, and foliage, while not entirely blocking a signal, can attenuate or reduce the signal.¹ Poor quality signals can lead to dropped calls, slower data speeds, and depleted battery life.

2. *Fixed Signal Boosters.* Signal boosters can be used in a variety of applications, both fixed and mobile. Fixed signal boosters facilitate the use of mobile devices inside homes, buildings, and other structures, such as sports arenas, by amplifying or distributing signals within the structure that would otherwise be too weak to achieve communications. A basic fixed signal booster can serve a single room in a house, while an enhanced booster can serve a multistory building. A typical fixed signal booster configuration includes an outside antenna installed on a roof or side of a building.² The outside antenna is connected via coaxial cable to an interior amplifier, which either has a built-in antenna or is connected to one or more interior panel antennas that permit communication with mobile devices in the structure.

3. A distributed antenna system (DAS) is a system of spatially separated antennas connected via cables (*i.e.*, coaxial or fiber optic cable) to a signal source, such as a base station or an external antenna capable of communicating with a base station wirelessly. DAS are used to distribute wireless signals through large structures such as skyscrapers, hospitals, hotels, arenas and tunnels where the signal coverage may be lacking or to increase the capacity of the wireless system by achieving channel reuse on a smaller scale. Some DAS configurations may be considered signal boosters when the network of internal antennas achieves communication through the use of an amplifier that is connected to an external antenna that communicates with a base station wirelessly.

4. *Mobile Signal Boosters.* Typically, mobile signal boosters transmit and receive wireless signals to and from a cell phone operated inside a vehicle (*e.g.*, car, boat or RV).³ A typical mobile signal booster installation consists of an outside antenna attached to the roof of a vehicle, which is connected using coaxial cable to an amplifier and an inside antenna. Depending on the manufacturer and model, a cell phone can connect to the mobile signal booster using an antenna adapter that connects directly to the wireless device, a docking “cradle,” or wirelessly.

5. *Problems Encountered with Signal Boosters.* Poorly designed, improperly installed or malfunctioning signal boosters can cause interference to both commercial and public safety wireless

¹ *Ex Parte* Letter from Russell D. Lukas to Marlene H. Dortch, Secretary, Federal Communications Commission (May 12, 2010), Attachment *In-Car Cellular Signal Boosters, White Paper Prepared for: Wilson Electronics* at 2.

² In consumer applications, the “outside” antenna is often mounted inside a window.

³ We recognize that some consumers may choose to use a mobile booster indoors such as in a home or office.

networks. Signal boosters can produce “noise,”⁴ which has the potential to interfere with wireless networks. This “noise” can take the form of adjacent channel interference, oscillation, or base station receiver overload, which are explained below.

6. *Adjacent Channel Noise (The “Near-Far” Problem)*. One “noise” problem that can be created by signal boosters occurs when a subscriber is far from the provider’s base station that provides its service, but near a different wireless provider’s base station that is using an adjacent frequency block. Many signal boosters are wideband and will amplify any signal within the frequency range or “passband”⁵ of the signal booster filter, which could include all of the licensees providing service in that area. Therefore, while the wideband booster would benefit the subscriber installing it, because it will amplify the subscriber’s weak signal to a level necessary to achieve communication, it could also harm an adjacent licensee because the booster is amplifying signals or creating noise on the adjacent spectrum block where it is not needed or desired. This scenario is more problematic for wideband mobile signal boosters because a signal booster could be operating with maximum amplification to assist provider “A’s” subscriber with a weak signal while driving by provider “B’s” base station, generating sufficient noise for provider B’s base station to drop communications with its subscribers that may be operating at the fringes of provider B’s base station’s coverage area.⁶ Higher power signal booster operation can thus create the potential for adjacent-channel interference to other wireless providers’ base stations that may be nearby if the device is not properly installed or not operating with appropriate safeguards.

7. *Oscillation*. Another type of “noise” signal boosters can create is oscillation (feedback). Oscillation occurs when the signal from the internal antenna of a signal booster reaches the external antenna of the device and generates uncontrollable high level signals.⁷ Oscillation can interfere with both the signal from the base station to the wireless device as well as the signal from the wireless device to the base station. As a result, the licensee as well as others operating within the passband frequencies of the signal booster may experience interference. To avoid oscillation, antennas require attenuation (isolation), *i.e.*, vertical and horizontal spacing between the antennas.⁸

8. *Base Station Receiver Overload*. Most wireless networks employ dynamic power control to maximize network capacity. Power control operates by precisely adjusting the power of the base stations and handsets within the network to achieve the optimal signal level for reliable communications. Power control minimizes interference, maximizes handset battery life, and increases the life span of base

⁴ In radio communications, “noise” refers to any unwanted electro-magnetic energy or signal that degrades or obstructs the desired signals.

⁵ The passband is the frequency range which the signal booster is designed to amplify.

⁶ Digital modulation techniques, especially Code Division Multiple Access (CDMA) rely upon power control of the subscriber units for efficient use. The network will monitor the received power of the subscriber units and send command signals to increase or lower transmitter power to ensure that all subscriber signals arrive at the base stations with similar power levels. If one subscriber’s signal is too strong, it reduces the capacity of the system and may result in the base station dropping calls from subscribers that are further away from the base station; this is called cell shrinkage.

⁷ This is similar to the noise created when a microphone is placed too close to a speaker.

⁸ AT&T explains that its Global System for Mobile Communications (GSM) network interprets an oscillating signal booster signal as external noise and as a result, the network electronically instructs all cell phones being served by that sector to increase power in an effort to overcome the perceived noise. AT&T further explains that this action effectively constricts the coverage of the affected cell site section, which causes cell phones to drop calls and lose coverage. In addition, AT&T notes that this action reduces battery life of the signal booster user’s own phone as well as the cell phones of other subscribers whose phones automatically increase power to overcome the interference caused by the signal booster. AT&T PN Comments at 26-27.

transceiver station power amplifiers.⁹ Typically, signal boosters are not dynamically controlled by the network and thus may continue to amplify a handset's signal even when it is not needed, which may overload the base station. This can apply both to mobile signal boosters that can travel close to a different provider's base stations, as well as fixed signal boosters that are not coordinated with the providers that the booster is capable of affecting. In addition, signal boosters create unique issues for Code Division Multiple Access (CDMA) networks. In a CDMA system, to maximize network capacity, wireless providers use power control to ensure that the received power of all subscribers at the base station is at the minimum level needed for reliable communications. The presence of a signal booster within the power control loop of a CDMA system can increase the received power of a subscriber at the base station, which would affect the power control operation of all wireless devices being served by that base station. As a result, the base station receiver may not be able to operate as efficiently as designed, could drop some calls, or could be overloaded,¹⁰ adversely affecting the coverage and capacity of the serving base station as a whole.

⁹ A base transceiver station power amplifier amplifies signals at the base station before they are transmitted through the antenna.

¹⁰ Overload occurs when a receiver is unable to reject excessive energy outside its intended frequency band of operation.

APPENDIX C

Final Regulatory Flexibility Act Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),¹ the Commission incorporated an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies and rules proposed in the *Notice of Proposed Rulemaking (NPRM)*. No comments were filed addressing the IRFA. Because we amend the rules in this *Report and Order*, we have included this Final Regulatory Flexibility Analysis (FRFA). This present FRFA conforms to the RFA.²

A. Need for, and Objectives of, the Report and Order

2. In the *Report and Order* the Commission adopts rules and policies that will enhance wireless coverage for consumers, particularly in rural and underserved areas, by broadening the availability of signal boosters while ensuring that boosters do not adversely affect wireless networks. Mobile voice and mobile broadband services are increasingly important to consumers and to our nation's economy. While nearly the entire U.S. population is served by one or more wireless providers, coverage gaps that exist within and at the edge of service areas can lead to dropped calls, reduced data speeds, or complete loss of service. Robust signal boosters can bridge these gaps and extend coverage at the fringe of service areas. Signal boosters are particularly useful in rural and difficult-to-serve indoor environments, such as hospitals. Signal boosters can also improve public safety communications by enabling the public to connect to 911 in areas where wireless coverage is deficient or where an adequate communications signal is blocked or shielded. In short, because signal boosters represent a cost-effective means of improving our nation's wireless infrastructure, the rules the Commission adopts today should lead to more robust service for many Americans at home, at work, and on the road.

B. Legal Basis

3. The actions are authorized pursuant to sections 1, 4(i), 4(j), 301, 302, 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 301, 302, 303(f), and 303(r).

C. Description and Estimate of the Number of Small Entities To Which the Rules Will Apply

4. The RFA directs agencies to provide a description of, and, where feasible, an estimate of the number of small entities that may be affected by the rules adopted, herein.³ The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."⁴ In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.⁵ A "small business

¹ See 5 U.S.C. § 603. The RFA, see 5 U.S.C. § 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996, (SBREFA) Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

² See 5 U.S.C. § 604.

³ 5 U.S.C. § 603(b)(3).

⁴ 5 U.S.C. § 601(6).

⁵ 5 U.S.C. § 601(3) (incorporating by reference the definition of "small-business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an (continued....)"

concern” is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.⁶ Below, we describe and estimate the number of small entity licensees that may be affected by the adopted rules.

5. *Small Businesses, Small Organizations, and Small Governmental Jurisdictions.* As of 2009, small businesses represented 99.9% of the 27.5 million businesses in the United States, according to the SBA.⁷ Additionally, a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”⁸ Nationwide, as of 2007, there were approximately 1,621,315 small organizations.⁹ Finally, the term “small governmental jurisdiction” is defined generally as “governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”¹⁰ Census Bureau data for 2007 indicate that there were 89,527 governmental jurisdictions in the United States.¹¹ We estimate that, of this total, as many as 88,761 entities may qualify as “small governmental jurisdictions.”¹² Thus, we estimate that most governmental jurisdictions are small.

6. *Wireless Telecommunications Carriers (except satellite).* This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular phone services, paging services, wireless Internet access, and wireless video services.¹³ The appropriate size standard under SBA rules is for the category Wired Telecommunications Carriers. Under that size standard, such a business is small if it has 1,500 or fewer employees.¹⁴ Census Bureau data for 2007, which now supersede data from the 2002 Census, show that
(Continued from previous page) _____
agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

⁶ 15 U.S.C. § 632.

⁷ See SBA, Office of Advocacy, “Frequently Asked Questions,” available at <http://web.sba.gov/faqs/faqindex.cfm?areaID=24> (last visited Dec. 11, 2012).

⁸ 5 U.S.C. § 601(4).

⁹ INDEPENDENT SECTOR, THE NEW NONPROFIT ALMANAC & DESK REFERENCE (2010).

¹⁰ 5 U.S.C. § 601(5).

¹¹ U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES: 2011, Table 427 (2007).

¹² The 2007 U.S. Census data for small governmental organizations are not presented based on the size of the population in each such organization. There were 89,476 local governmental organizations in 2007. If we assume that county, municipal, township, and school district organizations are more likely than larger governmental organizations to have populations of 50,000 or less, the total of these organizations is 52,095. If we make the same population assumption about special districts, specifically that they are likely to have a population of 50,000 or less, and also assume that special districts are different from county, municipal, township, and school districts, in 2007 there were 37,381 such special districts. Therefore, there are a total of 89,476 local government organizations. As a basis of estimating how many of these 89,476 local government organizations were small, in 2011, we note that there were a total of 715 cities and towns (incorporated places and minor civil divisions) with populations over 50,000. CITY AND TOWNS TOTALS: VINTAGE 2011 – U.S. Census Bureau, available at <http://www.census.gov/popest/data/cities/totals/2011/index.html>. If we subtract the 715 cities and towns that meet or exceed the 50,000 population threshold, we conclude that approximately 88,761 are small. U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES 2011, Tables 427, 426 (Data cited therein are from 2007).

¹³ <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517210&search=2007%20NAICS%20Search>

¹⁴ 13 C.F.R. § 121.201, NAICS code 517110.

there were 3,188 firms in this category that operated for the entire year. Of this total, 3,144 had employment of 999 or fewer, and 44 firms had employment of 1,000 employees or more. Thus under this category and the associated small business size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities that may be affected by our actions.¹⁵

7. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* The Census Bureau defines this category as follows: “This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment.”¹⁶ The SBA has developed a small business size standard for firms in this category, which is: all such firms having 750 or fewer employees.¹⁷ According to Census Bureau data for 2010, there were a total of 810 establishments in this category that operated for the entire year.¹⁸ Of this total, 787 had employment of fewer than 500, and an additional 23 had employment of 500 to 999.¹⁹ Thus, under this size standard, the majority of firms can be considered small.

D. Description of Projected Reporting, Recordkeeping, and other Compliance Requirements

8. In the *Report and Order*, the Commission amended Parts 1, 2, 20, 22, 24, 27, and 90 of its rules to adopt new technical, operational, and registration requirements for signal boosters. The new rules created two classes of signal boosters – Consumer and Industrial – with distinct regulatory requirements outlined below. *Consumer Signal Boosters* are designed to be used “out of the box” by individuals to improve their wireless coverage within a limited area such as a home, car, boat, or RV. *Industrial Signal Boosters* include a wide variety of devices that are designed for installation by licensees or professional installers. These devices are typically designed to serve multiple users simultaneously and cover larger areas such as stadiums, airports, office buildings, tunnels, and educational campuses.

9. Under the new rules, Consumer Signal Boosters will be authorized under provider licenses subject to certain requirements. Specifically, subscribers must: (1) obtain provider consent to operate the booster; (2) register the booster with their provider; (3) limit booster use to certain frequencies used for the provision of subscriber-based services; (4) use an appropriately labeled booster with manufacturer-specified antennas, cables, and/or coupling devices; (5) use a booster that meets the Network Protection Standard and is FCC certificated; (6) operate the booster on a secondary, non-

¹⁵ See http://factfinder.census.gov/servlet/IBQTable?_bm=y&-fds_name=EC0700A1&-geo_id=&-skip=600&-ds_name=EC0751SSSZ5&-lang=en

¹⁶ U.S. Census Bureau, 2007 NAICS Definitions, “334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing”; <http://www.census.gov/naics/2007/def/ND334220.HTM#N334220>.

¹⁷ 13 C.F.R. § 121.201, NAICS code 334220.

¹⁸ U.S. Census Bureau, American FactFinder, 2010 Economic Census, Industry Series, Industry Statistics by Employment Size, NAICS code 334220 (released June 26, 2012); <http://factfinder.census.gov>. The number of “establishments” is a less helpful indicator of small business prevalence in this context than would be the number of “firms” or “companies,” because the latter take into account the concept of common ownership or control. Any single physical location for an entity is an establishment, even though that location may be owned by a different establishment. Thus, the numbers given may reflect inflated numbers of businesses in this category, including the numbers of small businesses.

¹⁹ *Id.* Eighteen establishments had employment of 1,000 or more.

interference basis and shut it down if it causes harmful interference; and (7) not deactivate any booster features that are designed to mitigate harmful interference.

10. Wireless providers must create and maintain a registration mechanism to allow Consumer Signal Booster operators to register their devices. In addition, on March 1, 2015 and March 1, 2016, the nationwide wireless providers must make public certain information regarding their consent for their subscribers to use Consumer Signal Boosters. Specifically, these wireless providers must publicly indicate their status regarding consent for each Consumer Signal Booster which has received FCC certification.

11. Consumer Signal Boosters must meet the Network Protection Standard with the following requirements: (1) comply with existing technical parameters (*e.g.*, power and unwanted emissions) for the applicable spectrum band; (2) automatically self-monitor certain operations and shut down if not in compliance with our new technical rules; (3) automatically detect and mitigate oscillations in the uplink and downlink bands; (4) power down or shut down automatically when a device is not needed, such as when the device approaches the base station with which it is communicating; (5) be designed so that these features cannot be easily defeated; and (6) incorporate interference avoidance for wireless subsystems. In addition, Consumer Signal Boosters must comply with current RF exposure requirements. Consumers may continue to use existing signal boosters provided they (1) have the consent of their serving provider; and (2) register the booster with that provider.

12. The new rules also clarify that Industrial Signal Boosters require an FCC license or licensee consent to operate, must be appropriately labeled, and must comply with our current RF exposure requirements. Regarding Part 90 Private Land Mobile Radio (PLMR), non-consumer signal boosters operated by licensees, the Commission revised its technical and operational requirements aimed at preventing interference. In addition, Part 90 Class B signal booster operators must register their devices with the Commission.

13. The Commission established a two-step transition process for equipment certification: (1) on the release date of this *Report and Order*, the Commission will no longer accept applications for equipment certification of Consumer or Industrial Signal Boosters that do not comply with our new rules and will cease certification of devices that do not comply with our new rules; and (2) as of March 1, 2014, all Consumer and Industrial Signal Boosters sold and marketed in the United States must meet the new requirements.

E. Steps taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

14. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.²⁰

15. With the exception of the Consumer Signal Booster consent reporting requirement, the projected reporting, recordkeeping, and other compliance requirements resulting from the *Report and Order* will apply to all entities in the same manner. The Commission believes that applying the same rules equally to all entities in this context promotes fairness. The Commission does not believe that the

²⁰ 5 U.S.C. § 604(a)(6).

costs and/or administrative burdens associated with the rules will unduly burden small entities. The revisions the Commission adopts should benefit small entities by giving them more information for resolving instances of interference should it occur. Thus, for example, a small business experiencing interference in Part 90 frequencies, which it suspects may be the result of a signal booster, may access the Commission's Part 90 Class B signal booster registration tool and research any nearby Class B operators in an effort to stop the interference.

16. Regarding the reporting of wireless providers' consent to Consumer Signal Booster, this requirement only applies to nationwide wireless providers. The Commission concluded that it was appropriate to monitor provider behavior with respect to signal boosters. Specifically, in the event the Commission observes that providers are refusing to give timely and reasonable consideration to signal booster consent requests, it could take appropriate action including measures such as vigorous investigation or revisiting the authorization mechanism for Consumer Signal Boosters. The Commission determined, however, that it would be able to obtain sufficient information in this regard while limiting the requirement to nationwide wireless providers. Thus, the Commission was able to minimize the impact of this requirement on small entities.

F. Federal Rules that May Duplicate, Overlap, or Conflict with the Rules

17. None.

G. Report to Congress

18. The Commission will send a copy of the *Report and Order*, including the FRFA, in a report to Congress pursuant to the Congressional Review Act.²¹ In addition, the Commission will send a copy the *Report and Order*, including FRFA, to the Chief Counsel for Advocacy of the Small Business Administration. A copy of this *Report and Order* and FRFA (or summaries thereof) will be published in the Federal Register.²²

²¹ See 5 U.S.C. § 801(a)(1)(A). The Congressional Review Act is contained in Title II, § 251, of the CWAAA, see Pub. L. No. 104-121, Title II, § 251, 110 Stat. 868.

²² See 5 U.S.C. § 604(b).

APPENDIX D**List of Commenters****Comments:**

Association for Information Communications Technology Professionals (ACUTA)
Association of Public-Safety Communications Officials-International, Inc. (APCO)
Bird Technologies Group (BTG)
Blooston Licensees
CellAntenna Corp.
Cellphone-Mate, Inc.
Cellular Specialties, Inc.
CellLynx, Inc. (CellLynx)
CommScope, Inc.
CTIA-The Wireless Association (CTIA)
DAS Forum
Femto Forum
GTECH Corporation
Howard Melamed (CellAntenna)
Jack Daniel
Metropolitan Washington Airports Authority (MWAA), the City of Cambridge, Massachusetts, the Maryland Counties of Anne Arundel and Montgomery, and the Virginia Counties of Arlington and Fairfax, together with the City of Ontario, California, (collectively “Public Safety Licensees”)
Motorola Solutions, Inc. (Motorola)
Nextivity Inc.
PCIA (The Wireless Infrastructure Association)
Powerful Signal
Public Knowledge and New America Foundation (PK and NAF)
Sherman K. Finer
Smart Booster
Telecommunications Industry Association (TIA)
The DAS Forum
The National Association of Manufacturers and MRFAC, Inc. (NAM and MRFAC)
T-Mobile USA, Inc.
TriPower Group
TruePosition, Inc.
USA Mobility, Inc.
Verizon Wireless
Wilson Electronics, Inc.
Wireless Communications Association International, Inc. (WCAI)
Wireless Extenders, Inc. (Wi-Ex)

Reply Comments:

Bird Technologies Group (BTG)
CellAntenna Corporation
Cellphone-Mate, Inc.
Cincinnati Bell Wireless LLC

CTIA-The Wireless Association (CTIA)
Metropolitan Washington Airports Authority (MWAA), the City of Cambridge,
Massachusetts, the Maryland Counties of Anne Arundel and Montgomery, and the
Virginia Counties of Arlington and Fairfax, together with the City of Ontario, California,
(collectively “Public Safety Licensees”)
National Emergency Number Association
National Public Safety Telecommunications Council
Public Knowledge and the New America Foundation (PK and NAF)
Smart Booster
Sprint Nextel Corporation
Telecommunications Industry Association (TIA)
The DAS Forum
T-Mobile USA, Inc.
United States Cellular Corporation
Wilson Electronics, Inc.
Wireless Extenders, Inc.

**STATEMENT OF
CHAIRMAN JULIUS GENACHOWSKI**

Re: *Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, WT Docket No. 10-4*

While nearly the entire U.S. population is served by one or more wireless providers, we have coverage gaps – “dead spots” – within and at the edge of service areas.

These can lead to dropped calls, reduced data speeds, or loss of service. This is part of a serious problem, as the percent of consumers who rely on mobile only is above one-third of all people.

Signal boosters do what their name implies – amplify signals between wireless devices and wireless networks.

They are a cost-effective means of expanding the reach of our nation's wireless infrastructure. Individual consumers with no technical expertise can install signal boosters in their homes or in their vehicles.

Signal boosters can significantly increase coverage in rural areas, as well as dense, urban environments, such as hospitals or office buildings, that can be hard to serve. We've already seen benefits that boosters can bring.

In New York City, the transit authority is using signal boosters to enhance coverage in the subway system. In North Dakota, emergency personnel use signal boosters to facilitate communications on search and rescue operations in areas of challenging terrain. In Arizona, single boosters are used to improve wireless service on the Navajo reservation. In small towns in southwestern Virginia, signal boosters increase signal strength by three times.

The promise of signal boosters is clear. Now it is critical that signal boosters not interfere with commercial, private, and public safety wireless networks, as they have in the past.

I am pleased that we have worked with all stakeholders to create a common sense, consensus-based technical solution to mitigate interference risks to wireless networks.

The clear rules of the road we adopt today will enhance wireless coverage and public safety communications for consumers, both rural and urban. They're a big part of our answer to dead spots.

These new technical rules will encourage further technological advances and promote a robust competitive market for signal boosters.

Carriers serving the vast majority of American consumers have consented to allowing signal boosters on their networks if those boosters met the new technical standards.

This blanket consent will provide millions of consumers easier access to boosters.

I am encouraged by this type of thoughtful problem solving across all sectors of industry on such an important consumer issue.

Thank you to my colleagues, and to the Wireless Telecommunications Bureau, Office of Engineering and Technology, the Public Safety Homeland Security Bureau, Enforcement Bureau, and Office of General Counsel for your excellent, creative work on this item.

**STATEMENT OF
COMMISSIONER ROBERT M. McDOWELL**

Re: *Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, WT Docket No. 10-4*

The consumer benefits of signal boosters are unquestioned. They are important components in the comprehensive private sector effort to maximize spectral efficiency. Boosters allow Americans in rural areas and those that live on the fringe of a provider's service area to receive stronger signal strength and improved wireless broadband coverage. They are also used to improve public safety communications and wireless services in buildings, tunnels and other areas where service can be unreliable. These benefits and improvements can be accomplished rapidly and affordably without commercial mobile radio service (CMRS) providers building additional infrastructure.

Although it is estimated that over two million consumer signal boosters are currently deployed, there were no rules regarding their operation until today. While the majority of boosters have been improving the consumer experience without incident, wireless service providers have experienced some instances of harmful interference from boosters interacting with their networks. And, as we all know, the primary objective of the FCC's wireless policy is to prevent harmful interference to spectrum licensees. For these reasons, I vote in support of this order which, among other things, sets forth rules for the authorized operation of consumer signal boosters and requires that consumer and industrial boosters are clearly labeled. Today's action should help American consumers benefit from boosters, while ensuring that their neighbors continue to enjoy reliable service and that wireless service providers do not experience degradation to their networks.

This proceeding has been far from simple or easy. Since 2007, when CTIA filed a petition for declaratory ruling regarding the use of boosters in the CMRS bands, the Commission has analyzed the sharp debate regarding the operation of consumer signal boosters. I would like to acknowledge and thank the wireless industry and signal booster manufacturers for coming together with a joint proposal for technical standards that will result in affordable and reliable consumer signal boosters that are unlikely to cause interference. Private sector solutions are always preferable over government mandates, which is the key reason why I am supporting today's action.

Although the parties were able to reach consensus over technical standards, the Commission was left to resolve some remaining issues. A debate has ensued regarding carrier consent to signal boosters, registration and enforcement mechanisms, and the timeframe for implementing the new standards. In creating a framework for authorized consumer signal booster use, this order tries to weigh the costs and benefits to the wireless industry, signal booster manufacturers, and consumers. For instance, in adopting a similar licensing model to consumer handsets that operate on wireless networks, signal booster authorization will require provider consent and consumer device registration. Such requirements may be considered to be burdens by some. The largest wireless providers, however, have indicated that they will consent to the use of FCC-certified signal boosters meeting the new technical standard on their networks. Not only will such consent and registration requirements assist providers in preventing harmful interference, but they also ensure that wireless providers remain in control of their networks as required by the Communications Act.¹ I hope that we achieved the correct balance. The Commission, however, has committed to review the technical standard, registration and enforcement rules after two years to see if they should be modified or if there is room for improvement.

¹ 47 U.S.C. § 310(d).

Finally, I thank the Chairman for incorporating edits, my fellow Commissioners for engaging collegially on this matter, and the Commission staff from multiple Bureaus and Offices who worked on the order. I also would like to recognize the Mobility Division for all of your efforts in facilitating the industry consensus on technical rules and getting the proceeding to the point where we will be implementing rules, which a few years ago seemed to be unlikely. Thank you.

STATEMENT OF
COMMISSIONER MIGNON L. CLYBURN

Re: *Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, WT Docket No. 10-4*

Most of us have experienced an occasional dropped call or slower than normal mobile broadband data speeds. But for millions, service interruptions or delays are more than rare, trivial annoyances. These American consumers, including businesses, have found it necessary to purchase wireless signal boosters in order to bridge gaps in communications service.

Robust, quality, signal boosters have been properly narrowing service gaps without adverse consequences to wireless networks for many years. Unfortunately, there have been instances, when technically deficient, or improperly-installed signal boosters, have caused harmful interference to commercial and public safety wireless networks. In some cases, wireless companies have been forced to spend significant time locating and eliminating booster related interference.

Balancing the interests of consumers, who need signal boosters, with the interests of wireless carriers responsible for protecting the technical integrity of their networks has been difficult. Some of the engineering and other technical issues have been challenging, and some parties took rather adversarial positions on legal and technical issues.

But, at the end of the day, a signal booster manufacturer and a licensed wireless service provider share the same goal – improving the ability of consumers to receive uninterrupted, quality service from a licensed, wireless network. I'm pleased that the two sides were able to work past their differences and arrive at a solution that will benefit millions of Americans, who clearly need signal enhancement.

Most of the procedural and technical rules we adopt for consumer signal boosters are based on a Consolidated Proposal, agreed to by several signal booster manufacturers, the four nationwide wireless service providers, and over 90 small, rural, wireless service providers. They are designed to facilitate the development of safe, economical signal boosters, reduce consumer confusion, and encourage innovation in the booster market.

Those, who have closely followed this proceeding, know that we began with a Notice for Proposed Rulemaking that preferred what is known as a license by rule approach. Consumer advocates continue to assert that this approach would provide greater clarity to consumers in that, going forward, they can purchase and use any booster that meets the new network protection standards. I am voting to approve this item because the Order contains strong language that we will reconsider the license by rule approach if wireless carriers are unreasonably withholding their blanket authorizations. I wish to thank the Chairman and my colleagues, for working cooperatively, to find common ground on this language.

We also adopt different, but sensible rules for Industrial Signal Boosters. These devices are typically designed, to serve multiple users simultaneously, and cover larger areas such as stadiums, airports, office buildings, and hospitals. They are high powered and may use a greater number of antennas, amplifiers, and other components. Given the characteristics of industrial boosters, this Order reasonably requires greater coordination by the installer with the wireless service provider.

I would like to especially thank Ruth Milkman, John Leibovitz, Maria Kirby, Roger Noel, Joyce Jones, Tom Derenge, Becky Schwartz, the other talented staff members in the Wireless Bureau, OET, the Public Safety Bureau, and Enforcement Bureau, OGC, and my colleagues, for their patience and persistence, in finding a mutually beneficial, workable solution

**STATEMENT OF
COMMISSIONER JESSICA ROSENWORCEL**

Re: *Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, WT Docket No. 10-4*

According to the Centers for Disease Control, 41 percent of children live in households served only by wireless phones. One in three adults relies exclusively on wireless service at home. When a call is made to the doctor, to the workplace, to a child's school, and to 911—they trust that the call will go through. And they generally do. That is because carriers are working hard to improve the wireless customer experience and expand the edges of their network coverage.

The reach of those networks, however, is not yet ubiquitous and the experience is not always perfect. How do we know? The Pew Research Center's Internet and American Life Project tells us that 72 percent of cell phone owners experience dropped calls at least occasionally. But we also know from our own experience. I know, for instance, which parts of my home get only a single bar on my phone, and which parts enjoy multiple bars. Getting a better signal is as simple as traversing from the kitchen to the living room. I would hazard to guess that there are others here who have had the same experience. And we live in a metropolitan area where coverage is generally excellent. Many rural consumers are not so lucky.

Those who live on the remote end of a network may lose their signal when they stroll indoors or drive to the edge of their farm. But if they spend hundreds of dollars each year for wireless service they should get full value for their hard-earned money. The best solution, by far, is encouraging carriers to continue to build out and upgrade their networks. But that takes time and capital. So if the question is what can be done right now, one answer is the Order on signal boosters that we adopt today.

Historically, signal boosters have helped consumers extend the coverage of networks inside buildings and to rural, underserved, and hard-to-serve areas. Signal boosters also have helped first responders maintain connections in their vehicles. Unfortunately, however, shoddy devices can create more problems than they solve by causing harmful interference disrupting service to nearby wireless customers and impeding the use of public safety networks. This is not acceptable.

So today we put in place strict technical standards. They are designed to create immediate opportunities for extending service through quality signal boosters while curbing use of those that cause network harm. This means consumers who buy devices meeting our standards will be able to enjoy better wireless access without disrupting the service of their neighbors or the communications needs of first responders. Wireless carriers will also benefit as boosters extend the reach of their networks and reduce the number of dropped calls due to weak signals.

This outcome is the byproduct of the cooperative work of carriers and booster manufacturers. We commend their efforts and thank them for their input. As a result, the Commission has been able to establish a process that obviates the need for a license by rule regime. But going forward this agency must monitor the system we put in place. We should be on the lookout for further opportunities to streamline and improve this process, especially if unanticipated problems with approval or harmful interference occur.

Today's decision is a team effort. So thank you to the Wireless Telecommunications Bureau, Office of Engineering and Technology, Public Safety and Homeland Security Bureau, and Enforcement Bureau for their work on this item. I also want to thank the Consumer and Governmental Affairs Bureau in anticipation of the work they will do as a result of this Order.

**STATEMENT OF
COMMISSIONER AJIT PAI**

Re: *Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters, WT Docket No. 10-4*

When the FCC fails to confront challenges in a timely manner, it just makes those problems more difficult to solve. This item illustrates that simple truth. In November 2007, wireless companies asked the Commission to address the use of signal boosters. Since then, consumers have purchased millions of boosters to improve wireless coverage, particularly in rural areas and indoor environments. But sometimes, these boosters also harmfully interfere with commercial and public safety networks.

At this point, it is too late for us to put the genie back in the bottle. Instead, we have to focus on ensuring that new boosters entering the market do not cause harmful interference and mitigating as best we can the problems caused by technically deficient boosters now in use.

Today's item is the product of compromise. So naturally, no stakeholder likes every aspect of these rules. But I commend those carriers and booster manufacturers who came to the negotiating table and hammered out the proposals that formed the basis of this morning's order.

Because the rules we adopt today represent a plausible path forward, I am voting to approve this item. Whether these rules ultimately work, however, will depend upon how they are implemented. As they say, the proof will be in the pudding. I therefore want to set forth my expectations for what will happen following today's vote.

First, the carrier-consent requirement should be implemented in a consumer-friendly manner. Some carriers have signaled that they will give blanket consent to all boosters that comply with our rules. Others may provide consent on a model-by-model basis. Either of these options should work well. On the other hand, I do not expect carriers to require customers purchasing boosters to submit consent requests that would be evaluated on an individualized basis. Such a process would be inefficient for carriers and unnecessarily burdensome for consumers.

Second, the Commission should keep close tabs on how well the registration mechanism works. Are most boosters that are sold actually being registered? Is the registration system collecting enough information to make it easier for both the Commission and carriers to resolve interference issues? These are just some of the questions that we will need to ask, and I am pleased that my colleagues agreed to the suggestion that I made along with Commissioner McDowell to review our registration requirements in 2016.

Third, the Commission should enforce these rules in a firm but fair manner. If booster manufacturers put technically deficient devices into the marketplace, we must act swiftly and impose tough penalties.

On the other hand, we cannot expect that every American who currently uses a booster will know that he must register that booster and obtain his carrier's consent. Indeed, I very much doubt that most individuals will learn about these requirements in the foreseeable future. For some reason unbeknownst to me, most Americans just don't watch FCC open meetings or read FCC orders.

I therefore appreciate my colleagues' willingness to incorporate my suggestion that the Enforcement Bureau provide consumers who fail to register or obtain consent for the use of a booster with a warning and an opportunity to shut down that booster before any forfeiture is imposed. This will help ensure that unsuspecting Americans will not be sanctioned as a result of our action today.

Finally, I would like to thank the staff of the Wireless Telecommunications Bureau for all of their hard work on this item in collaboration with staff from the Public Safety and Homeland Security Bureau, the Office of Engineering and Technology, the Office of General Counsel, and the Enforcement Bureau.

The good news is that today's order is a significant accomplishment for which all of you deserve great credit. The bad news is that today's order creates even more work for you, especially for the engineers at the FCC Lab in Columbia whom I had the privilege of visiting two weeks ago and who will soon be establishing new testing protocols and testing many boosters. I look forward to working with you in the months ahead.