

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

In the Matter of)
)
Wireless E911 Location Accuracy Requirements) PS Docket No. 07-114
)
)
)

THIRD FURTHER NOTICE OF PROPOSED RULEMAKING

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separate statements.

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I. INTRODUCTION AND EXECUTIVE SUMMARY

1. The wireless landscape has changed significantly since the Commission first adopted its wireless Enhanced 911 (E911) location accuracy rules in 1996, and even since the last significant revision of these rules in 2010. Consumers are increasingly replacing traditional landline telephony with wireless phones,¹ and a majority of wireless calls are now made indoors. This increase in wireless usage is reflected in how Americans call for help when they need it: today, the majority of 911 calls come from wireless phones. In light of these circumstances, it is increasingly important for Public Safety Answering Points (PSAPs) to have the ability to accurately identify the location of wireless 911 callers regardless of whether the caller is located indoors or outdoors.

2. We believe the time has come to propose specific measures in our E911 location accuracy rules to ensure accurate indoor location information. In this *Third Further Notice of Proposed Rulemaking (Third Further Notice)*,² we propose to revise our regulatory framework to require delivery of accurate location information to PSAPs for wireless 911 calls placed from indoors. Our proposal includes both near- and long-term components. In the near term, we propose to establish interim indoor accuracy metrics that will provide approximate location information sufficient to identify the building for most

¹ For purposes of this notice, we use the terms “mobile” and “wireless” interchangeably. These terms do not encompass, for example, cordless telephones such as those using the DECT standard or PBX handsets using Wi-Fi connectivity.

² We limit the scope of this proceeding and the applicability of the proposed requirements set forth in this *Third Further Notice* to CMRS providers (and in limited instances, to their E911 System Service Providers, as discussed below) subject to Section 20.18 of the Commission’s rules. See 47 C.F.R. §20.18(a) (setting forth scope of Section 20.18 of the Commission’s rules). We note, however, that we will continue to examine whether it is appropriate to establish indoor location requirements for other categories of services – including services by VoIP and over-the-top providers. In addition, as required by the Next Generation 9-1-1 Advancement Act of 2012, 47 U.S.C. § 1401 note, the Public Safety and Homeland Security Bureau has sought comment on the feasibility of providing precise location in connection with wireline 911 calls using multi-line telephone systems (MLTSs) serving office, university campus, and other environments. Public Safety and Homeland Security Bureau Seeks Comment on Multi-line Telephone Systems Pursuant to the Next Generation 911 Advancement Act of 2012, *Public Notice*, 27 FCC Rcd 5329 (PSHSB 2012).

indoor calls. We also propose to add a requirement for provision of vertical location (z-axis or elevation) information that would enable first responders to identify floor level for most calls from multi-story buildings. In the long term, we seek comment on how to develop more granular indoor location accuracy requirements, consistent with the evolving capabilities of indoor location technology and increased deployment of in-building communications infrastructure. These requirements would provide for delivery to PSAPs of in-building location information at the room or office suite level.

3. In particular, we seek comment on the following proposals, and potential alternatives to these proposals, with respect to indoor location accuracy:

- CMRS providers would be required to provide horizontal location (x- and y-axis) information within 50 meters of the caller for 67 percent of 911 calls placed from indoor environments within two years of the effective date of adoption of rules, and for 80 percent of indoor calls within five years.
- CMRS providers would be required to provide vertical location (z-axis) information within 3 meters of the caller for 67 percent of indoor 911 calls within three years of the adoption of rules, and for 80 percent of calls within five years.
- As is the case of our existing E911 location rules, CMRS providers would be required to meet these indoor requirements at either the county or PSAP geographic level.
- CMRS providers would demonstrate compliance with indoor location accuracy requirements through participation in an independently administered test bed program modeled on the indoor test bed administered by the Communications Security, Reliability, and Interoperability Council (CSRIC), but providers would have the option to demonstrate compliance through alternative means so long as they provide the same level of test result reliability.
- PSAPs would be entitled to seek Commission enforcement of these requirements within their jurisdictions, but only so long as they have implemented location bid/re-bid policies that are designed to obtain all 911 location information made available by CMRS providers pursuant to our rules.

4. In addition, we examine whether there are additional steps the Commission should take to strengthen our existing E911 location accuracy rules to ensure delivery of more timely, accurate, and actionable location information for all 911 calls. We also seek comment on whether we should revisit the timeframe established by the Commission in 2010 for replacing the current handset- and network-based accuracy requirements with a unitary requirement, in light of the rapid proliferation of Assisted Global Navigation Satellite Systems³ (A-GNSS) technology in wireless networks and the prospect of improved location technologies that will soon support 911 communication over LTE networks.

5. Specifically, we seek comment on whether to implement the following measures:

- Adopt a 30-second requirement for the maximum time period allowed for a CMRS provider to generate a location fix (“time to first fix”) in order for the 911 call to be counted towards compliance with location accuracy requirements.

³ Global (satellite) navigation systems describe satellite navigation systems with global coverage. Currently operational GNSS systems include the Global Positioning System (GPS) and GLONASS, and the Galileo satellite system is scheduled to become operational in 2014. See http://en.wikipedia.org/wiki/Satellite_navigation (last visited Feb. 3, 2014). Assisted GNSS systems use data from the cellular network to enable faster position determination, using one or more satellite constellations. See <http://www.insidegnss.com/node/769> (last visited Feb. 18, 2014). A-GPS refers to an assisted GNSS that only relies on the GPS satellite constellation; the term is sometimes used informally to refer to any assisted satellite navigation system. For our purposes here, we continue to refer to A-GPS in light of common usage and practice. However, references to A-GPS are intended to include multi-constellation GNSS systems and are not exclusive to the Global Positioning System.

- When measuring compliance with location accuracy requirements, allow CMRS providers to exclude short 911 calls (*e.g.*, calls lasting 10 seconds or less) that may not provide sufficient time to generate a location fix.
- Standardize the content and the process for delivery of confidence and uncertainty data that is generated by CMRS providers for each wireless 911 call and delivered to PSAPs on request.
- Require CMRS providers to inform PSAPs of the specific location technology or technologies used to generate location information for each 911 call.
- Accelerate the previously established timeframe for replacing the current handset- and network-based accuracy requirements with a unitary requirement.
- Require that CMRS providers periodically report E911 Phase II call tracking information, indicating what percentage of wireless 911 calls include Phase II location information.
- Establish a separate process by which PSAPs or state 911 administrators could raise complaints or concerns regarding the provision of E911 service.
- Require CMRS providers to conduct periodic compliance testing.

6. In setting forth these proposals, we emphasize that our ultimate objective is that all Americans using mobile phones – whether they are calling from urban or rural areas, from indoors or outdoors – have technology that is functionally capable of providing accurate location information so that they receive the support they need in times of an emergency. We seek comment on whether our proposals in this notice are the best way to achieve this objective, and we encourage industry, public safety entities, and other stakeholders to work collaboratively to develop alternative proposals for our consideration.

II. BACKGROUND

A. E911 Regulatory History

7. In 1996, the Commission first adopted rules to require CMRS providers to implement basic 911 and E911 services.⁴ The Commission divided its wireless E911 service requirements into two stages.⁵ The initial stage – Phase I – required CMRS providers to deliver, by April 1998, E911 service that includes the telephone number of the wireless 911 caller and the location of the cell site or base station that received the call.⁶ Phase II requires delivery, under a phased-in schedule now extending until January 2019,⁷ of E911 service that includes the latitude and longitude of the 911 call within specific accuracy and reliability parameters, depending on the location technology that the carriers have chosen: (1) for network-based technologies, within 100 meters for 67 percent of calls, and 300 meters for 90 percent of calls; (2) for handset-based technologies, within 50 meters for 67 percent of calls, and 150

⁴ See Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, RM-8143, *Report and Order and Further Notice of Proposed Rulemaking*, 11 FCC Rcd 18676, 18683 ¶ 10 (1996) (*First E911 Report and Order*). The basic 911 service requirement, which is not at issue in this proceeding, is the simple requirement of transmission of wireless 911 calls to the PSAP (or designated default answering point or appropriate local emergency authority) without respect to their call validation process, and without reference to location accuracy. 47 C.F.R. § 20.18(b).

⁵ These E911 obligations are triggered only upon request by a PSAP that is capable of receiving and utilizing the data and has implemented a mechanism for recovering its costs. 47 C.F.R. § 20.18(j).

⁶ See *First E911 Report and Order*, 11 FCC Rcd at 18708-18710. See also 47 C.F.R. § 20.18(d).

⁷ For network-based technologies, the requirement reaches 85 percent of counties or PSAP service areas by January 2019; for hand-set based technologies, the 90 percent requirement for placement of location within 150 meters by that same date extends on a per county or per PSAP basis, with a 15 percent exception based on heavy forestation. See 48 C.F.R. § 20.18(h).

meters for 90 percent of calls.⁸ Under the Commission's rules, CMRS providers must file with the Commission reports on their plans for implementing Phase II, describing their location technology, and any changes thereto. While these reports must also describe the provider's intended conformance verification procedure, they do not require the provider to file the results of its conformance verification.⁹

8. The Commission's E911 Phase II requirements do not distinguish between indoor and outdoor 911 calls. In 2000, the Office of Engineering and Technology (OET) published Bulletin No. 71, providing testing guidelines for wireless licensees to comply with the location accuracy requirements set by the Commission.¹⁰ Later that same year, the Commission noted that the guidelines "express[ed] a preference for basing testing on locations from which 911 calls actually are placed."¹¹ Further, the Commission construed the OET guidelines as confirming that, for testing accuracy performance, carriers could exclude areas "where wireless calls cannot be completed,"¹² such as inside high-rise buildings and parking garages.¹³ The Commission later clarified that its Phase II requirements apply to outdoor measurements only.¹⁴

9. As more and more wireless calls were successfully placed from within buildings, the Commission examined new approaches and technological advances for improving location accuracy of wireless 911 calls from difficult environments, including indoor locations.¹⁵ In 2010, in the *E911*

⁸ 47 C.F.R. § 20.18(h)(1)(i), (ii) (applying to network-based technologies); 47 C.F.R. § 20.18(h)(2)(i), (ii) (applying to handset-based technologies). See Wireless E911 Location Accuracy Requirements, PS Docket No. 07-114, *Second Report and Order*, 25 FCC Rcd 18909, 18947-48 (2010) (*E911 Location Accuracy Second Report and Order*). Network-based location technologies use "hardware and/or software in the CMRS network and/or another fixed infrastructure" and do "not require the use of special location-determining hardware and/or software in the caller's portable or mobile phone." 47 C.F.R. § 20.3. Handset-based technologies use "special location-determining hardware and/or software in a portable or mobile phone" and "may also employ additional location-determining hardware and/or software in the CMRS network and/or another fixed infrastructure." 47 C.F.R. § 20.3.

⁹ See 48 C.F.R. § 20.18(i).

¹⁰ OET Bulletin No. 71, Guidelines for Testing and Verifying the Accuracy of Wireless E911 Location Systems (April 12, 2000), available at http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet71/oet71.pdf (last visited Feb. 3, 2014) (OET Bulletin No. 71). Rather than establishing mandatory procedures, OET Bulletin No. 71 states that compliance with the guidelines would establish "a strong presumption that appropriate means have been applied to ensure that an ALI system complies with the Commission's Rules." *Id.* at 2.

¹¹ Revision of the Commission's Rules To Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, *Fourth Memorandum Opinion and Order*, 15 FCC Rcd 17442, 17451 ¶ 22 (2000) (*Fourth Memorandum Opinion and Order*) (citing OET Bulletin No. 71 at 4).

¹² *Fourth Memorandum Opinion and Order*, 15 FCC Rcd at 17451 ¶ 22 (citing OET Bulletin No. 71 at 3).

¹³ *Id.* at 17451 ¶ 22.

¹⁴ See *E911 Location Accuracy Second Report and Order*, 25 FCC Rcd at 18920 ¶ 29, 18927-28 ¶¶ 48-49 (2010). See also 47 C.F.R. § 20.18(h).

¹⁵ In 2007, the Commission sought comment on several issues relating to wireless E911 location accuracy, including the capabilities and limitations of existing and new location technologies, the advantages of hybrid solutions combining handset-based and network-based location technologies, and compliance testing methodologies in different environments, such as indoor versus outdoor use and urban versus rural areas. Wireless E911 Location Accuracy Requirements; Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems for IP-Enabled Service Providers, PS Docket No. 07-114, CC Docket No. 94-102, WC Docket No. 05-196, *Notice of Proposed Rulemaking*, 22 FCC Rcd 10609, 10613-16 ¶¶ 8-19 (2007) (*E911 Location Accuracy Notice*). In 2010, the Commission sought further comment on the following issues: the adoption of a unitary location accuracy requirement; the methodology providers should use to verify compliance for initial and ongoing testing; and whether the Commission's location accuracy requirements should include a vertical elevation (z-axis) component. See Wireless E911 Location Requirements, PS Docket No. 07-114, *Further Notice of Proposed* (continued....)

Location Accuracy Further Notice and NOI, the Commission sought comment on how location accuracy could be improved in indoor settings and other more challenging environments.

10. In 2011, the Commission found indoor location accuracy to be a significant public safety concern because indoor incidents may not be visible to first responders, and a location accuracy of “100/300 meters . . . would only identify the city block in which a building is located.”¹⁶ Rather than attempting to impose an immediate solution, however, the Commission determined that “further work [was] needed in this area” and sought further comment on whether to require indoor location accuracy testing and whether the standards and testing methodologies for outdoor and indoor location accuracy testing should be different.¹⁷

11. Finally, the Commission tasked the Communications Security, Reliability, and Interoperability Council (CSRIC) with evaluating the performance and viability of various location technologies to support E911 services for indoor environments.¹⁸ The Commission directed CSRIC to provide initial findings and technical recommendations and consider “the cost effectiveness of any recommendations.”¹⁹ In addition, the Commission directed CSRIC “to explore and make recommendations on methodologies for leveraging commercial location-based services for 911 location determination.”²⁰

B. CSRIC Indoor Location Accuracy Test Bed Report

12. In June 2012, the CSRIC III Working Group 3 (WG3) released a report concerning its goals and recommendations for an indoor location accuracy test bed.²¹ WG3 indicated that the purpose of such a test bed would be to provide insight into which technologies are technically feasible and economically reasonable for providing indoor location for wireless emergency calls. WG3 conducted the

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Rulemaking and Notice of Inquiry, 25 FCC Rcd 18957, 18963-64 ¶ 17 (2010) (*E911 Location Accuracy Further Notice and NOI*). The Commission also initiated an inquiry requesting comment on how IP-enabled wireless devices and services, including Wi-Fi positioning capabilities, could support location accuracy determination in indoor environments such as residences and public hotspot locations. *See E911 Location Accuracy Further Notice and NOI*, 25 FCC Rcd at 18971-73 ¶¶ 36-38.

¹⁶ *See E911 Location Accuracy Second Further Notice*, 26 FCC Rcd at 10103 ¶ 86.

¹⁷ *See id.* at 10104 ¶ 87 (also seeking comment on the indoor location accuracy testing methodologies available and “the costs and benefits associated with each.”).

¹⁸ *See id.* at 10104 ¶¶ 87-88. CSRIC is a Federal Advisory Committee that was tasked with providing guidance and expertise on the nation’s communications infrastructure and public safety communications. *See CSRIC III Working Group Descriptions and Leadership* (updated Nov. 15, 2012) at 3, *available at* <http://transition.fcc.gov/pshs/advisory/csr3/wg-descriptions.pdf> (last visited Feb. 3, 2014).

¹⁹ *See id.* at 10104 ¶ 88.

²⁰ *See id.* at 10102 ¶ 79.

²¹ *See CSRIC III Working Group 3, E9-1-1 Location Accuracy Final Report v2* (June 1, 2012), *available at* http://transition.fcc.gov/bureaus/pshs/advisory/csr3/CSRICIII_6-6-12_WG3-Final-Report.pdf (last visited Feb. 3, 2014) (*CSRIC E911 Location Accuracy Report*). Prior to the June 2012 Report, CSRIC III WG3 released a report in March 2012 that addressed outdoor accuracy. *See CSRIC III Working Group 3, E9-1-1 Location Accuracy Final Report – Outdoor Location Accuracy* (Mar. 14, 2012), at 9 (focusing “exclusively on outdoor accuracy testing”), *available at* <http://transition.fcc.gov/bureaus/pshs/advisory/csr3/CSRIC-III-WG3-Final-Report.pdf> (last visited Feb. 3, 2014) (*CSRIC Outdoor Location Accuracy Report*). In that report, Working Group 3 (WG3) also made recommendations on outdoor compliance testing and maintenance testing based on the approaches in technical reports and the best practices recently developed by an industry standards body group. WG3 found those approaches and best practices more current and relevant to indoor location testing than the guidelines in the OET Bulletin No. 71. *See id.* at 3-5. We seek comment on these recommendations below, in Section IV.E.

indoor location test bed during the winter of 2012-2013.²² The test bed examined whether indoor location technologies could achieve the location result needed for improved public safety response – “actionable location” with dispatchable address within a tight search ring – for the representative environments (morphologies) where wireless devices are expected to be used, *i.e.*, urban, dense urban, suburban, and rural.²³

13. WG3 selected the San Francisco Bay Area because it included a variety of different environments within a fairly limited geographic area. The area chosen included several building types (steel, glass, concrete, and masonry) and different building heights that were representative of urban and dense urban environments.²⁴ The close proximity of the different environments selected allowed for testing by just one test team.²⁵ In addition, WG3 observed that multiple carriers use San Francisco “to assess location technologies.”²⁶

14. WG3 tested the indoor location capability of three technologies: (1) AGPS/AFLT by Qualcomm, (2) RF fingerprinting by Polaris, and (3) network beacon technology by NextNav.²⁷ The first two technologies are currently commercially available. The third technology is an in-building beacon technology that is independent of the CMRS provider’s wireless network and uses calibrated, atmospheric pressure sensors in handsets to provide vertical location information.²⁸

15. In March 2013, WG3 issued a report discussing the results of the test bed and making recommendations about how best to move forward on indoor location accuracy. In general, WG3 found that for the four representative environments analyzed, the test bed results “show significant promise with respect to high yield, relatively high confidence factors and reliability,” and “the ability to achieve

²² See CSRIC III WG3, Indoor Test Report to CSRIC III WG3 Bay Area Stage-1 Test Bed (Jan. 31, 2013), available at [http://transition.fcc.gov/bureaus/pshs/advisory/csric3/WG3 Indoor Test Report Bay Area Stage 1 Test Bed Jan 31%20 2013.pdf](http://transition.fcc.gov/bureaus/pshs/advisory/csric3/WG3%20Indoor%20Test%20Report%20Bay%20Area%20Stage%201%20Test%20Bed%20Jan%2031%202013.pdf) (last visited Feb. 3, 2014) (*CSRIC Indoor Location Test Bed Interim Report*). WG3 selected TechnoCom, a location technology vendor, as the “independent test house” for the indoor testing. See *id.* at 2.

²³ See CSRIC III WG3, Indoor Location Test Bed Report (Mar. 14, 2013), at 8-9, available at [http://transition.fcc.gov/bureaus/pshs/advisory/csric3/CSRIC III WG3 Report March %202013 ILTestBedReport .pdf](http://transition.fcc.gov/bureaus/pshs/advisory/csric3/CSRIC%20III%20WG3%20Report%20March%202013%20ILTestBedReport.pdf) (last visited Jan. 14, 2014) (*CSRIC Indoor Location Test Bed Report*) (defining “actionable location” as including the “essential” elements of location accuracy and “the ability to provide high reliability and consistency of [location] data” so that “telecommunicators and first responders have confidence in the underlying information”). WG3 selected the above four environment on the basis of industry standard, ATIS-0500011, defining the wireless use environments as Dense Urban, Urban, Suburban, and Rural. See *id.* at 11.

²⁴ *CSRIC Indoor Location Test Bed Report* at 12-13.

²⁵ *Id.* at 11.

²⁶ *CSRIC E911 Location Accuracy Report* at 14.

²⁷ *CSRIC Indoor Location Test Bed Report* at 54. Qualcomm, Polaris, and NextNav are location technology vendors. AGPS/AFLT combines GPS location technology with terrestrial wireless network technology, creating a significant range of hybrid solutions. *Id.* at 25. “RF fingerprinting,” also referred to as RF pattern matching, uses radio frequency pattern matching to compare mobile measurements against a geo-referenced database of the mobile operator’s radio environment. *Id.* at 24-25. Four vendors of other location technologies showed initial interest in the test bed effort but did not participate. These technologies included U-TDOA positioning, DAS proximity-based positioning, AGNSS/Wi-Fi/MEMS sensor hybrid, and LEO Iridium satellite-based positioning. See *CSRIC Indoor Location Test Bed Report* at 55. We discuss these technologies in greater detail below. See *infra* Section III.

²⁸ See *CSRIC Indoor Location Test Bed Report* at 8, 24, 45. NextNav’s beacon technology operates in spectrum licensed to Progeny LMS, LLC in the Multilateration Location and Monitoring Service (M-LMS) at 902-928 MHz. See Request by Progeny LMS, LLC for Waiver of Certain Multilateration Location and Monitoring Service Rules, Progeny LMS, LCC Demonstration of Compliance with Section 90.353(d) of the Commission’s Rules, WT Docket No. 11-49, *Order*, 28 FCC Red 8555, 8569 ¶ 32 (rel. June 6, 2013) (*NextNav Order*).

improved search rings in the horizontal dimension (often identifying the target building, or those immediately adjacent).”²⁹ WG3 concluded that “additional development is required to ensure” the provision of an “actionable location,” especially in urban and dense urban environments.³⁰ Moreover, the test bed found “substantial progress” in the beacon technology’s capability to provide vertical (z-axis) location information, providing approximate floor-level accuracy in a significant percentage of calls.³¹

16. To be sure, accuracy results varied by technology and the particular environment. As summarized in Table 1 below, depending on the representative environment and building structure tested, each technology demonstrated particular capabilities, advantages, and disadvantages.³² The *CSRIC Indoor Location Test Bed Report* observed that all three vendors participating in the test bed were in the process of making improvements to their location technologies.³³

²⁹ See, e.g., *CSRIC Indoor Location Test Bed Report* at 9. See also *id.* at 27-36 (summarizing the location accuracy results for the three technologies tested in each of the representative indoor environments).

³⁰ See *CSRIC Indoor Location Test Bed Report* at 8.

³¹ The beacon technology provided, across all indoor environments, vertical location accuracy for the median, 67th and 90th percentiles at 2 m, 2.9 m and 4.8 m, respectively (compared to an average floor separation of 3 meters). See *id.* at 9, 39.

³² See *CSRIC Indoor Location Test Bed Report* at 27-36 (summarizing the location accuracy results for the three technologies tested in each of the representative indoor environments). For example, in a “dense urban environment,” horizontal accuracy ranged between 57 meters/102 meters for NextNav, 156 meters/268 meters for Qualcomm, and 117 meters/400 meters for Polaris, for 67 and 90 percent of calls, respectively. In a “rural environment,” the range was between 28 meters/45 meters for NextNav, 48 meters/210 meters for Qualcomm, and 576 meters/3005.1 meters for Polaris. Results for the rural morphology are generally dependent on the density of cell site locations and location fixes are spread along relatively long stretches of rural roads. *Id.* at 34.

³³ See *id.* at 39-41 (noting that NextNav is working on “its next generation system;” that Polaris acknowledges that providing location information for the upper floors of a building presented a particular challenge, but it is improving its technology to address this challenge; and that Qualcomm is working on improvements to its hybrid GPS-AFLT technology using OTDOA for 4G LTE networks). OTDOA, or the Observed Time Difference of Arrival, is a location method “based on Reference Signal Time Difference (‘RSTD’) measurements conducted on downlink positioning reference signals received by the UE [User Equipment].” See *CSRIC III WG3, Leveraging LBS and Emerging Location Technologies for Indoor Wireless E9-1-1* (Mar. 14, 2013), at 35, available at http://transition.fcc.gov/bureaus/pshs/advisory/csric3/CSRIC_III_WG3_Report_March_%202013_LeveragingLBS.pdf (last visited Feb. 20, 2014) (*CSRIC LBS Report*). User Equipment includes “mobile devices such as feature phones, smartphones, and even tablets having a CMRS modem embedded.” *Id.* at 8.

Table 1. CSRIC San Francisco Test Bed - Location Accuracy Results by Technology (in meters)

Morphology	Technology					
	NextNav		Polaris		Qualcomm	
Percent of Calls	67%	90%	67%	90%	67%	90%
Dense Urban	57	102	117	400	156	268
Urban	63	141	198	448	227	449
Suburban	29	53	232	421	75	205
Rural	28	45	576	3005.1	48	210

17. Following the WG3 test bed in San Francisco, TruePosition, which did not participate in the test bed, commissioned TechnoCom to test TruePosition's indoor location solution, which is based on hybrid technology consisting of UTDOA and assisted Global Positioning System (A-GPS).³⁴ In February and early March 2013, TechnoCom conducted the testing, utilizing similar testing standards and methodology as used in the CSRIC test bed.³⁵ TechnoCom reports that, overall, "[t]he Hybrid [UTDOA and AGPS] system performed well indoors."³⁶ In the urban setting, 67 percent of calls were located within 87.3 meters and 90 percent of calls were located within 140.7 meters.³⁷ For the suburban environment, 67 percent of test calls were located within 66.1 meters and 90 percent of test calls were located within 116.2 meters.³⁸

C. Recent Comments on E911 Phase II Location Accuracy and Call Tracking Data

18. In August 2013, the California chapter of the National Emergency Number Association (CALNENA) filed an *ex parte* with the Commission raising concerns about what it noted to be a "significant decrease in the percentage of wireless 9-1-1 calls that delivered Phase II location information" to its PSAPs.³⁹ According to CALNENA, California State 911 Office data indicated that more than 55% of the over 1.5 million wireless 911 calls throughout the state in the month of March 2013 did not include Phase II location information. CALNENA noted that this phenomenon was much worse

³⁴ UTDOA is a network-based multilateral system that "determines location based on the time it takes a signal to travel from a mobile phone to a number of sensitive, well calibrated receivers called Location Measurement Units (LMUs). See Letter from Masoud Motamedi, President, TechnoCom Corporation, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114, Attachment at 7 (filed Apr. 22, 2013) (TruePosition Wilmington Test Bed Results) (detailing TruePosition's use of UTDOA and its test results for Wilmington, Delaware). See also TruePosition, "About TruePosition UTDOA," available at <http://www.trueposition.com/resource-center/fact-sheets/trueposition-utdoa-overview-fact-sheet/DownloadSecured.pdf> (last visited Feb. 3, 2014). We describe A-GPS above. See *supra* note 3.

³⁵ TruePosition Wilmington Test Bed Results at 2.

³⁶ *Id.* at 1.

³⁷ *Id.* at 28.

³⁸ *Id.* at 29.

³⁹ Letter from Danita L. Crombach, ENP, CALNENA, to the Honorable Mignon Clyburn, Chairwoman, Federal Communications Commission, PS Docket No. 07-114 (filed Aug. 12, 2013), at 1 (CALNENA *Ex Parte Letter*). See also Letter, Karen Wong, Assistant Director, Public Safety Communications, CalOES, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Sept. 26, 2013), at 2 (CalOES Workshop Comments) (In "a comparison of Phase I and Phase II location information for wireless 9-1-1 calls from 2007 through June 2013, California has seen a 15.6% decrease in Phase II location information within the call detail records.").

in urban areas, “possibly suggesting that whatever 9-1-1 technologies the wireless carriers may be using lately are not working for wireless calls placed in or near high rise buildings.”⁴⁰

19. The Commission subsequently received E911 Phase II call tracking data sets from several other state and local public safety entities that either oversee or administer E911 service, which in some cases also indicated a decrease in the percentage of calls to PSAPs that included Phase II location.⁴¹ In September 2013, the Commission’s Public Safety and Homeland Security Bureau (Bureau) announced that it would host a public workshop to discuss the issues raised by CALNENA and other E911 Phase II call tracking data sets, as well as recent developments in wireless location technology.⁴² The Bureau also invited interested parties to file comments on the E911 call tracking data and related topics for discussion, including current trends that may be affecting the provision and quality of E911 location information delivered to PSAPs.⁴³

20. Twenty-two parties filed comments, including four CMRS providers,⁴⁴ nine public safety organizations and entities, and eight vendors of location technologies, Next Generation system components, or PSAP consumer premises equipment. On November 18, 2013, the Bureau hosted the E911 Phase II Location Accuracy Workshop.⁴⁵

21. Providers uniformly attribute the declining rates of delivery of Phase II data observed by some PSAPs primarily to PSAPs’ not “rebidding,” *i.e.*, affirmatively seeking to “pull” the data from its source location, to obtain the Phase II data that the carriers are, in fact, providing.⁴⁶ Carriers indicate that while Phase II data is not always available to the PSAP on call set-up, it is subsequently delivered to the Mobile Positioning Center (MPC) (for GSM networks) or the Gateway Mobile Location Center (GMLC) (for CDMA networks) and is available for PSAPs through the “rebidding” process.⁴⁷ Other commenters

⁴⁰ CALNENA *Ex Parte* Letter at 2.

⁴¹ The entities are the California Governor’s Office of Emergency Services (all PSAPs, plus charts on 24 urban and rural PSAPs); North Carolina (statewide aggregate Phase II data); Oregon (statewide aggregate Phase II data); Pennsylvania (Delaware County); Texas (statewide aggregate Phase II data, Bexar Metro 911 District, Greater Harris County 911 Emergency Network, Capital Area Emergency Communications District, El Paso); Utah; and Washington (King County E-911 Program Office). All data sets are available at <http://www.fcc.gov/encyclopedia/phase-2-data-sets> (last visited Feb. 3, 2014).

⁴² See Public Safety and Homeland Security Bureau Announces Workshop of E911 Phase II Location Accuracy, *Public Notice*, PS Docket No. 07-114, DA 13-1873 (PSHSB Sept. 9, 2013) (*E911 Location Accuracy Workshop Notice*).

⁴³ See *E911 Location Accuracy Workshop Notice* at 1-3.

⁴⁴ CTIA also filed comments.

⁴⁵ Participants included public safety entities, as well as carrier industry and location technology vendor representatives. A webcast of the E911 Location Accuracy Workshop is available at <http://www.fcc.gov/events/workshop-e911-phase-ii-location-accuracy> (last visited Feb. 3, 2014). See also Public Safety and Homeland Security Bureau Announces Availability of Webcast and Additional Materials from November 18, 2013 Workshop on E911 Phase II Location Accuracy, *Public Notice*, PS Docket No. 07-114, DA 13-2226 (rel. Nov. 20, 2013).

⁴⁶ See, e.g., Sprint Nextel Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 2-5 (Sprint Workshop Comments); T-Mobile USA, Inc. Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 5, 19-20, 24 (T-Mobile Workshop Comments).

⁴⁷ In this item we refer to a network’s MPC or GMLC as a “location information center.”

contend, however, that even if PSAPs were to rebid more frequently, a 30-second delay in obtaining Phase II information is highly undesirable, given that a large percentage of 911 calls are under 30 seconds.⁴⁸

22. There was general agreement among public safety commenters that the majority of calls to 911 are now coming from wireless phones, that this trend is increasing, and that a large number of these calls are made from indoor environments.⁴⁹ Vendors argue that indoor location technology has since evolved considerably, suggesting the provision of indoor location information may be within reach.⁵⁰ TruePosition suggests that a combination of handset- and network-based location technology can provide Phase II location information for both indoor and outdoor calls.⁵¹

III. PROPOSED INDOOR LOCATION ACCURACY REQUIREMENTS

23. The record in this proceeding demonstrates that circumstances affecting wireless location accuracy have changed dramatically since the Commission adopted its original Phase II location accuracy rules. As discussed below, the great majority of calls to 911 now originate on wireless phones, and the majority of wireless calls now originate indoors. These changes elevate the importance of ensuring that indoor 911 calls can be accurately located.

24. While PSAPs and CMRS providers may be able to address some of the challenges through technological and operational improvements, the record also indicates that the outdoor-oriented focus of the Commission's Phase II rules to date has created a regulatory "gap": by focusing on outdoor measurements for verifying compliance, our rules provide no remedy to address poor performance of location technologies indoors.

25. In addition to changes in wireless usage, there has also been recent progress in the development of technologies that could support improved indoor location accuracy. The CSRIC test bed results, together with parties' representations that they have since been working on improvements to indoor location technologies, suggest that it is likely that location technologies can begin to be deployed in the near term that would deliver 50-meter location accuracy for many indoor environments with a high degree of reliability. The record also contains data suggesting the feasibility of using barometric pressure sensors in mobile devices to provide rough z-axis information when calls are placed from multi-story buildings. Finally,

⁴⁸ TruePosition Reply Comments, PS Docket No. 07-114 (filed Nov. 13, 2013), at 6-7 (TruePosition Workshop Reply Comments); CalOES Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 2 (CalOES Workshop Comments).

⁴⁹ See, e.g., CalOES Workshop Comments at 1 (43.8 percent increase in wireless 911 calls since 2007; in June 2013, comprised 72.7 percent of 911 volume); International Association of Chiefs of Police (IACP) Comments, PS Docket No. 07-114 (filed Sept. 24, 2013), at 1 (IACP Workshop Comments) (more than 70 percent of 911 calls from mobile phones, many from indoors); King County Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 1-2 (King County Workshop Comments) (steady increase in percentage of 911 calls from wireless indicating increasing number from indoors); NENA Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 1, 2-3 (NENA Workshop Comments) (70 percent or more of 911 calls now from wireless, increasing indoor environment challenge); Oakland Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 1 (Oakland Workshop Comments) (in 2012, 77 percent of 911 calls from wireless); Letter from William Jenaway, President, CFSI, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (Nov. 13, 2013), at 1 (increasing number of 911 calls from wireless; many are placed from indoors).

⁵⁰ NextNav, for example, indicates that the "capabilities of current and near-future wireless location technologies can provide sufficient horizontal accuracy, vertical accuracy, and yield to warrant the adoption of concrete indoor location standards." NextNav Comments, PS Docket 07-114 (filed Sept. 25, 2013), at ii (NextNav Workshop Comments). See also Polaris Wireless Comments, PS Docket 07-114 (filed Sept. 25, 2013), at 3 (Polaris Workshop Comments) ("changes occurring within the wireless industry ... are projected to improve both horizontal as well as vertical location... performance" (emphasis omitted)).

⁵¹ TruePosition Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 5 (TruePosition Workshop Comments) ("combination of handset ... and network based location technology ... provides prompt and Phase II accurate location information both indoors and outdoors").

providers assert that the deployment of LTE networks will be accompanied by improvements in location technology that could drive improved performance for both indoor and outdoor calls,⁵² but they also express concern about whether they can realistically meet the proposed requirements based on currently available technology.⁵³

26. We believe that it is now appropriate to propose measures designed to address public safety's critical need for obtaining indoor location information, and to ensure that wireless callers receive the same protection whether they place a call indoors or outdoors. In the following discussion, we propose a regulatory framework for addressing indoor location accuracy for wireless calls to 911 from indoors that includes a near-term requirement to achieve approximate indoor location information, comprised of horizontal (x- and y-axis) and vertical (z-axis) location information. We also seek comment on how to formulate a long-term requirement with an increased degree of location accuracy, sufficient to identify the caller's specific address, floor level, and suite/room number within a building. We discuss below the achievability of these technical requirements on our proposed time frames, the potential benefits and costs of our proposed indoor location accuracy requirements, a proposed compliance testing framework, and possible exclusions from the proposed requirements to ensure they are imposed in a way that maximizes the rules' effectiveness while mitigating the potential burdens on CMRS providers. We also seek comment on alternative approaches and, in this regard, invite relevant stakeholders – including public safety and industry – to propose a consensus approach that would help ensure that consumers placing wireless calls to 911 from indoor environments receive the same protections as callers in outdoor environments.

A. Costs and Benefits of Indoor Location Accuracy

27. In developing a regulatory framework for indoor location accuracy, our objective is to implement rules that serve the public safety goals established by Congress. While we acknowledge the potential difficulty of quantifying benefits and burdens, we seek to measure how the availability of indoor location information will benefit the public through reduced emergency response times. We also seek to maximize these benefits, while taking into consideration the burden of compliance to carriers. These costs and benefits can have many dimensions and affect many parties, including, for example, more efficient use of public safety resources; cost and revenue implications for the communications industry; health and financial benefits to the public; as well as other less tangible benefits, such as the value of any reduced or avoided pain and suffering, or the apprehension of criminal suspects. Providing accurate E911 information is particularly important in instances where a caller cannot provide information directly – either because they do not know or

⁵² See, e.g., T-Mobile Workshop Comments at 19, 34 (describing how “the transition to LTE promises the opportunity to select from multiple location methods, to maximize accuracy and yield, within the same overall latency budget,” and that “the best opportunity for implementing improved location technology is as carriers and consumers implement Voice Over LTE.”); Verizon and Verizon Wireless Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 6 (Verizon Workshop Comments) (discussing Verizon's efforts to improve E911 service for a forthcoming Voice over LTE offering, including supplementing GPS information with GLONASS and improved OTDOA performance as LTE small cells are deployed); see also Letter from Michele C. Farquhar, Counsel to Polaris Wireless, Inc., to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Aug. 14, 2013), at 1 (“[T]he ongoing deployment of LTE technology with O-TDOA ... measurements combined with the increased availability of Inter-RAT measurements will deliver positive impacts on future network-based indoor location systems.”) (Polaris Aug. 14, 2013 *Ex Parte* Letter).

⁵³ See, e.g., Letter from Brian Josef, CTIA-The Wireless Association, to Marlene Dortch, Secretary, FCC, PS Docket 07-114 (filed Feb. 14, 2014), at 2 (“It is hoped that such [indoor location] technologies would be tested and validated in future test bed campaigns.”); Letter from Joseph P. Marx, Assistant Vice President, AT&T Services, Inc., to Marlene Dortch, Secretary, FCC, PS Docket 07-114 (filed Feb. 13, 2014), at 1 (“[T]he time [is] right to begin discussing Indoor Location Accuracy for E911” but the “FCC should be careful to ensure that any proposed rules on location accuracy are aligned with proven capabilities of the current state of technology and they should set realistic accuracy benchmarks that the industry and public safety can embrace.”).

cannot communicate their location.⁵⁴ We therefore request comment on a wide range of questions that will enable us to weigh the costs and benefits associated with the rules we propose in this *Third Further Notice*.

28. First, in order to assess the potential scope of benefits from our proposed rules, we think it is relevant to assess the scope of current wireless usage, both indoors and outdoors. Overall wireless usage has increased substantially since the Commission adopted its E911 location accuracy rules in 1996. At that time, there were approximately 33 million cellular subscribers in the United States.⁵⁵ By the end of 2012, there were more than 326 million wireless subscriber connections.⁵⁶ At the end of 2007, only 15.8 percent of American households were wireless only.⁵⁷ During the first half of 2013, that number had increased to 39.4 percent (nearly two in every five American homes).⁵⁸ Furthermore, certain subsets of American consumers are more likely to use wireless phones – for example, adults living in poverty (54.7 percent) were more likely to be living in households with only wireless phones than adults living near poverty (47.5 percent) and higher income adults (35.3 percent).⁵⁹ In addition, younger Americans are more likely to live in households with only wireless phones.⁶⁰ Supporting this trend, several major CMRS providers now market wireless service as a replacement in the home for traditional landline service, using the same location determination technology for 911 as for mobile devices.⁶¹

⁵⁴ As we discuss in the benefits discussion above, location accuracy can be especially important where voice is not an option, *e.g.*, for people with disabilities, for those experiencing stroke, or others in extreme danger. *See supra* Section III.A. *See also* TDI Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 1 (“Ensuring reliable access to emergency services is an extremely important concern for Consumer Groups and TAP, and improved location identification technology has the ability to dramatically increase the effectiveness of 9-1-1 for Americans who are deaf or hard of hearing as well as for others who make emergency calls over voice and text.”).

⁵⁵ *First E911 Report and Order*, 11 FCC Rcd at 18680 ¶ 6.

⁵⁶ *See* CTIA, Wireless Quick Facts, available at <http://www.ctia.org/advocacy/research/index.cfm/aid/10323> (last visited Jan. 28, 2014) (*CTIA Wireless Quick Facts*). The Commission’s sixteenth annual report on the state of competition in the mobile services marketplace, released in March 2013, estimated that the “total number of mobile wireless connections now exceeds the total U.S. population.” *See* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services, WT Docket No. 11-186, *Sixteenth Report*, 28 FCC Rcd 3700, 3854 ¶ 244 (2013). The Commission based this estimate on year-end 2010 and year-end 2011 Numbering Resource Utilization Forecast (NRUF) filings, adjusted for porting, and CTIA’s Year-End 2011 Wireless Indices Report. *Id.* at 3854-55 ¶ 244. “Mobile Wireless Connections” refers to the number of connected devices rather than the number of individual subscribers. *Id.* at 3708 ¶ 2.

⁵⁷ *See CTIA Wireless Quick Facts*.

⁵⁸ *See* Blumberg, Stephen & Luke, Julian, Center for Disease Control National Center for Health Statistics, “Wireless Substitution: Early Release of Estimates from the National Health Interview Survey, January- June 2013,” at 2, available at <http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201312.pdf> (last visited Feb. 14, 2014) (*CDC Wireless Substitution Survey*).

⁵⁹ *See CDC Wireless Substitution Survey* at 3.

⁶⁰ For example, by the end of 2012 nearly two-thirds of adults aged 25-29 (65.6 percent) lived in wireless-only households. *See id.* at 2. For adults aged 18–24 the rate was 54.3 percent and for adults aged 30–34, the rate was 59.9 percent. *Id.*

⁶¹ *See, e.g.*, Verizon Wireless, Verizon Wireless Home Phone Connect (“Home Phone Connect offers... a reliable, portable, low-cost alternative to traditional home phone service using the Verizon Wireless Network all while keeping your same number and home phone.”), available at <http://www.verizonwireless.com/b2c/device/home-phone-connect> (last visited Feb. 18, 2014); AT&T, AT&T Wireless Home Phone (“Now you can connect the home telephone you already have to the AT&T wireless network.”), available at <http://www.att.com/shop/wireless/devices/att/wireless-home-phone-silver.html#fbid=BT-M86RbotW> (last visited Feb. 18, 2014); Sprint Nextel, Sprint Phone Connect, (“Replace your current landline or digital phone service with unlimited Sprint phone service at your home or office.”) available at

(continued....)

29. Significantly, the majority of 911 calls also now come from wireless phones. In January 2011, *Consumer Reports* reported that 60 percent of 911 calls were placed through wireless phones.⁶² More recently, the California Office of Emergency Services indicates that the percentage of 911 calls that came from wireless devices increased from 55.8 percent in 2007 to 72.7 percent as of June 2013.⁶³ Furthermore, an increasing percentage of wireless calls are placed from indoors. A 2011 study showed that an average of 56 percent of wireless calls were made from indoors, up from 40 percent in 2003.⁶⁴ That number is even higher for smartphone users, who represent the majority of wireless phone owners, as 80 percent of smartphone usage occurs inside buildings.⁶⁵

30. The large increase in indoor wireless usage over the last decade has made indoor location accuracy increasingly important. Accordingly, we seek more granular information regarding the percentage of wireless calls placed from indoors and, to the extent available, the percentage of wireless calls to 911 from indoors. We also seek data on the types of indoor environments 911 calls are placed, *e.g.*, in the caller's own home, his or her work location or in public accommodations such as airports, schools and movie theaters. Is it possible to identify the type of building morphology where current location technologies routinely fail to provide accurate location information?

31. We know that indoor locations pose particular challenges for first responders in finding the caller. Indoor incidents are often not visible to the first responder, and a city block in an urban environment could potentially contain thousands of apartments.⁶⁶ We seek comment on whether and how the increase in wireless calls to 911 from indoors has affected the delivery of E911 information and the ability of public safety officials to respond to calls for help. Has there been a market failure in the provision of E911 information for wireless calls originating indoors? We seek comment on this issue.

32. We believe that requiring location information for wireless calls to 911 from indoors will result in significant public interest benefits, most importantly in "promoting safety of life and property."⁶⁷

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http://shop.sprint.com/mysprint/shop/plan_details.jsp?tabId=plnTab4410001&planCatId=pln590002cat&planFamilyType=&flow=AAL (last visited Feb. 18, 2014).

⁶² See *Consumer Reports Magazine*, "For 911, is a Cell Phone as Safe as a Landline?" (Jan. 2011), available at <http://www.consumerreports.org/cro/magazine-archive/2011/january/electronics/best-cell-phones/911-from-cell-phone/index.htm> (last visited Jan. 28, 2014).

⁶³ See CalOES Workshop Comments at 1. See also King County Workshop Comments at 1 ("Statewide, the PSAPs are ... seeing 70% of 911 calls made from wireless phones."); NENA Workshop Comments at 1 ("70% or more of all 9-1-1 calls now originating from wireless subscribers in many jurisdictions."); Oakland Workshop Comments at 1 ("In 2012 ... 77% of ... calls [to Oakland County PSAPs] were wireless").

⁶⁴ See J.D. Power and Associates, 2011 U.S. Wireless Call Quality Performance Study, available at <http://www.jdpower.com/content/press-release/Kp2D0Ys/wireless-call-quality-performance-study.htm> (last visited Feb. 3, 2014) (*J.D. Power 2011 Study*). According to a recent letter from the San Francisco Department of Emergency Management, 70 percent of all wireless 911 calls originate indoors. See Letter from Lisa Hoffman, Deputy Director, Division of Emergency Communications, San Francisco Department of Emergency Management, to Julius Genachowski, Chairman, FCC, WT Docket No. 11-49 (Mar. 25, 2013) (SFDEM Mar. 25 Letter). See also King County Workshop Comments at 2 (stating that "wireline phone service has continually declined and now makes up only 22% of phone service in King County," and that "this trend would indicate that wireless phones are now making the 911 calls from homes that used to be made on the home wireline phone"); IAFC Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 1 (stating that the "majority of emergency calls placed to Emergency 911 are made from indoors") (IAFC Workshop Comments).

⁶⁵ See Carle, Christian, "Indoor Location: The Mobile Revolution Starts Now," *DIRECTIONS MAGAZINE*, June 24, 2013, available at <http://www.directionsmag.com/articles/indoor-location-the-mobile-revolution-starts-now/334122> (last visited Feb. 3, 2014) (Indoor Location Mobile Revolution Article).

⁶⁶ See *E911 Location Accuracy Second Further Notice*, 26 FCC Rcd 10074, 10103 ¶ 86.

⁶⁷ 47 U.S.C. § 151.

As APCO notes, in “the absence of accurate location data associated with a wireless call, the caller must be questioned in detail to provide verbal information regarding their location. This process can be time consuming and callers are sometimes unable to speak or provide correct information.”⁶⁸ A number of public safety commenters state that virtually any improvements in indoor location capabilities would be desirable, even if relatively modest or incremental.⁶⁹

33. We seek comment on the extent to which such improvements would result in tangible benefits with respect to safety of life and property. A study examining 73,706 emergency incidents during 2001 in the Salt Lake City area found that on average, a one-minute decrease in ambulance response times reduced the likelihood of 90-day mortality from 6 percent to 5 percent, *i.e.*, a 17 percent reduction in the total number of deaths.⁷⁰ This implies that, in the Salt Lake City area, a one-minute reduction in response times would have resulted in an annual saving of 746 lives. If we assume that this outcome is reasonably reflective of the country as a whole, we estimate that the location accuracy improvements we propose could save approximately 10,120 lives annually,⁷¹ for an annual benefit of

⁶⁸ See APCO Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 3 (APCO Workshop Comments). See also IACP Workshop Comments at 1 (“The limitations of [indoor wireless] location information are already having a negative impact on our public safety response”); IAFC Workshop Comments at 1 (deployment of advanced location technologies is critical to ... public safety response capabilities, and to the personal safety of all first responders”).

⁶⁹ See, *e.g.*, Letter from Terry Hall, President, APCO International, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 11-49, at 2 (filed May 6, 2013) (“APCO has consistently supported regulatory and technical initiatives targeted at achieving even incremental steps toward ensuring accurate, actionable location information is available for every 911 call.”); Letter from Adam D. Kennard, Executive Director, National Sheriffs’ Association, to Julius Genachowski, Chairman, FCC, WT Docket No. 11-49 (filed Apr. 3, 2013), at 1 (“Even a modest improvement in capabilities above the current 100-300 meter standards would represent a significant benefit to public safety.”); Letter from Telford E. Forgety, III, Director of Government Affairs & Regulatory Counsel, NENA: The 9-1-1 Association, to Julius Knapp, Chief Engineer, Office of Technology, FCC, WT Docket No. 11-49 (filed Mar. 22, 2013), at 2 (“Any significant improvement over the current regime of impossibly-large out-door search rings and indeterminate indoor search rings must be encouraged, whether or not it can reach our ultimate ideal right away.”).

⁷⁰ See Wilde, Elizabeth Ty, “Do Emergency Medical System Response Times Matter for Health Outcomes?,” 22 *Health Econ.* 7, pp. 790-806 (2013), available at <http://www.ncbi.nlm.nih.gov/pubmed/22700368> (last visited Feb. 6, 2014) (*Salt Lake City Study*). The study finds that the one-minute increase in response time caused annual mortality to increase 17 percent, *i.e.*, an increase of 746 deaths, from a mean of 4,386 deaths to 5,132 deaths. Because the regression is linear, this result implies that a one-minute reduction in response time also saves 746 lives, *i.e.*, a 17 percent reduction from a mean of 4,386 deaths to 3,640 deaths. The study also finds that a one-minute increase in response times increases mortality by 8 percent when measured one day after the initial incident. See *id.* at 791.

⁷¹ For the approximately 25 million individuals call for an ambulance each year (*i.e.*, 746 lives saved divided by 73,706 observed incidents multiplied by the 25 million callers seeking an ambulance = 253,032). See Key, Craig, Paul Pepe, David Persse, and Darrell Calderon, “Can First Responders Be Sent to Selected 911 Emergency Medical Service Calls without an Ambulance?” 10 *Academic Emergency Medicine* 4 (Apr. 2003), pp. 339-346, available at <http://onlinelibrary.wiley.com/doi/10.1111/j.1553-2712.2003.tb01346.x/pdf> (last visited Feb. 18, 2014). This assumes 80 percent of these calls are from mobile phones, and that only 5 percent of those wireless calls experience a one-minute reduction in response time due to the location accuracy improvements we propose (*i.e.*, $0.8 \times 0.05 \times 253,000$ deaths = 10,120 expected lives saved). As discussed earlier, the proportion of 911 calls made from mobile phones was estimated to be 73 percent a year ago and has been rising every year. See CalOES Location Accuracy Workshop Presentation (Nov. 18, 2013) at 5, available at http://transition.fcc.gov/bureaus/pshs/911/Phase%202/Workshop_11_2013/California_911_Wong_Nov2013.pdf (last visited Jan. 29, 2014) (for the period from January through September 2013, 73.1 percent of all calls to 911 were from wireless phones); see also Knutson, Ryan, “Cellphones Leave Gaps for Emergency Services,” *WALL STREET JOURNAL*, Dec. 1, 2013, available at <http://online.wsj.com/news/articles/SB10001424052702304579404579231913503559556> (last visited Jan. 29, 2014) (stating that, “[i]n California alone, 75% of 911 calls placed in the state during a recent 18-month period were (continued....)

approximately \$92 billion.⁷² The Commission has also previously relied on a 2002 study focusing on cardiac emergencies in Pennsylvania, which showed that when location information was provided contemporaneously with a 911 call, the reduction in response time correlated with an over 34 percent reduction in mortality rates from cardiac arrest within the first 48 hours following the incident.⁷³ Based on this study, we estimate that for cardiac incidents alone, the proposed indoor location rules may well save at least 932 lives nationwide each year, yielding an annual benefit of almost \$8.5 billion.⁷⁴ Furthermore, as location information quality improves and latency declines, we expect it will result in an even greater improvement in patient medical outcomes. We seek comment on the reasonableness of our analyses of these studies and our underlying assumptions. We also seek comment on whether the time benefit of vertical location, given the spread in horizontal location, is likely to be more, less, or comparable to the estimated gains in the *Salt Lake City Study* and the *Cardiac Study*, when moving from basic 911 to enhanced 911 services.

34. We also believe that improving location accuracy for wireless calls to 911, including from indoor environments, is particularly important for persons with disabilities and for those who may not be able to provide their address or otherwise describe their location. In recent testimony before the Senate Commerce Committee, Telecommunications for the Deaf and Hard of Hearing, Inc. (TDI) noted the importance of automatic and immediate provision of accurate location information, stating that “[p]eople with visual, speech, cognitive, or mobility disabilities will not have to worry about consuming additional minutes trying to identify their location.”⁷⁵ We seek comment on the increased value and benefits of providing more accurate location information to certain populations, such as people with disabilities, victims of crime, senior citizens and children. All such groups may have less ability to

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made using cellphones”); *J.D. Power 2011 Study* (56 percent of wireless calls from indoors); SFDEM Mar. 25 Letter (70 percent of wireless 911 calls from indoors).

⁷² An accepted model developed by the United States Department of Transportation presently estimates the value of a statistical life (VSL) at \$9.1 million. See Memorandum from Polly Trottenberg, Under Secretary for Policy, Office of the Secretary for Transportation, and Robert S. Rivkin, General Counsel, Department of Transportation, Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses (Feb. 28, 2013), at 1, available at http://www.dot.gov/sites/dot.gov/files/docs/VSL_Guidance_2013.pdf (last visited Feb. 14, 2014). The Department of Transportation defines VSL as “the additional cost that individuals would be willing to bear for improvements in safety (that is, reductions in risks) that, in the aggregate, reduce the expected number of fatalities by one.” *Id.* at 2. Assuming a VSL of \$9.1 million, $10,120 \times \$9.1 \text{ million} = \$92,092,000,000$.

⁷³ See Facilitating the Deployment of Text-to-911 & Other Next Generation 911 Applications Framework for Next Generation 911 Deployment, *Further Notice of Proposed Rulemaking*, 27 FCC Rcd 15659, 15687 ¶¶ 69-71 (2012), citing Athey, Susan and Stern, Scott, “The Impact of Information Technology on Emergency Health Care Outcomes,” 22 *The RAND J. of Econ.* 3 (Autumn 2002), pp. 399-432, available at <http://kuznets.fas.harvard.edu/~athey/itemer.pdf> (last visited Jan. 30, 2014) (*Cardiac Study*). The study notes that cardiac emergencies account for only 20 percent of medical emergency calls to 911, and that it is a subset of emergencies “for which timeliness is especially important.” See *id.* at 401, 428.

⁷⁴ As in the Text-to-911 proceeding, we assume 4,142 lives are saved per year nationally. *Text-to-911 FNPRM* at ¶ 71 n. 174. We then assume that 75 percent of cardiac incidents are reported to 911 on wireless phones, that 60 percent of those wireless calls are placed indoors, and that half of those incidents benefit from a quicker emergency response time due to the improved indoor location accuracy (*i.e.*, $.75 \times .6 \times .5 \times 4,142 \text{ lives} = 932 \text{ lives}$).

⁷⁵ See Written Testimony of Claude L. Stout, Executive Director, Telecommunications for the Deaf and Hard of Hearing, Inc., before the Senate Commerce Committee, Subcommittee on U.S. Senate Committee on Commerce, Science, and Transportation Communications, Technology, and the Internet, “Locating 911 Callers in a Wireless World” (Jan. 16, 2014) at 4, available at http://www.commerce.senate.gov/public/?a=Files.Serve&File_id=d561dcfb-a31f-432e-a600-0a804f76274c (last visited Feb. 3, 2014) (Stout Location Accuracy Testimony).

identify and relate to a 911 call-taker where they are located, especially in an emergency situation.⁷⁶ In such circumstances, accurate, automatically-generated location information can be critical to saving lives. We seek comment regarding the value and scope of benefits that improved location accuracy would provide in such circumstances.

35. We understand that implementation of indoor location accuracy will likely impose significant costs on providers. We seek comment generally on the costs of indoor location accuracy requirements. The CSRIC indoor location test bed report indicates that while CSRIC “attempted to provide some initial insight into costs associated with implementation of these new technologies, [it] did not attempt to quantify cost to deploy, cost to operate and maintain, and cost impact to the handset.”⁷⁷ According to the report:

Some technologies have relatively low costs upfront to deploy but are relatively costly to operate and maintain. Others have relatively high upfront costs and have lower operational/maintenance costs. Some methods have cost implications in the handset, some to the wireless network, and some impact both. Others require infrastructure development independent of the wireless network. Some require the development and maintenance of various databases to operate... Overall, each location technology requires substantial investment in both time and resources.⁷⁸

We seek detailed information on all of the costs providers estimate our proposed indoor location rules would impose on them, including how these costs were determined.

36. We anticipate that providers may implement different solutions to determine a caller’s indoor location, and that each of these solutions may present unique costs. We seek comment on what universal costs would be necessary across all indoor location technologies, as well as on any specific costs that are unique to different technologies. We understand that the specific manner in which we implement any indoor location accuracy requirement, including the degree of accuracy required and the timeframe for implementing any such requirement, potentially would affect providers’ costs of compliance. We seek comment on these specific factors and how they might affect costs.⁷⁹ Additionally, we seek comment on whether additional costs would be passed on to consumers, resulting in higher rates. If costs are likely to be passed on to consumers, we request information regarding how much rates would increase.

37. Finally, we believe that any costs imposed by our rules might be mitigated, at least to some degree, by the fact that providers are already undertaking significant indoor location technology research and development on their own for commercial, non-911 reasons. We seek further comment on the degree to which commercial development – unrelated to any Commission indoor location capability requirement – could be leveraged to mitigate the costs of compliance. What additional costs would be imposed by the potential indoor location requirements set forth in this *Third Further Notice* above and beyond the costs that commercial carriers would already have in implementing indoor location capabilities for commercial purposes?

B. Near-Term Indoor E911 Location Accuracy Requirements

38. As discussed in greater detail below, we propose that after a reasonable implementation period, CMRS providers subject to Section 20.18 of the Commission’s rules must (1) locate callers within

⁷⁶ For example, a person who is experiencing a heart attack may not be able to communicate verbally. See Rosenworcel, Jessica, “Bring Wireless 911 Up to Date,” *The Hill*, Jan. 14, 2014, available at <http://thehill.com/opinion/op-ed/195446-bring-wireless-911-up-to-date> (last visited Feb. 5, 2014).

⁷⁷ See *CSRIC Indoor Location Test Bed Report* at 54.

⁷⁸ See *id.* at 53.

⁷⁹ We discuss these factors in greater detail in the implementation discussion below. See *infra* Section III.B.3.

50 meters for 67 percent and 80 percent of indoor calls within two years and five years of the effective date of adoption of rules, respectively, and (2) provide vertical (z-axis) data, within 3 meters accuracy, for 67 percent and 80 percent of indoor calls within three years and five years of the effective date of adoption of rules, respectively. We propose that these indoor location accuracy requirements be implemented nationwide. Finally, we propose the institutionalization of an indoor location accuracy test bed for purposes of demonstrating compliance with these requirements and ask about other approaches to validating compliance.

39. We seek to promote several key objectives through these proposed rules: (1) make indoor location as widely available as technically and economically feasible, tracking recent improvements in location technology; (2) help CMRS providers, public safety entities, and the Commission to monitor performance and compliance; and (3) adopt rules that are technology-neutral, cost-efficient, and easy to understand and administer. We seek comment on how our proposed approach, as well as any potential alternatives – particularly any consensus proposals from industry and public safety stakeholders – might promote these objectives most effectively. We also seek comment on whether there are any other engineering or other issues, not raised in this *Third Further Notice*, that the Commission should consider with regard to promoting the location accuracy goals in this rulemaking proceeding.

1. Horizontal Location Information

40. *Background.* Prior to the *CSRIC Indoor Location Test Bed Report*, the record in response to the *E911 Location Accuracy Second Further Notice* generally reflected a consensus that it was premature to impose indoor location accuracy requirements. For example, while public safety entities generally expressed concern regarding the lack of indoor location accuracy requirements,⁸⁰ they acknowledged that further exploration of indoor testing would be necessary before any such requirements could be adopted.⁸¹ Industry representatives generally opposed the adoption of indoor accuracy requirements pending further study and testing.⁸² They also pointed out the difficulty of creating an adequate testing environment and the lack of currently available technologies.⁸³ Additionally, vendors' initial comments varied with regard to the speed and method by which they thought the Commission should adopt indoor location requirements, or even whether it should adopt such requirements.⁸⁴

⁸⁰ See, e.g., APCO Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 8 (APCO Second Further Notice Comments); IACP, *et al.* Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 1 (IACP Second Further Notice Comments).

⁸¹ See, e.g., NENA Comments, PS Docket No. 07-114 (filed Nov. 1, 2011) at 13 (NENA Second Further Notice Comments); APCO Further Notice Comments, PS Docket No. 07-114 (filed Jan. 18, 2011) at 3 (APCO Further Notice Comments).

⁸² See, e.g., AT&T Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 7 (AT&T Second Further Notice Comments); CTIA Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 4 (CTIA Second Further Notice Comments); MetroPCS Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 9 (MetroPCS Second Further Notice Comments).

⁸³ See, e.g., CTIA Second Further Notice Comments at 3.

⁸⁴ See, e.g., TruePosition Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 2 (TruePosition Second Further Notice Comments) (Commission should apply location accuracy metrics to indoor environments and test for compliance); CommLabs Reply Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 8 (CommLabs Second Further Notice Reply Comments) (Commission should not wait until the CSRIC report has been published before initiating next regulatory step); Boeing Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 20 (Boeing Second Further Notice Comments) (Commission should not implement rules mandating specific technology or standard); TeleCommunications Systems, Inc. Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 12 (TCS Second Further Notice Comments) (location accuracy for indoor calls requires more study); Motorola Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 9 (Motorola Second Further Notice Comments) (Commission should not require indoor location accuracy testing by providers).

41. More recently, after CSRIC's submission of its indoor location test bed report and recommendations in March 2013, some public safety groups and technology vendors now urge the Commission to require some level of accuracy for indoor 911 calls. For instance, APCO urges the Commission to begin "now to develop rules and policies" to provide "a reasonable level" of indoor accuracy.⁸⁵ NENA suggests the "introduction of an indoor location accuracy standard" and "the phase-in of a z-axis performance requirement."⁸⁶ TruePosition submits that the Commission "now has enough information about indoor location technologies to move forward."⁸⁷ At the same time, however, some industry representatives suggest that "future progress [is] needed to meet the expressed needs of the public safety community."⁸⁸ However, as discussed above, CMRS providers express concern about the ability to move forward with indoor location accuracy requirements at this time.⁸⁹

42. WG3 concluded approximately a year ago that "additional development is required to ensure" the provision of an "actionable location," especially in urban and dense urban environments.⁹⁰ However, participants in the WG3 test bed have indicated that they were then in the process of making improvements to their technologies. Other parties submit that recent developments in hybrid technologies and solutions show that improvements in location accuracy are being implemented. Verizon submits that it has been working "to improve the sensitivity of its [handsets'] GPS chipsets to satellite signals."⁹¹ T-Mobile asserts that "[t]he best opportunity for implementing improved location technology is as carriers and consumers implement [VoLTE]."⁹²

43. Some industry representatives note the possibility for improved indoor accuracy with the implementation of small cell networks. Verizon notes that "indoor small cell deployments, WLAN location information, and hotspot or femtocell technologies, all of which can be designed with a very

⁸⁵ Letter from Robert M. Guss, Senior Regulatory Counsel, APCO International, to Marlene H. Dortch, Secretary, FCC, PS Docket No.07-114 (filed Apr. 15, 2013), at 1 (APCO Apr. 15, 2013 *Ex Parte* Letter); *see also* APCO Workshop Comments at 5; IACP Workshop Comments at 1; IAFC Workshop Comments at 1.

⁸⁶ NENA Workshop Comments at 3.

⁸⁷ Letter from James Arden Barnett, Jr., Counsel for TruePosition, Inc., to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed June 25, 2013), at Attachment, "Wireless 911 and Indoor Location Accuracy" (TruePosition June 25, 2013 *Ex Parte* Letter). *See also* Letter from James Arden Barnett, Jr., Counsel for TruePosition, Inc., to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed June 14, 2013) (TruePosition June 14, 2013 *Ex Parte* Letter), attaching Letter from Commissioner Charles H. Ramsey, President, Major Cities Chiefs Association, to Julius Genachowski (filed May 27, 2013) ("urg[ing] . . . the Commission to consider regulations that require telecommunications providers to provide indoor cellular location data to law enforcement"). *See also* Letter from Tom W. Davidson, Counsel for TruePosition, Inc., to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Apr. 25, 2013) at Attachment 1, page 22 (TruePosition Apr. 25, 2013 *Ex Parte* Letter) ("The FCC now has enough information . . . to move forward to solve the increasing problem of inadequate indoor location coverage.").

⁸⁸ Letter from Bruce A. Olcott, Counsel for NextNav LLC (NextNav), to Marlene H. Dortch, Secretary, FCC, PS Docket No.07-114 (filed June 28, 2013), at 2 (NextNav June 28, 2013 *Ex Parte* Letter). *See also* T-Mobile Workshop Comments at 13 (near-term indoor accuracy deadlines are not feasible because, among several factors, "[s]ome technologies . . . show promise, but those are not yet near-term commercialized solutions").

⁸⁹ *See supra* Section III, para. 25 note 53.

⁹⁰ CSRIC *Indoor Location Test Bed Report* at 8.

⁹¹ Verizon Workshop Comments at 3 (also asserting that its "AFLT has become increasingly accurate" as it "has worked with vendors to optimize antenna placement and base station information"). Verizon adds that "enhancements to A-GPS and other location technologies . . . for VoLTE service will enable service providers to improve indoor location accuracy" to "leverage the existing A-GPS configuration." *Id.* at 5.

⁹² T-Mobile Workshop Comments at 34.

small coverage area, have the potential to provide very accurate location information....”⁹³ Sprint asserts that “the addition of ‘small cells’ into carrier networks, along with other in-building solutions, may hold some promise to help not only resolve coverage issues related to signal strength indoors....”⁹⁴

44. *Discussion.* We propose a near-term requirement to achieve “rough” indoor location information. We propose to require CMRS providers subject to Section 20.18 of the Commission’s rules to provide horizontal (x- and y-axis) information for wireless 911 calls that originate indoors.⁹⁵ Specifically, we propose to require CMRS providers to identify an indoor caller’s horizontal location within 50 meters.⁹⁶ We propose that CMRS providers must satisfy this accuracy requirement for 67 percent of calls within two years from the effective date of the adoption of any rules, and for 80 percent of calls within five years from the effective date of the adoption of any rules. Under this proposal, the requirement would apply uniformly to all indoor calls and would be technology-neutral; CMRS providers could use any location technology or combination of location technologies to meet this requirement.

45. We believe that a search radius of 50 meters will provide meaningful information while being attainable in the near-term. A larger search ring, while easier to implement, would not yield sufficiently granular information to be of use to first responders.⁹⁷ In the longer term, location information should be sufficiently granular to provide a specific residential or business address, including floor and suite or apartment information. Nevertheless, based on existing technological considerations and the needs of the public safety community, we find that the public safety and interest would be better served by adopting this requirement in the near term rather than allowing a regulatory gap to grow. We agree with CSRIC’s observation that the objective should “be for the smallest possible search ring,” and we seek comment on our proposed location accuracy requirement of 50 meters.⁹⁸

46. The *CSRIC Indoor Location Test Bed Report* also observed that the participating vendors are currently working on improvements to their location technologies that show promise toward achieving more precise accuracy performance.⁹⁹ Additionally, the record and the *CSRIC Indoor Location Test Bed Report* indicate that other vendors are actively working on advances in improving location technologies.¹⁰⁰ We seek comment on the extent to which mandating a 50-meter accuracy requirement to

⁹³ Verizon Workshop Comments at 7, citing Qualcomm Aug. 15, 2013 *Ex Parte* Letter, Att. at 10-11.

⁹⁴ Sprint Workshop Comments at 8 (adding that such technologies might “be able to provide additional assistance in locating callers with some specificity at indoor locations”). See also T-Mobile Workshop Comments at 12.

⁹⁵ We characterize this near-term indoor accuracy level as “rough” in view of CSRIC WG3’s test bed results that “[h]orizontal positional accuracy within 50 meters can provide a meaningful indoor location, particularly in rural or suburban environments,” but that “even this accuracy within heavily urbanized areas or downtown settings may still result in positions outside the actual building where the emergency call originated.” *CSRIC Indoor Location Test Bed Report* at 9.

⁹⁶ See 47 C.F.R. § 20.18(h)(2)(i)-(ii).

⁹⁷ For example, a 100-meter requirement would only narrow the search radius to a city block at best. A Manhattan city block is 80 meters by 270 meters. See “City block,” available at http://en.wikipedia.org/wiki/City_block (last visited Feb. 3, 2014). See also *Third E911 Report and Order*, 14 FCC Rcd at 17422 ¶ 74 (observing that “the 100 meter radius standard implies a circular area of 31,416 square meters”; but with a 50-meter requirement, “the area enclosed would be only a quarter the size, 7,854 square meters”).

⁹⁸ See *CSRIC Indoor Location Test Bed Report* at 9.

⁹⁹ See *id.* at 40–41 (discussing NextNav’s next generation system, Polaris’s improvements to its “signature representation” technology to solve signal path problems on the upper floors of buildings; and Qualcomm’s improvements to its 3G AFLT technology that will incorporate OTDOA location technology in 4G LTE networks).

¹⁰⁰ See TruePosition Wilmington Test Bed Results; Letter from Bruce A. Olcott, Counsel, NextNav, LLC, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Aug. 14, 2013) (NextNav Aug. 14, 2013 *Ex Parte* Letter) (reporting the test results for a second generation of NextNav’s technology); Cisco July 24, 2013 *Ex Parte* Letter at 1; *CSRIC Indoor Location Test Bed Report* at 55 (listing the following vendors who did not participate but (continued....))

indoor calls – after a reasonable period of time – would encourage CMRS providers to work with location and device vendors to implement the advances being made in indoor location technology.

47. As noted above, the CSRIC test bed examined the RF fingerprinting, A-GPS/AFLT, and beacon technologies of Polaris, Qualcomm, and NextNav, respectively. Horizontal location accuracy varied by technology and the representative environments – dense urban, urban, suburban, and rural. For each environment, CSRIC evaluated the accuracy of each technology for 67 percent and 90 percent of the total number of calls tested.¹⁰¹ While we acknowledge that the test bed results indicate that further improvement is necessary, we are encouraged that, at least in suburban and rural environments, a 50-meter (or less) search ring can already be produced by existing technology. Further, even if technology currently cannot satisfy the proposed near-term 50-meter accuracy requirement in more challenging indoor environments, the adoption of more stringent requirements for indoor location accuracy, together with a reasonable implementation timeframe, would afford CMRS providers with sufficient time and incentive to develop the necessary technology to enable compliance with the proposed requirement regardless of the environment.

48. We propose to combine the 50-meter accuracy requirement with a reliability threshold of 67 percent in two years and 80 percent in five years. With this requirement, the center point of the uncertainty circle should fall within 50 meters of the true location 67 or 80 percent of the time, as applicable, and must be delivered within 30 seconds.¹⁰² Thus, under the first two-year benchmark, up to 33 percent of calls may either have location outside the accuracy threshold or location data that arrives after a delay of more than 30 seconds. We seek comment on whether the proposed two-stage reliability thresholds of 67 and 80 percent would be useful to public safety entities and technically feasible for CMRS providers to achieve. Under the current E911 requirements based on outdoor measurements, CMRS providers using handset-based location technologies must satisfy a reliability requirement of 67 percent for 50 meters. We also note that CSRIC tested for location accuracy based on the reliability percentages of 67 percent and 90 percent of the total number of calls tested.¹⁰³ In proposing this two-stage reliability requirement, we seek comment on whether a reliability metric of 67 percent is adequate to meet the needs of public safety in the current environment. CSRIC considered that the public safety entities need reliable, “consistent caller location information” for indoor locations;¹⁰⁴ would a 67 percent requirement provide sufficiently reliable indoor location information? We note that CSRIC’s analysis of accuracy measurements versus reliability percentages indicates that an 80 percent reliability requirement for indoor calls, while not achievable now, may be attainable with a 50-meter accuracy requirement in the proposed near-term period.¹⁰⁵ We seek comment on whether two-stage approach to adopting reliability requirement would adequately address public safety needs, and seek comment on any alternative approaches.

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hopefully could in future test beds: TruePosition (UTDOA Positioning), CommScope (DAS Proximity-based Positioning), CSR (AGNSS/WiFi/MEMS Sensor Hybrid Positioning), and Boeing BTL (LEO Iridium Satellite-based Positioning)).

¹⁰¹ See *CSRIC Indoor Location Test Bed Report* at 26-27, Table 7.2-1, Summary Horizontal Accuracy Statistics in All Environments.

¹⁰² While we propose that CMRS providers must identify a location fix within 30 seconds, we propose to allow CMRS providers to exclude calls of 10 seconds or less, for which the CMRS provider is unable to obtain a location fix, in assessing compliance with the 67 and 80 percent reliability thresholds. See *infra* Section IV.A.

¹⁰³ See *CSRIC Indoor Location Test Bed Report* at 26-27, Table 7.2-1, Summary Horizontal Accuracy Statistics (also testing for accuracy for 95 percent of the total number of calls).

¹⁰⁴ See *id.* at 9.

¹⁰⁵ See *id.* at 27, 29, and 32, Figs. 7.3-1, 7.3-3, and 7.3-5 (illustrating cumulative horizontal accuracy in dense urban, urban, and suburban environments).

49. We also seek comment on whether the proposed two-stage reliability requirements are feasible in light of the types of specific challenges that CMRS providers may confront in indoor environments, such as the proliferation of signal boosters within buildings.¹⁰⁶ We seek comment on the extent to which these types of indoor-specific challenges may affect a providers' ability to deliver location information in compliance with our proposed reliability thresholds for indoor calls.

50. At the same time, we recognize that certain in-building systems and access devices – such as a DAS network – could be programmed to provide specific location information, including building address and floor level information, for the origination of the indoor call.¹⁰⁷ In addition to our proposed 50-meter accuracy requirement, should we consider adopting an alternative indoor location requirement that CMRS providers can satisfy by delivering a caller's building address and floor information? Such a requirement would be consistent with our long-term indoor location objective, which is the delivery of “dispatchable address” information, including the caller's building address, floor level, and suite/room number.

51. Further, we propose that the combined 50-meter accuracy and 67- and 80-percent reliability requirements comprise the sole ring for testing indoor location accuracy. We seek comment on this proposal. We note that, in the context of E911 location accuracy based on outdoor measurements, our rules include a “dual search ring” system, with different reliability thresholds for 50-meter and 150-meter accuracy.¹⁰⁸ While a dual search ring requirement was a reasonable approach based on outdoor measurements,¹⁰⁹ a search ring larger than 50 meters is unlikely to yield sufficiently granular information to prove useful to public safety in the context of locating a caller indoors.

52. We also seek comment on the costs of imposing a 50-meter accuracy requirement (versus some other benchmark), and a two-stage reliability requirement of 67 and 80 percent (or some other reliability benchmark or dual ring system). We anticipate that a more precise horizontal 50-meter accuracy requirement would come at a higher cost than a less precise accuracy requirement, but to what extent? We seek comment on what any cost differential might be, and whether such costs could be mitigated. For example, would a single 50-meter /67 or 80 percent requirement be more costly to CMRS providers than a dual search ring? For example, would a 50-meter/67 percent, 150-meter/80-90 percent requirement (similar to our existing Phase II E911 requirements based on outdoor measurements for handset-based location solutions) serve to reduce costs?

53. We seek comment on alternative approaches to implementing indoor location accuracy and reliability requirements. For example, a potential alternative approach would be to extend the existing E911 Phase II location accuracy requirements, which currently apply to outdoor measurements

¹⁰⁶ See 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 10-4, *Report and Order*, 28 FCC Rcd 1663, 1665 ¶ 3 n. 1 (2013) (*Signal Booster Report and Order*). In the *Signal Booster Report and Order*, the Commission defined a “signal booster” as including 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. The Commission noted that signal boosters can affect network-based E911 solutions in some instances, by introducing delay that alters the measured time-of-arrival used by network-based E911 systems. *Id.* at ¶ 83.

¹⁰⁷ See also *infra* Section III.C.1 (seeking comment on the potential for attaching specific address information to small cells and DAS networks, and transmitting such information with wireless calls to 911 from indoors).

¹⁰⁸ See 47 C.F.R. § 20.18(h)(2)(i), (ii) (applying to handset-based technologies and establishing 80 percent for the initial benchmark and 90 percent for the last benchmark in 2019); for network-based technologies, the reliability percentages are 67 and 90 percent but with less stringent accuracy standards. See 47 C.F.R. § 20.18(h)(1)(i), (ii).

¹⁰⁹ In the past, the Commission has observed that a dual ring approach encourages the implementation of location technologies that may not be accurate enough to satisfy a desired stringent standard but could provide beneficial “backstop and adjunct capabilities.” See *Third E911 Report and Order*, 14 FCC Rcd at 17423 ¶ 77 (also including network-based location technologies for rural environments).

only, to indoor environments. While this approach would permit providers to simply apply existing outdoor location accuracy requirements to indoor calls, such an approach could be inconsistent with the Commission's intent to progress towards more granular location data for all wireless calls to 911,¹¹⁰ and, as discussed above, would be unlikely to result in a sufficiently narrow search ring to be of use to public safety in indoor environments.¹¹¹ Further, we think that a uniform indoor accuracy requirement, independent from any existing outdoor location requirements, acknowledges that indoor environments are distinct from outdoor environments. In the *Indoor Location Test Bed Report*, CSRIC recommended that the Commission treat indoor location accuracy separately from outdoor location accuracy due to differences in testing and technologies.¹¹² We seek comment on this analysis and our proposed approach.

54. We also invite alternative approaches that would best weigh the costs and benefits of implementing an indoor location requirement with technical feasibility, timing, and other implementation concerns. In particular, we invite industry and public safety stakeholders to propose consensus-based, voluntary commitments that would address the public safety goals set forth in this proceeding and facilitate closing the regulatory gap between indoor and outdoor location accuracy without the need to adopt regulatory requirements. We seek comment on whether there has been a market failure in the provision of E911 information and, if not, whether the market could be relied upon to address indoor location issues on its own, and within a reasonable period of time. Could voluntary commitments, in conjunction with Commission monitoring of indoor location accuracy developments and actual performance, be sufficient and effective in satisfying the public safety objectives of this proceeding? We invite comment on the potential for voluntary commitments and other consensus-based proposals to address these issues.

55. *Timeframe.* In light of recent developments in wireless technology and usage trends, we believe it is critical to address the gap in our existing E911 regulatory framework regarding indoor location accuracy as quickly as possible. Accordingly, we propose a two-stage implementation timeframe from the effective date of an order adopting indoor E911 location accuracy requirements and seek comment on whether such a timeframe would be technically feasible and economically reasonable. We recognize that the extent to which a provider is able to satisfy a specific accuracy or reliability requirement will be linked to the timeframe allowed for implementation of such requirements.

56. The record, to date, is divided regarding whether location accuracy technology is sufficiently developed to support the near-term implementation of an indoor location accuracy requirement.¹¹³ However, evidence in the record suggests that technology is sufficiently developed to support the implementation of an indoor location accuracy requirement in the near term. For example, CSRIC observed that the participating vendors are currently working on improvements to their location

¹¹⁰ We discuss the Commission's intent to move towards more granular location information for outdoor calls below. See *infra* Section IV.A.

¹¹¹ The Commission has indicated that it will eliminate the larger 100/300-meter network-based accuracy standard for outdoor measurements and will require providers to satisfy a 50-meter standard for all calls over time. See *Wireless E911 Location Accuracy Requirements, Third Report and Order*, PS Docket No. 07-114, 26 FCC Rcd 10074, 10082 ¶ 19 (stating that "the network-based standard should sunset at an appropriate point after the end of the eight-year implementation period, at which point all carriers would be obligated to meet the handset-based location accuracy standard") (*E911 Location Accuracy Third Report and Order*). See also 47 C.F.R. § 20.18(h)(1)(ii)(C) (the last location accuracy benchmark for network-based providers is Jan. 18, 2019).

¹¹² See *CSRIC Indoor Location Test Bed Report* at 52 (noting that indoor testing may require different industry accepted methods of testing, compared to outdoor methods).

¹¹³ Wireless providers, while indicating there has been considerable development in indoor location technologies, nevertheless emphasize that "indoor location accuracy and vertical location are both areas where considerable work remains" and "caution against trying to impose aggressive rules ahead of either consensus on standards for indoor location accuracy or proven technologies." See, e.g., AT&T Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 6 (AT&T Workshop Comments).

technologies that show promise toward achieving more precise accuracy performance.¹¹⁴ These results also indicate that at least one indoor location technology is already close to achieving the indoor accuracy requirement equivalent to the existing outdoor handset-based location requirement (50 meters for 67 percent of calls).¹¹⁵ The record and the *CSRIC Indoor Location Test Bed Report* indicate that other vendors are actively working on advances in improving location technologies.¹¹⁶ In addition, recent filings suggest that the technology is sufficiently developed to support a near-term indoor location accuracy requirement.¹¹⁷

57. We seek comment on whether a two-year timeframe is sufficient for CMRS providers to satisfy the horizontal (x- and y-axis) component of the indoor location accuracy requirement discussed above for 67 percent of indoor 911 calls. We believe that the significant public interest benefits of providing indoor location as soon as possible, combined with the current pace of technological developments, suggest that an expedited timeframe may be feasible and warranted. The CSRIC test bed results, which tested three different technologies – all of which provided reasonably accurate indoor measurements – and subsequent testing by others of their indoor location technology with similar results,¹¹⁸ suggests that location technology, with further advancements, could satisfy our proposed accuracy requirement within this timeframe. Furthermore, as described above, at least two of the indoor location technologies tested in the CSRIC test bed are commercially available already, while TruePosition asserts that its solution is already in use by two of the nationwide CMRS providers and “can easily be paired with existing AGPS capabilities, used by many cell phone networks, in a hybrid solution.”¹¹⁹ We seek comment on our analysis. In what timeframe could technologies meet the proposed 50-meter requirement for 67 percent of all indoor calls? Is a five-year timeframe appropriate for technologies to meet the proposed 50-meter requirement for 80 percent of all indoor calls? How long would standards bodies need to develop any necessary standards? What else should the Commission consider with regard to the proposed timeframes?

58. We also seek comment on how any necessary network and handset upgrades would impact the proposed timeline. How long would it take CMRS providers to deploy location accuracy systems capable of meeting the proposed requirements throughout their networks? How long would providers need to obtain the hardware necessary for upgrading handsets to work with newly deployed location accuracy systems? How much time would be necessary for upgraded handsets to enter the

¹¹⁴ See, e.g., *CSRIC Indoor Location Test Bed Report* at 40–41 (discussing NextNav’s next generation system, Polaris’s improvements to its “signature representation” technology to solve signal path problems on the upper floors of buildings; and Qualcomm’s improvements to its 3G AFLT technology that will incorporate OTDOA location technology in 4G LTE networks).

¹¹⁵ *Id.* at 35.

¹¹⁶ See TruePosition Wilmington Test Bed Results; NextNav Aug. 14, 2013 *Ex Parte* Letter; Cisco July 24, 2013 *Ex Parte* Letter at 1; *CSRIC Indoor Location Test Bed Report* at 55 (listing the following vendors who did not participate but hopefully could in future test beds: TruePosition (UTDOA Positioning), CommScope (DAS Proximity-based Positioning), CSR (AGNSS/WiFi/MEMS Sensor Hybrid Positioning), and Boeing BTL (LEO Iridium Satellite-based Positioning)).

¹¹⁷ In a recent *ex parte*, for example, NextNav states that “[a]ll four major wide-area location providers [have] confirmed that their most advanced location technologies can be deployed and in commercial operation within two years.” See Letter from Bruce A. Olcott, Counsel, NextNav, LLC, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Nov. 26, 2013) at 8 (NextNav Nov. 26, 2013 *Ex Parte* Letter).

¹¹⁸ See *supra* Section II.B. para. 17; see also Table 1.

¹¹⁹ TruePosition April 22, 2013 *Ex Parte* Letter at 2. While handset-based providers have traditionally been the primary users of A-GPS, network-based providers have also been migrating in this direction. See Section IV.D (discussing migration to handset-based location accuracy technologies); see also *E911 Location Accuracy Third Report and Order*, 26 FCC Rcd at 10082 ¶ 18.

marketplace to sufficiently penetrate the marketplace, such that providers could meet the proposed 67 and 80 percent reliability requirements?

59. Some commenters suggest a longer implementation timeframe is necessary, but we believe that the establishment of firm timeframes – together with a clear accuracy requirement – will provide the regulatory certainty necessary¹²⁰ for parties to dedicate resources to improving location accuracy technology. Further, the extent and pace of recent advancements in indoor location technology suggests that technical feasibility will not prove to be a barrier to implementation of a near-term, two-year indoor location requirement of 50 meters for 67 percent of calls. Given that there are several different indoor location technology solutions already deployed or under development, we think that a two-year timeframe would allow for the development of technological alternatives and encourage competition among location technology vendors, so that CMRS providers would have a choice of solutions to implement. Two years would also allow time necessary to establish the indoor location accuracy test bed.

60. We also seek comment on alternatives to using the effective date of rules as the trigger for the timeline to comply with proposed indoor location accuracy requirements. For example, to address potential uncertainty in the development of technology, should we consider initiating the compliance timeline only after the test bed administrator certifies that a technology has met the proposed accuracy standards in the test bed? Would any process be necessary or appropriate for opportunity for comment on and Commission review of such a determination? If we used technology certification as the timeline trigger, should we require availability of competitive technology options? Should we retain the two- and five-year timelines proposed above or should they be shortened? Would linkage of the timeline to technology certification reduce the incentive to invest in technological development or create incentives to delay testing in the test bed? What other factors should we consider with regard to the impact of test bed certification on proposed timelines?

61. As another alternative, if the timeline is triggered by the adoption of rules, we seek comment on whether the Commission should consider reevaluating the compliance timeline at some interim point to evaluate the status of testing of location technology. For example, a year after the rules go into effect, the Commission could require the test bed administrator to report to the Commission on the results of technology testing, at which point the Commission could consider whether any adjustments to the timeline are necessary based on how technologies have performed in the test bed. Such an approach would enable the Commission to evaluate progress made during testing while retaining control over implementation timeframes and ensuring that testing efforts proceed in a timely manner. We seek comment on this alternative.

62. We invite parties who disagree with this proposed timeframe to provide specific reasons why more time is necessary, including the steps necessary to implement horizontal requirements and the time necessary to satisfy each step. We also seek comment on whether there have been sufficient advancements in location technology since the CSRIC test bed results. We also understand that additional capital investment may be necessary to meet any new proposed indoor testing requirements. We seek detailed and concrete data regarding the costs of implementing horizontal indoor location accuracy requirements within a two-year timeframe. We also seek comment on alternative reliability standards, as well as on whether we should phase in different reliability standards in conjunction with staged implementation timeframes, or different requirements for specific types of mobile devices (*e.g.*, only 4G-capable devices). Alternatively, would likely development timetables and cost considerations warrant a longer implementation timeframe that would permit integration of the vertical location capability proposed below on the same schedule?

63. *Facilitating Network Migrations and NG911 Transitions.* Whether we adopt the proposed requirements or another approach, we seek to encourage CMRS providers to invest in the near-term as a pathway to achieving more precise indoor accuracy in the long term. We also believe that any

¹²⁰ See *supra* Section III, para. 25 note 53.

near-term indoor location accuracy requirements should take into account long-term E911 and NG911 objectives to avoid requiring significant investment in technologies that could become stranded. In our view, a technology-neutral indoor accuracy requirement should allow CMRS providers flexibility to adopt an indoor location accuracy solution that best fits with their long-term business and technology plans.

64. We seek comment on how best to structure a near-term requirement so that it will promote our longer-term objectives. For instance, what approach would provide incentives to providers to leverage existing investments in implementing technologies in the near-term to facilitate their efforts to meet a long-term accuracy requirement? What effect if any would it have on their ability and incentive to accelerate deployment of the vertical location accuracy goals discussed below? On the transition to NG911? How would the adoption of a near-term 50-meter requirement affect the costs, deployment, and operation of the network upgrades that providers currently are making to deploy 4G technologies? Would the proposed near-term requirements have an adverse impact on current and future requirements work that could also serve to achieve meeting a long-term accuracy requirement? In this regard, we note that CSRIC concluded that more standards work will be required “to allow practical implementation of many emerging location technologies for emergency services use.”¹²¹

2. Vertical Location Information

65. *Background.* While horizontal location information is a critical element to locating a 911 caller, a third dimension of location information – a vertical, or “z-axis” component – would greatly enhance location accuracy. Vertical location information on a caller’s floor height would substantially benefit first responders trying to locate callers in multi-story buildings.

66. Locating 911 callers in a three-dimensional environment has been a longstanding goal of the Commission. In 1994, prior to the adoption of its initial E911 rules, the Commission envisioned a “Phase III” of E911 implementation, which would include a vertical location component.¹²² The Commission observed that “location information consisting only of latitude and longitude may be sufficient for radio transmitters operating outside of an urban environment,” but that “[e]ven greater accuracy could be necessary in urban environments to determine the precise location of a caller within a multi-story structure.”¹²³ Indeed, from the beginning, the Commission has noted the need for z-axis information for urban areas.

67. Building on this initial inquiry, in 1996 the Commission proposed that “carriers should be required to achieve the capabilities necessary to provide to PSAPs . . . information that locates a wireless 911 caller within a radius of 40 feet . . . using longitude, latitude, and vertical location data.”¹²⁴ It also sought comment on whether it would be appropriate to limit the applicability of vertical location requirements to certain geographic areas¹²⁵ and what additional costs would be imposed on providers in order to support the provision of vertical location data.¹²⁶

¹²¹ CSRIC *Indoor Location Test Bed Report* at 54. See also Cisco July 24, 2013 *Ex Parte* Letter at 1 (concerning Wi-Fi standards work and certification in 2015).

¹²² Revision of the Commission’s Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, *Notice of Proposed Rulemaking*, 9 FCC Rcd 6170 at ¶ 51 (1994).

¹²³ *Id.*

¹²⁴ *First E911 Report and Order*, 11 FCC Rcd at 18743-44 ¶ 138.

¹²⁵ *Id.* at 18744 ¶ 140 (seeking comment “whether it would be appropriate to limit a requirement for providing this type of location information to certain geographic areas.”).

¹²⁶ *Id.* at 18745 ¶ 141. Subsequently, the Commission focused its inquiry on horizontal location accuracy, as described above. See [cross-reference earlier discussion]. At that time, indoor wireless coverage was neither as prevalent nor as important, as landline phones were predominantly used indoors

68. The Commission most recently sought comment on the technical feasibility of implementing vertical location accuracy requirements in its 2010 *E911 Location Accuracy Further Notice*.¹²⁷ Specifically, the Commission sought comment on the state of industry development of z-axis technology and the development of relevant standards; what existing technologies could integrate z-axis components; how z-axis location data could be incorporated into the data already being delivered to PSAPs; and in what timeframe it would be reasonable to require carriers to deliver z-axis information with its location data.¹²⁸

69. In response to the *E911 Location Accuracy Further Notice*, most commenters submitted that z-axis information would be extremely useful for first responders.¹²⁹ At the time, however, most commenters agreed that no technology with sufficiently developed z-axis location capabilities existed.¹³⁰ Likewise, commenters stressed the unique challenges of providing vertical location as opposed to horizontal location.¹³¹ Commenters also emphasized that PSAPs would face difficulties with interpreting z-axis information and translating this data into a usable format for first responders.¹³² For example, Polaris Wireless noted that because vertical location is best expressed in contextual form, “PSAP call takers must be able to visualize vertical location information in computer-aided design (‘CAD’) or other display formats in order to dispatch personnel to the correct place.”¹³³ A number of commenters argued that the Commission should establish a task force to conduct a more in-depth analysis of issues relating to the delivery of usable z-axis location information.¹³⁴ Some commenters suggested that the Commission

¹²⁷ *E911 Location Accuracy Further Notice*, 25 FCC Rcd at 18966-67 ¶ 23.

¹²⁸ *Id.*

¹²⁹ See APCO Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 5 (APCO Further Notice Comments); AT&T Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 12 (AT&T Further Notice Comments); Motorola Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 8 (Motorola Further Notice Comments); NENA Comments (corrected), PS Docket No. 07-114 (filed Jan. 20, 2011), at 11 (NENA Further Notice Comments).

¹³⁰ See, e.g., AT&T Further Notice Comments at 12; APCO Further Notice Comments at 5; ATIS Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 9 (ATIS Further Notice Comments); CTIA Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 7 (CTIA Further Notice Comments); Motorola Further Notice Comments at 8; Polaris Wireless Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 8 (Polaris Further Notice Comments); Sprint Nextel Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 9 (Sprint Further Notice Comments); T-Mobile USA, Inc. Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 20 (T-Mobile Further Notice Comments); TeleCommunications Systems, Inc. Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 5 (TCS Further Notice Comments); Texas 911 Alliance Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 16 (Texas 911 Further Notice Comments). Two commenters argued that the provision of z-axis information was technically feasible in the near term. See CommLabs Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 12 (CommLabs Further Notice Comments); Intrado Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 4 (Intrado Further Notice Comments).

¹³¹ See Andrew, a Commscope Company Comments, PS Docket No. 07-114, (filed Jan. 18, 2011) at 6-7 (CommScope Further Notice Comments); AT&T Further Notice Comments at 12; Motorola Further Notice Comments at 8-9; Polaris Further Notice Comments at 20.

¹³² See APCO Further Notice Comments at 5; ATIS Further Notice Comments at 9; Motorola Further Notice Comments at 9; Polaris Further Notice Comments at 8; Sprint Further Notice Comments at 9; T-Mobile Further Notice Comments at 21; Verizon and Verizon Wireless Comments, PS Docket No. 07-114 (filed Jan. 19, 2011), at 14 (Verizon Further Notice Comments); NENA Further Notice Comments at 12; Sprint Workshop Comments at 7.

¹³³ Polaris Further Notice Comments at 8.

¹³⁴ See, e.g., AT&T Further Notice Comments at 12; AT&T Reply Comments, PS Docket No. 07-114 (filed Feb. 18, 2011), at 8 (AT&T Further Notice Reply Comments) (suggesting that the Commission postpone regulatory work on z-axis and instead task an E911 Technical Advisory Group to explore further); CTIA Further Notice Comments at 7 (“A stakeholder group would prove useful when evaluating and making recommendations on topics like [z-axis]”); see also Polaris Further Notice Comments at 9; Motorola Reply Comments, PS Docket No. 07-114 (filed Feb. 18, 2011), at 5 (Motorola Further Notice Reply Comments).

wait and impose a vertical location accuracy requirement in conjunction with a comprehensive rollout of Next Generation 911.¹³⁵ Most commenters agreed that there was still considerable work to be done to develop vertical location technology and standards and that regulation was inappropriate at that time.¹³⁶

70. CSRIC II's Working Group 4C (WG4C) was responsible for examining E911 and public safety location technologies in use today, identifying current performance and limitations for use in next generation public safety applications, examining emerging E911 public safety location technologies, and recommending options to CSRIC for the improvement of E911 location accuracy timelines.¹³⁷ Among other findings, WG4C identified several challenges with providing a vertical location data, noting in particular that "[c]urrent data formats for sending location to a PSAP do not support transmission of Z-height, and therefore a change to the relevant standards is required."¹³⁸ Finally, WG4C recommended that there be an in-depth analysis in the future of z-axis data and how it could be transmitted to PSAP securely.¹³⁹

71. The Commission later tasked CSRIC II with additional investigation of location accuracy¹⁴⁰ Subsequently, as discussed above, in 2012-2013, CSRIC III's WG3 conducted an indoor location test bed to explore further currently available and future indoor location technologies.¹⁴¹ Although it did not specifically focus on technologies that could provide z-axis information, one

¹³⁵ See CommScope Further Notice Comments at 7 ("it is not so much 'altitude' information that is useful as it is on which "floor(s)" the caller is likely located. The NG911 architecture capability of delivering civic address form of location . . . means that this "altitude" consideration may be better addressed in the context of NG911 rather than conventional Phase II cellular E911, because the "floor" and building address can be explicitly communicated in the NG911 architecture."); NENA Further Notice Comments at 12 ("With PSAPs in the beginning stages of the transition to NG9-1-1, it may be appropriate for the commission to address z-axis requirements in the context of a deployed NG9-1-1 system.").

¹³⁶ See, e.g., APCO Further Notice Comments at 5; NENA Further Notice Comments at 11; ATIS Further Notice Comments at 9; Motorola Further Notice Comments at 8; Polaris Further Notice Comments at 21; Sprint Further Notice Comments at 9; Verizon Further Notice Comments at 13-14. *But see* Texas 911 Further Notice Comments at 16 (suggesting that requirements in at least some contexts – such as requiring femtocells to provide MSAG address information – could mitigate some of the more difficult unresolved location accuracy issues); CommLabs Further Notice Comments at 14 ("The Commission should [also] move forward with the adoption of a z-axis mandate in its indoor location accuracy and testing rules.").

¹³⁷ *E911 Location Accuracy Further Notice and NOI*, 25 FCC Rcd at 18962 ¶ 12 (stating that "[o]ne of the Working Groups within CSRIC, Group 4C - Technical Options for E911 Location Accuracy, is responsible for examining E911 and public safety location technologies in use today, identifying current performance and limitations for use in next generation public safety applications, examining emerging E911 public safety location technologies, and recommending options to CSRIC for the improvement of E911 location accuracy timelines"). See also CSRIC II Working Group 4C, *Technical Options for E911 Location Accuracy Final Report*, at 5 (March 14, 2011), available at http://transition.fcc.gov/pshs/docs/csric/CSRIC_4C_Comprehensive_Final_Report.pdf (last visited Feb. 3, 2014) (*Technical Options for E911 Location Final Report*). CSRIC II spanned March 19, 2009 to March 19, 2011. CSRIC III was chartered from March 18, 2011 to March 18, 2013.

¹³⁸ *Technical Options for E911 Location Final Report* at 28. WG4C also acknowledged that at the time, "Phase II deployments were not designed to provide accurate Z-height" and that "significant development would be required for any Z-height compatible modifications or replacements." *Id.*

¹³⁹ *Id.* at 28.

¹⁴⁰ See CSRIC, Working Group Descriptions, Working Group 4C, available at <http://transition.fcc.gov/pshs/advisory/csric/wg-descriptions.pdf> (last visited Feb. 3, 2014). As mentioned previously, the CSRIC II charter expired in March 2011, when it was superseded by CSRIC III. CSRIC II's Working Group 4A, CSRIC III's Working Group 3, and CSRIC IV's Working Group 4C were tasked with the same function.

¹⁴¹ See *CSRIC Indoor Location Test Bed Report*.

participating vendor, NextNav, tested its indoor location technology for vertical location accuracy in the CSRIC test bed.¹⁴² NextNav provided vertical location accuracy within 2.9 meters and 4.8 meters for the 67th and 90th percentiles, respectively.¹⁴³ NextNav's second-generation technology was tested again in 2013 and demonstrated improvements on the results reported in the 2012 test bed, including z-axis performance.¹⁴⁴

72. WG3 noted that “[p]ublic safety recognizes that additional work remains before actionable altitude measurements can be broadly provided and utilized to aid first responders, including standardization, commercial availability, and deployment of such technologies.”¹⁴⁵ However, the record indicates that other vendors have been developing this capability, suggesting that z-axis technology has taken significant strides toward commercial viability since the Commission last considered it. For example, several commenters noted the feasibility of indoor and vertical location and have strongly urged the Commission to develop indoor location accuracy requirements.¹⁴⁶

73. *Discussion.* In light of advancements in indoor location technologies with vertical capabilities, and the growing use of smartphones with features such as barometric pressure sensors, we believe that vertical location technology has sufficiently matured to propose the near-term inclusion of z-axis location information for wireless 911 calls placed from indoors. Specifically, we propose to require CMRS providers to deliver z-axis location information within 3 meters of the caller's location, for 67 percent and 80 percent of indoor wireless 911 calls within three years and five years of the effective date of adoption of rules, respectively.¹⁴⁷ By using a 3-meter measurement, we are effectively requiring floor

¹⁴² *Id.* at 36.

¹⁴³ *Id.* at 39. To compare, an average floor height separation is 3 meters. *Id.* at 39. See also Council on Tall Building and Urban Habitat, Height Calculator, available at <http://www.ctbuh.org/TallBuildings/HeightStatistics/HeightCalculator/tabid/1007/language/en-GB/Default.aspx> (last visited Feb.3, 2014) (*Height Calculator*) (assuming a standard floor-to-floor height of 3.9 meters in office buildings, 3.1 meters in residential and hotel buildings, and 3.5 meters in mixed- or unknown use buildings).

¹⁴⁴ NextNav Aug. 14, 2013 *Ex Parte* Letter at 1-2.

¹⁴⁵ *CSRIC Indoor Location Test Bed Report* at 9.

¹⁴⁶ See, e.g., NENA Workshop Comments at 3 (explaining that “as the recent CSRIC test bed results make clear, technology exists and can be (or in some cases already is) deployed today that can much better meet the needs of the public,” including with respect to vertical location) See also Letter, Bruce A. Olcott, Counsel to NextNav, to Marlene Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Nov. 13, 2013), at 3 (“Although NextNav was the only vendor to demonstrate ‘floor level’ vertical location accuracy in the CSRIC test-bed, other location technology vendors have developed vertical indoor location capabilities. The CSRIC LBS Report discussed several technologies capable of providing vertical location accuracy including Observed Time Difference of Arrival technologies, Distributed Access System proximity-based location technologies, and hybrid A-GPS technologies. Further, the underlying approach to NextNav’s vertical location capabilities (the use of calibrated miniature pressure sensors in handsets) is a technique numerous other vendors have noted can be supported by their systems as well.”) (footnotes omitted); TruePosition Workshop Comments at 6 (“New pressure sensors are available for installation in wireless phones which can be used to determine the altitude, or Z-axis. These pressure sensors have absolute and relative errors which must be calibrated in order to provide an accurate altitude. Experimental calibration schemes have shown promise on prototype systems.”); Mission Critical Partners, Inc. Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 2 (Mission Critical Partners Workshop Comments) (“Submissions to the record in this proceeding claim the potential for a technology that would provide a ... possible z-axis accuracy of less than five meters indoors. The benefits and improvements to the safety and capabilities of first responders that would utilize a network with these location specifications would be immeasurable.”) (footnotes omitted).

¹⁴⁷ The vertical location accuracy requirement would be a separate and independent requirement from the horizontal location accuracy requirement discussed above. The vertical requirement would apply independently – and would be measured and tested independently – from any horizontal location accuracy requirement.

level information.¹⁴⁸ A vertical search ring greater than 3 meters from the caller could lead to mistaken floor identification.¹⁴⁹ In response to the *E911 Location Accuracy Further Notice*, CommScope noted that “vertical accuracy standard would need to be far more stringent than the current standards for the X-Y (Latitude/Longitude) components to provide effective information for emergency location purposes.”¹⁵⁰ We seek comment below on various aspects of our proposal.

74. We think a 3-meter vertical location accuracy requirement is technically feasible. Significantly, based on the test bed report and filings in the record to date, at least one vendor has developed vertical location technology that already can locate callers to within 2.9 meters at the 90th percentile,¹⁵¹ and others estimate having similar granular capabilities within three to five years.¹⁵² Below, we seek comment on whether an initial deployment requirement of three years from the effective date of our new rules would be achievable, including whether such a timeframe ensures that CMRS providers have sufficient competitive choices of vendors and time to incorporate, test, and deploy their technology of choice, and whether setting such a timetable would spur the advancement of vertical location solutions already in development.

75. We also seek comment on the potential costs associated with a vertical location requirement. If a provider were to modify handsets to incorporate barometers in handsets, for example, what would be the cost per handset? We seek comment on how best to structure a vertical location accuracy requirement to mitigate potential costs to providers while still ensuring PSAPs obtain useful vertical location information. We note that our proposed requirement is technology-neutral, and our proposed approach affords providers with the flexibility to choose the most cost-effective means of integrating vertical location technology into their networks.

76. We also seek comment on whether PSAPs are ready to make use of z-axis location information. In recent testimony before the Senate Commerce Committee, NENA stated that the existing location databases have data fields capable of capturing other location elements, such as z-axis readings. NENA opined that many PSAPs are prepared to accept an extended range of data, once the provider has the capability to capture such data.¹⁵³ We note that elevation and floor level information

¹⁴⁸ The average floor height of a multi-story building floor is 3.1 meters in residential buildings, 3.9 meters in office buildings, and 3.5 meters in mixed-use settings. See *Height Calculator*. By proposing a 3-meter requirement, first responders would be able to determine the likely floor level of the 911 caller. As mentioned earlier, if there is vertical location information on the caller of greater than 6.2 meters, then it is reasonable to assume multiple levels, which are primarily indoor environments, and that the call is therefore originating from indoors.

¹⁴⁹ We therefore intend to tighten these z-axis accuracy parameters for long-term implementation, as discussed below in Section III.C.

¹⁵⁰ CommScope Further Notice Comments at 6.

¹⁵¹ In the CSRIC test bed, NextNav was able to locate a caller’s vertical location within 3 meters more than 67 percent of the time in dense urban, urban, and rural morphologies. See *CSRIC Indoor Location Test Bed Report* at 36. NextNav conducted additional testing on the second generation of its location technology and reported improvements in both horizontal and vertical location accuracy. It provided callers’ vertical location within 3.2 meters 80 percent of the time, across all morphologies. See NextNav Aug. 14, 2013 *Ex Parte* Letter at 3-11.

¹⁵² See Polaris Wireless, Inc. Comments, PS Docket No. 07-114 (filed Sept. 25, 2013), at 3 (Polaris Workshop Comments) (estimating “that the vertical location accuracy performance of its system should achieve floor-level precision across all indoor environments in the 3-5 year timeframe”). We discuss the appropriate implementation timeframe for z-axis location capabilities in the discussion below.

¹⁵³ See U.S. Senate Committee on Commerce, Science, and Transportation, Subcommittee on Communications, Technology, and the Internet Hearing, “Locating 911 Callers in a Wireless World,” Jan. 16, 2014, available at http://www.commerce.senate.gov/public/index.cfm?p=Hearings&ContentRecord_id=c8765be1-6155-459f-8ca7-7e9e557e84b5&ContentType_id=14f995b9-dfa5-407a-9d35-56cc7152a7ed&Group_id=b06c39af-e033-4cba-9221-de668ca1978a (last visited Jan. 28, 2014) (E911 Location Accuracy Senate Hearing).

have been an optional component of ALI standards for several years.¹⁵⁴ Polaris Wireless, however, notes that “PSAP call takers must be able to visualize vertical location information in computer-aided design (‘CAD’) or other display formats in order to dispatch personnel to the correct place” and that “significant challenges lie ahead in designing and upgrading public safety equipment, databases, and procedures in preparing for future availability of vertical information.”¹⁵⁵ In addition, NextNav states that “many PSAPs are not presently prepared to fully utilize Z-axis data in the emergency dispatch process because they do not have accurate mapping systems to convert Z-axis data into floor-level dispatchable information.”¹⁵⁶ To the extent that PSAPs must take additional measures to be capable of receiving z-axis information, we seek comment on what steps must be taken and any corresponding costs, as well as the timeframe in which these steps reasonably could be completed.

77. *Timeframe.* We seek comment on a reasonable timeframe for provision of vertical (z-axis) information. We recognize that the development of vertical location technology, the incorporation of these capabilities into a sufficient number of consumer handsets, and the development of any necessary industry standards, may take additional time. We therefore propose that CMRS providers must deliver z-axis information for 67 percent of calls within a three-year timeframe and for 80 percent of calls within a five-year timeframe. We seek comment on whether this would afford a sufficient implementation period. We seek comment on any necessary developments that must take place in order for the delivery of z-axis information would be feasible.

78. Commenters should explain what the path to implementation of a z-axis requirement would look like, including specific steps and corresponding timeframe estimates. We note that only one vendor participating in CSRIC’s indoor location accuracy test bed provided location information with a z-axis component.¹⁵⁷ In this regard, CSRIC states that, “even the best location technologies tested have not proven the ability to consistently identify the specific building and floor, which represents the required performance to meet Public Safety’s expressed needs. This is not likely to change over the next 12-24 months.”¹⁵⁸ Several commenters also argue that vertical location technology is not yet sufficiently developed or widely enough available to reasonably require providers to support this capability at present.¹⁵⁹

¹⁵⁴ NENA, Standard Data Formats for 9-1-1 Data Exchange & GIS Mapping, Version 9 (Mar. 28, 2011), at 86, available at http://c.ymcdn.com/sites/www.nena.org/resource/collection/C74A8084-E3BD-405D-93C2-48AFCFA5B490/NENA_02-010-v9_Data_Formats_for_ALI_MSAG_GIS.pdf (last visited Feb.3, 2014).

¹⁵⁵ Polaris Workshop Comments at 8.

¹⁵⁶ See Letter from Bruce A. Olcott, Counsel to NextNav, LLC, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Nov. 26, 2013), at 4 (NextNav Nov. 26, 2013 *Ex Parte* Letter), citing the remarks of John Snapp, Senior Technical Officer and Vice President, Intrado, at FCC E911 Phase II Location Accuracy Workshop, at minute 146, available at <http://www.fcc.gov/events/workshop-e911-phase-ii-location-accuracy> (last visited Dec. 20, 2013). NextNav notes that “[t]he question of how Z-axis information is ultimately implemented into PSAPs, however, need not delay the adoption of vertical accuracy rules because such information can be useful to first responders with or without accompanying mapping systems.” NextNav Nov. 26, 2013 *Ex Parte* Letter at 5

¹⁵⁷ See *CSRIC Indoor Location Test Bed Report* at 36, 39.

¹⁵⁸ See *id.* at 54-55.

¹⁵⁹ See, e.g., AT&T Workshop Comments at 6 (stating that “considerable work remains” with respect to vertical location accuracy data, and that while A-GPS can provide an estimate of above-sea-level altitude, “there is still a lot of variability in this data and, without the appropriate context about the environment, that data will be all but useless to public safety”); CTIA Workshop Comments at 9 (“[E]ven the best location technologies tested have not proven the ability to consistently identify the specific building and floor, which represents the required performance to meet Public Safety’s expressed needs.”) (citing *CSRIC Indoor Location Test Bed Report* at 54-55); TruePosition Workshop Comments at 6 (stating that “[c]urrent technologies do not yet support the Z-axis”); T-Mobile Workshop Comments at 31 (stating that “[n]o currently available technology can provide accurate vertical location”).

79. At the same time, however, based on the CSRIC test bed results and on filings in the record to date, at least one vendor has developed vertical location technology that already can locate callers to a more granular degree than what we propose here,¹⁶⁰ and others estimate having similar granular capabilities within three to five years.¹⁶¹ In addition, nearly all smartphones are now equipped with sensors that can determine speed, compass direction, and movement.¹⁶² Thus, many devices can now gauge direction, turns, speed, and height above sea level, and thereby generate a three-dimensional view of the user's location.¹⁶³ We believe that this trend will continue.¹⁶⁴ We seek comment on these developments, and how these trends should affect the ability of CMRS providers to provide z-axis information for 67 percent of calls within three years and 80 percent of calls within five years. As discussed above, we also seek comment on whether test bed certification should serve as a triggering date rather than the effective date of the adoption of rules.¹⁶⁵ Alternatively, if the timeline is triggered by the adoption of rules, should the Commission consider reevaluating the compliance timeline at some interim point to evaluate the status of testing of location technology?

80. Finally, we seek comment on the timeframe in which a significant fraction of PSAPs would be capable of receiving and processing z-axis information, and how that should impact the timeframe in which a z-axis requirement could reasonably be imposed on CMRS providers, or whether PSAPs are ready to accept z-axis information today.¹⁶⁶ In addition, we seek comment on any technical, operational, manufacturing, or other issues that may impact CMRS providers' ability to implement the proposed requirement in the near future.

3. Implementation Issues

a. Compliance Testing for Indoor Location Accuracy Requirements

81. *Background.* As noted above, our current Phase II location accuracy rules contain no requirement for testing compliance with the standards or for reporting the results thereof. Despite the acknowledged difficulties with indoor testing, the International Association of Chiefs of Police suggested that the Commission nevertheless formulate a testing regime that requires periodic indoor testing to verify

¹⁶⁰ NextNav was able to locate a caller's vertical location within 3 meters more than 67 percent of the time. See *CSRIC Indoor Location Test Bed Report* at 42. NextNav conducted additional testing on the second generation of its location technology and reported improvements in both horizontal and vertical location accuracy. See Letter from Bruce A. Olcott, Counsel, NextNav, LLC, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Aug. 14, 2013) at 3-11 (NextNav Aug. 14, 2013 *Ex Parte* Letter).

¹⁶¹ See Polaris Workshop Comments at 3 (estimating that its vertical location accuracy performance "should achieve floor-level precision across all indoor environments in the 3-5 year timeframe").

¹⁶² Lawson, Stephen, "Ten Ways your Smartphone Knows Where You Are," PC WORLD, Apr. 6, 2012, available at http://www.pcworld.com/article/253354/ten_ways_your_smartphone_knows_where_you_are.html (last visited Feb. 3, 2014).

¹⁶³ The measurement of turns is distinct from compass direction. For example, if a device makes a 180-degree turn, this could mean from north to south or east to west. To further illustrate, one vertical location experiment used the frequency of 180-degree turns made by the device to count the landings between and at floor heights to estimate the device's vertical location. See Schulzrinne, *et al.*, "Improving the Vertical Accuracy of Indoor Positioning for Emergency Communication," Columbia University Computer Science Technical Reports (Oct. 30, 2012) at 4, available at <http://academiccommons.columbia.edu/catalog/ac:154021> (last visited Feb. 3, 2014) (*Vertical Accuracy Technical Report*).

¹⁶⁴ See, e.g., Clarke, Peter, "MEMS in Mobiles to be \$6B Market," EE TIMES, July 30, 2013, available at http://www.eetimes.com/document.asp?doc_id=1319091 (last visited Feb. 3, 2014).

¹⁶⁵ See *supra* Section III.B.1 at paras. 60-61.

¹⁶⁶ See *supra* Section III.B.2 at paras. 70-71 (seeking comment on PSAP readiness to use z-axis information).

compliance.¹⁶⁷ NENA agreed that it “is incumbent upon the Commission to establish a testing regime under which such technologies can be evaluated with an eye toward improving access to accurate indoor location information for the public and the public safety community.”¹⁶⁸ APCO concurred, stating that “[c]ompliance testing [including indoor testing] must also be repeated within a reasonable time frame.”¹⁶⁹ Location technology vendors also supported indoor location testing.¹⁷⁰ Many commenters also urged the Commission to consider the standard developed by ATIS (ATIS-0500013), in collaboration with public safety entities, to assess the performance of indoor wireless location technologies.¹⁷¹

82. As discussed above, the Commission referred the indoor testing issue to CSRIC for further development of technical recommendations.¹⁷² In response, WG3 developed a test bed, in conjunction with ATIS/ESIF, to “determine actual performance levels in various real-world conditions, representative of indoor environments across the country.”¹⁷³ The test bed used the San Francisco Bay area, which provided “a sufficient diversity of points in close enough proximity” to allow a single team to be deployed, rather than multiple teams to different geographic regions.¹⁷⁴ In each morphology (or broad wireless use environment), WG3 identified a number of buildings of different sizes and types and selected test points in each building to represent the range of conditions encountered within that structure. The number of test points in a given building depended on its size and complexity. At each test point, a statistically significant number of independent test calls were placed.¹⁷⁵

83. The test bed participants selected a third-party testing house through a competitive RFI process.¹⁷⁶ According to WG3, the capability and credibility of this test house were key factors in the success of the test bed.¹⁷⁷ Only summary data was made available to all other parties.¹⁷⁸ An oversight committee composed of a group of stakeholder interests was included, so that all stakeholders’ views received a hearing and due weight.¹⁷⁹ Participating vendors and wireless operators jointly funded the

¹⁶⁷ See IACP Second Further Notice Comments at 1.

¹⁶⁸ See NENA Second Further Notice Comments at 14.

¹⁶⁹ See APCO Further Notice Comments at 4.

¹⁷⁰ See TruePosition Reply Comments, PS Docket No. 07-114 (filed Nov. 2, 2011), at 11 (TruePosition Second Further Notice Reply Comments); Commlabs Second Further Notice Comments at 17.

¹⁷¹ See, e.g., APCO Second Further Notice Comments at 8; CTIA Second Further Notice Comments at 3; SouthernLINC Second Further Notice Reply Comments at 10; Qualcomm Second Further Notice Comments at 11. See also “Approaches to Wireless E9-1-1 Indoor Location Performance Testing,” ATIS Technical Report 0500013. This ATIS standard, as well as other ATIS standards discussed in this proceeding, will be available for review and download on the ATIS website during the pendency of the period for filing comments. See <http://www.atis.org/fcc/locationaccuracy.asp> (last visited Feb. 14, 2014). Paper copies will also be available for review (but not photocopying) at Commission headquarters upon request by contacting Dana Zelman at 202-418-0546 or dana.zelman@fcc.gov. To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (TTY).

¹⁷² See *supra* Section II.B; see also *E911 Location Accuracy Second Further Notice*, 26 FCC Rcd at 10104 ¶ 88.

¹⁷³ See *CSRIC LBS Report* at 57.

¹⁷⁴ See *CSRIC Indoor Location Test Bed Report* at 11.

¹⁷⁵ See *id.* at 12.

¹⁷⁶ See *id.* at 11.

¹⁷⁷ See *id.* at 47.

¹⁷⁸ See *id.* at 46; 11-12. WG3 noted that protecting proprietary information was a key to making the test work. See *CSRIC Indoor Location Test Bed Report* at 46.

¹⁷⁹ See *id.* at 48.

testing process to ensure no one party had excessive influence over the testing process.¹⁸⁰

84. *Discussion.* We believe that WG3 demonstrated the feasibility of establishing a test bed for purposes of evaluating the accuracy of different indoor location technologies across various indoor environments. Accordingly, we propose that a test bed approach, representative of real-life call scenarios, would be the most practical and cost-effective method for testing compliance with indoor location accuracy requirements. Specifically, we propose a rule requiring CMRS providers to participate in an independently administered test bed program that is representative of real-life call scenarios and that includes, but is not limited to, the following testing components:

- Testing in representative indoor environments based on standards adopted by an industry standards body group;
- Testing for the following performance attributes: location accuracy, latency (Time to First Fix), and reliability (yield)¹⁸¹;
- Requiring CMRS providers to show that the indoor location technology used for purposes of its compliance testing is the same technology (or technologies) that it is deploying in its network, and is being tested as it will actually be deployed in the network.

As an alternative, however, we also propose that CMRS providers may use other testing methods that may better suit their particular business plans or practices. In order to maintain the same level of test result reliability, however, CMRS providers must demonstrate that their alternative methodology and testing procedures are at least equivalent to the testing methodology and procedural standards used in the independently administered indoor location accuracy test bed. In using alternative testing methods, CMRS providers would need to provide the same information about the location technologies' effectiveness, and also show that the indoor location technology used in the test bed is the same technology deployed in their network.

85. Certification under either the proposed test bed or an alternative test methodology (of equivalent reliability) would provide a safe harbor to demonstrate that the CMRS provider meets the indoor location accuracy requirement. Under our safe harbor proposal, a technology that meets the location requirements in the test bed, upon certification by the CMRS provider that it has been deployed in a manner consistent with the test bed parameters, would be presumed to comply with the Commission's rules, without the need for the provider to conduct indoor testing in all locations where the technology is actually deployed. We seek comment on the practical effect of this safe harbor. What factual showing would be necessary to overcome the presumption of compliance? If a compliance issue arises that overcomes the presumption, should we afford the provider an opportunity to resolve the issue before considering initiation of enforcement action? If the provider can demonstrate that it is using best efforts to meet the accuracy requirements, but is prevented from doing so by circumstances beyond its control, should we limit the scope of potential enforcement activity? We seek comment on these issues.

(i) Test Bed Methodology

86. We propose that CMRS providers may demonstrate compliance with indoor location accuracy requirements by participating in an independently administered test bed program. Certification by the test bed administrator would provide CMRS providers a "safe harbor" that they meet any indoor location accuracy requirements we may adopt in this proceeding. As part of the test bed participation, CMRS

¹⁸⁰ See *id.* at 11.

¹⁸¹ As discussed earlier, we propose to require CMRS providers to meet a 67/80 percent reliability standard for indoor calls. In the indoor location test bed, CSRIC measured "yield" as the number of calls that delivered location information as compared to the number of completed calls. In the discussion below, we propose a definition for yield for the purpose of determining whether a technology, as tested in the test bed, meets our proposed reliability standard.

providers must show that the indoor location technology used in the test bed is the same technology deployed in their networks, with similar parameters, such as beacon or cell tower density and topology. We believe that such an independently administered program would provide an objective platform for testing the accuracy of the provider's chosen indoor location technology in a variety of representative indoor environments and building types, without requiring ubiquitous in-building testing, and that such an approach would mitigate the potential costs of compliance testing.

87. Based on the record and the methodology used by WG3 for its test bed, we propose certain minimal test bed requirements. Specifically, the test bed must (1) include testing in representative indoor environments; (2) test for certain performance attributes (discussed in greater detail below); and (3) require CMRS providers to show that the indoor location technology used for purposes of its compliance testing is the same technology (or technologies) that it is deploying in its network, and is being tested as it will actually be deployed in the network. We discuss each of these proposed requirements below. We also seek comment on which aspects of the testing process – administrative, technical, and operational – should be set forth in our rules and which are better left to the discretion of the test bed administrator.

88. *Representative Environment.* First, we propose that the test bed should reflect, to the extent possible, a representative sampling of the different real world environments in which CMRS providers will be required to deliver indoor location information. We seek comment on whether, by doing so, the test bed could provide reliable information about how location technologies perform in different circumstances, without necessitating ubiquitous testing in real-world environments. Both WG3 and commenters note that the industry standards body group, ATIS, has adopted indoor testing standards incorporating representative test environments rather than ubiquitous testing.¹⁸² The CSRIC WG3 test bed used dense urban, urban, suburban and rural morphologies, as defined by the ATIS-0500013 standard.¹⁸³ We seek comment on whether these morphologies are sufficiently representative and inclusive of the variety of indoor environments in which wireless 911 calls are made, or whether there are different environments that should be included.

89. *Performance Attributes.* We propose that any location accuracy test bed must evaluate a CMRS provider's choice of location accuracy technology in light of several key performance requirements: location accuracy, latency (TTFF), and reliability (yield). For purposes of determining compliance with the location accuracy and TTFF requirements, we propose to follow the methodology used by WG3 in its test bed. For location accuracy, the CSRIC test bed computed "the error in estimating the location of the device under test ... by comparing each vendor's reported horizontal position ... to the surveyed ground truth position of the test location (determined through a precise land survey)."¹⁸⁴ Further, "[e]ach test call (or equivalent) was assumed to be independent from prior calls and accuracy was based on the first location delivered by the vendor after 'call initiation.'"¹⁸⁵ With regard to latency, the CSRIC test bed calculated TTFF by "establishing the precise time for call initiation (or an equivalent initiation event if the vendor's test configuration did not support the placement of an emulated emergency

¹⁸² See *CSRIC Indoor Location Test Bed Report* at 11, 12. See also ATIS Second Further Notice Comments at 6 ("This industry standard recommends the testing of representative samples of indoor environments"); Commlabs Reply Comments, PS Docket 07-114 at 7 (filed Nov. 2, 2011) ("Alliance for Telecommunications Industry Solutions ... recommended in its comments that, rather than require wide scale indoor testing, verification should be conducted through 'testing of representative samples of indoor environments'") (Commlabs Second Further Notice Reply Comments).

¹⁸³ See *CSRIC LBS Report* at 57; *CSRIC Indoor Location Test Bed Report* at 12.

¹⁸⁴ *CSRIC Indoor Location Test Bed Report* at 14.

¹⁸⁵ *Id.* at 14.

test call).”¹⁸⁶ More specifically, we propose to measure latency “from the time the user presses SEND after dialing 9-1-1, to the time the location fix appears at the [location information center].”¹⁸⁷

90. We propose that providers measure yield in the test bed for purposes of testing whether a location technology satisfies that proposed reliability requirement. With respect to yield, the CSRIC test bed defined the “yield of each technology ... as the [percentage] of calls with delivered location to overall ‘call attempts’ at each test point.”¹⁸⁸ As with indoor calls in real-world scenarios, however, not all test call attempts will actually connect with the testing network established for the test bed and therefore constitute “completed” calls. In view of the difficulties that WG3 encountered in testing indoor locations, we propose a modified definition of yield for purposes of determining compliance with the proposed 67 and 80 percent reliability requirements in the test bed. We therefore suggest that the yield percentage be based on the number of test calls that deliver a location in compliance with any applicable indoor location accuracy requirements, compared to the total number of calls that successfully connect to the testing network. We propose to exclude calls that are dropped or otherwise disconnected in 10 seconds or less, for which providers do not get a Phase II fix, from calculation of the yield percentage (both the denominator and numerator).¹⁸⁹ We seek comment on this proposed calculation of yield.

91. For purposes of assessing yield, we propose that CMRS providers should satisfy the 67 and 80 percent reliability requirements for each individual indoor location morphology (dense urban, urban, suburban, and rural) in the test bed, and based upon the specific type of location technology that the provider intends to deploy in real-world areas represented by that particular morphology. We believe this approach is consistent with our proposal that providers must satisfy the location accuracy requirement at the PSAP- or county-level. We seek comment on this approach.

92. Finally, we seek comment on whether the foregoing metrics are sufficient for assessing each performance requirement and our proposed indoor location requirements as a whole. What other performance requirements, if any, should we require to determine compliance with our proposed location accuracy requirements?

93. *Testing to Emulate Actual Network Deployment.* We propose that a CMRS provider must show both (1) that the indoor location technology used for purposes of its compliance testing is the same technology that will be deployed in its network, and (2) that this technology is being tested as it will actually be deployed in the CMRS provider’s network. The CSRIC test bed tested both commercially available technologies as well as new and emerging technologies. Accordingly, two of the three participating vendors could not test their technology as it would be deployed in a provider’s network to provide an end-to-end E911 location solution.¹⁹⁰ For this reason, technical performance in the test bed

¹⁸⁶ *Id.* at 14. We note that, in its location-based services report, CSRIC states that “[t]he ideal definition [for TTFF] would be to measure from the time the user presses SEND after dialing 9-1-1, to the time the location fix appears at the MPC.” See *CSRIC LBS Report* at 8.

¹⁸⁷ *CSRIC LBS Report* at 8.

¹⁸⁸ *CSRIC Indoor Location Test Bed Report* at 14.

¹⁸⁹ Several commenters indicate that TTFF is presently often less than 30 seconds. See, e.g., Letter from Nneka Chiazor, Executive Director, Federal Regulatory Affairs, Verizon, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Dec. 19, 2013), at 1 (Verizon has taken “steps ... to improve the location information delivered to PSAPs,” such as “[m]aking caller location information available within an average of 12-15 seconds, and within 25 seconds for 99 percent of all calls for which the information is available”); TruePosition Comments, PS Docket No. 07-114 (filed Aug. 6, 2013), at 22 (test results demonstrate that AGPS/UTDOA and Terrestrial Beacons solutions exceeded the FCC’s current outdoor requirements for network-based positioning solutions ... with UTDOA producing an overall average TTFF of approximately four (4) seconds and Terrestrial beacons producing an overall average TTFF of approximately 27 seconds”).

¹⁹⁰ Qualcomm’s AGPS/AFLT technology was tested fully in the wireless network. See *CSRIC Indoor Location Test Bed Report* at 25. However, CSRIC tested Polaris’ RF pattern matching technology “off-line” because “the Polaris (continued....)

was necessarily different than what could be achieved in an actual production implementation.¹⁹¹ We seek comment on our proposal to require testing of the indoor location technology to be used as it will actually be deployed in CMRS provider's network. Moreover, we seek comment on the feasibility of establishing a test bed that addresses our concerns that any compliance test bed provide a close simulation of real-world indoor calling scenarios. Are there factors such as beacon or cell tower density and topology that may cause the test bed results to differ materially from performance for actual 911 calls outside the test bed? Should the test bed be constrained to a small geographic area, similar to the CSRIC IV example, or should the selection of test points change periodically or cover a larger geographic area?

94. *Test Bed Approach.* In order to accommodate a technology-neutral approach and to encourage advancements in indoor location technology, as well as to avoid the costs of unnecessary testing requirements in a given situation, we think it appropriate to allow for some flexibility in compliance testing procedures. For this reason, we propose allowing the indoor test bed administrator sufficient discretion to determine the actual test approaches to be used, *e.g.*, the number of test points, number of test calls, and the best combination of devices to test simultaneously per technology.¹⁹² We seek comment on this proposal.

95. *Test Bed Administration.* WG3 indicated that a competent and reliable administration is necessary in order to establish and operate an effective test bed.¹⁹³ There are multiple administrative issues inherent in setting up any test bed for purposes of compliance testing, including (1) selecting an independent test bed administrator; (2) establishing a test bed funding mechanism; (3) finding an acceptable third-party test house or houses; (4) establishing and maintaining the test bed, including maintenance of any data and data confidentiality, and (5) establishing and administering a certification process for CMRS providers to demonstrate compliance with the Commission's indoor location accuracy requirements. We seek comment on these views and on whether there are any other such administration issues that we should consider.

96. The Commission recently renewed the CSRIC charter for an additional two years,¹⁹⁴ asking CSRIC IV WG1 to examine many of the foregoing issues.¹⁹⁵ Its report on these issues is due in

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position computing platforms were not integrated into the AT&T or T-Mobile networks serving the Bay Area." See *CSRIC Indoor Location Test Bed Report* at 25. CSRIC also did not test NextNav's beacon location technology in a wireless provider network because it was not commercially available at the time. Instead, it was tested by use of standalone receivers that received the beacon signals in order to compute their location. See *CSRIC Indoor Location Test Bed Report* at 24, 41, and 54.

¹⁹¹ See *CSRIC Indoor Location Test Bed Report* at 54 (CSRIC reported, "[i]n some cases determination of the position estimate (position calculation function) for test bed effort was computed in non-real time, using non-standardized signaling methods independent of the wireless carrier network [leading to d]ifferences in technical performance resulting from these deviations, relative to an actual production implementation.").

¹⁹² See *CSRIC Indoor Location Test Bed Report* at 12-13.

¹⁹³ See *id.* at 48 ("oversight was necessary ... to sponsor the [test bed] activity and handle the logistics of getting the work done"). See also *2013 CSRIC III Location-Based Services Report* at 60 ("a test bed management structure with contractual authority that extends beyond [CSRIC] cycles will encourage ongoing technology development").

¹⁹⁴ See FCC Announces Membership of the Communications Security, Reliability, and Interoperability Council, *Public Notice*, 28 FCC Rcd 6904 (rel. May 16, 2013) (announcing that the Commission renewed the CSRIC charter through Mar. 18, 2015).

¹⁹⁵ See CSRIC IV Working Group Leadership and Descriptions at 2 ("Working Group 1 – NG911, Tasking 3"), available at http://www.fcc.gov/pshs/advisory/csric4/wg_descriptions.pdf (last visited Feb. 3, 2014) (Under the charter, CSRIC IV WG1 will: "[E]xamine the requirements to establish a permanent entity to design, develop, and manage an ongoing public test bed for indoor location technologies that can provide the FCC with regular comprehensive, unbiased and actionable data on the efficacy of location technologies. The Working Group will consider chartering requirements, including prerequisites for impartial test bed administration and maintenance of

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June 2014.¹⁹⁶ While CSRIC IV WG1 is not considering requirements for the establishment and administration of an ongoing test bed for the specific purpose of assessing compliance with location accuracy requirements, we expect that its recommendations will be informative. As such, we direct the Bureau to seek further comment on them in this proceeding. These comments should address whether the test bed being developed by CSRIC IV WG1 would be sufficient for the purpose of compliance testing for indoor location accuracy.

97. We also note that the test bed CSRIC IV WG1 is developing would not include a certification component. Is such a certification requirement necessary or appropriate? Are there other Commission compliance regimes (such as for equipment authorizations pursuant to part 2 of our rules) that may serve as appropriate models? We seek comment on how any compliance certification process should work for the indoor location accuracy compliance test bed. We also ask commenters to provide us with cost estimates for the certification component of the indoor location accuracy compliance test bed.

(ii) Alternative Testing Methods

98. As an alternative to the test bed method outlined above, we propose to allow CMRS providers to demonstrate compliance with our indoor location accuracy requirements through alternative means. We believe this would serve the public interest by allowing CMRS providers the flexibility to test their indoor location accuracy solution in a manner that suits their particular business needs while, at the same time, maintaining the same level of test result reliability. We also propose that CMRS providers could combine resources to develop their own test methodology. We propose, however, that CMRS providers choosing an alternative approach must demonstrate in any certification requirement that their methodology and testing procedures are at least equivalent to the rigor and standards used in the independent location accuracy test bed approach discussed above. Thus, they would have to provide the same information about the technologies' effectiveness and also show that the indoor location technology used in the test bed is the same technology deployed in their network.

99. What is the feasibility of allowing CMRS providers to develop such an alternative mechanism for testing indoor location accuracy? For example, how should the Commission determine whether CMRS providers choosing to forego the test bed have demonstrated that their methodology and testing procedures are at least equivalent to the rigor and standards used in the test bed approach discussed above? Should we require providers electing to use an alternative testing approach to file their proposed approach with the Commission in advance, in order to allow us to review their proposed methodology? What further requirements, if any, are appropriate and necessary to ensure that a provider using an alternative testing approach is satisfying our accuracy requirements? Finally, should the Commission leave it to the industry to determine whether and how to establish any jointly used program in order to save costs?

(iii) Test Frequency

100. We seek comment regarding the extent to which CMRS providers should be required to re-test the accuracy of their indoor location technologies. For example, as CMRS providers make material upgrades to their networks and handsets to incorporate new or updated system and location technologies, further testing might be appropriate to show that the system continues to satisfy any indoor

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data confidentiality; types of entities that could assume the role as test bed administrators; technical requirements; scope and scale of necessary facilities and locations; permanent or contracted human resources to manage the test bed; start-up and ongoing cost requirements to maintain the test bed on an ongoing basis; and other considerations necessary to establishing an independent testing administrator.”).

¹⁹⁶ See CSRIC, Working Group #1: NG911 (Dec. 4, 2013), available at http://transition.fcc.gov/bureaus/pshs/advisory/csric4/CSRIC_IV_WG1_STATUS_120413.pdf (last visited Feb. 3, 2014).

location accuracy requirements.¹⁹⁷ What types of changes would be substantive enough to warrant re-testing? Alternatively, should we require periodic re-testing, regardless of whether a provider has made any significant updates to its network?¹⁹⁸ We also seek comment on any alternative methods that might best ensure that indoor location technologies continue to comply with our requirements.

(iv) Confidentiality of Test Results

101. Under the WG3 test bed regime, all parties agreed that raw results would be made available only to the vendors whose technology was to be tested, participating wireless providers, and the third-party testing house.¹⁹⁹ In order to protect vendors' proprietary information, only summary data was made available to all other parties.²⁰⁰ Should these restrictions be carried forward to the proposed indoor location accuracy test regime? Or should some or all test data also be made available to the Commission, or to requesting PSAPs and other 911 authorities? We note that APCO states that "test results need to be shared with relevant PSAPs," and that "PSAPs may also want to conduct independent tests to verify accuracy data."²⁰¹ Moreover, given the extent to which mobile wireless communications services are becoming increasingly central to the day-to-day lives of Americans, should this data also be available, at least to some extent, to the public? Can and should the Commission's location accuracy requirements and enforcement of compliance therewith preempt any state or local determinations to the contrary, absent agreements between CMRS providers and PSAPs for more stringent requirements?

(v) Cost/Benefit Analysis

102. We also seek comment on the costs and benefits of all of our proposed compliance testing measures, as well as on additional ways to reduce the costs of compliance testing, without adversely impacting the reliability and accuracy of the test results. CSRIC reported that the 2013 test bed cost approximately \$240,000.²⁰² We anticipate that the costs of the proposed indoor test bed program may exceed that amount for several reasons. CSRIC noted that its test bed costs were for only the limited San Francisco Bay area, tested with a limited number of test points.²⁰³ If a single test bed remains sufficient for determining compliance with our indoor location accuracy requirements, we anticipate that costs will not increase substantially in this regard. However, larger or additional test beds may be necessary for purposes of compliance testing, which would increase costs. A larger number of test points and the participation of more CMRS providers and location technology vendors could also increase costs.²⁰⁴ Further, CSRIC noted that, in some instances, the test bed process did not include testing "the end-to-end E911 solution as it would be deployed in a carrier's network,"²⁰⁵ which may increase costs.

103. Nevertheless, we believe that the broader test bed approach proposed here, based on

¹⁹⁷ See *CSRIC LBS Report* at 60 ("Location technologies continue to evolve and new technologies continue to emerge. ... New technologies, or significant updates to existing technologies, will require future rounds of test bed characterization.").

¹⁹⁸ See also *infra* Section IV.G (on outdoor periodic testing).

¹⁹⁹ See *CSRIC Indoor Location Test Bed Report* at 12.

²⁰⁰ See Presentation by CSRIC WG3, Indoor Location Accuracy – Test Bed Framework (Sept. 12, 2012), at 6, available at <http://transition.fcc.gov/pshs/advisory/csric3/3-WG%20Presentation%209-12-12.pdf> (last visited Feb. 19, 2014) (noting agreement reached among test bed participants that CMRS providers could only view raw results if they signed a nondisclosure agreement); see also *CSRIC Indoor Location Test Bed Report* at 12.

²⁰¹ See APCO Further Notice Comments at 4.

²⁰² See *CSRIC Indoor Location Test Bed Report* at 52.

²⁰³ *Id.*

²⁰⁴ *Id.*

²⁰⁵ *Id.* at 54.

testing in representative environments, is likely to cost significantly less than ubiquitous in-building testing. Both the record and CSRIC's report indicate that ubiquitous in-building testing is likely to be both costly and impractical due to security and permission issues that make it difficult to access private buildings.²⁰⁶ Based on CSRIC's recommendation to test in representative environments and on initial CMRS industry comments supporting CSRIC's and standards body processes,²⁰⁷ we find that, by avoiding the need for ubiquitous testing, our proposed test bed process would significantly lower costs. Moreover, it would reduce the costs of participation by CMRS providers, by providing them the opportunity to share costs for the test bed. We also propose that CMRS providers may choose an alternative testing means. This may afford a way for CMRS providers to test their indoor location technology in a more cost-effective manner, depending upon their particular business plans. We seek specific cost data, where available, and comment on all of the foregoing, and any other, factors related to the implementation costs of an indoor location accuracy compliance test bed.

b. Applicability of Indoor Location Accuracy Requirements

104. We propose to apply the indoor location accuracy requirements on a nationwide-basis, across all geographic areas. As noted earlier, one of our key objectives is to make indoor location as widely available as is technologically and economically feasible. While we recognize that certain indoor environments are more likely to present challenges in identifying a caller's location, other indoor environments may not present greater challenges than outdoor environments. Based on the CSRIC test bed results, as well as additional information regarding the ability of location-based technologies to perform indoors, we believe that existing location-based technology is sufficient to identify a caller's location in a number of indoor environments already, and that providers might be capable of satisfying indoor location requirements nationwide within a reasonable period of time.²⁰⁸ CMRS providers also confirm that A-GPS technology works well in most indoor locations,²⁰⁹ and U.S. Census data suggests that the majority of indoor environments are likely to be the types of structures that are suitable for A-GPS location-based solutions.²¹⁰ A 2011 peer-reviewed journal article, which presented the results of a study evaluating the ability of GPS- and A-GPS-enabled mobile phones to identify reference locations with known coordinates in an indoor two-story structure, found that "whenever a valid GPS position fix

²⁰⁶ See *supra* Section II.A.; *CSRIC Indoor Location Test Bed Report* at 49-50, 52.

²⁰⁷ See *supra* Section II.B.

²⁰⁸ The CSRIC test bed study indicates more generally that "[o]utstanding GPS performance, almost as good as outdoors, can be achieved inside single story homes." *CSRIC Indoor Location Test Bed Report* at 31. The report further notes that "[a]lmost as good performance is achieved inside the upper floor of relatively small building with composite or tile roof material." *Id.*

²⁰⁹ See, e.g., Letter from John Nakahata, Counsel to T-Mobile USA, Inc., to Marlene H. Dortch, Secretary, FCC (filed Nov. 16, 2013), at 1 ("If three quarters of wireless 911 calls are placed from indoors, ... then at least two-thirds of all of T-Mobile's indoor UMTS 911 calls of more than 30 seconds in length are getting position fixes based on A-GPS"); Letter from Nneka Ezenwa Chiazor, Executive Director, Federal Regulatory Affairs, Verizon, to Marlene H. Dortch, Secretary, FCC (filed Nov. 14, 2013), at 2, n. 7 ("Phase II ... was available for ... 93 percent of [Verizon] indoor calls," *citing* King County, Washington data). See also Letter, George Rice, Jr., Executive Director, iCERT, to Marlene H. Dortch, Secretary, FCC (filed Sept. 25, 2013), at 5 ("data provided by Verizon Wireless demonstrates a high Phase II yield (91-95%) for all wireless 9-1-1 calls including those from indoor locations").

²¹⁰ A recent study released by the United States Census Bureau indicates that during the years 2009-2011 approximately 61 percent of all housing units in the United States were single-family, detached homes. See Mazur, Christopher, "Physical Characteristics of Housing: 2009-11" (Apr. 2013), *available at* <http://www.census.gov/prod/2013pubs/acsbr11-20.pdf> (last visited Feb. 3, 2014) (*Census Bureau Housing Study*). Another 5.8 percent were single-family homes attached to other structures, usually other homes. *Id.* at 1. During the same period, units in buildings with two to four apartments comprised 9.1 percent of housing inventory, while mobile homes constituted another 6.5 percent. *Id.*

was obtained, the maximum positional error never exceeded 100 [meters], even when considering the indoor tests.²¹¹ We anticipate that additional improvements in location technologies since that time, together with advancements that will take place over the new few years, will reduce this potential for error even further. For example, additional global navigation satellite systems are being deployed or activated, such as GLONASS, Galileo and Compass.

105. Given the ability of A-GPS to perform well across a large number of indoor environments, together with the fact that the majority of CMRS providers are already using handset-based, A-GPS solutions,²¹² we believe that only a limited number of environments would require additional infrastructure in order for CMRS providers to comply with our proposed indoor accuracy requirements. We therefore believe that indoor location across all areas is technologically feasible, as well as economically reasonable. We seek comment on this analysis.

106. Alternatively, we ask whether we should apply our proposed indoor location accuracy requirement in a more targeted fashion, and if so, how? For example, would it be more effective to phase in application of the indoor location accuracy requirements, by first focusing on areas throughout the nation with the largest volume of indoor calls? If so, should we limit the application of our horizontal indoor location accuracy requirements to urban areas? The Census Bureau defines “urban” as “[c]ore census block groups or blocks that have a population density of at least 1,000 people per square mile (386 per square kilometer) and surrounding census blocks that have an overall density of at least 500 people per square mile (193 per square kilometer).”²¹³ ATIS also provides definitions of “urban” and “dense urban” areas.²¹⁴ We seek comment on whether the Census Bureau or ATIS definitions would provide a useful basis for defining and focusing the application of indoor location requirements.

²¹¹ See P. A. Zandbergen and S. J. Barbeau, “Positional Accuracy of Assisted GPS Data from High-Sensitivity GPS-enabled Mobile Phones,” 64 *Journal of Navigation* 3, pp. 381-399 (July 2011), at 381, 397. The study evaluated the ability of the GPS-enabled phones to determine location in a two-story residential structure consisting mostly of wood and concrete stucco. See *id.* at 387, 393. The authors note, however, “only a limited set of indoor conditions were evaluated, reducing the general reliability of the results for indoor positioning. Further research into the performance of A-GPS under indoor conditions would be very relevant given the FCC requirements for the performance of mobile phones.” *Id.* at 398.

²¹² Verizon Wireless, Sprint, and U.S. Cellular operate on CDMA networks and use handset-based location technology. AT&T and T-Mobile have historically operated on GSM networks and have used network-based location technology. However, AT&T announced in 2012 its plans to discontinue service on its 2G/GSM networks, and it has stated that it is making “a steady migration toward AGPS,” a handset-based location technology. Furthermore, as of Jan. 31, 2014, “AT&T will be considered a handset-based carrier and will measure compliance based on the location accuracy associated with handset-based technologies.” See Letter from Joseph P. Marx, Assistant Vice President, AT&T Services, Inc. to Marlene Dortch, Secretary, FCC (filed Jan. 31, 2014), at 1 (AT&T Jan. 31, 2014 *Ex Parte* Letter). See also *infra* notes 430, 467; Letter from Jamie Tan, Director, Federal Regulatory, AT&T, to Marlene Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Sept. 9, 2013) at 12 (AT&T Sept. 9, 2013 *Ex Parte* Letter). T-Mobile stated that it “used U-TDOA for its 2G GSM network (later adding A-GPS capability for A-GPS-capable handsets), and it migrated to A-GPS for its UMTS/HSPA+ network.” See Letter from John Nakahata, Counsel to T-Mobile USA, Inc., to Marlene H. Dortch, Secretary, FCC (filed Sept. 25, 2013), at 1.

²¹³ See Urban Criteria for the 2010 Census, 76 Fed. Reg. 53030, 53039 (Aug. 24, 2011), available at <http://www.census.gov/geo/reference/pdfs/fedreg/fedregv76n164.pdf> (last visited Feb. 3, 2014) (Urban Criteria Census 2010).

²¹⁴ ATIS defines “urban” as an area with “[h]igh population density where multi-story apartment and office buildings are observed, and with “[h]igh [cell] site concentration due to capacity requirements and high signal penetration margins are encountered.” See ATIS, Define Topologies & Data Collection Methodology Technical Report (ATIS-0500011) (2007), at 1 (*ATIS Define Topology Report*). ATIS defines “dense urban” as areas that are “typically downtown environments in larger urbanized cities,” where “[u]rban canyons are commonly encountered,” and “[v]ery high cell site concentration is also observed.” *Id.*

107. As another alternative, we seek comment on whether we should allow certain exclusions from the indoor location requirements. For example, should we exclude certain geographic areas from the indoor location requirements and if so, what areas should be excluded and why? What other potential distinctions might be appropriate? Should, for example, different considerations apply in with respect to vertical accuracy? Rather than establishing exclusions, should any exclusions be reported on a case-by-case basis? Our current E911 regulatory framework currently allows providers to file reports noting certain exclusions, such as areas with dense forestation.²¹⁵ We also seek comment on how compliance based on one or more test beds, as discussed above, would affect the definition of areas to exclude. We also seek comment on whether we should establish any exceptions for smaller wireless providers and, if so, why. Rather than excluding certain areas from indoor location requirements, would it be more appropriate to apply a different accuracy threshold (for example, 100 meters instead of 50 meters) in certain indoor environments?²¹⁶

108. As noted above, we anticipate that the z-axis requirement should be applied co-extensively, in the same geographic areas, with any x- and y-axis indoor requirements. In the alternative, we seek comment on whether we should apply the z-axis requirement to only a subset of those environments where we apply the horizontal indoor location requirement, or otherwise apply the z-axis requirement in a manner that is independent from the application of horizontal indoor location requirements.

109. Finally, we seek comment on any other alternative approaches that would enable us to focus the application of indoor location requirements in the most effective and cost-efficient way possible. We recognize that the implementation of any indoor location accuracy requirements will impose costs on CMRS providers, and seek comment on the ways in which any implementation requirements could be designed to mitigate those costs to the extent possible, without sacrificing our important public safety objectives. We seek detailed comment on the costs associated with each of the proposed alternatives. We also seek comment on how we these different approaches may affect smaller CMRS providers and whether there are particular measures we should take to minimize the potential burdens on these smaller providers.

c. County/PSAP-Level Measurements; Enforcement Tied to PSAP Readiness

110. Under Section 20.18(h) of the Commission's rules, licensees subject to Section 20.18(h) must satisfy the existing E911 Phase II requirements at either a county-based or PSAP-based geographic level.²¹⁷ We propose to adopt this standard here, and require CMRS providers to satisfy the proposed indoor location accuracy requirements on a PSAP-level or county-level basis. This geographic requirement has been in place since 2010,²¹⁸ and we believe that it continues to provide a sufficient degree of accuracy to PSAPs in most cases.²¹⁹ We also believe that extending this requirement to indoor location accuracy requirements would be most efficient and cost-effective for CMRS providers, by allowing them to choose which requirement best meets their needs based on individualized factors like

²¹⁵ See 47 C.F.R. § 20.18(h) (1)(vi) (permitting exclusions for counties or portions of counties where triangulation is not technically possible); 20.18(h)(2)(iii) (permitting exclusions for heavily forested areas).

²¹⁶ See 47 C.F.R. §20.18(h)(i).

²¹⁷ See 47 C.F.R. §20.18(h).

²¹⁸ *E911 Location Accuracy Second Report and Order*, 25 FCC Rcd at 18913-20 ¶¶ 12-29.

²¹⁹ As noted in the *E911 Location Accuracy Second Report and Order*, the county-based compliance standard conforms to PSAPs' recent consolidation efforts to mirror county boundaries. *Id.* at 18915 ¶ 16. Moreover, where PSAP service areas either exceed or are smaller than county boundaries, allowing a PSAP service area-based compliance standard allows the reported accuracy to match the exact boundary of the PSAP's service area. *Id.* at ¶ 17.

natural and network topographies.²²⁰ We recognize, however, that a county- or PSAP-based requirement may be difficult to verify if testing is performed within a more geographically constrained test bed, as proposed above.²²¹ We seek comment on this proposal.

111. We intend that CMRS providers' investment in and deployment of improved indoor location capabilities are targeted towards those PSAPs or counties that are capable of utilizing this location information. In this regard, PSAPs would be entitled to seek Commission enforcement of these requirements within their jurisdictions,²²² but as a precondition would be required to demonstrate that they have implemented bid/re-bid policies that are designed to obtain all 911 location information made available to them by CMRS providers pursuant to our rules.²²³ In this manner, we also intend to ensure we receive consistent and reliable E911 call tracking data, based on all available E911 information, in connection with any claims for enforcement action. We note that the accurate and reliable delivery of E911 location information depends upon the willingness and readiness of PSAPs and CMRS providers to work together. We seek comment on this proposal.

d. Liability Protection

112. *Background.* In general, liability protection for provision of 911 service is governed by state law and has traditionally been applied only to LECs. However, Congress has expanded the scope of state liability protection by requiring states to provide parity in the degree of protection provided to traditional and non-traditional 911 providers, and more recently, to providers of NG911 service.²²⁴

113. *Discussion.* We recognize that adequate liability protection is needed for CMRS providers to proceed with implementation of the indoor location accuracy requirements. The recent NET 911 Act and Next Generation 9-1-1 Advancement Act have significantly expanded the scope of this liability protection, and we believe this provides sufficient liability protection for CMRS providers. Nevertheless, we seek comment on whether there are additional steps the Commission could or should take – consistent with our regulatory authority – to provide additional liability protection to CMRS providers. Do CMRS providers have sufficient liability protection under current laws to implement our proposed indoor location accuracy requirements, or is additional protection still necessary or desirable? Have there been instances where this liability protection has proven to be insufficient?

²²⁰ *Id.* at 18916 ¶ 18.

²²¹ *See supra* Section III.B.3.a.i.

²²² PSAPs that seek enforcement may be required to provide a showing to overcome the proposed safe harbor described in para. 85, *supra*.

²²³ *See infra* Section IV.E., para. 167 (discussing providers' delivery of E911 location information to its location information center and the need for PSAPs to "pull" or bid for this information).

²²⁴ In 2008, Congress enacted the New and Emerging Technologies 911 Improvement Act (NET 911 Act), which provides that a "wireless carrier, IP-enabled voice service provider, or other emergency communications provider ... shall have" the same liability protection as a local exchange provider under federal and state law. 47 U.S.C. § 615a. In February 2012, Congress further extended state liability protection to providers of NG911 service in the Next Generation 9-1-1 Advancement Act of 2012, enacted as subtitle E of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat 156, 237-45. The Next Generation 9-1-1 Advancement Act of 2012 provides that "[a] provider or user of Next Generation 9-1-1 services...shall have immunity and protection from liability under Federal and State law [to the extent provided under section 4 of the Wireless Communications and Public Safety Act of 1999]," with respect to "the release of subscriber information related to emergency calls or emergency services," "the use or provision of 9-1-1 services, E9-1-1 services, or Next Generation 9-1-1 services," and "other matters related to 9-1-1 services, E9-1-1 services, or Next Generation 9-1-1 services." 47 U.S.C. § 1472. In addition, Section 6503 of the Act amends the National Telecommunications and Information Administration Organization Act to define "emergency call" as "any real-time communication with a public safety answering point or other emergency management or response agency," including communication "through voice, text, or video and related data." 47 U.S.C. § 942(e)(4).

114. More specifically, we seek comment on liability concerns that may be raised in conjunction with the possible adverse effect on indoor location accuracy from signal boosters.²²⁵ At the time of the *Signal Booster Report and Order*, the Commission noted that its “existing E911 location accuracy requirements do not apply to calls placed indoors, where we expect the vast majority of [multiple dwelling unit] calls will be placed.”²²⁶ Because we now propose to apply location accuracy requirements to indoor calls, we seek comment regarding any liability concerns with regard to the operation of signal boosters, and in satisfying our proposed indoor location accuracy requirements. CMRS providers commenting in the *Signal Booster Report and Order* were especially concerned about liability for location accuracy when those capabilities are affected by signal booster use.²²⁷ Have these liability concerns abated in any way, in light of technological developments that might improve location accuracy or based on liability protection afforded by existing laws? If not, what position, if any, could and should the Commission take regarding potential liability for interference with location accuracy technology from signal booster use, whether in the multiple dwelling unit context or otherwise?

e. Waiver Process

115. We seek comment on whether we should adopt a specific waiver process for CMRS providers who seek relief from our indoor location accuracy requirements. As discussed above, we seek to adopt cost-efficient, technology-neutral rules that are easy to understand and administer. In doing so, we intend to allow CMRS providers flexibility to comply with any indoor location accuracy requirements in a manner that suits their particular business plans and technology choices. At the same time, however, we recognize that there may be instances where a provider may require limited relief. In general, the Commission’s rules may be waived for good cause shown.²²⁸ In the context of its E911 Phase II requirements, the Commission recognized that technology-related issues or exceptional circumstances could delay providers’ ability to comply with the requirements, and that such cases could be dealt with through individual waivers as these implementation issues were more precisely identified.²²⁹

116. We seek comment on whether our existing waiver processes are sufficient for purposes of any indoor location accuracy requirements, or whether we should adopt a waiver process that is specific to indoor location accuracy. In the event that commenters believe a specific waiver process would serve the public interest, we seek comment on how such a specific waiver process would be implemented. Furthermore, should we establish criteria for a streamlined process for waiver relief? For example, under one potential approach, providers who believe they cannot comply with a particular indoor location accuracy benchmark, despite their good faith efforts, may submit a certification to this effect six months prior to the applicable benchmark. The certification must include an alternative timeframe for satisfying the benchmark, as well as an explanation of how they will achieve compliance within this alternative timeframe. In the event a provider submits such a certification, and provided the certification is not false and the alternative timeframe is not unreasonable, should we defer enforcement action during the pendency of the alternative timeframe? What additional criteria, if any, might be warranted to justify a waiver or extension of time to satisfy an indoor location accuracy benchmark? We seek comment on how best to structure a waiver process that ensures providers take their obligation to satisfy indoor location accuracy requirements seriously, while at the same time acknowledging that unforeseeable circumstances might arise that would justify limited relief.

²²⁵ See *supra* Section III.B.1. (discussing the potential effects of signal boosters on location accuracy).

²²⁶ *Signal Booster Report and Order*, 28 FCC Rcd at 1696 ¶ 90 n. 206.

²²⁷ *Id.* at 1696 ¶ 92.

²²⁸ See 47 C.F.R. §1.3.

²²⁹ See Revision of the Commission’s Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, *Report and Order and Further Notice of Proposed Rulemaking*, 11 FCC Rcd 18676, 18710 ¶ 66, 18718 ¶ 84 (1996) (*E911 First Report and Order*).

C. Long-Term Indoor E911 Location Accuracy Requirements

117. In developing a framework for E911 location accuracy, we seek comment on how any potential near-term requirements would operate in a NG911 environment, as well as how these requirements could facilitate the Commission's long-term location accuracy objectives. The accuracy requirements discussed above only provide for a "rough" approximation of a wireless 911 caller's location. The proposed requirements for horizontal location within 50 meters and z-axis information within 3 meters could still result in building misidentification, and are insufficiently granular to provide room or apartment-level location. We agree with commenters who assert that public safety would be best served through the delivery of a dispatchable address.²³⁰ Commscope, however, notes that delivering location information in the form of a civic address may be better addressed in the context of NG911, because NG911 architecture allows for the explicit communication of floor and building address information, rather than conventional Phase II E911.²³¹

118. Over the long term, we seek comment on how to formulate requirements that would require sufficiently granular location information to provide PSAPs with "dispatchable" address information, which would include a building address as well as specific floor and suite/room number information for indoor calls. We seek comment on this goal, including its costs and benefits. We also seek comment on what technologies might facilitate the delivery of dispatchable address information, and within what timeframe. We also seek comment on what future location-based solutions and NG911 technologies may make the provision of dispatchable address information easier. In the following sections, we seek comment on ways in which we can take steps towards achieving our long-term indoor location objectives.

1. Leveraging Indoor Network Access Technologies

119. We seek comment on ways in which we can take steps towards achieving our long-term indoor location objectives by leveraging measures that CMRS providers are already taking to expand and enhance their networks. For instance, to account for technical difficulties of urban and indoor environment, CMRS providers are already deploying both small cells and DAS to improve and expand their network coverage and speed.²³² In its report on leveraging location-based services for E911

²³⁰ For example, Intrado notes that "[f]or obvious reasons, the physical address of the 911 caller is still the most effective information for rendering emergency assistance to those inside a structure," and urges the Commission to require carriers to provide a "dispatchable address" for wireless callers. Intrado Further Notice Comments at 3-4.

²³¹ CommScope Further Notice Comments at 7.

²³² See, e.g., PR Newswire, "Verizon Wireless Activates DAS System In Empire State Plaza," Sept. 16, 2013, available at <http://www.prnewswire.com/news-releases/verizon-wireless-activates-das-system-in-empire-state-plaza-223946991.html> (last visited Feb. 3, 2014); DeGrasse, Martha, "Small cells: Carriers focus on handoffs to legacy networks," RCR WIRELESS, Nov. 21, 2013, available at <http://www.rcrwireless.com/article/20131121/heterogeneous-networks-2/small-cells-carriers-focus-on-handoff-to-legacy-networks/> (last visited Feb. 3, 2014); AT&T, "Small Cells, Big Steps," available at http://www.att.com/Common/about_us/pdf/small_cell.pdf (last visited Feb. 3, 2014) ("by 2015, AT&T plans to deploy 40,000 small cells in the network"). For our purposes here, we use the term "small cell" to refer to picocells and microcells. A picocell has a limited range of connectivity and is often employed to provide coverage over an area such as a single floor of a building or an airport terminal. A microcell offers a larger deployment footprint, such as a residential neighborhood or an entire airport. See *E911 Location Accuracy Further Notice and NOI*, 25 FCC Rcd at 18973 ¶ 40. A DAS is "[a] network of spatially separated antenna nodes connected to a common source via transport medium that provides wireless service within a geographic area or structure." DAS Forum, "In-Building Enterprise DAS for Wireless Infrastructure 2011," available at <http://www.thedasforum.org/wp-content/uploads/2011/10/PPT-InBuilding-Enterprise-DAS-for-Wireless-Infrastructure-2011.pdf> (last visited Feb. 3, 2014). DAS are often deployed across entire building wings, floors, and concourses. *CSRIC LBS Report* at 47 (describing CommScope's GeoLENs System, which utilizes DAS). Though the Commission sought comment on femtocells in the *Location Accuracy Further Notice*, we intend to exclude these from this discussion, as well as signal boosters specifically designed for "out of the box" consumer use. See <http://wireless.fcc.gov/signal->

(continued....)

purposes, CSRIC noted that “[a]s cell sizes shrink, the location of the serving cell itself may suffice for a position estimate for both E9-1-1 call routing and first responder dispatch [because] the base station itself can be a Phase II positioning technology.”²³³

120. Providing specific location information through small cells and DAS may be able to save critical time during an emergency. We seek comment on whether small cells and DAS could be leveraged to provide critical location information for public safety entities responding to emergencies located indoors, and if so, how. In particular, we seek comment on whether, as part of a long-term indoor location solution, CMRS providers should be subject to a requirement to program all small cell and geographically identifiable DAS extensions of their CMRS networks with address information at the time of installation and/or prior to the commencement of commercial service using the small cell or DAS.²³⁴ We also ask whether wireless providers should also program existing small cell and DAS deployments with location information whenever those sites and system are upgraded or replaced.

121. We seek comment on the technical feasibility of programming both small cells and DAS with location information, as well as the feasibility of installing A-GPS chips within small cell nodes and DAS antennae.²³⁵ We note that Navanu, a location technology vendor, submits that its technology incorporates a passive RF analyzer that can also be “embedded within ... a DAS system ... or any wireless broadband access point” and “can isolate a signal from a mobile device and map [the device] location.”²³⁶ Can CMRS providers currently configure small cells, DAS, and industrial signal boosters to provide this information? If not, what additional developments must be made? Would additional work be necessary to develop industry standards? We also seek comment on whether configuring DAS and industrial signal boosters to identify the address of the building from which the 911 call originated might compensate for any potential adverse effect on determining location information through network-based methods that otherwise might arise from the use of signal boosters and DAS.²³⁷ Finally, we seek comment on whether CMRS providers could retroactively program existing small cells, DAS, and industrial signal boosters to contain specific address information.

122. We seek comment on the potential costs to CMRS providers to program small cell nodes with dispatchable address information. We also seek comment on the potential costs of configuring DAS to perform the same function. We believe that leveraging actions that CMRS providers are already undertaking should lower the potential costs for providers to achieve more granular location information that is consistent with our long-term E911 objectives.

123. We also seek comment on what steps, if any, PSAPs would need to take to incorporate and use this additional information. Could existing information fields be used to display additional

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boosters/index.html (describing different types of signal boosters use and current Commission requirements governing their use). Consumer Signal Boosters are devices that are marketed and sold to the general public for their personal use to improve wireless coverage in limited areas such as homes and vehicles. See 47 C.F.R. §§ 20.3, 20.21(a).

²³³ See *CSRIC LBS Report* at 10; see also Remarks of Timothy Lorello, Senior Vice President/Chief Marketing Officer of TCS, FCC E911 Phase II Location Accuracy Workshop, at minutes 212, 241, available at <http://www.fcc.gov/events/workshop-e911-phase-ii-location-accuracy> (last visited Feb. 3, 2014).

²³⁴ Again, we would envision that any potential requirements would apply only to small cell and DAS network extensions that are installed at the behest of the CMRS provider, though a third party may install the device.

²³⁵ See also *E911 Location Accuracy Further Notice*, 25 FCC Rcd at 18973 ¶ 41.

²³⁶ See Navanu Feb. 11, 2013 *Ex Parte* Letter at 2 (also submitting that an RF analyzer can reside within a small cell). According to Navanu, the capability currently is in early development but has minimal costs because it does not demand new requirements for site deployments. See *id.* (asserting that the costs “can range from a few dollars to somewhere under fifty dollars, depending on the small cell’s design”).

²³⁷ See notes 160 and 339-341 for further discussion of how signal boosters can impact location accuracy.

address information, like floor and apartment number? If not, what additional upgrades would be necessary to PSAP equipment? What modifications to PSAP operating procedures would be necessary to accommodate any additional information from small cell deployments?

2. Differentiating Between Indoor and Outdoor Calls

124. CMRS providers generally have indicated that it is not possible to differentiate between indoor and outdoor calls to 911.²³⁸ We seek comment on whether technology has evolved such that CMRS providers are able now, or will be able in the foreseeable future, to determine whether a call originates from indoors and make this information available to PSAPs. If not, what additional technological advancements need to take place in order to differentiate between calls that originate indoors versus outdoors? In what timeframe would these advancements likely take place?

125. We suggest that one way in which indoor and outdoor calls could be differentiated is by using location information provided by small cell and DAS infrastructure. If dispatchable address information from a small cell or DAS node is available to the PSAP, this information would include the floor and suite/room number, thereby signifying the call originated indoors. Similarly, to the extent that providers convey z-axis information that indicates that a call originated above a certain height above ground, it could be reasonable to infer that a wireless call originated indoors. Furthermore, consistent with the observations in the *CSRIC LBS Report*, CMRS providers may be able to use certain commercial location-based services on a device to provide a reasonable estimate of the device's location and whether the device is located indoors. We seek comment on these methods, as well as on any other ways that CMRS providers could use to determine whether a call originates from indoors. In addition, what costs would be associated with developing this capability? What steps would CMRS providers have to take, if any, to make information on whether a call originated from indoors available in its location information center?

126. We also seek comment on whether identifying a wireless 911 call as originating indoors versus outdoors, by itself, would be useful information to public safety entities. Would it be sufficient to provide public safety entities with more granular location information, which presumably would identify whether a call originated indoors within a certain search radius? We also seek comment on whether existing PSAP equipment could readily make use of this information. What costs could be associated with a PSAP's ability to use this kind of information?

3. Leveraging Commercial Location-Based Services, Emerging Technologies, and other Sources of Location Information

127. Commercial location-based services (LBS) are applications that CMRS providers load, or consumers download, onto their phones, and are independent of any solutions that CMRS providers might be required to adopt to comply with our location accuracy requirements. Such applications, which typically combine GPS and Wi-Fi, are currently implemented in all major commercial mobile operating systems. In its *E911 Location Accuracy Second Further Notice*, the Commission noted that these commercial LBS “could potentially permit service providers and applications developers to provide PSAPs with more accurate 911 location information,”²³⁹ and sought comment on whether it should encourage mobile service providers to enable the use of commercial LBS for emergency purposes.²⁴⁰ It also sought comment on the value of operational benchmarks to assist consumers in evaluating the ability of carriers to provide precise location information for emergency purposes based on the location-based

²³⁸ See, e.g., AT&T Workshop Comments at 2-3 (“To this point, it should be noted that AT&T Mobility – and presumably other wireless carriers – does not and cannot maintain call data on the origin of the call; that is, whether calls originate indoors or outdoors.”); T-Mobile Workshop Comments at 16 (submitting that it “has no way to know and track when a wireless 911 call is made from an indoor location”).

²³⁹ *E911 Location Accuracy Second Further Notice*, 26 FCC Rcd at 10101 ¶ 79.

²⁴⁰ *Id.*

capabilities of devices.²⁴¹ The Commission tasked WG3 with investigating how commercial location-based services might be leveraged for indoor wireless E911 service.²⁴²

128. In response to the *E911 Location Accuracy Second Further Notice*, numerous commenters supported investigation by CSRIC of the use of commercial LBS by public safety,²⁴³ though some commenters suggested that further study beyond the CSRIC report – then pending – would be necessary.²⁴⁴ CTIA and AT&T urged the Commission to allow the industry to come up with best practices for using location-based services.²⁴⁵ Several commenters noted that industry standards work would be necessary before commercial LBS would be a viable option for 911 purposes.²⁴⁶

129. Several commenters cautioned against using commercial LBS.²⁴⁷ Verizon stated that certain commercial LBS technologies “potentially could serve as a supplement to A-GPS, particularly for indoor areas,”²⁴⁸ but noted that “[n]ot all customers subscribe to commercial LBS, and even those who do may not have the service turned on at the moment they make a 911 call” and that currently, “not all handsets will support commercial LBS applications.”²⁴⁹ VON Coalition also argued that “[neither Wi-Fi positioning or commercial LBSs] can guarantee accurate location data.”²⁵⁰ TCS also noted that “[t]he use of commercial [LBS] can be inhibited by regulatory and funding conditions” and suggested that questions of funding also be referred to CSRIC.²⁵¹

130. WG3’s final report in March 2013 investigated commercial LBS and emerging location technologies for indoor wireless E911 use, and made recommendations on how they could be best leveraged for E911 purposes.²⁵² While the report concluded that few of these technologies are presently available for indoor E911 use, it found that “good progress is being made” in addressing challenges to

²⁴¹ *Id.*

²⁴² *Id.* (“CSRIC should be directed to explore and make recommendations on methodologies for leveraging commercial location-based services for 911 location determination. CSRIC should also suggest whether it is feasible or appropriate for the Commission to adopt operational benchmarks that will allow consumers to evaluate carriers’ ability to provide accurate location information.”).

²⁴³ APCO Second Further Notice Comments at 8; CenturyLink Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 6 (CenturyLink Second Further Notice Comments); MetroPCS Comments, PS Docket No. 07-114 (filed Oct. 3, 2011) at 15 (MetroPCS Second Further Notice Comments).

²⁴⁴ AT&T Second Further Notice Comments at 6-7 (suggesting that further investigation of commercial LBS be referred to the E911 Technical Advisory Group (ETAG)); Verizon Second Further Notice Comments at 19- 20 (believes that Commission should seek further comment after CSRIC issued its report); T-Mobile Second Further Notice Comments at 6-7 (though supportive of CSRIC’s efforts, generally thinks that commercial LBS is not a viable solution for 911 purposes); TIA Comments, PS Docket No. 07-114 (filed Oct. 3, 2011), at 3, 7 (suggesting that ETAG is the best forum for these issues to be discussed) (TIA Second Further Notice Comments); SouthernLINC Second Further Notice Reply Comments at 6-8.

²⁴⁵ CTIA Second Further Notice Comments at 7, 9; AT&T Second Further Notice Comments at iii.

²⁴⁶ Verizon Second Further Notice Comments at 20; SouthernLINC Second Further Notice Reply Comments at 7.

²⁴⁷ Verizon Second Further Notice Comments at 19, 20; VON Coalition Comments, PS Docket No. 07-114 (filed Oct. 3, 2011), at 10 (VON Coalition Second Further Notice Comments); TCS Second Further Notice Comments at 11.

²⁴⁸ Verizon Second Further Notice Comments at 19.

²⁴⁹ *Id.* at 20.

²⁵⁰ VON Coalition Second Further Notice Coalition Comments at 10.

²⁵¹ TCS Second Further Notice Comments at 11.

²⁵² *See CSRIC LBS Report.*

such use.²⁵³ At the same time, the *CSRIC LBS Report* highlights several concerns with regard to leveraging commercial LBS for 911.²⁵⁴ The *CSRIC LBS Report* recommends further evaluation of LBS.²⁵⁵

131. Since the Commission last sought comment on leveraging commercial LBS for 911 purposes, considerable developments have been made.²⁵⁶ Industry bodies have already created wireless E911 standards that support a range of technologies that can provide indoor location information.²⁵⁷ Moreover, there is increasing commercial interest in developing LBS, particularly services that rely on indoor location, for a range of different applications.²⁵⁸ Indeed, indoor location technology has become such a large market that it is bigger than its outdoor counterpart, if commercial buildings are included.²⁵⁹

132. Indoor location solutions are also being developed that use Wi-Fi and similar in-building technology to locate calls. Cisco's technology, for example, uses RF fingerprinting to determine location over a Wi-Fi network using signal strength and time of arrival lateration techniques.²⁶⁰ Cisco indicates that, with respect to indoor environments, "location data today is generally available in enterprise [Wi-Fi]

²⁵³ See *id.* at 56. In addition to the three technologies tested in the CSRIC test bed, discussed above, the *CSRIC LBS Report* also noted the potential for such other technologies as Wi-Fi, See *id.* at 20-28 (discussing Assisted Global Navigation Satellite System (A-GNSS); *id.* at 29-30 (Observed Time Difference of Arrival (O-TDOA)); *id.* at 35-42 (LEO Satellite-Based Positioning); and *id.* at 42-47 (Uplink Time Difference of Arrival (U-TDOA) for LTE).

²⁵⁴ Particularly, CSRIC notes that commercial LBS "have not been subjected to mandated accuracy levels and rigorous compliance testing and evaluation to ensure that database integrity and peak accuracy levels are maintained." *CSRIC LBS Report* at 17. CSRIC further notes that commercial LBS are problematic because "not all customers subscribe to [commercial location based services], and even those who do may not have the service or their location privacy setting turned on at the moment they make a 9-1-1 call," and because the user equipment must be able to handle simultaneous voice and data. *Id.*

²⁵⁵ *Id.* at 2.

²⁵⁶ See *id.* at 56 (stating that there is continual development in this field). See also NENA Workshop Comments at 3 (noting improvements in time to first fix and satellite- and ground-based positioning systems and significant and rapid increase in the deployment and use of LBS); Polaris Wireless Workshop Comments at 3 (forecasting substantial improvements in indoor location accuracy, both horizontally and vertically).

²⁵⁷ See *CSRIC LBS Report* at 15. The predominant standard is J-STD-036, developed by the Telecommunications Industry Association and the Alliance for Telecommunications Industry Solutions. *Id.* The report notes, however, that further standards may need to be developed for over-the-top (OTT) technologies. *Id.* at 16.

²⁵⁸ See "Location-based Services – An Overview of Opportunities and Other Considerations," *Report*, Wireless Telecommunication Bureau, FCC (rel. May 2012), at 10, available at <http://www.fcc.gov/document/location-based-services-report> (last visited Feb. 5, 2014) (*Location-Based Services Report*). See also Gross, Doug, "The Growing Push to Track Your Location Indoors," CNN, Mar. 26, 2013 available at <http://www.cnn.com/2013/03/25/tech/mobile/apple-indoor-gps> (last visited Feb. 5, 2014) (*Growing Push Article*) (noting that "a new move in mobile tech is seeing startups who want to help you find the store you're looking for in the mall, turn around when you're getting farther from your terminal at the airport or figure out where your friends are in an expansive convention hall."). Analyst firm ABI Research predicts that by 2017, the indoor location technology market will reach \$5 billion in revenues, and represent over 200,000 installations of infrastructure equipment, including Wi-Fi hotspots and Bluetooth antennas, and over 800 million branded applications downloads. See also Carle, Christian, "Indoor Location: The Mobile Revolution Starts Now," INVESTVINE (June 6, 2013), available at <http://investvine.com/indoor-location-the-mobile-revolution-starts-now/> (last visited Feb. 19, 2014) (*Indoor Location Mobile Revolution Article*).

²⁵⁹ See *Indoor Location Mobile Revolution Article*.

²⁶⁰ See Cisco, "Unified Wireless Location Services," available at <http://www.cisco.com/en/US/docs/solutions/Enterprise/Mobility/emob41dg/ch13Loca.html> (last visited Feb. 5, 2014).

networks and is technologically feasible in residential Wi-Fi networks.”²⁶¹ At the same time, however, Cisco acknowledges that “significant work remains” on generating civic addresses (including floor numbers) and location data for Wi-Fi enabled devices that are not authenticated to the Wi-Fi access points.”²⁶² Also, Cisco noted that current standards efforts should be ready for Wi-Fi Alliance certification some time in 2015.²⁶³ Cisco indicated that implementation of Wi-Fi protocols will provide “10 feet of accuracy on a horizontal x/y axis 90% of the time.”²⁶⁴

133. Location-based technologies are also already being rolled out in conjunction with consumer application and device offerings. Indeed, commercial location technologies, typically combining GPS and Wi-Fi, currently are implemented in all major commercial mobile operating systems,²⁶⁵ with multiple independent Wi-Fi access location databases, maintained by Google, Apple, and Skyhook, among others.²⁶⁶ The use of Bluetooth beacon technology is also potentially attractive for indoor location although, at present, such technology is less developed than that for Wi-Fi.²⁶⁷ At a recent consumer electronics trade show and the 2014 Super Bowl, Bluetooth low energy (LE) beacons were demonstrated.²⁶⁸ Moreover, essentially all smartphones now sold have Wi-Fi and Bluetooth network

²⁶¹ Letter from Mary L. Brown, Director, Cisco Government Affairs, Cisco Systems, Inc., to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed June 5, 2013), at 1 (Cisco June 5, 2013 *Ex Parte* Letter). Cisco states that while significant work remains to be done, “location accuracy of 5 meters, and even ... 1 meter, is achievable.” *Id.* at 1-2.

²⁶² *Id.* at 1-2.

²⁶³ *Id.* at 1.

²⁶⁴ *Id.* (referring to “the 802.11mc Fine Timing Measurement protocol over the 802.11ac (80MHz) physical layer.” Cisco also asserts that “more accurate data is possible depending upon implementation and the use of ‘angle of arrival’ data.”).

²⁶⁵ See, e.g., “Android Location,” available at <http://developer.android.com/reference/android/location/package-summary.html> (last visited Feb. 5, 2014) (listing GPS functions as part of Android location services); “iOS 6: Understanding Location Services,” available at <http://support.apple.com/kb/HT5467> (last visited Feb. 5, 2014); “Turning on and querying Location Services on the device,” available at http://docs.blackberry.com/en/developers/deliverables/17954/Turning_on_querying_Location_Services_1222726_1_1.jsp (last visited Feb. 5, 2014); Windows Phone, “Location and My Privacy FAQ,” available at <http://www.windowsphone.com/en-us/how-to/wp7/web/location-and-my-privacy> (last visited Feb. 5, 2014).

²⁶⁶ See, e.g., Google, Configure access points with Google Location Service, available at <https://support.google.com/maps/answer/1725632?hl=en> (last visited Feb. 5, 2014) (“Google, as a location service provider, uses publicly broadcast Wi-Fi data from wireless access points, as well as GPS and cell tower data.”); Cox, John, “Apple Leverages Wi-Fi location with latest acquisition,” NETWORK WORLD, Mar. 25, 2013, available at <http://www.networkworld.com/news/2013/032513-apple-wifislam-268054.html> (last visited Feb. 5, 2014) (“Apple has bought a small software startup that lets smartphones and tablets pinpoint their location indoors using nearby Wi-Fi signals.”) (Apple-WiFiSLAM Article); Skyhook, Coverage Area, available at <http://www.skyhookwireless.com/location-technology/coverage.php> (last visited Feb. 5, 2014) (“To pinpoint location, Skyhook uses a massive reference network comprised of the known locations of over 700 million Wi-Fi access points and cellular towers.”).

²⁶⁷ See *CSRIC LBS Report* at 34-35 (noting that “Bluetooth is a nearly standard feature on all current cell phones and smart phones” and that it is “ideally suited to create low cost beacons that could be deployed indoors to determine location.”)

²⁶⁸ See Business Wire, “CEA Announces iBeacon Scavenger Hunt at 2014 International CES, Jan. 2, 2014, available at <http://www.businesswire.com/news/home/20140102005966/en/CEA-Announces-iBeacon-Scavenger-Hunt-2014-International> (last visited Feb. 5, 2014); Wingfield, Nick, “Another Super Bowl Ad Fest, This Time on the Cellphone,” N.Y. TIMES, Jan. 30, 2014 at A1, available at <http://www.nytimes.com/2014/01/31/technology/For-Super-Bowl-Personalized-Phone-Alerts.html> (last visited Feb. 5, 2014).

interfaces.²⁶⁹ As noted earlier, these capabilities also provide a means of determining indoor location.²⁷⁰ In fact, indoor location applications are now mainstream for iPhone and Android devices, which together cover about 80 percent of the smartphone market.²⁷¹

134. Furthermore, almost all smartphones sold today are equipped with multiple sensors that can determine acceleration, magnetic fields (compass direction) and movement (gyroscope), which also provide a means of determining the operating environment.²⁷² In addition, a number of large mobile device vendors have started to include barometric pressure sensors in their devices, which can calculate z-axis information.²⁷³ In light of the fact that 61 percent of CMRS subscribers owned a smartphone as of May 2013,²⁷⁴ the majority of wireless subscribers already have access to some form of indoor location-

²⁶⁹ See, e.g., Galbraith, Craig, “Number of Wi-Fi Access Points Growing Quickly,” BILLING AND OSS WORLD, Sept. 6, 2013, available at <http://www.billingworld.com/news/2013/09/number-of-wi-fi-access-points-growing-quickly.aspx> (last visited Feb. 5, 2014) (“Virtually all new smartphones now have Wi-Fi connectivity as standard”); *CSRIC LBS Report* at 34 (Bluetooth is nearly a standard feature on all current cell phones and smart phones). See also, e.g., Apple, iPhone Tech Specs, available at <http://www.apple.com/iphone/specs.html> (last visited Feb. 5, 2014); Android, Developers, Connectivity, available at <http://developer.android.com/guide/topics/connectivity/bluetooth.html> (last visited Feb. 5, 2014).

²⁷⁰ See Cisco June 5, 2013 *Ex Parte* Letter at 1-2. See also Skyhook, “Submit a Wi-Fi Access Point,” available at http://www.skyhookwireless.com/howitworks/submit_ap.php (last visited Feb. 5, 2014) (“Skyhook’s location technology leverages Wi-Fi access point information to accurately determine location information in dense urban areas or indoor environments.”); Apple-WiFiSLAM Article (Apple acquires company that uses Wi-Fi signals to determine indoor location); Costa, Tony, “Indoor Venues are the Next Frontier for Location-Based Services,” FORBES, Jan. 23, 2013, available at <http://www.forbes.com/sites/forrester/2013/01/23/indoor-venues-are-the-next-frontier-for-location-based-services/> (last visited Feb. 5, 2014) (“Apple, Broadcom, Google, Microsoft, Nokia, and Qualcomm ... are extending the capabilities of their platforms and products to enable indoor positioning.”); Google, “A New Frontier for Google Maps: Mapping the Indoors,” Nov. 29, 2011, <http://googleblog.blogspot.com/2011/11/new-frontier-for-google-maps-mapping.html> (last visited Feb. 5, 2014) (“Google Maps for Android enables you to figure out where you are and see where you might want to go when you’re indoors.”).

²⁷¹ See Indoor Location Mobile Revolution Article (“The fusion of multiple technologies, such as Wi-Fi, Bluetooth Low Energy and GPS, along with specific ones already integrated in smartphones (accelerometer, magnetometer, gyroscope, and pressure sensor acting as an altimeter) allowed [the overcoming of] the main technical barriers that prevented indoor location to be successful in the market.”).

²⁷² For example, an iPhone 5 comes with the following sensors: three-axis gyro, accelerometer, proximity sensor, ambient light sensor, and compass; a Samsung Galaxy SIII comes with an accelerometer, RGB light, digital compass, proximity, gyro, and barometer. See Tolentino, Melissa, “Compared: iPhone 5 vs. Samsung Galaxy SIII and Note II,” SILICON ANGLE, Sept. 2012, available at <http://siliconangle.com/blog/2012/09/13/compared-iphone-5-vs-samsung-galaxy-siii-and-note-ii/> (last visited Feb. 3, 2014). See also Ravindranath, Lenin, *et al.*, “Improving Wireless Network Performance Using Sensor Hints,” in Proceedings of the 8th USENIX conference on Networked systems design and implementation at 1, 9 (2011), available at <http://nms.csail.mit.edu/papers/wesp-nsdi11-final.pdf> (last visited Feb. 3, 2014) (“Commodity smartphones and tablet devices come equipped with a variety of sensors, including GPS, accelerometers, magnetic compasses, and gyroscopes, which can provide hints about the device’s mobility state and its operating environment.”). See also Growing Push Article (“WiFiSlam ... is one of several startups that are marrying traditional GPS coordinates with smartphone tools like accelerometers and compasses to get more precise coordinates.”).

²⁷³ See Happich, Julien, “Samsung Leads the Adoption of Pressure Sensors in Smartphones, for Floor-Accurate Indoor Geolocation,” EE TIMES EUROPE, Mar. 21, 2013, available at http://www.electronics-eetimes.com/en/samsung-leads-the-adoption-of-pressure-sensors-in-smartphones-for-floor-accurate-indoor-geolocation.html?cmp_id=7&news_id=222916211 (last visited Jan. 28, 2014).

²⁷⁴ See Smith, Aaron, “Smartphone Ownership 2013,” Pew Internet & American Life Project, June 5, 2013, available at <http://pewinternet.org/Reports/2013/Smartphone-Ownership-2013/Findings.aspx> (last visited Feb. 14, 2014).

based technology. Moreover, the performance reached by such indoor location technologies has now surpassed GPS for the outdoors, with an average accuracy of a few square feet compared to several tens of square feet for GPS.²⁷⁵ We seek comment on these developments and on how they may relate to potential location accuracy requirements.

135. Recent data shows that adults are increasingly using location-based services and data networks.²⁷⁶ We seek comment on how providers could use commercial LBS to provide or enhance E911 location information, assuming CMRS providers can obtain usable location information from commercial LBS applications. To what extent can CMRS providers access and provide this supplemental information, where available, to the location information center for retrieval by the PSAP, now or in the foreseeable future? Could smart phones be programmed in such a manner that, when the phone initiates a voice call to 911, a separate and additional query within the handset is made for information on the device's last known location, with all location information then being sent to the provider's location information center? Moreover, what technical and operational challenges, if any, do PSAPs face in receiving location accuracy information from LBS services, and in what timeframe could they be addressed? What are the associated costs, if any, to meeting those challenges?

136. What privacy concerns, if any, might be implicated by sharing location information obtained through commercial LBS with CMRS providers, in order to enhance the accuracy of E911 location information? Many commercially deployed location information systems have privacy settings to restrict the amount of information shared by a smartphone user. CSRIC noted, however, that despite user privacy controls over location data, "for 9-1-1 calls, GPS or other location methods are activated regardless of the user's privacy setting."²⁷⁷ CSRIC added that "[i]t is therefore imperative that any new location technology . . . adhere to the same privacy principles," and that "location technology cannot be downloaded in the form of an application, which would be subject to the user's privacy settings."²⁷⁸ Could location software application programming interfaces (APIs)²⁷⁹ be more tightly integrated into the user equipment's lower level services, such that location capabilities remained activated despite user privacy settings or create a separate privacy setting for "911-only" restricted-use location data, or would it be necessary to require that smartphone users affirmatively "opt in" to permit the disclosure of this information? What other privacy issues should the Commission take into account?

137. We recognize that commercial LBS may present trade-offs. For example, location information from LBS applications on the phone may be inaccurate and untimely, as the user could have terminated any active location-based services session well before that user dials 911. Furthermore, continuously maintaining active sessions with location-based applications could have practical implications for users, including a negative effect on the battery life of a user's device and increased data usage fees.²⁸⁰ Nevertheless, given the increasing usage of commercial LBS and the importance of

²⁷⁵ See Indoor Location Mobile Revolution Article. See also NexGen Comments Workshop at 3 ("Since almost any calibrated altimeter will be more accurate in reading altitude than GPS, the incorporation of altimeter technology into cell phones will provide more accurate z-axis location information than will a GPS provided reading in this state in the evolution of GPS technology.").

²⁷⁶ See Zickhur, Kathryn, "Location-Based Services," Pew Research Center Internet & American Life Project, Jun. 5, 2013, at 4, available at http://pewinternet.org/~media/Files/Reports/2013/PIP_Location-based%20services%202013.pdf (last visited Feb. 6, 2014) (noting that 74 percent of adult smartphone owners have used location-based services at least once, which works out to roughly 45 percent of all American adults).

²⁷⁷ CSRIC LBS Report at 19.

²⁷⁸ *Id.*

²⁷⁹ An application programming interface is a set of software instructions on how software components should interact with each other.

²⁸⁰ See, e.g., Apple, Guidelines for Extending iPhone Battery life, available at <http://www.apple.com/batteries/iphone.html> (last visited Feb. 14, 2014) (noting that "[a]pps that actively use (continued....)

determining a 911 caller's location, we believe it should be considered as a potential resource for E911 purposes.

138. *Institutional and Enterprise-based Location Systems.* We also seek comment on how institutional and enterprise location systems could be leveraged to provide location data for E911. For example, Cisco Systems has demonstrated possible use cases for its location technologies for hotels, hospitals, higher education campuses, and large enterprise settings.²⁸¹ Cisco indicates that it “will be capable of producing 10 feet of accuracy on a horizontal X/Y axis 90% of the time although more accurate data is possible depending upon implementation and the use of ‘angle of arrival’ data.”²⁸² Cisco also states “the client can query the network for its own location for use in applications such as emergency services,” but that “the architecture that would allow the delivery of location data to a [PSAP] is still being studied by industry.”²⁸³ Furthermore, in 2013, Guardly released its Indoor Positioning System, a subscription-based mobile security system for businesses, school campuses, apartment buildings and parking garages which Guardly states can provide “the building name, floor, and room number of the wireless caller in less than 5 seconds” to emergency and/or security personnel.²⁸⁴

139. Because of the numerous commercial and operational incentives for location technology in these settings, we anticipate that the number of deployed institutional and enterprise-based location systems will increase in the near future. We seek comment on whether location information from these systems could be provided to CMRS providers and, ultimately, made available to public safety entities together with other E911 location information. Cisco states that per existing standards, “the client can query the network for its own location for use in applications such as emergency services,” but that “the architecture that would allow the delivery of location data to a [PSAP] is still being studied by industry.”²⁸⁵ Today many such location systems can only interact with – and therefore provide emergency location information for – devices that have Wi-Fi or Bluetooth capabilities. Do any indoor location systems already make this information available to CMRS providers, and if so, what are they? What modifications to Wi-Fi hotspots, location beacons, or devices with location information would be necessary to enable the transmission of location information to CMRS providers?

140. *Smart Building Technology.* Indoor location positioning is in high demand for commercial uses, and major industry stakeholders are investing in the development of indoor positioning technologies for applications in retail, health, gaming, entertainment, and advertising.²⁸⁶ Many of these systems are designed to assist smartphone users in finding specific locations and estimating walking time,²⁸⁷ as well as to assist retailers with precise marketing and advertising based on a customer's

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location services, such as Maps, may reduce battery life.”); Casti, Taylor, “9 Apps Draining Your Phone's Battery,” MASHABLE, Sept. 21, 2013, available at <http://mashable.com/2013/09/21/battery-draining-app/> (last visited Dec. 19, 2013) (recommending users to “[k]eep location services off until you need it” in order to save battery life.).

²⁸¹ See Cisco July 24, 2013 *Ex Parte* Letter at 1.

²⁸² *Id.*

²⁸³ *Id.* at 2.

²⁸⁴ See Guardly, Indoor Positioning System, <https://www.guardly.com/technology/indoor-positioning-system> (last visited Feb. 3, 2014).

²⁸⁵ Cisco July 24, 2013 *Ex Parte* Letter at 2.

²⁸⁶ See, e.g., Lessin, Jessica, “Apple Acquires Indoor Location Company WifiSLAM,” WALL STREET JOURNAL, Mar. 23, 2013, available at <http://blogs.wsj.com/digits/2013/03/23/apple-acquires-indoor-location-company-wifislam/> (last visited Feb. 3, 2014); Schutzberg, Adena, “Ten Things You Need to Know About Indoor Positioning,” DIRECTIONS MAGAZINE, May 6, 2013, available at <http://www.directionsmag.com/articles/10-things-you-need-to-know-about-indoor-positioning/324602> (last visited Feb. 3, 2014).

²⁸⁷ See, e.g., Nokia Indoor Navigation demonstration, available at <http://www.youtube.com/watch?v=S2GALFBrXk&feature=youtu.be> (last visited Feb. 14, 2014); IndoorLBS.com, (continued....)

movement.²⁸⁸ Though some “smart building” technology is already commercially available, its deployment has been largely limited to public settings, given the cost of the necessary in-building supporting infrastructure. Nevertheless, some residential “smart building” technologies are available today, which could potentially be registered with dispatchable address information, including Wi-Fi-enabled home security systems, door locks, and thermostats.²⁸⁹ We seek comment on how Bluetooth or Wi-Fi-enabled locks, thermostats, smoke detectors, lighted exit signs, security systems and other residential “smart building” technologies could be registered with dispatchable address information and, if so, how it could be achieved.

IV. IMPROVING THE DELIVERY OF PHASE II LOCATION INFORMATION

141. In the following sections, we seek comment on measures to ensure that PSAPs receive Phase II information in a swift and consistent format. We also seek comment on whether CMRS providers should differentiate between the type of location technology used to generate a location fix. Further, we seek comment on whether recent technological developments, including the proliferation of GPS-enabled smartphones capable of providing more granular location information, warrants strengthening our current E911 Phase II requirements to provide location information within 50 meters for all wireless 911 calls. We also propose periodic Phase II call tracking requirements, measures to facilitate the swift resolution of PSAP Phase II concerns, and compliance testing requirements to ensure that we can monitor and ensure compliance with our E911 rules. Through these measures, we seek to ensure that PSAPs receive the full breadth of information they need to respond swiftly and effectively to emergency calls, and that this information is provided in a way that is clear and useful.

A. Time to First Fix (TTFF)

142. *Background.* The Commission’s current E911 location accuracy rules do not require CMRS providers to test for and meet a specific Time to First Fix (TTFF). In the *E911 Location Accuracy Third Report and Order*, the Commission tasked CSRIC with the “making recommendations concerning cost-effective and specific approaches to testing requirements, methodologies, and implementation timeframes,” including appropriate updates to OET Bulletin 71.²⁹⁰ In response, CSRIC WG3 noted that, while the OET Bulletin No. 71 “suggests an acceptable time limit [Time to First Fix] for delivering the location estimate of 30 seconds,” the OET guideline is “generally accepted as the *de facto* standard for maximum latency in E9-1-1 location delivery.”²⁹¹

143. The record shows that with current location technologies, there is a trade-off between the accuracy of the location information and the time to complete a location fix.²⁹² This trade-off depends in

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 “Indoor Navigation Demos,” available at <http://www.indoorlbs.com/p/indoor-navigation-systems.html> (last visited Feb. 3, 2014).

²⁸⁸ Clifford, Stephanie, and Hardy, Quentin, “Attention, Shoppers: Store Is Tracking Your Cell,” N.Y. TIMES, July 14, 2013, at A1, available at http://www.nytimes.com/2013/07/15/business/attention-shopper-stores-are-tracking-your-cell.html?pagewanted=all&_r=0 (last visited Feb. 3, 2014).

²⁸⁹ See, e.g., August Smart Locks, <http://www.august.com/> (last visited Feb. 4, 2014); Sargent Locks, http://www.sargentlock.com/products/product_landing.php?item_id=1589 (last visited Feb. 4, 2014); Lockitron, <https://lockitron.com/preorder> (last visited Feb. 4, 2014). Nest Thermostats allows the owner to adjust their home thermostat using a smart phone or other device. See Meet the Nest Account and Nest Mobile App, available at <https://nest.com/blog/2011/11/10/meet-the-nest-account-and-nest-mobile-app/> (last visited Feb. 3, 2014).

²⁹⁰ See *E911 Location Accuracy Third Report and Order*, 26 FCC Rcd 10089 ¶ 37. See also OET Bulletin No. 71. The Commission indicated that it would seek comment on CSRIC’s recommendations prior to implementing specific testing requirements and procedures. See *id.* at 10089 ¶ 37.

²⁹¹ See *CSRIC Outdoor Location Accuracy Report* at 12.

²⁹² See *infra*, Section IV.C. (describing the trade-off between accuracy and latency). See also NENA Workshop Comments at 3 (asserting that “existing network-based and network-assisted location technologies can provide very (continued....)

part on the location technology a carrier employs. For instance, the time for A-GPS technologies to generate a location fix is typically longer than the time needed for network-based location solutions.²⁹³ TruePosition asserts that “[the] failure to accurately and timely locate all E-911 calls is the direct result of the wireless carriers’ decision to move toward reliance on handset-based [A-GPS] technology as their primary E-911 location technology ... [and] the use of low-cost, inferior ‘fall-back’ technology when [A-GPS] fails.”²⁹⁴ TruePosition adds that “[A-GPS] takes time to report an accurate location, typically at least 30 seconds, and has difficulty performing in ... environments such as urban areas where very high volumes of 911 calls routinely occur.”²⁹⁵ However, while CMRS providers using A-GPS technologies acknowledge that the time to generate an initial location fix based on GPS satellite signals may take longer than five seconds,²⁹⁶ they submit that, generally, they can deliver Phase II location fixes within 12-15 seconds.²⁹⁷

144. *Discussion.* We propose that, as part of our existing Phase II E911 requirements as well as our proposed indoor requirements,²⁹⁸ CMRS providers must deliver E911 location information, with the specified degree of accuracy,²⁹⁹ within a maximum period of 30 seconds to the location information center.³⁰⁰ We believe this proposal is consistent with the record, both in terms of addressing a need for the Commission to take action regarding latency, as well as what is technically feasible. Public safety

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fast first fixes, which are valuable to public safety, even if they are subject to larger uncertainties than final GNSS [satellite] fixes.”).

²⁹³ See *infra*, Section IV.C at para. 154 (concerning the trade-off between accuracy and latency).

²⁹⁴ TruePosition Workshop Reply Comments at 1.

²⁹⁵ *Id.*

²⁹⁶ See Letter from Nneka Chiazor, Executive Director, Federal Regulatory Affairs, Verizon, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Sept. 11, 2013), at 5 (stating that its “A-GPS solution first attempts to generate a location fix exclusively using GPS satellites, in which case a very precise Phase II fix can be obtained in as little as 5 seconds.”) (Verizon Sept. 11, 2013 *Ex Parte* Letter).

²⁹⁷ See Verizon Sept. 11, 2013 *Ex Parte* Letter at 5 (submitting that a “pure GPS-based location fix often will be available with the PSAP’s initial bid, but because Verizon Wireless’ average time to deliver a Phase II fix to the MPC is around 12-15 seconds, in most cases the PSAP will often receive the ‘Phase I’ cell site/sector location first with the voice call, and thus will need to ‘re-bid’ to obtain ... Phase II location.] See also Letter from Allison M. Jones, Counsel-Legal/Government Affairs, Sprint Corporation, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Sept. 30, 2013), at Attachment at 21 (stating that “Phase II location information calculation at the PDE generally takes 15-20 seconds, but could take up to 30 seconds or more, and will not be available to the PSAP until it is calculated.”).

²⁹⁸ See *supra*, Section III.B.3.a. i (proposing, for indoor accuracy testing, key performance attributes, including a TTFB of a maximum 30 seconds to deliver location information meeting a horizontal accuracy standard of 50 meters).

²⁹⁹ See 47 C.F.R. § 20.18(h)(1)-(2) (for the currently specified accuracy standards for outdoor measurements only).

³⁰⁰ See *supra*, Section II.C para. 21 note 47 (using the term “location information center” to refer to either the MPC or GMLC, depending on the carrier and type of network). Once the CMRS provider generates the location fix, it is transmitted to the location information center, where it is available for retrieval by PSAPs through their initial bidding or re-bidding process. See, e.g., Verizon Sept. 11, 2013 *Ex Parte* Letter, at 5 (stating that “the fix ... is transmitted to the third party vendor’s [Location Information Center] for retrieval by the PSAP via a bid to [the PSAP’s] ALI Database, which, in turn, accesses the MPC”). See also Sprint Workshop Comments at 2-3 (describing the process for wireless carriers to transmit the Phase II location information to the MPC and then PSAPs bidding to receive Phase II information or rebidding to update or verify the initial Phase II bid location information); AT&T Sept. 9, 2013 *Ex Parte* Letter, Attachment B, at 2 (concerning the delivery of Phase II location information to the GMLC and the bidding by a PSAP).

commenters call for improvements in TTFF.³⁰¹ Similarly, Mission Critical Partners emphasizes that “[a]ny improvements to the yield, accuracy, and time to first fix (TTFF) of locations would be welcomed by PSAPs nationwide.”³⁰² The E911 Location Accuracy Workshop also shed light on the need for CMRS providers to deliver Phase II location fixes with a level of accuracy and within a short time frame, *e.g.* 30 seconds, in order to be useful to PSAPs, depending on the re-bidding practices of each jurisdiction.³⁰³

145. The record evidences trends and technological developments that may reduce the time in which CMRS providers can obtain and transmit location fixes. First, as CSRIC notes and as discussed above, there are ongoing developments in hybrid location technologies.³⁰⁴ As CMRS providers refine and deploy hybrid technologies to achieve better location accuracy indoors, is it technically feasible for providers to leverage those hybrid deployments for wireless 911 calls from outdoor environments to achieve improved yield and TTFF? On the one hand, the record indicates that implementing hybrid or “fall-back” location technologies may result in longer TTFFs and less accuracy. TruePosition asserts that in challenging environments, whether outdoors or indoors, fall-back technologies are unlikely to deliver Phase II compliant information as quickly as PSAPs need it.³⁰⁵ Typically, however, providers using A-GPS have built their networks to deliver a location fix using hybrid location or “fall-back” technologies only if their systems cannot obtain an A-GPS fix within a TTFF of 30 seconds.³⁰⁶ For example, Verizon indicates that it has taken “steps . . . to improve the location information delivered to PSAPs,” such as “[m]aking caller location information available within an average of 12-15 seconds, and within 25 seconds for 99 percent of all calls for which the information is available.”³⁰⁷ Will hybrid technologies, complemented by beacon technologies, DAS networks, and small cells, make it possible to achieve improvements in TTFF in challenging environments?

146. The second major factor that is likely to improve the delivery of location information is the migration by CMRS providers to 4G VoLTE networks, which the record indicates can achieve swifter times to first fix.³⁰⁸ Consequently, we seek comment on how the migration to 4G VoLTE might affect a requirement for the specific TTFF level that we propose as well as timetables for compliance.³⁰⁹

³⁰¹ See NENA Workshop Comments, at 2-3 (concerning possible impact of indoor wireless calls on TTFF). See also E911 Phase II Workshop webcast, morning session, at <http://www.fcc.gov/events/workshop-e911-phase-ii-location-accuracy>.

³⁰² Mission Critical Partners Workshop Comments at 1.

³⁰³ See E911 Phase II Location Accuracy Workshop webcast, afternoon session, *available at* <http://www.fcc.gov/events/workshop-e911-phase-ii-location-accuracy>. See also Letter from Bruce A. Olcott, Counsel for NexNav, LLC to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Dec. 23, 2013) at 3 (noting that at the workshop, public safety representatives said a view that “30 seconds is often too long to assist 911 operators because, rather than wait 30 seconds for Phase II location information, operators often spend the . . . initial portion of an E911 call orally eliciting location information . . .”).

³⁰⁴ See CSRIC *Indoor Location Test Bed Report* at 41 (detailing a hybrid solution by Qualcomm); see *id.* at 43 (detailing NextNav’s hybrid solution).

³⁰⁵ See TruePosition Workshop Comments at 2 (asserting that, in such cases, the information is not Phase II equivalent and that Round Trip Time technology “will never deliver . . . more than Phase I-type information”).

³⁰⁶ See *infra*, Section IV.C (describing when a fall-back location mode is triggered). Providers using handset-based location technologies, as well as providers using network-based technologies but deploying A-GPS capable handsets, fall back to hybrid location fixes if a Phase II fix cannot be delivered to their respective location information centers within a TTFF of 30 seconds.

³⁰⁷ See Verizon Dec. 19, 2013 *Ex Parte* Letter at 1 (emphasis in original) (referring to the improvements in the context of “enhancing the A-GPS location accuracy solution for VoLTE in ways . . . , including coupling location data from additional satellite systems (GLONASS) and OTDOA with GPS data.”).

³⁰⁸ See T-Mobile Workshop Comments at 19 (“[F]or pre-LTE radio access network technologies, any ‘hybrid’ of location technologies must be run sequentially. This means that ‘fallback’ technologies (with less accuracy but (continued....))

147. Further, we recognize that wireless 911 calls may terminate after a short period of time, before CMRS providers' networks can generate a location fix. Therefore, we propose to exclude wireless 911 calls that are dropped or disconnected in 10 seconds or less, and in which CMRS networks have not yet delivered a location fix to the location information center, for purposes of determining compliance. We seek comment on whether 10 seconds is the right cut-off for an exclusion for short calls. Alternatively, should we base the exclusion on some other timeframe (*e.g.*, should we instead exclude calls shorter than 15 seconds, 20 seconds, or 30 seconds)? If we were to adopt an exclusion for short calls, are there other measures to provide the best available information, even if the location information is not a full Phase II fix? For instance, should CMRS providers share with PSAPs Class of Service (COS) information, *e.g.*, whether the location fix is Phase I- or Phase II-compliant, in order to alert PSAPs of information that might not be Phase II-compliant but may be helpful in the emergency?³¹⁰ For example, the record indicates that with wider deployment of micro-cells, Phase I may be more helpful than PSAPs have recently viewed it.³¹¹

148. Additionally, we propose that, based on the outdoor testing procedures recommended by WG3, CMRS providers should implement periodic testing procedures to ensure that they meet a TTFF requirement.³¹² We seek comment on both the costs of implementing a 30-second TTFF, as well as for compliance testing. We would expect providers to measure and test for such compliance with the proposed TTFF at the appropriate point in their E911 networks. The record shows that CMRS providers already test for and collect data on yield and TTFF.³¹³ We seek comment on whether this would mitigate any potential costs of compliance testing. We recognize that WG3 found that costs for testing can be

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higher yield) run after a primary technology has been tried and failed. . . . This will change with LTE, for which the industry standards allow multiple location technologies to be run simultaneously.”). *See also* E911 Phase II Workshop webcast, morning session, at <http://www.fcc.gov/events/workshop-e911-phase-ii-location-accuracy>. *See also* T-Mobile Workshop Comments at 12 (submitting that the running of fall-back technologies “after a primary technology has been tried” will be resolved “once LTE networks are rolled out, which allow multiple location technologies to run concurrently”); Verizon Workshop Comments at 6 (“911 calls from VoLTE handsets will utilize Observed Time Difference of Arrival (‘OTDOA’) instead of AFLT as the network-based fallback location technique,” and that OTDOA should outperform AFLT “due to higher LTE bandwidth . . . and more advanced processing.”).

³⁰⁹ Concerning a potential timeframe for such requirements, with the imminent deployment by major providers of 4G VoLTE, it is reasonable to expect that 4G VoLTE will be widely deployed before the sunset of the network-based standards. *See infra*, Section IV.D. (seeking further comment on revision of Commission’s existing E911 rules for outdoor calls).

³¹⁰ *See infra*, Section IV.G (on confidential treatment of sharing testing results for periodic outdoor testing). Such COS results could be aggregated and shared over a period of time with those PSAPs who do not collect it. *Cf.* Sprint Workshop Comments at 4 (“The initial bid or call-set up that occurs on Sprint’s network will normally include Phase I level data and this is typically provided to PSAPs in the Class of Service designation.”).

³¹¹ *See e.g.*, Verizon Workshop Comments at 7 (“[I]ndoor small cell deployments . . . with a very small coverage area, have the potential to provide very accurate location information via the equivalent of a ‘Phase I’ location fix.”) (*citing* Qualcomm Aug. 2013 Ex Parte Letter, Attachment at 10-11); NextNav Workshop Comments at 14-15 (“[C]all routing on Phase I information may significantly narrow the performance differences noted by the CalNENA report and the various carrier responses. . . . Such operational issues are arguably best resolved by a cooperative effort of PSAPs and carriers to improve their procedures through automated rebidding and reduced time intervals to provide Phase II information.”).

³¹² *See infra*, Section IV.G (on periodic outdoor testing).

³¹³ *See* T-Mobile Workshop Comments at 21 (stating that it generates daily reports on data from its GMLC); Sprint Workshop Comments at 5-6, n.8 (concerning Phase II data delivered to its MPC with respect to E911 service to five California PSAPs); AT&T Sept. 9, 2013 Ex Parte Letter, Attachment B, at 2-3.

high.³¹⁴ We seek comment on whether this magnitude of costs is accurate. How would the cost ranges in WG3's data be affected by the transition to 4G VoLTE networks? Would the cost of TTF improvements likely be incorporated into the 4G network upgrades and the roll-out of 4G VoLTE? Would costs decrease after providers have fully deployed such networks? Additionally, what would the cost burdens be for the regional and smaller CMRS carriers who are also planning to migrate to 4G VoLTE networks using A-GPS technologies, to meet and test for the proposed TTF of 30 seconds?³¹⁵

149. Alternatively, we seek comment on whether voluntary efforts are sufficient to improve latency, such that it is unnecessary to impose any additional regulations at this time. For instance, would more frequent coordination between CMRS providers and PSAPs be sufficient to address concerns regarding TTF performance levels, without regulatory metric or testing requirements for TTF?

B. Confidence and Uncertainty Data

150. *Background.* Our current rules require CMRS providers presently subject to the Commission's E911 requirements to provide confidence and uncertainty (C/U) data on a *per-call* basis upon PSAP request.³¹⁶ C/U data reflects the level of confidence that a specific 911 caller is within a specified distance of the location that the carrier provides. Confidence data is expressed as a percentage, indicating the statistical probability that the caller is within the area defined by the "uncertainty" statistical estimate, while uncertainty is expressed as a radius in meters around the reported position.³¹⁷

151. The Commission has held that "[o]nce a [wireless service provider] has established baseline confidence and uncertainty levels in a county, ongoing accuracy shall be monitored based on the trending of uncertainty data and additional testing shall not be required."³¹⁸ However, WG3 subsequently indicated that "uncertainty estimates on a call-by-call basis are not a reliable substitute for empirical location accuracy testing."³¹⁹ Nevertheless, it also stated that "[u]ncertainty estimates . . . can indicate a

³¹⁴ For instance, WG3 notes that the deployment of field test resources can range from \$250 to \$1000 per cell site, and that, for testing systems with the capability to monitor Key Performance Indicators (KPIs) (such as latency with respect to TTF), the annual costs "to maintain reporting and data storage" range from \$500,000 to \$1,500,000 for a large network. *CSRIC Outdoor Location Accuracy Report* at 27.

³¹⁵ See *CSRIC Outdoor Location Accuracy Report* at 27 (also informing that some vendors have a per PSAP costing structure that might charge from \$50,000 to \$150,000 per PSAP, regardless of the number of cell sites tested).

³¹⁶ See 47 C.F.R. § 20.18(h)(3) (providing that "all carriers subject to this section shall be required to provide confidence and uncertainty data on a per-call basis upon the request of a PSAP," and that "[a]ll entities responsible for transporting confidence and uncertainty between wireless carriers and PSAPs, including LECs, CLECs, owners of E911 networks, and emergency service providers (collectively, System Service Providers (SSPs)) must implement any modifications that will enable the transmission of confidence and uncertainty data provided by wireless carriers to the requesting PSAP").

³¹⁷ See Public Safety and Homeland Security Bureau Reminds CMRS Providers of the January 18, 2013 Deadline for Meeting the First Benchmark of the Commission's Updated E911 Location Accuracy Rules, *Public Notice*, 28 FCC Rcd 253, 255 n.14 (PSHSB Jan. 16, 2013) (*PSHSB E911 First Benchmark Notice*) (citing *E911 Location Accuracy Second Report and Order*, 25 FCC Rcd at 18928-30 ¶¶ 50-55). The uncertainty estimate is expressed in meters. For example, the E911 Phase II location information that CMRS providers provide to PSAPs is accompanied by a 90 percent/35 meter "C/U score," reflecting 90 percent confidence that the caller is within 35 meters of the estimated location. See *E911 Location Accuracy Second Report and Order*, 25 FCC Rcd at 18928-30 ¶¶ 51-53.

³¹⁸ See *E911 Location Accuracy Second Report and Order*, 25 FCC Rcd at 18928 ¶ 51.

³¹⁹ *CSRIC Outdoor Location Accuracy Report* at 22.

trend that may reflect continued proper system operation or system problems.”³²⁰ WG3 also has noted the importance of C/U data in the testing context.³²¹

152. Public safety entities have indicated that C/U data play a meaningful role in assessing the quality of the location information that accompanies a wireless 911 call. According to APCO, “many PSAPs find [confidence and uncertainty] information to be invaluable in evaluating the location data received with 9-1-1 calls.”³²² NENA further explains that a “position reported with high confidence . . . allow[s] responders to narrow the field of search and thus reduce the required search time and the number of responders required and thereby the cost of responding to a given call”³²³ According to Intrado, “X/Y [coordinates] should never be used alone,” but should always be combined with uncertainty measurements.³²⁴

153. The record also suggests, however, that C/U data is not always perceived as useful by PSAPs. Following the Commission’s recent E911 Location Accuracy workshop, NextNav indicated that “[w]orkshop participants acknowledged that the value of confidence and uncertainty information to PSAPs has in the past been uncertain.”³²⁵ T-Mobile also indicated that “[c]onfidence level is suppressed (not submitted to the PSAP) – per public safety request.”³²⁶ The record suggests that, to the extent public safety entities do not request or use C/U data, it may be due to the variable way in which such information is generated or presented. NENA explains:

Different location technologies in use today generate differing forms of confidence and uncertainty measurements which can cause interpretation issues in PSAPs. This in turn can affect real-time decision-making on caller location and response methods. . . . Such differences complicate the training of call takers and the day-to-day operation of PSAPs, impose unnecessary costs on local public safety agencies, and can reduce the speed and efficiency with which response services are delivered.³²⁷

WG3 acknowledges that “disparate service providers and technologies report confidence and uncertainty values differently,”³²⁸ but that “[u]ncertainty trending is still useful within a single service provider and single technology environment.”³²⁹

154. Given this lack of uniformity in the delivery of C/U data, NENA states that it is “critical that the Commission establish a *uniform* standard for the delivery of such information to PSAPs and for

³²⁰ *Id.* at 22.

³²¹ *See id.* at 39 (“in the context of location system testing in general (not only indoors) the results provide an indication of how well a location system under test is performing in a certain environment”).

³²² *See* APCO Further Notice Comments at 3.

³²³ *See* NENA Further Notice Comments at 5.

³²⁴ *See* Intrado Location Accuracy Workshop Presentation (Nov. 18, 2013) at 6, *available at* http://transition.fcc.gov/bureaus/pshs/911/Phase%202/Workshop_11_2013/Intrado_Snapp_Nov2013.pdf (last visited Feb. 18, 2014) (Intrado Workshop Presentation).

³²⁵ *See* NextNav Nov. 26, 2013 *Ex Parte* Letter at 7. NextNav further stated that “[s]ome carriers may collect but, at the request of public safety, not transmit confidence level information to the PSAP.” *Id.*

³²⁶ *See* T-Mobile Location Accuracy Workshop Presentation (Nov. 18, 2013) at 3, *available at* http://transition.fcc.gov/bureaus/pshs/911/Phase%202/Workshop_11_2013/T_Mobile_Nov2013_FINAL.pdf (last visited Jan. 29, 2014) (T-Mobile Workshop Presentation).

³²⁷ *See* NENA Further Notice Comments at 6.

³²⁸ *CSRIC Outdoor Location Accuracy Report* at 22.

³²⁹ *Id.*

the meaning of the data delivered.”³³⁰ NextNav suggests that “the Commission may wish to follow the guidance of the ATIS Emergency Services Interconnection Forum (‘ESIF’), which recommends 90 percent be used as a standard required confidence level.”³³¹ T-Mobile likewise indicates that this “90% confidence level is recommended by ESIF and public safety.”³³²

155. *Discussion.* We believe that C/U data is a critical component in helping PSAPs understand the quality of the location information they receive from providers, whether the 911 calls are made indoors or outdoors.³³³ We seek to develop a better understanding of why C/U data is not always utilized by PSAPs. What are the problems PSAPs have encountered with its use? How could C/U data be provided in a more helpful fashion?

156. We also seek comment on NextNav’s suggestion to incorporate ESIF’s recommended 90 percent confidence level as a requirement.³³⁴ Is it important that all CMRS providers subject to Commission’s E911 requirements use the same confidence level when calculating C/U data? If a standard confidence level is desirable across Phase II data, is 90 percent the correct level? Why or why not? Moreover, if not, should the Commission nevertheless still require CMRS providers to use the same confidence level? If so, what should that level be and why? What potential costs would be associated with implementing this requirement? In the event we establish a uniform confidence level, should CMRS providers be required to demonstrate compliance with that confidence level to the FCC, and if so, how?

157. We seek comment regarding the format in which C/U data is provided to the PSAPs. What are the various formats in which this data is presently provided? Is the fact that horizontal uncertainty is expressed either as a circle or an ellipse problematic?³³⁵ Should the Commission require that C/U data be provided in a standard, uniform format? If so, what should that format be? What are the potential costs involved in standardizing C/U data for all stakeholders involved? What additional measures, if any, should the Commission could take to increase the usefulness of C/U data for PSAPs?

158. Finally, we anticipate that any requirements we adopt regarding standardization of the delivery and format of C/U data would apply in conjunction with the delivery of both indoor and outdoor location information. Is there any reason why the format of C/U requirements should differ for indoor versus outdoor calls? We seek comment on this issue as well.

C. Identifying the Type of Technology Used to Deliver the E911 Location Fix

159. *Background.* Typically, when a wireless caller initiates a call to 911, CMRS providers first attempt to locate the caller using A-GPS.³³⁶ However, GPS signals may be blocked in certain

³³⁰ See NENA Further Notice Comments at 6.

³³¹ See NextNav Nov. 26, 2013 *Ex Parte* Letter at 7.

³³² See T-Mobile Workshop Presentation at 3.

³³³ Our current rules require providers to furnish C/U data on per-call basis upon the request of a PSAP. These requirements would extend to any proposed indoor location accuracy requirements. In any case, as a practical matter, because providers and PSAPs do not distinguish between wireless 911 calls that originate indoors versus outdoors, providers must, by necessity, provide C/U data for all calls.

³³⁴ See NextNav Nov. 26, 2013 *Ex Parte* Letter at 7.

³³⁵ See Sprint Location Accuracy Workshop Presentation (Nov. 18, 2013) at 9, *available at* http://transition.fcc.gov/bureaus/pshs/911/Phase%202/Workshop_11_2013/Sprint_No2013_FINAL.pdf (last visited Feb. 18, 2014) (Sprint Workshop Presentation).

³³⁶ See Verizon Sept. 11, 2013 *Ex Parte* Letter at 5 (describing Verizon Wireless’s A-GPS solution, which firsts attempts to generate location based on GPS only, then a hybrid of GPS and AFLT, and then a pure AFLT attempt); Letter from John Nakahata, Counsel to T-Mobile USA, Inc., to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Sept. 27, 2013) at 1 (“For 911 calls placed using A-GPS capable handsets (the substantial majority of T-Mobile 911 calls), T-Mobile first attempts to obtain an A-GPS fix.”) (T-Mobile Sept. 27, 2013 *Ex Parte* Letter); TruePosition Workshop Reply Comments at 4 (stating that “the primary technology currently relied upon by the (continued....)

environments, compromising the accuracy and reliability of GPS technology.³³⁷ In the event that A-GPS fails to provide a sufficiently accurate location fix within the 30 second timeframe recommended in OET Bulletin 71,³³⁸ CMRS providers then rely on “fall-back” technologies, which provide location information that may be less accurate.³³⁹ The record shows that providers using network-based location solutions also first attempt to locate callers with GPS-capable handsets using A-GPS, but then “fall back” if necessary to a hybrid of A-GPS and Round Trip Time (RTT), which calculates the distance between the handset and the nearest base station, and subsequently, will attempt a location fix using RTT only.³⁴⁰

160. Each location technology presents a trade-off between accuracy and latency. For example, though A-GPS can locate wireless 911 callers within 10-20 meters, it is dependent on whether the device can reach four or more satellites,³⁴¹ and it often takes 30 seconds or more to generate a precise location, though shorter times are possible.³⁴² On the other hand, a location fix via RTT may provide location information within a short period of time, but is significantly less accurate.³⁴³

161. *Discussion.* To ensure that PSAPs can understand and make educated assessments regarding the quality of Phase II location information, we seek comment on whether to require CMRS providers to identify the technology used to determine a location fix and to provide this information to PSAPs that have the capability to receive this information. We seek comment regarding the technical feasibility of determining the type of technology used to identify a caller’s location on a call-by-call basis. What potential costs might a provider incur to implement a requirement that it differentiate between the types of technology used to provide a location fix?

162. We also seek comment on the usefulness of this additional information to PSAPs, and whether the benefits of this information would exceed any potential costs that might be necessary to make use of this information. If PSAPs were aware of the type of location fix received, would they be able to assess whether it is necessary to re-bid for better location information? To what extent would C/U data

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carriers for the vast majority of their customers to calculate a Phase II compliant location” is AGPS); TruePosition Location Accuracy Workshop Presentation (Nov. 18, 2013) at 2, *available at* http://transition.fcc.gov/bureaus/pshs/911/Phase%202/Workshop_11_2013/TruePosition%20FCC%20briefing%201-18-2013.pdf (last visited Dec. 19, 2013) (noting that “[c]arriers have come to rely on AGPS for primary E-911 location”) (TruePosition Workshop Presentation).

³³⁷ Some CMRS providers report an A-GPS failure rate of approximately 20 percent, much of which results from location attempts for wireless callers who are indoors. *See* AT&T Workshop Comments at 4; Verizon Workshop Comments at 4. *See also* TruePosition Workshop Reply Comments at 8.

³³⁸ OET Bulletin No. 71 at 4 (“An acceptable time limit for such testing [of location accuracy] is 30 seconds after the call is sent.”).

³³⁹ For example, a handset-based provider may attempt to generate Phase II location information by using, in order: (1) A-GPS, when four or more satellites are within view of the device; (2) a hybrid of A-GPS and Advanced Forward Link Trilateration (AFLT), which combines GPS information from available satellites (fewer than four) with cell-tower AFLT; and (3) AFLT by itself. Verizon Sept. 11, 2013 *Ex Parte* Letter at 5. TruePosition also notes that “fall-back technologies currently employed by the wireless carriers do not meet the FCC Phase II accuracy requirements.” TruePosition Workshop Reply Comments at 9.

³⁴⁰ T-Mobile Sept. 27, 2013 *Ex Parte* Letter at 1; AT&T Sept. 9, 2013 *Ex Parte* Letter at 9 (noting its use of RTT as fallback technology); TruePosition Workshop Reply Comments at 9.

³⁴¹ TruePosition Workshop Presentation at 2 (noting that GPS signals are often compromised in indoor environments, resulting in fallback location fixes which can be highly inaccurate).

³⁴² Verizon Sept. 11, 2013 *Ex Parte* Letter at 5 (noting that a precise Phase II fix via GPS can take up to 30 seconds but in most instances is generated within 12-15 seconds but can be generated in as few as 5 seconds).

³⁴³ *See* T-Mobile Workshop Comments at 12 (describing RTT as a “medium accuracy solution”); TruePosition Workshop Comments at 2 (asserting that RTT “will never deliver anything more than Phase I-type information”).

already reflect sufficient information on this score, since that data would generally reflect discounted certainty? Could existing information fields be used to display information on the type of location fix that? If not, would it be possible to add an information field to the PSAP console with a software update, or would more substantial upgrades of hardware or CPE be necessary? Could CPE be programmed to automatically rebid if it receives Phase II location information from a fall-back technology? We seek comment on whether and to what extent PSAPs might need to reconfigure their call-taking processes and console displays in order to make use of this information, and whether the benefits of receiving this information would outweigh any costs that might be entailed.

D. Updating the E911 Phase II Requirements Based on Outdoor Measurements

163. *Background.* Among other actions, in 2010 the Commission required CMRS providers to satisfy location accuracy requirements over an eight-year implementation period, ending in 2019, with interim benchmarks.³⁴⁴ At that time, certain CMRS providers exclusively used network-based location technology to identify Phase II location.³⁴⁵ Accordingly, the Commission established E911 requirements and exclusions specific to network-based providers, and provided a path by which these providers would eventually migrate to handset-based technologies.³⁴⁶ The Commission agreed with T-Mobile that “[a]s carriers transition to A-GPS, they will also transition from network-based accuracy standards to handset-based standards, moving toward a *de facto* unified standard.”³⁴⁷ Because it had recently adopted the existing E911 benchmarks, however, the Commission decided in the *E911 Location Accuracy Third Report and Order* that it was premature to seek comment on a sunset date,³⁴⁸ but tentatively concluded “that the network-based standard should sunset at an appropriate point after the end of the eight-year implementation period.”³⁴⁹

164. *Discussion.* We seek comment on whether there have been sufficient advancements in technology and a sufficient number of handsets with A-GPS capabilities in the consumer subscriber base to warrant modification of our existing Phase II requirements as they apply to outdoor calls. We note that CMRS providers are increasingly turning to handset-based technologies, namely A-GPS, to provide E911 Phase II information, which would support a more granular location accuracy requirement. When the current rules were adopted, the CMRS providers that used network-based location technology on their GSM networks had already begun to migrate to 4G and LTE networks, using handset-based location technologies.³⁵⁰ These CMRS providers have continued to migrate away from networks requiring network-based location technology.³⁵¹ We also note that nearly all handsets are now GPS-enabled.³⁵²

³⁴⁴ See *E911 Location Accuracy Second Report and Order*, 25 FCC Rcd at 18947, Appendix C.

³⁴⁵ See *id.* at 18920 ¶ 30 (noting that “network-based providers will be unable to meet the new proposed county-level accuracy standards in all areas relying solely upon current network-based technology solutions”).

³⁴⁶ *Id.* at 18920, 18927-28 ¶¶ 29, 48-49.

³⁴⁷ *Id.* at 10082 ¶ 18.

³⁴⁸ *Id.* at 10081 ¶ 16.

³⁴⁹ *Id.* at 10083 ¶ 21.

³⁵⁰ *Id.* at 10081 ¶ 17 (“the record in this proceeding clearly signals that the wireless industry is engaged in a broad migration away from the dichotomy between network- and handset-based approaches to location accuracy. Current handset-based carriers are increasingly combining A-GPS technologies with refinements based on location determinations using network-based technologies.”).

³⁵¹ See, e.g., Letter from Jamie Tan, Director, Federal Regulatory, AT&T, to Marlene Dortch, Secretary, FCC, PS Docket No. 07-114 (filed Jan. 31, 2014), at 1 (as of Jan. 31, 2014, AT&T considers itself a handset-based carrier) (AT&T Jan. 31, 2014 *Ex Parte* Letter); AT&T Sept. 9, 2013 *Ex Parte* Letter, Attachment A at 9 and Attachment B at 2 (noting, respectively, a “steady migration toward AGPS” and describing how AT&T began deploying AGPS throughout its networks partially in response to criticisms from public safety about poor E911 performance). Additionally, in 2012, AT&T announced that it would fully discontinue service on its 2G/GSM networks by January

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165. The record suggests that the migration to handset-based technologies can provide more accurate location fixes.³⁵³ In response to the E911 Phase II Location Accuracy Workshop, King County submits that “[i]n particular, the wireless carriers that use a network-based location technology that have recently added [A-GPS] location technology to their Phase II solutions have shown dramatic improvement in accuracy since 2005.”³⁵⁴ AT&T adds that the migration to A-GPS has resulted in “increased accuracy in the Phase II location information provided, especially in rural areas where the number and location of cell sites made trilateration-based location data less reliable,” as well as in lower costs.³⁵⁵ On the other hand, TruePosition contends that “[t]here is no direct relationship between a carrier’s transition from 2G to 3G or 4G network technology and . . . the E911 location accuracy that the same carrier can deliver.”³⁵⁶ In any case, the record indicates that CMRS providers and technology vendors have been working steadily to improve A-GPS performance.³⁵⁷

166. In particular, and in light of any recent improvements or advancements in A-GPS technology, we seek comment on whether all CMRS providers reasonably could comply with a 50-meter accuracy/67 percent reliability requirement within two years, such that we could adopt a unitary requirement for both indoor and outdoor calls. Establishing such a unitary requirement for all calls would help standardize the information afforded to public safety entities while raising the level of accuracy

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2017. See AT&T SEC Form 10-Q (Nov. 2, 2012) at 21, available at http://www.sec.gov/Archives/edgar/data/732717/000073271712000088/q3_10q.htm (last visited Feb. 5, 2014). See also Fitchard, Kevin, “AT&T Starts Replacing 2G with HSPA in NYC,” GIGAOM (May 23, 2012), available at <http://gigaom.com/2012/05/23/att-starts-replacing-2g-with-hspa-in-nyc/> (last visited Jan. 24, 2014); Fitchard, Kevin, “T-Mobile Pounds the First Nail in 2G’s Coffin,” GIGAOM (Feb. 23, 2012), available at <http://gigaom.com/2012/02/23/t-mobile-pounds-the-first-nail-in-2gs-coffin/> (last visited Jan. 24, 2014).

³⁵² See Lendino, Jamie, “How to Find the Right GPS App for Your Phone,” PC Mag (May 29, 2012), available at <http://www.pcmag.com/article2/0,2817,2363154,00.asp> (last visited Jan. 27, 2014); *E911 Location Accuracy Second Further Notice*, 26 FCC Rcd at 10083 ¶ 21 (stating that, in 2010, “almost all 2G and 3G handsets shipped by manufacturers were equipped with GPS-chips”); Zandbergen, Paul, “Accuracy of iPhone Locations: A Comparison of Assisted GPS, WiFi and Cellular Positioning,” 13 Transactions in GIS s1 (2009), pp. 5-26, at 6, available at http://www.paulzandbergen.com/PUBLICATIONS_files/Zandbergen_TGIS_2009.pdf (last visited Jan. 29, 2014) (Zandbergen Article) (noting that, in 2009, “[m]ost newer model cell phones are GPS-enabled.”); Berg Insight, “GPS and Mobile Handsets,” (2009) available at <http://www.berginsight.com/ReportPDF/ProductSheet/bi-gps4-ps.pdf> (last visited Jan. 24, 2014) (estimating that GPS sales would reach about 960 million, or 60 percent of total handset shipments, in 2014).

³⁵³ T-Mobile Workshop Comments at 11, 17 (noting that “accuracy is much higher and uncertainty is lower when A-GPS produces a location estimate,” and “A-GPS results are typically highly accurate”); AT&T Sept. 9, 2013 *Ex Parte* Letter, Attachment B at 2 (describing AT&T’s switch to AGPS “because of [its] greater accuracy”).

³⁵⁴ King County Workshop Comments, at 5.

³⁵⁵ AT&T Workshop Comments at 5; see also iCERT Workshop Comments at 4.

³⁵⁶ TruePosition Workshop Comments at 3. TruePosition asserts that “[t]he variable is the location technology that the carrier chooses,” and that “the fall-off associated with increased latency and indoor inaccuracy” results from certain providers’ decision to transition from UTD OA for GSM to A-GPS. *Id.* at 3. UMTS is an acronym for Universal Mobile Telecommunications System – “a third generation mobile cellular system for networks based on the GSM standard” but using “wideband code division multiple access (W-CDMA) . . . technology to offer greater spectral efficiency and bandwidth . . .” See http://en.wikipedia.org/wiki/Universal_Mobile_Telecommunications_System (last visited Oct. 24, 2013).

³⁵⁷ See Qualcomm Second Further Notice Comments at 8-9 (noting Qualcomm’s efforts in 2011 to enhance A-GPS and AGNSS technology); Verizon Workshop Comments at 1-4, citing Qualcomm Aug. 15, 2013 *Ex Parte* Letter at 4-5 (stating that Verizon has been working to improve GPS chipset sensitivity and to update its network databases to generate more accurate fixes using hybrid and AFLT); T-Mobile Workshop Comments at 11 (stating that “A-GPS’ ability to obtain a fix indoors has been improving over time, with technology and algorithmic advances in both the handset and network components.”).

across all calls, both indoors and outdoors. Would it be feasible for all CMRS providers to comply with a 50-meter accuracy/67 percent reliability (single search ring) requirement in two years? Or is there a benefit in continuing to allow a dual search ring requirement? In the event we were to sunset network-based requirements in two years and require a 50-meter accuracy requirement (with either an 80 percent or 67 percent reliability requirement), should we adopt any exceptions for certain providers who might be adversely affected, such as smaller or rural CMRS providers, or allow them a longer implementation timeframe? Alternatively, would our existing waiver process be sufficient?

E. Monitoring E911 Phase II Call Tracking Data

167. *Background.* According to APCO, “Phase II information sometimes lacks sufficient accuracy to ensure a rapid and efficient emergency response.”³⁵⁸ As discussed earlier in this *Third Further Notice*, CALNENA filed E911 call tracking data with the Commission that suggests there may be a decline in the percentage of wireless 911 calls that include Phase II location information.³⁵⁹ In addition, several other state and local public safety entities filed similar E911 call tracking data, also suggesting a potential decline in the percentage of wireless calls that include Phase II location information.³⁶⁰ As noted above, however, various providers responded that CALNENA’s reports mischaracterized the E911 data, and suggest that PSAPs are not rebidding to obtain, or “pull” the location data.³⁶¹

168. The record provides insight on PSAPs’ ability to collect and monitor Phase II performance data. For example, APCO notes that PSAP monitoring of Phase II data can be very costly depending on the method utilized,³⁶² and “many smaller PSAPs may not have the expertise or the funding to compile detailed statistics concerning performance.”³⁶³ In another example, NENA comments that “all analytical systems deployed by 9-1-1 authorities lack visibility into the internal process of carrier networks, in many cases, to those of the 9-1-1 system service providers on which the PSAPs and authorities depend.”³⁶⁴ Consequently, the same data may be subject to different interpretations.³⁶⁵ Alternatively, CalOES states that California PSAPs are able to monitor Phase II performance on an individualized basis, because there is “a statewide enterprise call tracking management information system to collect, analyze, and monitor various call performance measure.”³⁶⁶

169. *Discussion.* We seek comment on whether the Commission should require providers to periodically report E911 Phase II call tracking information, similar to the call data provided in

³⁵⁸ APCO Workshop Comments at 3.

³⁵⁹ See CALNENA *Ex Parte* Letter; see also *supra* Section II.C.

³⁶⁰ NENA Workshop Comments at 2 (stating that “NENA’s members report having noticed a decrease in the fraction of wireless call for which Phase II location data is available *early in the call.*”) (emphasis in original). *But see* King County Workshop Comments at 8 (stating that “the percentage of wireless 911 calls with Phase II location has remained fairly constant over the past five years.”). Phase II 911 Call Tracking Data submitted by certain states and public safety entities to the Commission is available at <http://www.fcc.gov/encyclopedia/phase-2-data-sets>.

³⁶¹ See AT&T Workshop Comments at 4; Sprint Workshop Comments at 6; T-Mobile Workshop Comments at 24; Verizon Sept. 11, 2013 *Ex Parte* Letter at 2.

³⁶² APCO Workshop Comments at 4.

³⁶³ *Id.*

³⁶⁴ NENA Workshop Comments at 2 (emphasis in original).

³⁶⁵ *Id.* (noting that AT&T capably explains this discrepancy). According to AT&T, the difference in their interpretation of data and CALNENA’s interpretation of data can be explained as a difference of vantage points. See AT&T Sept. 9, 2013 *Ex Parte* Letter, Attachment B at 2.

³⁶⁶ CalOES Workshop Comments at 2.

conjunction with the recently held E911 Location Accuracy Workshop.³⁶⁷ Would such a requirement help promote the delivery of Phase II E911 information? In the event we were to require periodic reporting of Phase II E911 call tracking data,³⁶⁸ we seek to implement a requirement that provides meaningful data while minimizing the potential burden on providers. We seek comment regarding the scope of information required in the reports. What information should be provided in Phase II call tracking reports? How frequently should providers be required to report Phase II E911 call tracking data? We also seek comment on any alternative measures that could ensure that providers are delivering Phase II E911 information. Could we rely instead on periodic certifications of compliance with Commission requirements based on the test bed or alternative measurements described above? Are there other ways that the Commission could monitor Phase II E911 data without imposing a requirement on CMRS providers?

170. We realize that a reporting requirement would impose a cost on providers. We seek comment on the estimated costs of such a requirement. Could existing call monitoring mechanisms be leveraged for this purpose? We also seek estimates regarding how these costs might vary, depending on the nature of the reporting obligations and the size of the representative sample of the provider's coverage area that is subject to these requirements.

F. Monitoring and Facilitating Resolution of E911 Compliance Concerns

171. Our objective in proposing indoor location accuracy requirements, as well as testing metrics and reporting requirements, is to ensure that public safety providers have consistent and reliable access to accurate location information on a call-by-call basis, as well as for the Commission and public safety entities to have sufficient information to monitor E911 performance more generally. Filings submitted in conjunction with the E911 Location Accuracy workshop, as well as statements made at the workshop itself, indicate there have been instances in which public safety believes it is receiving inadequate location information and where the Commission can help foster a dialogue between CMRS providers and public safety entities to help address PSAP concerns and promote a better understanding of E911 practices.³⁶⁹ We seek comment on whether we should establish a separate process by which PSAPs or state 911 administrators could file an informal complaint specific to the provision of a CMRS provider's E911 service, and if so, how the complaint procedure should be structured in light of our existing informal complaint process.³⁷⁰ We propose that, in connection with the filing of any informal complaint, PSAPs would be required to demonstrate that they have implemented bid/re-bid policies that are designed to obtain all 911 location information made available to them by CMRS providers pursuant to our rules.

172. We also recognize that public safety organizations such as NENA or APCO might be well-suited to monitor and facilitate resolution of PSAP concerns. We seek comment on additional measures the Commission could take to help facilitate discussion and the swift resolution of public safety concerns, whether it is through establishment of an informal Commission process or through continued coordination with public safety organizations such as NENA or APCO.

³⁶⁷ A webcast of the E911 Location Accuracy Workshop is available at <http://www.fcc.gov/events/workshop-e911-phase-ii-location-accuracy> (last visited Feb. 19, 2014). See also Public Safety and Homeland Security Bureau Announces Availability of Webcast and Additional Materials from November 18, 2013 Workshop on E911 Phase II Location Accuracy, *Public Notice*, PS Docket No. 07-114, DA 13-2226 (rel. Nov. 20, 2013).

³⁶⁸ See *infra*, Section IV.G.

³⁶⁹ As discussed above, the workshop highlighted the need for PSAPs to re-bid, in order to obtain Phase II location information and provided additional information regarding the latency issues inherent in producing a first location fix using A-GPS. See *supra* Section IV.A. A webcast of the E911 Phase II Location Accuracy Workshop is available at <http://www.fcc.gov/events/workshop-e911-phase-ii-location-accuracy> (last visited Jan. 23, 2014).

³⁷⁰ See 47 C.F.R. § 1.716.

G. Periodic Outdoor Compliance Testing and Reporting

173. *Background.* In the 2010 *E911 Location Accuracy Second Report and Order*, the Commission held that “[o]nce a wireless service provider has established baseline confidence and uncertainty levels in a county or PSAP service area, ongoing accuracy shall be monitored based on the trending of uncertainty data and additional testing shall not be required.”³⁷¹ In the 2011 *E911 Location Accuracy Third Report and Order*, however, the Commission found that periodic testing “is important to ensure that test data does not become obsolete as a result of environmental changes and network reconfiguration.”³⁷² The Commission tasked CSRIC with the “making recommendations concerning cost-effective and specific approaches to testing requirements, methodologies, and implementation timeframes . . . , including appropriate updates to OET Bulletin 71, issued in 2000.”³⁷³

174. The Commission stated that it will require CMRS providers to test outdoor location accuracy compliance on a periodic basis and make the results available to the Commission, PSAPs within their service areas, and state 911 offices in the states or territories in which they operate, subject to confidentiality safeguards.³⁷⁴ However, the Commission also stated that specific testing requirements and procedures would not become mandatory until the Commission sought comment on CSRIC’s recommendations.

175. CSRIC’s *Outdoor Location Accuracy Report* examined several issues concerning testing methodologies and procedures and concluded that technical reports issued by ATIS since the publication of OET Bulletin No. 71 provided more useful, updated methods for CMRS providers to conduct initial and periodic testing.³⁷⁵ Based on the ATIS technical reports, CSRIC Working Group 3 (WG3) made several recommendations for both initial testing³⁷⁶ and periodic testing.³⁷⁷

176. Further, WG3 found that several standards adopted by ATIS since the issuance of OET Bulletin No. 71 “generally provide more current and relevant procedures and guidelines than are available

³⁷¹ See *E911 Location Accuracy Second Report and Order*, 25 FCC Rcd at 18928 ¶ 51.

³⁷² See *E911 Location Accuracy Third Report and Order*, 26 FCC Rcd 10088 ¶ 36.

³⁷³ See *id.* at 10089 ¶ 37. See also OET Bulletin No. 71, available at http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet71/oet71.pdf. The Commission indicated that it would seek comment on CSRIC’s recommendations prior to implementing specific testing requirements and procedures. See *E911 Location Accuracy Third Report and Order*, 26 FCC Rcd at 10089 ¶ 37. The Commission also noted that disclosure of such test results would enable it “to monitor trends in location accuracy and thereby ensure that its regulations are appropriately tailored to enhance location accuracy without imposing unnecessary costs or administrative burdens.” *Id.* at 10088 ¶ 36.

³⁷⁴ *Id.* at 10088 ¶ 34.

³⁷⁵ See *CSRIC Outdoor Location Accuracy Report* at 15; ATIS-0500001, High Level Requirements for Accuracy Testing Methodologies (2011) (finding that ATIS-0500001 “focuses on providing a set of minimum technical requirements for testing location accuracy of a typical network deployment of positioning technologies for wireless E9-1-1 services in order to assess FCC compliance.”); *CSRIC Outdoor Location Accuracy Report* at 16 (describing ATIS 0500010, Maintenance Testing (ATIS Maintenance Testing Report (2006) as “a useful technical foundation for maintenance testing . . .”). See also *CSRIC Outdoor Location Accuracy Report* at 16, 24-25.

³⁷⁶ See *id.* at 24. More recently, ATIS has stated that “[i]nitial compliance at the county- or PSAP-level needs to be established through empirical data collection methods that include ground truth and actual error measurements pursuant to the Commission’s rules.” See Letter, Thomas Goode, General Counsel, ATIS, to Jeffrey Goldthorp, Chief, Communications Systems Analysis Division, Public Safety and Homeland Security Bureau, FCC, PS Docket 07-114 (filed Apr. 12, 2012), at 2 (ATIS Apr. 12, 2012 *Ex Parte* Letter).

³⁷⁷ See *id.* at 24-25 (recommending that periodic testing include the following alternative testing methods: predictive testing, incremental testing, reduced empirical data sample size, key performance indicator (KPI) monitoring, testing in representative environments, and empirical spot-checking).

in OET 71.”³⁷⁸ WG3 made several recommendations for performance and maintenance testing, including “key performance indicators” (KPIs) that CMRS providers would “routinely monitor and archive” to assess system performance and determine “when further testing and system improvements are needed at the local level.”³⁷⁹ WG3 further indicated that, while the costs for empirical testing can be expensive,³⁸⁰ alternative techniques, such as monitoring KPIs, are more cost-efficient.³⁸¹

177. The comments received in response to the workshop show that both public safety entities and CMRS providers agree that higher Phase II yield levels are desirable in order to ensure that public safety entities receive the benefits of Phase II location information. Further, the E911 Location Accuracy Workshop showed that yield can be a useful tool for assessing how well a particular location technology performs in various challenging environments.³⁸²

178. *Discussion.* Consistent with the Commission’s reasons and conclusions in the *E911 Location Accuracy Third Report and Order*, we believe that periodic testing is necessary as providers upgrade their networks and migrate to handset-based technologies.³⁸³ We seek comment on the recommendations in WG3’s report. We also invite industry and public safety stakeholders to submit a consensus proposal that addresses WG3’s recommendations, and that provides a technically feasible path forward for periodic compliance testing and reporting. The *CSRIC Outdoor Location Accuracy Report* identifies a suite of five ATIS technical reports,³⁸⁴ and we seek comment on whether these reports collectively represent the best practices for outdoor location accuracy.³⁸⁵ The *CSRIC Outdoor Location*

³⁷⁸ See *id.* at 4. See also ATIS Technical Report 0500001- High Level Requirements for Accuracy Testing Methodologies (July 2004); ATIS Technical Report 0500010- Maintenance Testing (Feb. 2007).

³⁷⁹ See *id.* at 5; 22-23 (reporting that “[a]verage local latency values for a given location technology are typically well-behaved and don’t normally vary significantly . . . “ but noting that “[i]ncreases in average latency can serve as a trigger for investigation”). Network latency affects the time in which a carrier can generate and deliver a location fix to the MPC/GMLC of the carrier. WG3’s KPIs also include uncertainty estimate trends. See *id.* at 22.

³⁸⁰ See *id.* at 26 (stating that “[e]mpirical testing methods are highly reliable, but not necessarily cost effective if applied repeatedly at a PSAP or county level”).

³⁸¹ See *id.* at 10.

³⁸² See APCO Workshop Comments at 4 (submitting that “yield” is extremely important as it would provide a more useful evaluation of the location information that is provided for all wireless calls to 9-1-1” and that “accuracy performance testing should include a consideration of ‘yield’”); NENA Workshop Comments at 3 (also stating that “the Commission’s current rules . . . largely leave the question of what qualifies as a valid Phase II fix up to the discretion of each carrier.”); T-Mobile Workshop Comments at 17 (stating that “[i]ndoor environments tend to reduce yield” and that various factors, like the “length of the 911 call[,]” and “the specific nature of the indoor environment, including the amount of RF attenuation and level of multipath (RF reflections)” can adversely affect the yield level). See generally T-Mobile Workshop Comments at 21 (noting that T-Mobile “generates other KPI [Key Performance Indicator] reports from other systems to look at specific E911 parameters like yield . . .”).

³⁸³ See *E911 Location Accuracy Third Report and Order*, 26 FCC Rcd at 10088 ¶ 34 (stating that “requiring CMRS providers to periodically test their outdoor location accuracy . . . is important to ensure that . . . location accuracy requirements are being met”; and that “[t]he lack of available data has also made it difficult to assess the effects of emerging technologies on location accuracy results . . .”).

³⁸⁴ See *CSRIC Outdoor Location Accuracy Report* at 4 (ATIS Technical Report numbers 0500001 (High Level Requirements for Accuracy Testing Methodologies), 0500009 (High Level Requirements for End-to-End Functional Testing), 0500011 (Define Topologies & Data Collection Methodology), 0500010 (Maintenance Testing), and 0500013 (Approaches to Wireless Indoor Location)).

³⁸⁵ This ATIS standard, as well as other ATIS standards discussed in this proceeding, will be available for review and download on the ATIS website during the pendency of the period for filing comments. See <http://www.atis.org/fcc/locationaccuracy.asp> (last visited Feb. 14, 2014). Paper copies will also be available for review (but not photocopying) at Commission headquarters upon request by contacting Dana Zelman at 202-418-

(continued....)

Accuracy Report also identifies several alternative testing concepts developed in ATIS-05000010 to provide a useful technical foundation for maintenance testing.³⁸⁶ The record demonstrates that providers already have processes in place that are capable of testing for yield and TTFF.³⁸⁷ Should the Commission consider any other alternative testing concepts not included in ATIS-05000010? To the extent we adopt a rule specifying that a particular ATIS technical standard, methodology, or suite of ATIS technical standards should be used by CMRS providers for purposes of periodic maintenance testing of outdoor location accuracy, we propose to accommodate future updates of that standard by delegating rulemaking authority to the Chief of the Public Safety and Homeland Security Bureau. We seek comment on this approach.

179. In addition, WG3 recommends that “[a]lternative testing methods replace full compliance testing every” 24 months.³⁸⁸ We seek comment on whether 24 months is an appropriate timeframe for conducting periodic tests. We also invite comment on what enforcement mechanisms would be appropriate to ensure compliance with any required timeframe for periodic testing.

180. Finally, we recognize that our current rules allow the monitoring of ongoing accuracy based on the trending of uncertainty data.³⁸⁹ We propose to remove this provision, in light of our proposed periodic testing requirement. As NENA has noted, confidence and uncertainty trends are not sufficient proxies for location accuracy testing because “[r]eported confidence and uncertainty data are themselves subject to systemic error.”³⁹⁰ We seek comment on this proposal.

181. *Reporting Requirements and Confidentiality Safeguards.* We recognize that imposing reporting requirements may implicate CMRS providers’ proprietary information.³⁹¹ Accordingly, we seek comment on what safeguards should be implemented to ensure that confidential information is protected. Under the CSRIC indoor test bed regime, all parties agreed that raw results would be made available only to the vendors whose technology was to be tested, participating wireless providers, and the third-party testing house; only summary data was made available to other parties.³⁹² Would it be sufficient for CMRS providers to report only summary data to the Commission, PSAPs within their service areas, and state 911 offices in the states or territories in which they operate, in order to demonstrate compliance with the Commission’s requirements? If so, what data should be included in the summary? We seek comment on whether public safety’s need for improvements in yield and TTFF components supports the inclusion of specific reporting metrics, such as those that WG3 described in its *Outdoor Location Accuracy Report*.³⁹³ Given the extent to which mobile wireless communications services are becoming increasingly

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0546 or dana.zelman@fcc.gov. To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (TTY).

³⁸⁶ See *CSRIC Outdoor Location Accuracy Report* at 20-21.

³⁸⁷ See T-Mobile Workshop Comments at 21 (concerning the generation of daily reports from its GMLC and that of other [KPI] reports from other systems, which look at specific E911 and location technology parameters, such as yield and uncertainty estimate trends”). See also *Verizon Ex Parte* (filed Sept. 11, 2013) at 5 (submitting that “in Verizon Wireless’s experience the caller’s location is calculated within 12-15 seconds on average”).

³⁸⁸ See *CSRIC Outdoor Location Accuracy Report* at 25.

³⁸⁹ See 47 C.F.R. § 20.18(h)(3).

³⁹⁰ See NENA Reply to T-Mobile *Ex Partes*, PS Docket No. 07-114, WC Docket No. 05-196 (filed July 5, 2011), at 2 (NENA Reply to T-Mobile).

³⁹¹ *E911 Location Accuracy Third Report and Order*, 26 FCC Rcd 10088 ¶ 36.

³⁹² See *CSRIC Indoor Location Test Bed Report* at 12.

³⁹³ See *CSRIC Outdoor Location Accuracy Report* at 27 (observing that performance testing systems afford the capability to monitor KPIs, including yield and latency).

central to the day-to-day lives of Americans, should this data also be available, at least to some extent, to the public?³⁹⁴ If so, what data would be useful to the public? For instance, would public disclosure of location accuracy test results provide consumers with a reasonable “yardstick” regarding competing providers’ abilities to provide Phase II location information in the counties or PSAP service areas where they are likely to make a wireless 911 call?³⁹⁵ Finally, should the confidentiality safeguards in this regard mirror those that we might adopt in relation to the indoor location accuracy compliance testing requirement?³⁹⁶

H. Roaming Issues

182. In the 2007 *E911 Location Accuracy Notice* and the 2010 *E911 Location Accuracy Further Notice and NOI*, the Commission sought comment on location accuracy while roaming.³⁹⁷ The Commission expressed concern that “a wireless caller whose carrier employs one type of location technology may not be provided Phase II service at all when roaming on the network of another carrier that relies on a different technology, or when there is no roaming agreement between carriers using compatible technologies.”³⁹⁸ In 2011, CSRIC II’s Working Group 4C similarly noted that “[t]he ability to support Phase II location for roamers may be limited in some carriers’ networks.”³⁹⁹

183. We seek comment on whether the provision of Phase II information for roamers continues to be a concern, or whether this concern has been addressed by the evolution of location technology since the Commission last examined this issue. In comments responding to the *E911 Location Accuracy Further Notice and NOI*, NENA noted that “carriers are now migrating to network-assisted GNSS positioning solutions, though not all carriers have yet adopted this technology,” and asked the Commission to “seek input from carriers on how best to ensure that E9-1-1 calls in a roaming environment are completed.”⁴⁰⁰ AT&T indicated that “at least in the case of GSM carriers, there is no clear problem in locating roamers that requires a regulatory solution,” and stated that it “can support locating roaming handsets as long as the handsets support compatible spectrum.”⁴⁰¹ Verizon similarly stated that it can provide Phase II location for all Code Division Multiple Access (CDMA) roamers using location-capable handsets “in the same manner as for our subscribers.”⁴⁰² However, Verizon also noted that it is unable to provide Phase II location capability to customers using handsets that are not location-capable (*i.e.*, without a GPS chip) or that use a different air interface.⁴⁰³

³⁹⁴ See, e.g., Improving the Resiliency of Mobile Wireless Communications Networks; Reliability and Continuity of Communications Networks, Including Broadband Technologies, PS Docket 13-239; PS Docket 11-60, *Notice of Proposed Rulemaking*, FCC 13-125 at paras. 13-14 (rel. Sept. 27, 2013) (*Resiliency of Mobile Wireless Communications Networks NPRM*) (discussing benefits of public disclosure of data on the resiliency of mobile wireless networks, including increasing competitive pressure to encourage providers to significantly harden their networks).

³⁹⁵ See *Resiliency of Mobile Wireless Communications Networks NPRM*, FCC 13-125, at ¶¶ 1-2.

³⁹⁶ See *supra*, Section III.B.3.a.iv.

³⁹⁷ See *E911 Location Accuracy Notice*, 22 FCC Rcd at 10615 ¶ 17; *E911 Location Accuracy Further Notice and NOI*, 25 FCC Rcd at 18967 ¶ 24.

³⁹⁸ See *id.*.

³⁹⁹ See *Technical Options for E911 Location Final Report* at 21.

⁴⁰⁰ NENA Further Notice Comments at 13-14.

⁴⁰¹ AT&T Further Notice Reply Comments at i, 8.

⁴⁰² Verizon Further Notice Comments at 14.

⁴⁰³ *Id.*

184. The record suggests that in most cases, handset-based carriers and network-based carriers can support Phase II location for roamers on their networks because roamers typically use compatible technologies. In addition, potential incompatibility in location technology used by roamers may be reduced further as both handset and network-based carriers migrate to A-GPS and move forward with the planned implementation of VoLTE. We seek comment on this analysis. Notwithstanding these technology trends, are there circumstances in which accurate location of roamers could continue to be hindered by technological incompatibilities? Could implementation of our indoor location proposals create any challenges in the roaming context that the Commission should address?

V. CONCLUSION

185. By this *Third Further Notice*, we seek comment on proposed measures to ensure the delivery of more accurate Phase II location information. In proposing an indoor location regulatory framework, as well as measures to ensure that our existing E911 requirements continue to keep pace with technological developments and changing consumer and public safety needs, we intend to ensure that all wireless calls to 911 receive the support they need in times of an emergency.

VI. PROCEDURAL MATTERS

A. *Ex Parte* Presentations

186. The proceedings initiated by this *Third Further Notice* shall be treated as “permit-but-disclose” proceedings in accordance with the Commission’s *ex parte* rules.⁴⁰⁴ Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must: (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made; and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter’s written comments, memoranda, or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission’s *ex parte* rules.

B. Comment Filing Procedures

187. Pursuant to sections 1.415 and 1.419 of the Commission’s rules, 47 CFR §§ 1.415, 1.419, interested parties may file comments and reply comments in response to this *Third Further Notice of Proposed Rulemaking* on or before the dates indicated on the first page of this document. Comments may be filed using the Commission’s Electronic Comment Filing System (ECFS). See *Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <http://fjallfoss.fcc.gov/ecfs2/>.

⁴⁰⁴ 47 C.F.R. §§ 1.1200 *et seq.*

- Paper Filers: Parties that choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.

Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

- All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12th St., SW, Room TW-A325, Washington, DC 20554. The filing hours are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes and boxes must be disposed of before entering the building.
- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th Street, SW, Washington DC 20554.

C. Accessible Formats

188. To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (TTY).

D. Regulatory Flexibility Analysis

189. As required by the Regulatory Flexibility Act of 1980, *see* 5 U.S.C. § 604, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities of the policies and rules addressed in this document. The IRFA is set forth in Appendix B. Written public comments are requested in the IRFA. These comments must be filed in accordance with the same filing deadlines as comments filed in response to this *Third Further Notice of Proposed Rulemaking* as set forth on the first page of this document, and have a separate and distinct heading designating them as responses to the IRFA.

E. Paperwork Reduction Analysis

190. This *Third Further Notice of Proposed Rulemaking* contains proposed new information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and OMB to comment on the information collection requirements contained in this document, as required by PRA. In addition, pursuant to the Small Business Paperwork Relief Act of 2002,⁴⁰⁵ we seek specific comment on how we might "further reduce the information collection burden for small business concerns with fewer than 25 employees."⁴⁰⁶

VII. ORDERING CLAUSES

191. IT IS FURTHER ORDERED, pursuant to Sections 1, 2, 4(i), 7, 10, 201, 214, 222, 251(e), 301, 302, 303, 303(b), 303(r), 307, 307(a), 309, 309(j)(3), 316, 316(a), and 332, of the Communications Act of 1934, 47 U.S.C. §§ 151, 152(a), 154(i), 157, 160, 201, 214, 222, 251(e), 301, 302, 303, 303(b), 303(r), 307, 307(a), 309, 309(j)(3), 316, 316(a), 332; the Wireless Communications and Public Safety Act of 1999, Pub. L. No. 106-81, 47 U.S.C. §§ 615 note, 615, 615a, 615b; and Section 106

⁴⁰⁵ Pub. L. No. 107-198.

⁴⁰⁶ 44 U.S.C. § 3506(c)(4).

of the Twenty-First Century Communications and Video Accessibility Act of 2010, Pub. L. No. 111-260, 47 U.S.C. § 615c, that this *Third Further Notice of Proposed Rulemaking* is hereby ADOPTED.

192. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of *this Third Further Notice of Proposed Rulemaking*, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Commonly Used Abbreviations for Organizations/Entities

<u>Name of Organization/Entity</u>	<u>Abbreviation/Short Name</u>
Andrew, a Commscope Company, Inc.	CommScope
Association of Public-Safety Communications Officials- International	APCO
AT&T Services, Inc.	AT&T
Alliance for Telecommunications Industry Solutions	ATIS
The Boeing Company	Boeing
California Chapter of the National Emergency Number Association	CALNENA
California Office of Emergency Services	CalOES
Commlabs, Inc.	Commlabs
Congressional Fire Services Institute	CFSI
CTIA – The Wireless Association	CTIA
International Association of Chiefs of Police	IACP
International Association of Fire Chiefs	IAFC
Industry Council For Emergency Response Technologies	iCERT
Intrado, Inc.	Intrado
King County, Washington – E911	King County Comments
MetroPCS Communications, Inc.	MetroPCS
Metropolitan Emergency Service Board Of Minnesota	Metropolitan Emergency Service Board
Mission Critical Partners, Inc.	Mission Critical Partners
Motorola Solutions, Inc.	Motorola
National Emergency Number Association	NENA
NexGen Global Technologies, LLC	NexGen
NextNav, LLC (formally CommLabs, Inc.)	NextNav
Oakland County Office of the Sheriff	Oakland County
Polaris Wireless, Inc.	Polaris
Qualcomm, Inc.	Qualcomm
Southern Communications Services, Inc.	SouthernLINC
Sprint Nextel Corporation	Sprint Nextel
T-Mobile- USA, Inc.	T-Mobile
TeleCommunications Systems, Inc.	TCS
Telecommunications for the Deaf and Hard of Hearing, Inc.	TDI
Texas 911 Alliance	Texas 911
TruePosition, Inc.	TruePosition
Verizon and Verizon Wireless Corporation	Verizon

APPENDIX B

Initial Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),¹ the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact of the proposals described in the attached *Third Further Notice of Proposed Rulemaking (Third Further Notice)* on small entities. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments in the *Third Further Notice*. The Commission will send a copy of the *Third Further Notice of Proposed Rulemaking*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).² In addition, the *Third Further Notice* and IRFA (or summaries thereof) will be published in the Federal Register.³

A. Need for, and Objectives of, the Proposed Rules

2. In this *Third Further Notice*, we propose rules that would update and expand the Commission's wireless Enhance 911 (E911) location accuracy requirements to include indoor environments and to reflect patterns in modern wireless usage and advancements in location-based technology. Specifically, we propose that all CMRS providers subject to Section 20.18(a) of the Commission's rules must provide the caller's horizontal (x- and y-axis) location within 50 meters and vertical (z-axis) data within 3 meters for 67 percent of 911 calls placed from indoor environments, within two and three years of the effective date of the rules, respectively. Within five years of the effective date of the rules, all CMRS providers subject to Section 20.18(a) of the Commission's rules must provide the caller's horizontal (x- and y-axis) location within 50 meters and vertical (z-axis) data within 3 meters for 80 percent of 911 calls placed from indoor environments. All CMRS providers would be required to meet these indoor requirements at either the county or PSAP geographic level. Over a longer period (to be determined), indoor requirements would be strengthened to provide for delivery of "dispatchable" indoor location, i.e., room-level identification. We propose that compliance with any indoor location requirements would be measured through testing in an independently administered test bed program, or through alternative testing mechanisms of equivalent reliability. Public Safety Answering Points (PSAPs) would be entitled to seek Commission enforcement of these requirements, provided they have implemented re-bid policies that are designed to obtain all 911 location information made available to them by CMRS providers. We also seek comment on whether we should adopt a specific waiver process for those providers who seek relief from our indoor location accuracy requirements.

3. Additionally, we seek comment on whether to implement various measures for modifying our existing E911 rules for indoor and outdoor 911 calls. Specifically, we seek comment on whether to adopt a metric for time to first location fix (in order to count towards compliance of the location accuracy requirements, a location fix must be generated within 30 seconds). We note that our proposal would exclude short calls (i.e., calls lasting 10 seconds or less) that may not provide sufficient time to generate a fix. We also seek comment on whether to standardize the content and delivery of confidence/uncertainty data generated for wireless 911 calls. We seek comment on whether CMRS providers should inform PSAPs of the specific location technology used to generate location information for each call. We also seek comment on whether to require CMRS providers to inform PSAPs of their specific location technology, accelerate the currently established timeframe for establishing a unitary compliance requirement for measuring location accuracy for outdoor calls, and require CMRS providers to track and

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. § 603(a).

³ See 5 U.S.C. § 603(a).

periodically report aggregate data on E911 performance. We also seek comment on whether to establish a process by which PSAPs can report concerns regarding the provision of E911 services and whether CMRS providers should be required to conduct periodic compliance testing for indoor and outdoor calls.

4. In proposing an indoor location regulatory framework, as well as measures to ensure that our existing E911 requirements continue to keep pace with technological developments and changing consumer and public safety needs, we emphasize that our ultimate objective is that all Americans – whether they are calling from urban or rural areas, from indoors or outdoors – receive the support they need in times of an emergency. Recent data reveals that overall wireless usage has increased significantly since the Commission’s adoption of E911 location accuracy rules, and further, that the majority of 911 calls also are now placed from wireless phones. Additionally, current trends indicate that a significant percentage of Americans resides in urban areas where there are high concentrations of multi-story buildings. Therefore, improvements to indoor location accuracy have become increasingly important. At the same time, we seek comment on whether our proposals in this notice are the best way to achieve this objective, and we encourage industry, public safety entities, and other stakeholders to work collaboratively to develop alternative proposals for our consideration.

B. Legal Basis

5. Sections 1, 2, 4(i), 7, 10, 201, 214, 222, 251(e), 301, 302, 303, 303(b), 303(r), 307, 307(a), 309, 309(j)(3), 316, 316(a), and 332, of the Communications Act of 1934, 47 U.S.C. §§ 151, 152(a), 154(i), 157, 160, 201, 214, 222, 251(e), 301, 302, 303, 303(b), 303(r), 307, 307(a), 309, 309(j)(3), 316, 316(a), 332; the Wireless Communications and Public Safety Act of 1999, Pub. L. No. 106-81, 47 U.S.C. §§ 615 note, 615, 615a, 615b; and Section 106 of the Twenty-First Century Communications and Video Accessibility Act of 2010, Pub. L. No. 111-260, 47 U.S.C. § 615c.

C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules Would Apply

6. 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 proposed rules.⁴ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”⁵ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.⁶ A small business 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 Small Business Administration (SBA).⁷

7. *Small Businesses, Small Organizations, and Small Governmental Jurisdictions.* Our action may, over time, affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three comprehensive, statutory small entity size standards.⁸ First, nationwide, there are a total of approximately 27.9 million small businesses, according to the SBA.⁹ In addition, a

⁴ 5 U.S.C. §§ 603(b)(3), 604(a)(3).

⁵ 5 U.S.C. § 601(6).

⁶ 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 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 terms which are appropriate to the activities of the agency and publishes such definitions(s) in the Federal Register.”

⁷ 15 U.S.C. § 632.

⁸ See 5 U.S.C. §§ 601(3)–(6).

⁹ See SBA, Office of Advocacy, available at http://www.sba.gov/sites/default/files/FAQ_Sept_2012.pdf (last viewed Jan. 31, 2014).

“small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”¹⁰ Nationwide, as of 2007, there were approximately 1,621,315 small organizations.¹¹ Finally, the term “small governmental jurisdiction” is defined generally as “governments of cities, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”¹² Census Bureau data for 2011 indicate that there were 89,476 local governmental jurisdictions in the United States.¹³ We estimate that, of this total, as many as 88,506 entities may qualify as “small governmental jurisdictions.”¹⁴ Thus, we estimate that most governmental jurisdictions are small.

1. Telecommunications Service Entities

a. Wireless Telecommunications Service Providers

8. Pursuant to 47 C.F.R. § 20.18(a), the Commission’s 911 service requirements are only applicable to Commercial Mobile Radio Service (CMRS) “[providers], excluding mobile satellite service operators, to the extent that they: (1) Offer real-time, two way switched voice service that is interconnected with the public switched network; and (2) Utilize an in-network switching facility that enables the provider to reuse frequencies and accomplish seamless hand-offs of subscriber calls. These requirements are applicable to entities that offer voice service to consumers by purchasing airtime or capacity at wholesale rates from CMRS licensees.”

9. Below, for those services subject to auctions, we note that, as a general matter, the number of winning bidders that qualify as small businesses at the close of an auction does not necessarily represent the number of small businesses currently in service. Also, the Commission does not generally track subsequent business size unless, in the context of assignments or transfers, unjust enrichment issues are implicated.

10. *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.¹⁵ The appropriate size standard under SBA rules is for the category Wireless Telecommunications Carriers. The size standard for that category is that a business is small if it has 1,500 or fewer employees.¹⁶ For this category, census data for 2007 show that there were 11,163

¹⁰ 5 U.S.C. § 601(4).

¹¹ INDEPENDENT SECTOR, THE NEW NONPROFIT ALMANAC & DESK REFERENCE (2010).

¹² 5 U.S.C. § 601(5).

¹³ U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES: 2011, Table 427 (2007).

¹⁴ 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 small 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 52,125. If we make the same assumption about special districts, and also assume that special districts are different from county, municipal, township, and school districts, in 2007 there were 37,381 special districts. Therefore, of the 89,476 small governmental organizations documented in 2007, as many as 89,506 may be considered small under the applicable standard. This data may overestimate the number of such organizations that has a population of 50,000 or less. U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES 2011, Tables 427, 426 (Data cited therein are from 2007).

¹⁵ U.S. Census Bureau, North American Industry Classification System, Definition of “Wireless Telecommunications Carriers (except Satellite),” NAICS code 517210, available at <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517210&search=2007%20NAICS%20Search> (last viewed Jan. 31, 2013).

¹⁶ See *id.* See also 13 C.F.R. § 121.201, NAICS code 517210.

establishments that operated for the entire year.¹⁷ Of this total, 10,791 establishments had employment of 999 or fewer employees and 372 had employment of 1000 employees or more.¹⁸ 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 proposed action.¹⁹ In addition, the SBA has developed a small business size standard for wireless firms within the two broad economic census categories of “Paging” and “Cellular and Other Wireless Telecommunications.” Under both categories, the SBA deems a wireless business to be small if it has 1,500 or fewer employees. For the census category of Paging, Census Bureau data for 2002 show that there were 807 firms in this category that operated for the entire year. Of this total, 804 firms had employment of 999 or fewer employees, and three firms had employment of 1,000 employees or more. Thus, under this category and associated small business size standard, the majority of firms can be considered small. For the census category of Cellular and Other Wireless Telecommunications, Census Bureau data for 2002 show that there were 1,397 firms in this category that operated for the entire year. Of this total, 1,378 firms had employment of 999 or fewer employees, and 19 firms had employment of 1,000 employees or more. Thus, under this second category and size standard, the majority of firms can, again, be considered small.

11. *Incumbent Local Exchange Carriers (Incumbent LECs).* Neither the Commission nor the SBA has developed a small business size standard specifically for incumbent local exchange services. 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.²⁰ Census Bureau data for 2007, which now supersede data from the 2002 Census, show that 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 had employment of 1000 or more. According to Commission data, 1,307 carriers reported that they were incumbent local exchange service providers.²¹ Of these 1,307 carriers, an estimated 1,006 have 1,500 or fewer employees and 301 have more than 1,500 employees.²² Consequently, the Commission estimates that most providers of local exchange service are small entities that may be affected by the rules and policies proposed in the Notice. Thus under this category and the associated small business size standard, the majority of these incumbent local exchange service providers can be considered small.²³

12. *A Competitive Local Exchange Carriers (Competitive LECs), Competitive Access Providers (CAPs), Shared-Tenant Service Providers, and Other Local Service Providers.* Neither the Commission nor the SBA has developed a small business size standard specifically for these service providers. 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.²⁴ Census

¹⁷ U.S. Census Bureau, Subject Series: Information, Table 5, “Establishment and Firm Size: Employment Size of Firms for the United States: 2007 NAICS Code 517210” (issued Nov. 2010), available at http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ2&prodType=table (last viewed Jan. 31, 2014).

¹⁸ *Id.* Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with “100 employees or more.”

¹⁹ *Id.*

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

²¹ See *Trends in Telephone Service*, Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division at Table 5.3 (Sept. 2010) (*Trends in Telephone Service*).

²² See *id.*

²³ See http://factfinder.census.gov/servlet/IBQTable?_bm=y&-fds_name=EC0700A1&-geo_id=&-skip=600&-ds_name=EC0751SSSZ5&-lang=en.

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

Bureau data for 2007, which now supersede data from the 2002 Census, show that 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 had employment of 1,000 employees or more. Thus under this category and the associated small business size standard, the majority of these Competitive LECs, CAPs, Shared-Tenant Service Providers, and Other Local Service Providers can be considered small entities.²⁵ According to Commission data, 1,442 carriers reported that they were engaged in the provision of either competitive local exchange services or competitive access provider services.²⁶ Of these 1,442 carriers, an estimated 1,256 have 1,500 or fewer employees and 186 have more than 1,500 employees.²⁷ In addition, 17 carriers have reported that they are Shared-Tenant Service Providers, and all 17 are estimated to have 1,500 or fewer employees.²⁸ In addition, 72 carriers have reported that they are Other Local Service Providers.²⁹ Of the 72, seventy have 1,500 or fewer employees and two have more than 1,500 employees.³⁰ Consequently, the Commission estimates that most providers of competitive local exchange service, competitive access providers, Shared-Tenant Service Providers, and Other Local Service Providers are small entities that may be affected by rules adopted pursuant to the Notice.

13. *Broadband Personal Communications Service.* The broadband personal communications services (PCS) spectrum is divided into six frequency blocks designated A through F, and the Commission has held auctions for each block. The Commission initially defined a “small business” for C- and F-Block licenses as an entity that has average gross revenues of \$40 million or less in the three previous calendar years.³¹ For F-Block licenses, an additional small business size standard for “very small business” was added and is defined as an entity that, together with its affiliates, has average gross revenues of not more than \$15 million for the preceding three calendar years.³² These small business size standards, in the context of broadband PCS auctions, have been approved by the SBA.³³ No small businesses within the SBA-approved small business size standards bid successfully for licenses in Blocks A and B. There were 90 winning bidders that claimed small business status in the first two C-Block auctions. A total of 93 bidders that claimed small business status won approximately 40 percent of the 1,479 licenses in the first auction for the D, E, and F Blocks.³⁴ On April 15, 1999, the Commission completed the reauction of 347 C-, D-, E-, and F-Block licenses in Auction No. 22.³⁵ Of the 57 winning bidders in that auction, 48 claimed small business status and won 277 licenses.

²⁵ See http://factfinder.census.gov/servlet/IBQTable?_bm=y&-fds_name=EC0700A1&-geo_id=&-skip=600&-ds_name=EC0751SSSZ5&-lang=en.

²⁶ See *Trends in Telephone Service* at Table 5.3.

²⁷ See *id.*

²⁸ See *id.*

²⁹ See *id.*

³⁰ See *id.*

³¹ See Amendment of Parts 20 and 24 of the Commission’s Rules – Broadband PCS Competitive Bidding and the Commercial Mobile Radio Service Spectrum Cap; Amendment of the Commission’s Cellular/PCS Cross-Ownership Rule; WT Docket No. 96-59, GN Docket No. 90-314, *Report and Order*, 11 FCC Rcd 7824, 7850–52, paras. 57–60 (1996) (*PCS Report and Order*); see also 47 C.F.R. § 24.720(b).

³² See *PCS Report and Order*, 11 FCC Rcd at 7852 ¶ 60.

³³ See Letter from Aida Alvarez, Administrator, Small Business Administration, to Amy Zoslov, Chief, Auctions and Industry Analysis Division, Wireless Telecommunications Bureau, Federal Communications Commission (Dec. 2, 1998) (*Alvarez Letter 1998*).

³⁴ See Broadband PCS, D, E and F Block Auction Closes, *Public Notice*, Doc. No. 89838 (rel. Jan. 14, 1997).

³⁵ See C, D, E, and F Block Broadband PCS Auction Closes, *Public Notice*, 14 FCC Rcd 6688 (WTB 1999). Before Auction No. 22, the Commission established a very small standard for the C Block to match the standard used for F Block. Amendment of the Commission’s Rules Regarding Installment Payment Financing for Personal

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14. On January 26, 2001, the Commission completed the auction of 422 C and F Block Broadband PCS licenses in Auction No. 35. Of the 35 winning bidders in that auction, 29 claimed small business status.³⁶ Subsequent events concerning Auction 35, including judicial and agency determinations, resulted in a total of 163 C and F Block licenses being available for grant. On February 15, 2005, the Commission completed an auction of 242 C-, D-, E-, and F-Block licenses in Auction No. 58. Of the 24 winning bidders in that auction, 16 claimed small business status and won 156 licenses.³⁷ On May 21, 2007, the Commission completed an auction of 33 licenses in the A, C, and F Blocks in Auction No. 71.³⁸ Of the 12 winning bidders in that auction, five claimed small business status and won 18 licenses.³⁹ On August 20, 2008, the Commission completed the auction of 20 C-, D-, E-, and F-Block Broadband PCS licenses in Auction No. 78.⁴⁰ Of the eight winning bidders for Broadband PCS licenses in that auction, six claimed small business status and won 14 licenses.⁴¹

15. *Narrowband Personal Communications Services.* To date, two auctions of narrowband personal communications services (PCS) licenses have been conducted. For purposes of the two auctions that have already been held, “small businesses” were entities with average gross revenues for the prior three calendar years of \$40 million or less. Through these auctions, the Commission has awarded a total of 41 licenses, out of which 11 were obtained by small businesses. To ensure meaningful participation of small business entities in future auctions, the Commission has adopted a two-tiered small business size standard in the Narrowband PCS Second Report and Order.⁴² A “small business” is an entity that, together with affiliates and controlling interests, has average gross revenues for the three preceding years of not more than \$40 million. A “very small business” is an entity that, together with affiliates and controlling interests, has average gross revenues for the three preceding years of not more than \$15 million. The SBA has approved these small business size standards.⁴³

16. *AWS Services (1710–1755 MHz and 2110–2155 MHz bands (AWS-1); 1915–1920 MHz, 1995–2000 MHz, 2020–2025 MHz and 2175–2180 MHz bands (AWS-2); 2155–2175 MHz band (AWS-3)).* For the AWS-1 bands, the Commission has defined a “small business” as an entity with average annual gross revenues for the preceding three years not exceeding \$40 million, and a “very small business” as an entity with average annual gross revenues for the preceding three years not exceeding \$15 million.⁴⁴ In 2006, the Commission conducted its first auction of AWS-1 licenses.⁴⁵ In that initial AWS-

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Communications Services (PCS) Licensees, WT Docket No. 97-82, *Fourth Report and Order*, 13 FCC Rcd 15743, 15768, ¶ 46 (1998).

³⁶ See C and F Block Broadband PCS Auction Closes; Winning Bidders Announced, *Public Notice*, 16 FCC Rcd 2339 (WTB 2001).

³⁷ See Broadband PCS Spectrum Auction Closes; Winning Bidders Announced for Auction No. 58, *Public Notice*, 20 FCC Rcd 3703 (WTB 2005).

³⁸ See Auction of Broadband PCS Spectrum Licenses Closes; Winning Bidders Announced for Auction No. 71, *Public Notice*, 22 FCC Rcd 9247 (WTB 2007).

³⁹ *Id.*

⁴⁰ See Auction of AWS-1 and Broadband PCS Licenses Closes; Winning Bidders Announced for Auction 78, *Public Notice*, 23 FCC Rcd 12749 (WTB 2008).

⁴¹ *Id.*

⁴² Amendment of the Commission’s Rules to Establish New Personal Communications Services, Narrowband PCS, GEN Docket No. 90-314, ET Docket No. 92-100, PP Docket No. 93-253, *Second Report and Order and Second Further Notice of Proposed Rulemaking*, 15 FCC Rcd 10456 (2000).

⁴³ See *Alvarez Letter 1998*.

⁴⁴ See Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands, *Report and Order*, 18 FCC Rcd 25162, App. B (2003), modified by Service Rules for Advanced Wireless Services In the 1.7 GHz and 2.1 GHz Bands, *Order on Reconsideration*, 20 FCC Rcd 14058, App. C (2005).

1 auction, 31 winning bidders identified themselves as very small businesses.⁴⁶ Twenty-six of the winning bidders identified themselves as small businesses.⁴⁷ In a subsequent 2008 auction, the Commission offered 35 AWS-1 licenses.⁴⁸ Four winning bidders identified themselves as very small businesses, and three of the winning bidders identified themselves as a small business.⁴⁹ For AWS-2 and AWS-3, although we do not know for certain which entities are likely to apply for these frequencies, we note that the AWS-1 bands are comparable to those used for cellular service and personal communications service. The Commission has not yet adopted size standards for the AWS-2 or AWS-3 bands but has proposed to treat both AWS-2 and AWS-3 similarly to broadband PCS service and AWS-1 service due to the comparable capital requirements and other factors, such as issues involved in relocating incumbents and developing markets, technologies, and services.⁵⁰

17. *Rural Radiotelephone Service.* The Commission has not adopted a size standard for small businesses specific to the Rural Radiotelephone Service. A significant subset of the Rural Radiotelephone Service is the Basic Exchange Telephone Radio System (“BETRS”). In the present context, we will use the SBA’s small business size standard applicable to Wireless Telecommunications Carriers (except Satellite), i.e., an entity employing no more than 1,500 persons.⁵¹ There are approximately 1,000 licensees in the Rural Radiotelephone Service, and the Commission estimates that there are 1,000 or fewer small entity licensees in the Rural Radiotelephone Service that may be affected by the rules and policies adopted herein.

18. *Wireless Communications Services.* This service can be used for fixed, mobile, radiolocation, and digital audio broadcasting satellite uses in the 2305-2320 MHz and 2345-2360 MHz bands. The Commission defined “small business” for the wireless communications services (WCS) auction as an entity with average gross revenues of \$40 million for each of the three preceding years, and a “very small business” as an entity with average gross revenues of \$15 million for each of the three preceding years.⁵² The SBA has approved these definitions.⁵³ The Commission auctioned geographic area licenses in the WCS service. In the auction, which commenced on April 15, 1997 and closed on April 25, 1997, there were seven bidders that won 31 licenses that qualified as very small business entities, and one bidder that won one license that qualified as a small business entity.

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⁴⁵ See Auction of Advanced Wireless Services Licenses Scheduled for June 29, 2006; Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments and Other Procedures for Auction No. 66, AU Docket No. 06-30, *Public Notice*, 21 FCC Rcd 4562 (2006) (*Auction 66 Procedures Public Notice*).

⁴⁶ See “Auction of Advanced Wireless Services Licenses Closes; Winning Bidders Announced for Auction No. 66,” *Public Notice*, 21 FCC Rcd 10,521 (2006) (*Auction 66 Closing Public Notice*).

⁴⁷ See *id.*

⁴⁸ See *AWS-1 and Broadband PCS Procedures Public Notice*, 23 FCC Rcd at 7499. Auction 78 also included an auction of broadband PCS licenses.

⁴⁹ See Auction of AWS-1 and Broadband PCS Licenses Closes, Winning Bidders Announced for Auction 78, Down Payments Due September 9, 2008, FCC Forms 601 and 602 Due September 9, 2008, Final Payments Due September 23, 2008, Ten-Day Petition to Deny Period, *Public Notice*, 23 FCC Rcd 12749 (2008).

⁵⁰ Service Rules for Advanced Wireless Services in the 1915–1920 MHz, 1995–2000 MHz, 2020–2025 MHz and 2175–2180 MHz Bands et al., *Notice of Proposed Rulemaking*, 19 FCC Rcd 19263, App. B (2005); Service Rules for Advanced Wireless Services in the 2155–2175 MHz Band, *Notice of Proposed Rulemaking*, 22 FCC Rcd 17035, App. (2007); Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band, *Further Notice of Proposed Rulemaking*, 23 FCC Rcd 9859, App. B (2008).

⁵¹ NAICS Code 51210.

⁵² Amendment of the Commission’s Rules to Establish Part 27, the Wireless Communications Service (WCS), *Report and Order*, 12 FCC Rcd 10785, 10879 ¶ 194 (1997).

⁵³ See *Alvarez Letter 1998*.

19. *700 MHz Guard Band Licenses.* In the *700 MHz Guard Band Order*, the Commission adopted size standards for “small businesses” and “very small businesses” for purposes of determining their eligibility for special provisions such as bidding credits and installment payments.⁵⁴ A small business in this service is an entity that, together with its affiliates and controlling principals, has average gross revenues not exceeding \$40 million for the preceding three years.⁵⁵ Additionally, a “very small business” is an entity that, together with its affiliates and controlling principals, has average gross revenues that are not more than \$15 million for the preceding three years.⁵⁶ SBA approval of these definitions is not required.⁵⁷ An auction of 52 Major Economic Area (MEA) licenses commenced on September 6, 2000, and closed on September 21, 2000.⁵⁸ Of the 104 licenses auctioned, 96 licenses were sold to nine bidders. Five of these bidders were small businesses that won a total of 26 licenses. A second auction of 700 MHz Guard Band licenses commenced and closed in 2001. All eight of the licenses auctioned were sold to three bidders. One of these bidders was a small business that won a total of two licenses.⁵⁹

20. *Upper 700 MHz Band Licenses.* In the *700 MHz Second Report and Order*, the Commission revised its rules regarding Upper 700 MHz licenses.⁶⁰ On January 24, 2008, the Commission commenced Auction 73 in which several licenses in the Upper 700 MHz band were available for licensing: 12 Regional Economic Area Grouping licenses in the C Block, and one nationwide license in the D Block.⁶¹ The auction concluded on March 18, 2008, with 3 winning bidders claiming very small business status (those with attributable average annual gross revenues that do not exceed \$15 million for the preceding three years) and winning five licenses.

21. *Lower 700 MHz Band Licenses.* The Commission previously adopted criteria for defining three groups of small businesses for purposes of determining their eligibility for special provisions such as bidding credits.⁶² The Commission defined a “small business” as an entity that,

⁵⁴ Service Rules for the 746-764 MHz Bands, and Revisions to Part 27 of the Commission’s Rules, *Second Report and Order*, 15 FCC Rcd 5299 (2000). Service rules were amended in 2007, but no changes were made to small business size categories. See Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, WT Docket No. 06-150, Revision of the Commission’s Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, Section 68.4(a) of the Commission’s Rules Governing Hearing Aid-Compatible Telephones, WT Docket No. 01-309, Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services, WT Docket 03-264, Former Nextel Communications, Inc. Upper 700 MHz Guard Band Licenses and Revisions to Part 27 of the Commission’s Rules, WT Docket No. 06-169, Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band, PS Docket No. 06-229, Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communications Requirements Through the Year 2010, WT Docket No. 96-86, *Report and Order and Further Notice of Proposed Rulemaking*, 22 FCC Rcd 8064 (2007).

⁵⁵ *Id.* at 5343 ¶ 108.

⁵⁶ *Id.*

⁵⁷ *Id.* at 5343 ¶ 108 n.246 (for the 746-764 MHz and 776-704 MHz bands, the Commission is exempt from 15 U.S.C. § 632, which requires Federal agencies to obtain Small Business Administration approval before adopting small business size standards).

⁵⁸ See 700 MHz Guard Bands Auction Closes: Winning Bidders Announced, *Public Notice*, 15 FCC Rcd 18026 (WTB 2000).

⁵⁹ See 700 MHz Guard Bands Auction Closes: Winning Bidders Announced, *Public Notice*, 16 FCC Rcd 4590 (WTB 2001).

⁶⁰ *700 MHz Second Report and Order*, 22 FCC Rcd 15289.

⁶¹ See Auction of 700 MHz Band Licenses Closes, *Public Notice*, 23 FCC Rcd 4572 (WTB 2008).

⁶² See Reallocation and Service Rules for the 698–746 MHz Spectrum Band (Television Channels 52–59), *Report and Order*, 17 FCC Rcd 1022 (2002) (*Channels 52–59 Report and Order*).

together with its affiliates and controlling principals, has average gross revenues not exceeding \$40 million for the preceding three years.⁶³ A “very small business” is defined as an entity that, together with its affiliates and controlling principals, has average gross revenues that are not more than \$15 million for the preceding three years.⁶⁴ Additionally, the lower 700 MHz Service had a third category of small business status for Metropolitan/Rural Service Area (MSA/RSA) licenses—“entrepreneur”—which is defined as an entity that, together with its affiliates and controlling principals, has average gross revenues that are not more than \$3 million for the preceding three years.⁶⁵ The SBA approved these small size standards.⁶⁶ An auction of 740 licenses (one license in each of the 734 MSAs/RSAs and one license in each of the six Economic Area Groupings (EAGs)) was conducted in 2002. Of the 740 licenses available for auction, 484 licenses were won by 102 winning bidders. Seventy-two of the winning bidders claimed small business, very small business or entrepreneur status and won licenses.⁶⁷ A second auction commenced on May 28, 2003, closed on June 13, 2003, and included 256 licenses.⁶⁸ Seventeen winning bidders claimed small or very small business status, and nine winning bidders claimed entrepreneur status.⁶⁹ In 2005, the Commission completed an auction of 5 licenses in the Lower 700 MHz band. All three winning bidders claimed small business status.

22. In 2007, the Commission reexamined its rules governing the 700 MHz band in the *700 MHz Second Report and Order*.⁷⁰ An auction of A, B and E block 700 MHz licenses was held in 2008.⁷¹ Twenty winning bidders claimed small business status (those with attributable average annual gross revenues that exceed \$15 million and do not exceed \$40 million for the preceding three years). Thirty three winning bidders claimed very small business status (those with attributable average annual gross revenues that do not exceed \$15 million for the preceding three years).

23. *Offshore Radiotelephone Service*. This service operates on several UHF television broadcast channels that are not used for television broadcasting in the coastal areas of states bordering the Gulf of Mexico.⁷² There are presently approximately 55 licensees in this service. We are unable to estimate at this time the number of licensees that would qualify as small under the SBA’s small business size standard for the category of Wireless Telecommunications Carriers (except Satellite). Under that SBA small business size standard, a business is small if it has 1,500 or fewer employees.⁷³ Census data for 2007, which supersede data contained in the 2002 Census, show that there were 1,383 firms that operated that year.⁷⁴ Of those 1,383, 1,368 had fewer than 100 employees, and 15 firms had more than 100 employees. Thus, under this category and the associated small business size standard, the majority of firms can be considered small.

⁶³ See *id.*, 17 FCC Rcd at 1087–88 ¶ 172.

⁶⁴ See *id.*

⁶⁵ See *id.*, 17 FCC Rcd at 1088 ¶ 173.

⁶⁶ See *Alvarez Letter 1998*.

⁶⁷ See *Lower 700 MHz Band Auction Closes, Public Notice*, 17 FCC Rcd 17272 (2002).

⁶⁸ See *Lower 700 MHz Band Auction Closes, Public Notice*, 18 FCC Rcd 11873 (2003).

⁶⁹ See *id.*

⁷⁰ *700 MHz Second Report and Order, Second Report and Order*, 22 FCC Rcd 15,289, 15,359 n.434 (2007).

⁷¹ See *Auction of 700 MHz Band Licenses Closes, Public Notice*, 23 FCC Rcd 4572 (2008).

⁷² This service is governed by Subpart I of Part 22 of the Commission’s Rules. See 47 C.F.R. §§ 22.1001-22.1037, NAICS code 517210.

⁷³ 13 C.F.R. § 121.201, NAICS code 517210.

⁷⁴ 2007 Economic Census Report Employment Size of Firms, at NAICS Code 517210.

24. *Wireless Telephony.* Wireless telephony includes cellular, personal communications services, and specialized mobile radio telephony carriers. As noted, the SBA has developed a small business size standard for Wireless Telecommunications Carriers (except Satellite).⁷⁵ Under the SBA small business size standard, a business is small if it has 1,500 or fewer employees.⁷⁶ According to *Trends in Telephone Service* data, 413 carriers reported that they were engaged in wireless telephony.⁷⁷ Of these, an estimated 261 have 1,500 or fewer employees and 152 have more than 1,500 employees.⁷⁸ Therefore, more than half of these entities can be considered small.

25. The second category, *i.e.*, “All Other Telecommunications,” comprises “establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation. This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems. Establishments providing Internet services or Voice over Internet Protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry.”⁷⁹ For this category, Census Bureau data for 2007 show that there were a total of 2,623 firms that operated for the entire year.⁸⁰ Consequently, the Commission estimates that the majority of All Other Telecommunications firms are small entities that might be affected by rules proposed in the *Third Further Notice*.

b. Equipment Manufacturers

26. *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.” The SBA has developed a small business size standard for Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing which is: all such firms having 750 or fewer employees. According to Census Bureau data for 2007, there were a total of 939 establishments in this category that operated for part or all of the entire year. Of this total, 784 had less than 500 employees and 155 had more than 100 employees.⁸¹ Thus, under this size standard, the majority of firms can be considered small.

27. *Semiconductor and Related Device Manufacturing.* These establishments manufacture “computer storage devices that allow the storage and retrieval of data from a phase change, magnetic, optical, or magnetic/optical media. The SBA has developed a small business size standard for this category of manufacturing; that size standard is 500 or fewer employees storage and retrieval of data from

⁷⁵ 13 C.F.R. § 121.201, NAICS code 517210.

⁷⁶ *Id.*

⁷⁷ TRENDS IN TELEPHONE SERVICE, tbl. 5.3.

⁷⁸ *Id.*

⁷⁹ See <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517919&search=2007%20NAICS%20Search> (last viewed Jan. 31, 2014).

⁸⁰ See http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ1&prodType=table (last viewed Jan. 31, 2014).

⁸¹ The NAICS Code for this service 334220. See 13 C.F.R. 121/201. See also http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_00A1&prodType=table (last viewed Jan. 31, 2014).

a phase change, magnetic, optical, or magnetic/optical media.”⁸² According to data from the 2007 U.S. Census, in 2007, there were 954 establishments engaged in this business. Of these, 545 had from 1 to 19 employees; 219 had from 20 to 99 employees; and 190 had 100 or more employees.⁸³ Based on this data, the Commission concludes that the majority of the businesses engaged in this industry are small.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

28. The *Third Further Notice* proposes a regulatory framework to require delivery of accurate location information to PSAPs for wireless 911 calls placed from indoors. Our proposal includes both near- and long-term components. In the near term, the Commission proposes that CMRS providers subject to Section 20.18 of the Commission’s rules provide horizontal location information within 50 meters for 67 percent of 911 calls placed from indoor environments within two years of the effective date of the rules and provide vertical location information within 3 meters for 67 percent of 911 calls placed from indoor environments within three years. Within five years of the effective date of the rules, the Commission proposes that all CMRS providers subject to Section 20.18(a) of the Commission’s rules must provide the caller’s horizontal (x- and y-axis) location within 50 meters and vertical (z-axis) data within 3 meters for 80 percent of 911 calls placed from indoor environments. These standards would apply nationwide. For the long term, we propose to develop more granular indoor location accuracy standards, consistent with the evolving capabilities of indoor location technology and increased deployment of in-building communications infrastructure that would provide for delivery to PSAPs of in-building location information at the room or office/suite level. Additionally, the *Third Further Notice* proposes that CMRS providers demonstrate compliance with indoor location accuracy requirements through a test bed or through other testing methods, provided that the methodologies are equivalent to the test bed approach. The *Third Further Notice* seeks comments on whether CMRS providers should certify compliance with the indoor location accuracy requirements.

29. The *Third Further Notice* also addresses several ways to improve the delivery of Phase II location information. The *Third Further Notice* proposes to require CMRS providers to deliver location information within 30 seconds to the location information center (but with a provision to exclude short calls of 10 seconds or less that may not provide sufficient time to generate a location fix) and identify the technology used to determine a location fix and to provide this information to the PSAP. The *Third Further Notice* seeks comment on whether the Commission should standardize the content and process for delivery of confidence and uncertainty data generated for each wireless 911 call. Additionally, the *Third Further Notice* seeks comment on whether it would be feasible to expedite the timeframe for implementing a unitary location accuracy standard for outdoor calls. The *Third Further Notice* also seeks comment on whether CMRS providers should track and periodically report information regarding the percentage of wireless calls to 911 that include E911 Phase II information, and conduct periodic compliance testing for both indoor and outdoor calls. The *Third Further Notice* also seeks comment on whether CMRS providers should track and periodically report E911 call information also seeks comment on what safeguards should be implemented to ensure that CMRS providers’ confidential information is protected in relation to reporting requirements. The *Third Further Notice* also seeks comment on whether to adopt a process by which PSAPs or state 911 administrators could raise complaints or concerns regarding the provision of E911 service. Many of the foregoing requirements will likely require the use of professionals for compliance, e.g. engineers and attorneys.

⁸² U.S. Census Bureau, 2007 Economic Census, Industry Series: Manufacturing, “Semiconductor and Related Device Manufacturing,” NAICS code 334413.

⁸³ See http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=&-_skip=300&-ds_name=EC0731I1&-_lang=en.

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

30. The RFA requires an agency to describe any significant, specifically small business alternatives that it has considered in reaching its proposed 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) and exemption from coverage of the rule, or any part thereof, for small entities.”⁸⁴

31. The *Third Further Notice* analyzes a variety of possible means of implementing various near- and long-term E911 location accuracy requirements, without imposing undue costs or regulatory burdens. The *Third Further Notice* recognizes that the implementation of any indoor location accuracy requirements will impose costs on CMRS providers and seeks comment on the ways in which any implementation requirements could be designed to mitigate those costs to the extent possible, without sacrificing important public safety objectives. The *Third Further Notice* seeks comment on how we different approaches may affect smaller CMRS providers and whether there are particular measures the Commission should take to minimize the potential burdens on these smaller providers. The *Third Further Notice* seeks comment on a wide range of questions that will enable the Commission to weigh the costs and benefits of its proposals, including whether to establish any exceptions for smaller wireless providers. The *Third Further Notice* suggests that costs of compliance are likely to be mitigated by the fact that providers are already undertaking various indoor location technology research and development efforts for their own commercial, non-911 related purposes.

32. The *Third Further Notice* proposes to offer CMRS providers flexibility in implementing the indoor location requirements. For example, the *Third Further Notice* proposes to allow CMRS providers to implement whatever location technology it chooses, and foresees that providers may implement different solutions to determine a caller’s indoor location, each of which may present unique costs. The *Third Further Notice* seeks comment on the technical feasibility and specific challenges of its various proposals. The *Third Further Notice* also seeks comment on whether, in order to increase flexibility for CMRS providers, the Commission should adopt a specific waiver process for those providers who seek relief from our indoor location accuracy requirements. In addition, the *Third Further Notice* seeks comment on any other alternative approaches that would enable the Commission to focus the application of indoor location requirements in the most effective and cost-efficient way possible, and asking for possible voluntary approaches agreed upon between CMRS providers and public safety as an alternative to regulation. These or other alternatives in the comment record can help to reduce the compliance burden on small businesses.

33. The *Third Further Notice* also seeks comment on various Phase II E911 delivery issues. For example, the *Third Further Notice* seeks comment on requiring CMRS providers to satisfy a unitary E911 location accuracy standard (for outdoor calls) within an expedited timeframe. In doing so, the *Third Further Notice* seeks comment on how expediting the timeframe towards more granular location accuracy standards may affect smaller CMRS providers, and specifically seeks comment on the implementation timeframe, as well as the sufficiency of the Commission’s existing waiver process to provide relief.

34. The *Third Further Notice* also invites industry and public safety stakeholders to collaborate to identify alternative proposals for improving indoor location accuracy, including a consensus-based, voluntary proposal to address the public safety goals detailed in this proceeding.

⁸⁴ 5 U.S.C. §§ 603(c)(1)-(c)(4).

Finally, the proposals in the *Third Further Notice* do not become effective until after the Commission seeks comment and adopts an order implementing them. We seek comment on the effect of the various proposals described in the *Third Further Notice*, as summarized above, will have on small entities, and on what effect alternative rules would have on those entities.

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

35. None.

APPENDIX C

Proposed Rules

Part 20 of the Code of Federal Regulations is amended as follows:

PART 20 – COMMERCIAL MOBILE RADIO SERVICES

1. The authority for Part 20 is revised to read as follows:

Authority: 47 U.S.C. §§ 151, 152(a), 154(i), 157, 160, 201, 214, 222, 251(e), 301, 302, 303, 303(b), 303(r), 307, 307(a), 309, 309(j)(3), 316, 316(a), 332, 615, 615a, 615b, 615c.

2. Section 20.18 is amended by removing paragraph (h)(3) and redesignating paragraphs (i) through (n) as paragraphs (l) through (q), adding new paragraphs (i) through (k), and revising paragraph (l) of redesignated new paragraph (m) to read as follows:

* * * * *

(i) *Indoor Location Accuracy for 911 and testing requirements.* CMRS providers subject to this section must provide to the designated Public Safety Answering Point the location of 911 wireless calls, based on indoor measurements, within 50 meters (by longitude and latitude) no later than two years from [the effective date of the adoption of this rule], and, within 3 meters (vertical height) no later than three years from [the effective date of the adoption of this rule], for 67 percent of all such calls. No later than five years from the [effective date of the adoption of this rule], CMRS providers must comply with the 50 meter (by longitude and latitude) accuracy requirement and the 3 meter (vertical height) accuracy requirement, for 80 percent of all such calls. CMRS providers shall satisfy these indoor location accuracy standards on a PSAP-level or county-level basis, and may demonstrate compliance by either:

- (1) Participating in an independently administered test bed program that includes a sampling of different environments that is representative of real-life indoor call scenarios, employs the same technology or technologies actually employed in their networks, and relies on tests of how the technology or technologies will actually be so employed; or
- (2) Using alternative testing methods, provided that CMRS providers demonstrate that their methodology and testing procedures are at least equivalent to the testing methodology and procedure standards used in the independently administered indoor location accuracy test bed under paragraph (i)(1) of this section.

(j) *Latency (Time to First Fix).* For purposes of measuring compliance with the outdoor location accuracy standards of paragraph (h) and the indoor location accuracy standard of paragraph (i), a call will be deemed to satisfy the standard only if it provides the specified degree of location accuracy within a maximum period of 30 seconds (“Time to First Fix”), as measured at the location information center of the E911 network. For such purposes, CMRS providers may exclude 911 calls of a duration of 10 seconds or less.

(k) *Confidence and uncertainty data:* CMRS providers subject to this section shall provide for all wireless 911 calls, whether from outdoor or indoor locations, x- and y-axis (latitude, longitude) confidence and uncertainty information (C/U data) on a per-call basis upon the request of a PSAP. Such C/U data shall specify (1) the caller’s location within a specified confidence level, and (2) the radius in meters from the reported position at that same confidence level. All entities responsible for transporting confidence and uncertainty between wireless carriers and PSAPs, including LECs, CLECs, owners of

E911 networks, and emergency service providers, must enable the transmission of confidence and uncertainty data provided by wireless carriers to the requesting PSAP.

(l) *Reports on Phase II plans.* * * *

(m) * * *

(1) *Generally.* The requirements set forth in paragraphs (d) through (k) of this section shall be applicable only to the extent that the administrator of the applicable designated PSAP has requested the services required under those paragraphs and such PSAP is capable of receiving and utilizing the requested data elements and has a mechanism for recovering the PSAP's costs associated with them.

* * * * *

**STATEMENT OF
CHAIRMAN THOMAS E. WHEELER**

Re: *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114

One of the Commission's most important responsibilities is to preserve certain core values even as technology advances and the way that consumers use that technology evolves. Nowhere is that imperative more clear than in the arena of public safety.

Our E911 location accuracy rules were written when wireless phones were a secondary means of communication, and were mostly used outside. Today, more and more consumers use wireless phones as their primary means of communication, and more and more 911 calls are coming from wireless phones, from indoors.

The numbers make this trend very plain, but the stories really bring the issue home. Earlier this week, I met with folks from local PSAPs who told me their stories about why this is so important. They talked about how, during the Navy Yard shootings, people were calling 911 from inside the building – not using their office phones; using their mobile phones. Another story involved a person whose iPad had been stolen – the location information delivered to the PSAP was off by almost 3 miles, but the information provided using the iPad's location app provided pinpoint accuracy.

Our rules need to reflect the new realities of the always-connected mobile world. A lot of good work already has been done on this issue. In particular, through the CSRIC, FCC staff worked with wireless providers and technology vendors to establish a test bed to determine the state of location technology. What we learned has given us confidence that further advances in technology should enable us to locate callers indoors with the same degree of accuracy as outdoors. The Notice we adopt today builds on that experience by proposing an accuracy threshold for indoor locations that is just as effective as the threshold for outdoor locations, and an aggressive but reachable timeline for achieving that threshold.

Another important development is the ability to find a caller on the so-called "Z-axis" – that is, not just knowing what building the caller is in, but also what floor. This technology is relatively new, but it's already being installed in many handsets for commercial services. The proposals we adopt today seek to leverage that innovation to make sure that information is available to public safety.

Of course, as the saying goes, it takes two to tango. Providers will deliver the information, but it will mean little if PSAPs and state and local governments do not take the necessary steps on their part. This item asks important questions about what steps the FCC can take to encourage PSAPs to continue moving forward, but state and local governments must also step up to ensure that PSAPs have sufficient funding to deploy the necessary technologies and, ultimately, make the migration to NG911.

The item also proposes changes to our rules to address some of the challenges and issues raised by the data that was submitted to the FCC last year by the California chapter of the National Emergency Number Association.

Finally, this item also asks some very important questions about the opportunities new technologies enable in the longer term. Technologies that already exist and are already widely deployed should be able to provide granular location information. For example, can we leverage Wi-Fi or other small cell technologies to locate not just the building a caller is in, but the room? Today, for instance, stores in the mall know when you enter because they bounce a Wi-Fi signal off your mobile handset.

Our job is to ensure that as network providers and their customers upgrade to new technologies, there is no downgrade in reliability, availability, or public safety. Today's item takes the next steps to ensure that our rules continue to evolve along with technology and changing consumer habits.

Thank you to everyone in the Public Safety Bureau for their work on this item.

**STATEMENT OF
COMMISSIONER MIGNON L. CLYBURN**

Re: *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114

Improving emergency response times has been a primary goal for 9-1-1 services, since 1967, when President Lyndon Johnson first encouraged the FCC to collaborate with the wire line industry in the development of a nation-wide emergency number. Consumers have made it clear that improving response times for 9-1-1 calls from wireless phones must also be a national priority. As today's item notes, the number of American households that are wireless only has grown from roughly 16 percent, in 2007, to 39 percent. And, for those living below the poverty line, that number has risen to 54 percent.

At our November 2013 workshop on location accuracy, we listened with unease about call centers in certain areas of the country not receiving the information they needed to dispatch help to those in need because mobile calls pose more challenges to first responders than wire line calls. Citizens understandably expect and believe that their mobile handsets – especially those smartphones with location based services – provide them with the same capacity to get help as their wire line phones. But all too often, this is simply not the case and the results can be heartbreaking.

Last month, at a Senate hearing on location accuracy, a witness testified that in Horry County, South Carolina, where you can find sixty miles of sun and fun, on and near Myrtle Beach, along with millions of other visitors each year, how 50% of their 9-1-1 callers cannot provide dispatchers with meaningful location information. And, with estimates as high as 80 percent of emergency calls being placed from cellular phones, it should come as no surprise that we have also been hearing pleas for location standards when wireless 9-1-1 calls are made from indoors. Location services must improve, as quickly as possible, and the Commission's response time to that end should also be swift.

We must ensure that our public safety obligations keep pace with consumer demand and technology shifts and I commend Chairman Wheeler for bringing forth a comprehensive Further Notice just three months after the November workshop. The item includes creative rule proposals and asks a wide range of technical questions designed to improve the timeliness and accuracy of all wireless location information. It also proposes, for the first time, location accuracy standards for wireless 9-1-1 calls from indoor locations. I am pleased that we seek comment on testing compliance with all of these standards and on requiring carriers to send location information within 30 seconds from the time the mobile consumer makes her 9-1-1 call.

Also noteworthy are the detailed questions about how developments in roaming, Wi-Fi, location based services and emerging technologies could impact the delivery of location information. We need to make sure our location accuracy standards account for future innovations in mobile services. The Further Notice also properly seeks comment on the abilities of PSAPs to access the location data that wireless providers send.

I understand some members of the wireless industry are bristling because the Commission is proposing to enhance the location accuracy rules at a pace that is seen as a bit aggressive. But today's item asks the wireless industry, the public safety entities, and others to work collaboratively toward developing alternative proposals for our consideration. And allow me to point out that one of the hallmarks of leadership in this industry is that it has, on many occasions, exceeded our expectations. We have already heard from those, who concur, that it is time for the industry to adopt indoor location standards, and today, I wish to commend those entities. It would be great to see other examples of this kind of leadership, and for the wireless industry to actually move ahead of schedule, in implementing all the proposed location accuracy rules that our nation so desperately expects and needs.

I thank Admiral Simpson, and the dedicated staff, of the Public Safety Homeland Security Bureau, for their good work on this Further Notice, and for the presentation this morning.

**STATEMENT OF
COMMISSIONER JESSICA ROSENWORCEL**

Re: *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114

During my time at the Commission, I have made it a priority to visit public safety officials and talk about communications technologies where they work. So over the course of a year or so, I visited one 911 call center every month. That means I have seen public safety officials at work from Alaska to Arkansas, California to Colorado, Vermont to Virginia—and a whole lot of places in-between.

In every visit, I get the privilege of meeting emergency call operators and watching them work. They always amaze. Because when crises mount, they answer calls with steely calm and help ensure that help is on the way.

In every visit, I also hear one refrain: the number of wireless calls to 911 is skyrocketing. The data bear this out. Today, more than 70 percent of 911 calls are from wireless phones. That is more than 400,000 calls across the country every day. And this number is only going to grow. Today, for roughly 2 in 5 households, their wireless phone is their only phone. In some places, that number is even higher. In Idaho, for instance, more than half of all households no longer have a landline phone. In Mississippi, one half of adults live in wireless-only households. Closer to home, the numbers are similar right here for the District of Columbia.

The way we connect and call is changing. So is the way we reach out for help at our moment of greatest need. But our rules that provide first responders with information about where we are when we call 911 are stranded in calling practices of the last century.

So today, under our rules, if you call 911 from a wired phone, first responders know where you are and where to send help.

If you call 911 from a wireless phone outdoors, the Commission has standards that help ensure first responders can locate you and send assistance.

But if you call 911 from a wireless phone indoors, you should cross your fingers and hope and pray, because no location accuracy standards apply.

This is an unacceptable gap in our policies. But today we do something about it. On the heels of a hearing on this issue led by Senator Mark Pryor, we start a rulemaking to narrow this gap and fix this problem. He has been a champion on this issue and I thank him for it. To be sure, our proposals are aggressive. But I think we can fix this problem if all stakeholders work together. I am encouraged that carriers have told me they intend to work with public safety officials and the Commission to find technologies that work. For my part, I will be watching closely.

Finally, I want to note that this is important to me. I have traveled far and wide and witnessed this problem and I have spoken and written about it at length. So I am really pleased that the Chairman made it a priority to put it before the Commission and put it on the agenda today. I want to thank him for making public safety a priority. I look forward to working with my colleagues—and icons in the public safety community like Steve Souder—to improve our policies and make us all more safe. Because one thing is certain—when you call 911—you want first responders to find you.

**STATEMENT OF
COMMISSIONER AJIT PAI
APPROVING IN PART AND CONCURRING IN PART**

Re: *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114

It is one of the most elementary questions one can ask, yet it has been a challenging one for technology alone to answer: Where are you? The answer to this question is vital during an emergency. For this reason, there is tremendous value in transmitting accurate location data to emergency responders whenever someone dials 911. By knowing the location of someone in need, 911 dispatchers can send first responders immediately to the scene. Without it, police officers, firefighters, and emergency medical technicians may spend precious seconds, minutes, or even hours searching for a caller. And that is true whether a call is made indoors or outside.

I saw the promise of accurate indoor location technology for myself in the summer of 2012 inside a large Silicon Valley hotel. As I rode the elevator from floor to floor on that July afternoon, the prototype device tracked me fairly well. Had I needed to call 911, transmitting that information could have made all the difference.

I therefore support today's decision to commence a rulemaking proceeding to examine whether the Commission should adopt indoor location accuracy requirements. I also believe that we should enact rules in this area that are both aggressive *and* achievable. Unfortunately, I am skeptical that the timeframes proposed in today's item are realistic. As a result, I am voting to approve in part and concur in part.

Concerned about the feasibility of the timeframes proposed in this item, my office asked Commission staff and stakeholders for a step-by-step timeline that would show how it would be possible for a carrier to meet the timeframes contained in our proposed rules. But to date, no one has been able to produce such a timeline. It appears that today's proposal takes its inspiration from *Field of Dreams*: "If you build it, he will come." Only in this case, the mantra is: "If we mandate it, they will comply."

This is unfortunate. The Commission's rules should be more than aspirational. Our rulemaking process is not a feel-good exercise. It imposes legally binding obligations on regulated entities. It is unfair to saddle them with obligations that cannot be met. And such rules don't help the American people either. Indeed, they can be counterproductive since they stand a good chance of sparking litigation or paralyzing the industry with fear of taking any action if there is no clear path to compliance.

Americans recently have witnessed several instances where unrealistic mandates were imposed on businesses and had to be delayed. In order to prevent history from repeating itself, I would like to highlight two specific suggestions teed up in today's item for enabling carriers to comply with any location accuracy rules. *First*, the trigger for compliance should not be the effective date of the rules we ultimately adopt. Instead, the clock should start running when our Communications Security, Reliability and Interoperability Council (CSRIC) certifies that a technology vendor has demonstrated through an independently administered test bed program that a solution meets the horizontal and vertical location accuracy benchmarks set forth in those rules. To me, this is a matter of common sense. Carriers cannot begin to deploy a technology solution that does not yet exist. And the public should not be led to rely on a promise that cannot be kept.

Second, carriers should not be subject to enforcement action if they prove they are making their best efforts to deploy a technology that has been certified by CSRIC as complying with the Commission's location accuracy standards. Creating such a safe harbor would incentivize every vendor to partake in the CSRIC process. After all, the first to get CSRIC certification would have a leg up on competitors in getting its technology deployed in the field. This race to certification, in turn, would have the serendipitous effect of getting an independently verified technology out in the field further and faster. This will save lives.

We also need to have this safety valve because we do not know how long it will take for carriers to deploy a compliant technology nationwide or whether a compliant technology will work in every single county in the United States. Deploying a compliant technology across the whole country will be a daunting and time-consuming task. Judging from our experience with Phase II, which the FCC mandated in 1996 but will not be fully implemented until 2019, I am skeptical that this deployment can be completed in two to three years.

The item indicates, for example, that CMRS carriers are increasingly turning to handset-based solutions for providing location information. But what would that entail here? First, the technology in question will need to go through the standards process. Second, device manufacturers will need to incorporate it into handsets. Third, consumers then will need to replace their old handsets with new ones. Experience with the deployment of AGPS-capable handsets has taught us that this is a cycle that will take many years to complete—and that's if everything goes smoothly. While I wish that we could click our heels together three times and watch the technology magically deploy itself on a nationwide basis, we're not in Oz (or Kansas, for that matter).

One other aspect of the proposed rules is worth mentioning. Today's item proposes that accurate location information must be transmitted to a Public Safety Answering Point within 30 seconds. At the same time, however, it also proposes to exclude from compliance determinations only calls lasting 10 seconds or less. So what is given with one hand would be taken away by the other. If a call lasts for twenty seconds, then a carrier will be penalized for failing to transmit accurate location information within those twenty seconds even though the rule ostensibly provides the carrier with thirty seconds to do so. This does not make sense. Whatever time period we end up choosing, whether it be 10 seconds, 20 seconds, or 30 seconds, we should have one consistent measure of how long carriers have to provide location accuracy information.

Finally, there's another critical aspect of the location accuracy problem worth thinking about. Last month, I began an inquiry into the state of 911 availability in establishments, such as hotels, motels, office buildings, and schools, that use multiline telephone systems (MLTS). Location accuracy matters with MLTS systems as well. A recent tragedy in Utah illustrates why.

On January 22, Randy Palmer suffered a heart attack while shopping at a Midvale, Utah auto parts store. An employee promptly called 911. But the call went to the wrong dispatch center because the store's phone system indicated that the call was being placed from the company's Salt Lake City office. First responders were consequently sent to the wrong location and took about 15 minutes to arrive in Midvale. Unfortunately, Mr. Palmer passed away. His widow put it well when she said: "People need to know what happened and I don't want something like this to happen to someone else. My husband was the most important person in my life [and] in my daughter's life. The [extra] minutes absolutely cost him his life." To me, the lesson is this: As we design indoor location accuracy requirements, we must not forget about MLTS location accuracy.

I would like to thank the staff of the Public Safety and Homeland Security Bureau for their hard work on these issues and my colleagues for agreeing to incorporate some of my suggestions into this item. I look forward to working together in the months to come to hasten the day when that vexing question—where are you?—becomes an academic one when it comes to emergency calling.

**STATEMENT OF
COMMISSIONER MICHAEL O'RIELLY
APPROVING IN PART AND CONCURRING IN PART**

Re: *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114

As more Americans rely exclusively on mobile phones, we must ensure that first responders can quickly and accurately locate wireless callers that dial 911 in an emergency. For this reason, I am supportive of issuing today's notice.

Going forward, however, we should avoid imposing location accuracy rules that are too far ahead of available technology. Aspirational goals are laudable, but they cannot be the basis for regulation. Any requirements that develop from this proceeding must be truly feasible as judged by experts operating in the field.

The deadlines we impose must also be realistic. I am concerned that the proposed timelines for implementing indoor location accuracy requirements do not meet this objective. Many steps are needed to deploy these new technologies. Vendors will have to test their technology and go through the standards setting process. Location systems will have to be built. Hardware will have to be added to handsets. New handsets will have to be introduced to consumers and achieve sufficient market penetration. This all takes time.

In fact, the record suggests that, after a system-wide deployment of new technology, it can take approximately four years for upgraded handsets to comprise 67 percent—and approximately five years to comprise 80 percent—of the total phones on a wireless provider's network.¹ We must ask whether it is possible, within two, three or even five years, for wireless providers to meet the proposed location accuracy requirements for 67 or 80 percent of all indoor calls to 911 when the necessary handsets may not even make up 67 or 80 percent of the total phones in the marketplace.

We learned these important lessons with the Phase II location accuracy rulemaking. There, the Commission established requirements and deadlines based on representations of emerging, as opposed to proven, technologies. It is fair to say that implementation did not go smoothly. A year after these rules were adopted, the Commission had to modify its benchmarks to "provide carriers with a reasonable prospect of meeting the [Phase II] accuracy and reliability requirements."² Despite this relief, the Commission still had to issue approximately 40 waivers, extensions or stays and a dozen enforcement actions.³

For these reasons, I regret that I must concur to the proposed deadlines in the notice. I look forward to engaging with stakeholders regarding timeframes in which it is feasible to meet the proposed indoor location accuracy requirements. One idea is basing the effective date of any rules on a successful demonstration, in a test bed, that there is technology available that meets the location accuracy requirements, but there may be others. We want to ensure that industry is capable of implementing any rules both timely and successfully so that this information is available for first responders.

Separately, I am pleased that the notice raises important questions about privacy. I hope the Commission will examine the privacy implications of advanced technologies and government access to

¹ Letter from Joseph P. Marx, Assistant Vice President, AT&T Services Inc., to Marlene H. Dortch, Secretary, FCC, Attachment, at 4 (Jan. 31, 2014).

² Letter from Brian M. Josef, CTIA-The Wireless Association, to Marlene H. Dortch, Secretary, Federal Communications Commission, at 1 (Feb. 14, 2014) (citing *Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems*, Fourth Memorandum Opinion and Order, 15 FCC Rcd 17442 ¶ 23 (2000)).

³ *Id.* at 2.

consumers' location information. We need to be extremely careful with such data as technology evolves to better pinpoint a user's location for use in emergencies. We are entering a world where the Commission may require the ability to identify a person's location within 3 meters vertically—which is basically at floor level—and 50 meters horizontally. Law-abiding Americans should not have to worry about being tracked by law enforcement or other government entities in non-emergency circumstances.

Finally, I appreciate hearing from Steve Souder, the Director of the Department of Public Safety Communications for Fairfax County, Virginia and thank him for joining us here today. His perspective is helpful to our process and I applaud his service. I would, however, like to take this opportunity to echo the comments made by Chairman Wheeler at our last Open Meeting. Just as we look to require providers of technology to improve their public safety offerings, we need Public Safety Answering Points (PSAPs) to modernize their capabilities as well.

I thank the Chairman for including a number of my edits and the dedicated staff of the Public Safety and Homeland Security Bureau for all of their hard work on this notice. I also thank my colleague Commissioner Rosenworcel for her work on this issue.