

FCC FACT SHEET^{*}
Wireless E911 Location Accuracy Requirements
Fourth Further Notice of Proposed Rulemaking - PS Docket No. 07-114

Background: This item builds on the Commission's ongoing efforts to improve its wireless E911 location accuracy rules. It sets forth a proposal that would reduce emergency response times and ultimately save lives by enabling 911 call centers and first responders to more accurately identify the floor level for most wireless 911 calls made from multi-story buildings. In an emergency, the ability to locate wireless 911 callers quickly and accurately is of critical importance to first responders and those they are seeking to help.

What the *Fourth Further Notice* Would Do:

- Propose to specify a vertical location accuracy metric (z-axis) of plus or minus 3 meters for 80% of indoor wireless E911 calls.
- Tentatively find that a z-axis metric of 3 meters would be:
 - sufficiently accurate to identify the caller's floor level in most cases, and
 - technically feasible within the timeframes specified in the rules.
- Tentatively find that the 5-meter metric proposed by the nationwide wireless providers would not be sufficiently precise to meet public safety needs.

* This document is being released as part of a "permit-but-disclose" proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in PS Docket No. 07-114, which may be accessed via the Electronic Comment Filing System (<https://www.fcc.gov/ecfs/>). Before filing, participants should familiarize themselves with the Commission's *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. See 47 CFR § 1.1200 *et seq.*

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

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

FOURTH FURTHER NOTICE OF PROPOSED RULEMAKING*

Adopted: []

Released: []

Comment Date: [45 days from the date of publication in Federal Register]
Reply Comment Date: [75 days from the date of publication in Federal Register]

By the Commission:

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I. INTRODUCTION

1. Since the Commission first adopted its wireless Enhanced 911 (E911) location accuracy rules in 1996, the wireless landscape has undergone major changes. In 2018 the number of Americans with smartphones rose to 77%, up from just 35% in Pew Research Center’s first survey of smartphone

* This document has been circulated for tentative consideration by the Commission at its March 15, 2019, open meeting. The issues referenced in this document and the Commission’s ultimate resolutions of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Chairman has determined that, in the interest of promoting the public’s ability to understand the nature and scope of issues under consideration, the public interest would be served by making this document publicly available. The Commission’s ex parte rules apply and presentations are subject to “permit-butdisclose” ex parte rules. See, e.g., 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission’s ex parte rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission’s meeting. See 47 CFR §§ 1.1200(a), 1.1203.

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ownership conducted in 2011.¹ As the adoption of cellphones and smartphones has skyrocketed, they have become an indispensable tool to protect consumers' health, property, and wellbeing, and many Americans are now relying on mobile phones as their only phones. Of the 240 million calls made to 911 each year, more than 80% are from wireless devices.² For both first responders and consumers, the capability to locate wireless 911 callers quickly and accurately is of critical importance regardless of where the call originates.

2. To ensure that first responders and Public Safety Answering Points (PSAPs) can find 911 callers quickly and accurately when a consumer calls from a multi-story building, we propose a vertical, or z-axis, location accuracy metric of plus or minus 3 meters relative to the handset for each of the benchmarks and geographic requirements previously established in the Commission's E911 wireless location accuracy rules.³ This proposed metric will more accurately identify the floor level for many if not most 911 calls, reduce emergency response times, and save lives.

II. BACKGROUND

3. In the 2014 *Third Further Notice of Proposed Rulemaking* in this proceeding, the Commission proposed measures and timeframes to improve location accuracy for wireless E911 calls originating indoors, including, among others, a 3-meter z-axis metric for 80% of such calls.⁴ In the 2015 *Fourth Report and Order* in this proceeding, the Commission established benchmarks and timetables for the deployment of z-axis technology or dispatchable location (which includes a vertical location component) in the top 50 Cellular Market Areas, but deferred a decision on a specific z-axis metric until it received additional testing data.⁵ Specifically, the Commission required the four nationwide Commercial Mobile Radio Service (CMRS) providers to establish a test bed to develop a proposed z-axis accuracy

¹ Pew Research Center, Internet and Technology, *Mobile Device Report* (Feb. 5, 2018), <http://www.pewinternet.org/fact-sheet/mobile/>.

² 9-1-1 Statistics, National Emergency Number Assoc., <https://www.nena.org/page/911Statistics>, (last visited Feb. 20, 2019).

³ See *Wireless E911 Location Accuracy Requirements*, Fourth Report and Order, 30 FCC Rcd 1259 (2015) (*Fourth Report and Order*); 47 CFR § 20.18(i)(2)(ii).

⁴ See *Wireless E911 Location Accuracy Requirements*, Third Further Notice of Proposed Rulemaking, 29 FCC Rcd 2374, 2390-91, para. 38 (2014) (*Third Further Notice*). The Commission proposed to require that CMRS providers provide z-axis information within 3 meters of the caller for 67% of indoor 911 calls within 3 years of the adoption of rules, and for 80% of calls within 5 years. *Id.* at 2403, para. 73. See Federal Communications Commission, *Wireless E911 Location Accuracy Requirements*, 79 Fed. Reg. 17819 (Mar. 28, 2014).

⁵ *Fourth Report and Order*, 30 FCC Rcd at 1304, paras. 116-117. The Commission amended Section 20.18 to set several benchmarks for deploying z-axis technology. Within six years after the effective date of adoption of the rule, nationwide CMRS providers shall deploy in each of the top 25 Cellular Market Areas either (1) dispatchable location, or (2) z-axis technology in compliance with the metric approved by the Commission and covering 80% of the Cellular Market Area population. 47 CFR § 20.18(i)(2)(ii)(C). Within eight years, nationwide CMRS providers shall deploy dispatchable location or such z-axis technology in the top 50 Cellular Market Areas. 47 CFR § 20.18(i)(2)(ii)(D). Non-nationwide CMRS providers that serve any of the top 25 or 50 Cellular Market Areas have an additional year to meet these benchmarks. 47 CFR § 20.18(i)(2)(ii)(E).

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metric and to submit the proposed metric to the Commission for approval within 3 years (*i.e.*, by August 3, 2018).⁶ The Commission stated that the proposal would be placed out for public comment.⁷

4. On August 3, 2018, CTIA submitted the “Stage Z Test Report” (Report or Stage Z Test Report) on behalf of the four nationwide CMRS providers.⁸ According to the Report, Stage Z testing sought to assess the accuracy of solutions that use barometric pressure sensors in the handset for determining altitude in support of E911.⁹ Two vendors, NextNav LLC (NextNav) and Polaris Wireless, Inc. (Polaris), participated in Stage Z.¹⁰ The test results showed that in 80% of NextNav test calls, vertical location was identified to a range of 1.8 meters or less, while 80% of Polaris test calls yielded a vertical accuracy range of 4.8 meters or less.¹¹ The Report noted that Polaris’ performance “could likely be significantly improved should a more robust handset barometric sensor calibration approach [than that used in the test bed] be applied.”¹²

5. In its August 3, 2018, cover letter submitting the Report, CTIA stated that the test results provided “helpful insight” into the state of z-axis technologies, but that “significant questions remain about performance and scalability in live wireless 9-1-1 calling environments.”¹³ On behalf of the four nationwide wireless providers, CTIA therefore proposed a z-axis metric of “+/- 5 meters for 80% of fixes from mobile devices capable of delivering barometric pressure sensor-based altitude estimates.”¹⁴ CTIA

⁶ *Fourth Report and Order*, 30 FCC Rcd at 1304, para. 116. *See, e.g., Public Safety and Homeland Security Bureau Provides Guidance To CMRS Providers Regarding Upcoming Certification Of Compliance with Three-Year E911 Location Accuracy Benchmark and Reminds CMRS Providers of Additional Location Accuracy Deadlines in 2018*, Public Notice, 33 FCC Rcd 2981 (PSHSB 2018) (reminding nationwide CMRS providers of the August 3, 2018, deadline to submit the proposed z-axis metric).

⁷ *Fourth Report and Order*, 30 FCC Rcd at 1304, para. 116.

⁸ 9-1-1 Location Technologies Test Bed, LLC, Report on Stage Z (2018), <https://www.fcc.gov/ecfs/filing/10803074728956> (Report or Stage Z Test Report). CTIA is a wireless communications industry trade association. The four nationwide CMRS providers are AT&T Mobility, Sprint, T-Mobile USA, and Verizon.

⁹ Report at 27. According to the Report, the overall objective of the z-axis test campaign was to “provide a rigorous, transparent process to evaluate the accuracy and overall assessment of Z-axis technology based on standard testing methodologies.” Report at 3.

¹⁰ Report at 3. The Report notes that the systems tested are primarily based on barometric pressure observations but may include additional location sources or a form of vendor-specific processing customized by each z-axis technology vendor. Report at 13.

¹¹ Report at 120. The Report defines Vertical Location Accuracy as “the error between the reported altitude location of the device, as provided by the Stage Z vendor’s location system under test, and the surveyed ground truth position of the test location (determined through a precise land survey).” Report at 55. For both participants in the Stage Z testing, the Report included delivered altitude (Z) and computed vertical distance error in meters. Test results also included the following for each test handset, at a test point, in a test building, and aggregated per morphology: average (arithmetic mean) altitude error, standard deviation of altitude error (in meters), average (arithmetic mean) vertical distance error (absolute value of altitude error; always positive), and 67th, 80th, and 90th percentiles of vertical distance error (in meters). *Id.*

¹² Report at 99.

¹³ Letter from Scott K. Bergmann, Senior Vice President of Regulatory Affairs, CTIA, et al., to Marlene H. Dortch, Secretary, FCC at 5 (Aug. 3, 2018), (on file in PS Docket No. 07-114 <https://www.fcc.gov/ecfs/filing/10803074728956>) (Cover Letter).

¹⁴ Cover Letter at 6. CTIA notes that a “fix” is a location estimate. *See id.* at 2.

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also stated that further testing of vertical location technologies could yield results to validate adoption of a more accurate z-axis metric.¹⁵

6. On September 10, 2018, the Public Safety and Homeland Security Bureau (Bureau) released a *Public Notice* seeking comment on the Report and the carriers' proposed z-axis metric.¹⁶ The *Public Notice* sought to gather information that would inform the Bureau's recommendations to the Commission concerning next steps in the development of the z-axis accuracy metric contemplated by the *Fourth Report & Order*.¹⁷ Fourteen entities filed comments and reply comments.¹⁸

7. Public safety organizations unanimously opposed CTIA's proposed 5-meter metric as too imprecise to identify a caller's floor level.¹⁹ Some public safety organizations expressed support for a 3-meter metric,²⁰ while others encouraged the Commission to adopt a 2-meter metric.²¹ NextNav and Polaris asserted that they could meet a 3-meter metric for 80% of wireless indoor calls within the prescribed timeframes.²²

8. In their initial comments, CTIA and some nationwide CMRS providers argued that the Commission should defer setting a more aggressive z-axis metric than 5 meters pending further testing.²³ In a December 2018 *ex parte* filing, however, CTIA and all four nationwide CMRS providers revised their recommendation. These parties recognized "that public safety representatives have encouraged the Commission to adopt a more aggressive Z-Axis metric of ± 3 meters in the near term."²⁴ While

¹⁵ Cover Letter at 6.

¹⁶ *Public Safety and Homeland Security Bureau Seeks Comment on Vertical (Z-Axis) Accuracy Metric Proposed by the Nationwide Wireless Carriers*, Public Notice, DA 18-928 (PSHSB rel. Sept. 10, 2018) (*Public Notice*).

¹⁷ *Id.*

¹⁸ Association of Public-Safety Communications Officials-International, Inc.(APCO); Boulder Regional Emergency Telephone Service Authority (BRETSA); CTIA; International Association of Chiefs of Police, International Association of Fire Chiefs, National Association of State Emergency Medical Services Official, National Sheriffs' Association (IACP et al.); International Association of Fire Fighters (IAFF); National Public Safety Telecommunications Council (NPSTC); NENA: The 911 Association (NENA); NextNav, LLC (NextNav); State of Florida Department of Management Services, Division of Telecommunications, Bureau of Public Safety (Florida) and Verizon filed comments. AT&T Services, Inc. (AT&T); CTIA; National Association of State 911 Administrators (NASNA); NENA; Polaris Wireless, Inc. (Polaris); Texas 9-1-1 Alliance, Texas Commission on State Emergency Communications, and Municipal Emergency Communication Districts Association (Texas 911 Entities) filed reply comments.

¹⁹ *See, e.g.*, NENA Comments at 2, 3; NENA Reply Comments at 1-2; IACP et al. Comments at 1-3; Florida Comments at 1; NPSTC Comments at 4; APCO Comments at 1-3-6; IAFF Comments at 3; Texas 911 Entities Reply Comments at 2-3; NASNA Reply Comments at 1.

²⁰ *See* IAFF Comments at 1; NENA Comments at 2; NENA Reply Comments at 1; *see also* Texas 911 Entities Reply Comments at 2 (A metric greater than 3 meters for 80% of calls "would not satisfy the critical requirements of public safety.").

²¹ *See* NASNA Reply Comments at 1; Florida Comments at 1; BRETSA Comments at 4-5.

²² Letter from Bruce A. Olcott, Counsel to NextNav, LLC, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114, at 2-3 (filed Nov. 7, 2018) (NextNav Nov. 7, 2018 *Ex Parte* Letter); NextNav Comments at 7-8; Polaris Reply Comments at 2-3.

²³ CTIA Comments at 3; Verizon Letter at 1-2; AT&T Reply Comments at 3.

²⁴ *See* Letter from Matthew Gerst, Assistant Vice President, Regulatory Affairs, CTIA, to Marlene H. Dortch, Secretary, FCC at 2 (filed Dec. 19, 2018), <https://ecfsapi.fcc.gov/file/122016364060/181219%20CTIA%20911%20Location%20Accuracy%20Ex%20Parte.pdf> (CTIA Dec. 19, 2018 *Ex Parte* Letter).

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continuing to stress the importance of further testing, CTIA and the four providers stated that “certainty as to the Z-Axis metric in the near term, whether via an Order or expeditiously seeking public comment, may help advance the development process necessary to meet the 2021 and 2023 vertical location accuracy benchmarks in the *Fourth Report & Order*.”²⁵

9. Herein, we take steps to build on the Commission’s adoption of the *Fourth Report and Order* by proposing a metric for the z-axis compliance standard for wireless 911 calls that is available to those providers that do not choose the dispatchable location compliance standard for vertical location accuracy.²⁶

III. DISCUSSION

10. Given the current state of the record, we believe it is appropriate to propose a z-axis metric based on a 3-meter standard. The adoption of such a standard would provide certainty to all parties; establish a focal point for any further testing, development, and implementation of vertical location technologies; and maintain the existing timetable for wireless providers to meet their vertical location accuracy obligations. To ensure a complete and comprehensive record on this issue, we seek comment on our proposal as discussed below.

A. Floor Level Accuracy

11. We propose a z-axis metric of 3 meters relative to the handset for 80% of wireless E911 calls for each of the benchmarks and geographic requirements previously established in the Commission’s E911 wireless location accuracy rules. To comply with this proposed requirement, the caller’s handset should be located within 3 meters above or below the vertical location provided by the phone for 80% of indoor wireless calls to 911. Under our proposal, we would amend Section 20.18 of the Commission’s

²⁵ *Id.* CTIA and the nationwide providers urge the Commission to “ensure that the adopted Z-Axis metric is technologically neutral, consistent with the approach the Commission has typically taken.” *Id.* Further, they note that the Test Bed LLC is evaluating “whether additional Z-Axis testing can be accelerated in 2019 as wireless providers will need to validate whether a technology solution can achieve the metric consistent with the *Fourth Report & Order*.” *Id.* CTIA also notes that it expects that future testing will look at “new and emerging vertical location technologies” in addition to the existing barometric pressure sensor-based technologies. CTIA Reply Comments at 4.

²⁶ On March 23, 2018, while z-axis testing was being conducted, the President signed the Consolidated Appropriations Act of 2018 into law, which included the Repack Airwaves Yielding Better Access for Users of Modern Services Act of 2018 (RAY BAUM’S Act), Pub. L. No. 115-141, 132 Stat. 348, 1095 (codified at 47 U.S.C. § 615 note). Section 506 of RAY BAUM’S Act requires the Commission to “conclude a proceeding to consider adopting rules to ensure that the dispatchable location is conveyed with a 9-1-1 call, regardless of the technological platform used and including with calls from multi-line telephone systems” by September 23, 2019. *See* RAY BAUM’S Act, § 506(a). Section 506 also states that in conducting the required proceeding, “the Commission may consider information and conclusions from other Commission proceedings regarding the accuracy of the dispatchable location for a 9-1-1 call, but nothing in this section shall be construed to require the Commission to reconsider any information or conclusion from a proceeding regarding the accuracy of the dispatchable location for a 9-1-1 call in which the Commission has adopted rules or issued an order” before the March 23, 2018 enactment date of Section 506. *See id.* § 506(b). To comply with the requirements in RAY BAUM’S Act, the Commission recently initiated a new proceeding proposing to apply dispatchable location requirements to multi-line telephone systems and other platforms. *See Implementing Kari’s Law and Section 506 of RAY BAUM’S Act; Inquiry Concerning 911 Access, Routing, and Location in Enterprise Communications Systems*, Notice of Proposed Rulemaking, PS Docket Nos. 18-261 and 17-239, FCC 18-132, paras. 51-109 (September 26, 2018). However, consistent with the statutory acknowledgement in RAY BAUM’S Act of the wireless location accuracy rules previously adopted in this docket, the Commission declined to reopen wireless location accuracy issues in that proceeding. Similarly, the scope of this Further Notice is limited to our proposed adoption of a z-axis metric for wireless 911 calls, and we do not otherwise reopen or reexamine our previously adopted wireless location accuracy rules.

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rules to require that by April 3, 2021, nationwide CMRS providers must deploy in each of the top 25 Cellular Market Areas either dispatchable location or z-axis technology in compliance with the 3-meter metric.²⁷ By April 3, 2023, these requirements would be expanded to cover each of the top 50 Cellular Market Areas. Non-nationwide CMRS providers that serve any of the top 25 or 50 Cellular Market Areas would continue to have an additional year to meet each of these benchmarks in the relevant Cellular Market Area.

12. We seek comment on our proposed 3-meter metric. We tentatively agree with commenters responding to the Stage Z Test Report who assert that 3 meters will provide sufficient accuracy to identify the caller's floor level in most cases. For example, IAFF comments that the Commission should require vertical location information that provides true floor level accuracy, "i.e., no more than 3 meters."²⁸ NENA states that "[c]itizens and public safety require, in the absence of a dispatchable location solution, a z-axis accuracy benchmark of +/-3 meters."²⁹ The Texas 911 Entities assert that a metric greater than 3 meters for 80% of calls "would not satisfy the critical requirements of public safety."³⁰ We acknowledge that a 3-meter metric is not always certain to yield floor level accuracy. If the indoor wireless caller's handset is located at the vertical center of a floor with an average height of 3.1 to 3.9 meters, the margins of a 3-meter metric allow for a variance of up to six meters, which would extend the search range to one floor above and one floor below the location of the handset.³¹ Nevertheless, we believe this search range will significantly narrow the scope of the search and can provide a reasonable basis for identifying the correct floor in many most cases. We seek comment on this tentative conclusion. Do commenters agree that the metric should be set at 3 meters? If not, what vertical location metric should the Commission adopt, and why?

13. We also tentatively conclude that a 5-meter metric should not be adopted because the record indicates it would not yield the floor level accuracy that first responder commenters consider necessary.³² APCO states that a 5-meter metric "translates to a range of up to two floors below, or up to two floors above, the actual floor where a 911 caller may be located, and some lesser degree of accuracy for one in five calls to 911."³³ APCO and NENA also assert that adopting a metric of 5 meters would

²⁷ In each Cellular Market Area where z-axis technology is used, nationwide CMRS providers must deploy z-axis technology to cover 80% of the Cellular Market Area population. See 47 CFR § 20.18(i)(2)(ii)(C)(2).

²⁸ IAFF Comments at 1.

²⁹ NENA Comments at 2; see also NENA Reply Comments at 1 (stating that NENA "reiterates its stance that CTIA's z-axis accuracy recommendation of ± 5 meters is not sufficiently precise for public safety and that floor-level accuracy (± 3 meters) is both necessary for public safety and feasible based on the Test Bed's results").

³⁰ Texas 911 Entities Reply Comments at 2.

³¹ In the *Third Further Notice* the Commission noted that an average floor height separation is 3 meters. *Third Further Notice*, 29 FCC Rcd at 2402-03, para. 73. The Commission cited the Council on Tall Building and Urban Habitat. See Council on Tall Building and Urban Habitat, Height Calculator, <http://www.ctbuh.org/TallBuildings/HeightStatistics/HeightCalculator/tabid/1007/language/en-US/Default.aspx> (last visited Nov. 1, 2018) (noting that the average height of an office floor is 3.9 meters, the average height of a residential/hotel floor is 3.1 meters, and the average height of a mixed-use building floor is 3.5 meters). See *Third Further Notice*, 29 FCC Rcd at 2403, n.148.

³² Public safety commenters assert that a metric of 5 meters would not be adequate for their needs and urge the Commission not to adopt such a metric. See NENA Comments at 2, 3; NENA Reply Comments at 2; IACP et al. Comments at 1-2, 3; Florida Comments at 1; NPSTC Comments at 4; APCO Comments at 1, 2, 3-6; IAFF Comments at 3; Texas 911 Entities Reply Comments at 2-3; NASNA Reply Comments at 1; see also BRETSA Comments at 1-2 (proposing a 2-meter metric).

³³ APCO Comments at 1.

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undermine incentives for CMRS providers to invest in the development of more accurate z-axis solutions.³⁴ We seek comment on our tentative conclusion.

14. We also seek comment on other elements of the proposed metric. Should the metric apply to 80% of wireless calls? If not, what percentage of calls is appropriate? CTIA's proposed metric would apply only to "mobile devices capable of delivering barometric pressure sensor-based altitude estimates."³⁵ Should the z-axis metric apply only to calls from such devices, only devices manufactured after a date certain, or should it apply to wireless calls from all mobile devices, as we propose? Additionally, NPSTC asserts that reporting vertical location information as height above ground level (AGL) would be preferable to height above mean sea level (MSL).³⁶ Should the Commission specify that CMRS providers must report z-axis information as AGL, as NPSTC suggests, or are there advantages to keying height estimates to MSL? Alternatively, should we decline to specify this level of detail so that entities developing z-axis solutions have more flexibility?

B. Technical Feasibility

15. We tentatively conclude that our proposed 3-meter z-axis metric is technically feasible under the timeframes established in the *Fourth Report and Order*.

16. The test bed results show that in 80% of NextNav test calls, vertical location was identified to a range of 1.8 meters or less.³⁷ NextNav achieved a vertical accuracy within 2 meters for 67% of test calls and within 3 meters for 90% of test calls in the dense urban, urban, and suburban morphologies.³⁸ NextNav also achieved a vertical accuracy within 2 meters for 80% of test calls for every handset tested.³⁹ According to NextNav, these results "were consistent across age of handsets, with the oldest devices (2016 models) performing identically to the newest (2018)."⁴⁰ NextNav asserts that the results demonstrate reasonable consistency between handsets, weather, building types, environments, and

³⁴ See APCO Comments at 5-6; NENA Comments at 4.

³⁵ CTIA Cover Letter at 2.

³⁶ See NPSTC Comments at 7; see also APCO Comments at 5 (stating that vertical location provided as a value relative to mean sea level is not actionable for public safety). AGL height at any horizontal (x,y) location can be obtained by subtracting the terrain height at that horizontal (x,y) location from the corresponding AMSL value. Terrain heights are typically provided in Digital Elevation Model (DEM) databases with varying horizontal (x,y) resolution or bin sizes (e.g., several meters) and corresponding digitized terrain heights resolution (e.g., 1 meter). See, e.g., Dai Yamazaki, Daiki Ikeshima, Ryunosuku Tawatari, Tomohiro Yamaguchi, Fiachra O'Loughlin, Jeffrey C. Neal, Christopher C. Sampson, Shinjiro Kanae, Paul D. Bates, A high-accuracy map of global terrain elevations, *Geophys. Res. Lett.*, 44, 5844-5853 (May 31, 2017), <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2017GL072874>. Converting z axis values from AMSL to AGL, however, could introduce additional uncertainty generated by the resolution of the DEM database.

³⁷ Report at 65, 120.

³⁸ Report at 65, 127. NextNav Comments at 5, Table 1. In the Addendum to the Report, NextNav notes that the only notable variation in NextNav performance was the Dense Urban test in Atlanta. NextNav believes that result is "skewed by the fact that 45% of the Atlanta Dense Urban points (more than 20% of total Dense Urban points), were in a single building. The San Francisco Dense Urban points, on the other hand, were distributed among a larger number of buildings, resulting in performance consistent with all other test points. It is important for the reader not to ascribe this to a 'bad building.' Rather, it is a combination of the building effects, the building location relative to NextNav's network and other factors." Report at 128.

³⁹ Report at 66.

⁴⁰ Report at 128.

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time of day and that they demonstrate “the efficacy of the overall altitude determination system (< 1m @ 80%).”⁴¹

17. In addition, Polaris states that it was able to achieve aggregate accuracy performance of 2.8 meters for 80% of test calls by using additional available location data to recalibrate and refine its Stage Z data.⁴² This also supports our tentative conclusion in favor of a 3 meter metric. Polaris also indicates that in a real-world deployment its solution would use an active compensation correction model that operates in an application running continuously in the background of the device.⁴³ As stated by Dr. R. Michael Buehrer of Virginia Tech, we also expect that this calibration process would be at least as accurate as the limited (once per month) calibration process Polaris used in reprocessing its Stage Z data.⁴⁴ Accordingly, we tentatively conclude that Polaris’ reprocessing of the data presents a reasonably accurate picture of the capabilities of its solution. We seek comment on this view.

18. Additionally, we are encouraged that entities outside the test bed have reported on technologies that may be able to achieve an equivalent degree of vertical location accuracy.⁴⁵ For instance, on September 18, 2018, Google announced the launch of its Emergency Location Service in the United States.⁴⁶ According to Google, Emergency Location Service is “a supplemental service that sends enhanced location directly from Android handsets to emergency services when an emergency call is placed.”⁴⁷ Emergency Location Service works on “99 percent of Android devices (version 4.0 and above).”⁴⁸ Emergency Location Service is part of the Android operating system and does not require any

⁴¹ Report at 128.

⁴² Report at 130-34. Polaris states that it originally proposed to include an active compensation correction model that would operate in an application running in the background of the device but that it did not enable this feature on the basis of communications with the test bed administrator and Polaris’ understanding of instructions from the test bed on allowable procedures. *Id.* at 131-132. The reprocessed data offers adjusted performance outcomes accordingly.

⁴³ See Letter from James Arden Barnett, Jr., Counsel to Polaris Wireless, Inc., to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114, at 2, (filed Nov. 30, 2018) (Polaris Nov. 30, 2017 *Ex Parte* Letter).

⁴⁴ In its reply comments, Polaris includes a statement by Dr. R. Michael Buehrer of Virginia Tech, who finds that the updated data is “consistent with what one would expect using [Polaris’] ‘limited active compensation’ process and is likely “a conservative estimate of the improvement that could be achieved through active compensation.” Polaris Reply Comments at 2. Polaris states that Dr. Buehrer, an independent industry expert, reviewed the Stage Z Report and addendum, Polaris’ barometric sensor compensation algorithms, and the methodology Polaris used in reprocessing its Stage Z data. *Id.*

⁴⁵ APCO notes that “[e]ntities outside the test bed have reported on technologies that demonstrate that a much higher degree of vertical location accuracy – presented as a floor level – is achievable.” APCO Comments at 3. For example, APCO notes that an academic paper described a system capable of predicting the correct floor level with 100% accuracy that does not require the use of beacons, prior knowledge of the building infrastructure, or knowledge of user behavior. *Id.*, citing William Falcon & Henning Schulzrinne, “Predicting Floor Level for 911 Calls with Neural Networks and Smartphone Sensor Data” (Sept. 15, 2018), <https://arxiv.org/pdf/1710.11122.pdf>.

⁴⁶ Jen Chai, Product Manager, Android, Expanding Emergency Location Service in Android to the U.S. (Sept. 19, 2018), <https://www.blog.google/products/android/expanding-emergency-location-service-android-us/>. In partnership with RapidSOS, Google provides Emergency Location Service location directly to emergency communications centers through their IP-based data platform. *Id.* Additionally, Emergency Location Service is now available for Android users on T-Mobile in the U.S. *Id.*

⁴⁷ See Google, Helping our Partners Provide Faster, More Accurate Location for Emergency Services, <https://crisisresponse.google/emergencylocationservice/> (last visited January 31, 2019).

⁴⁸ Jen Chai, Product Manager, Android, Expanding Emergency Location Service in Android to the U.S. (Sept. 19, 2018), <https://www.blog.google/products/android/expanding-emergency-location-service-android-us/>.

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special hardware or updates.⁴⁹ Regarding vertical location accuracy, Google states that it is working to provide accurate altitude and floor location and “improve [Emergency Location Service] location quality, especially for challenging locations, such as urban canyons and indoors.”⁵⁰

19. We recognize that some public safety commenters urge us to adopt a 2-meter metric, which would increase the likelihood of providing floor-level accuracy. However, we believe it is not yet established that such a metric is technically achievable on a consistent basis, although it may become achievable in the long term as technology continues to evolve. While NextNav’s test bed results demonstrate that its solution can achieve an accuracy of 1.8 meters or less for 80% of test calls overall, it could only achieve an accuracy of 2.5 meters or less for 80% of test calls in the dense urban morphology, where calls from multi-story buildings are most likely to occur.⁵¹ Similarly, even after reprocessing its data, Polaris’ solution yielded only 2.8 meters or less for 80% of test calls. Because the existing record does not indicate that 2-meter accuracy is currently achievable by either vendor in the dense urban morphology, we tentatively conclude that it would be premature to adopt a 2-meter metric. We believe, however, that our proposed 3-meter metric will encourage CMRS providers to work with NextNav, Polaris, and emerging location and device vendors to achieve more precise vertical location accuracy solutions. We seek comment on this view.

C. Testing

20. We propose to adopt a 3-meter z-axis metric instead of deferring the matter for further testing. Although CTIA initially maintained that additional testing was needed before a metric could be adopted, it has since taken the opposite view.⁵² Additionally, vendors’ comments suggest that the 3-meter metric is technically feasible, and public safety commenters acknowledge that such a metric, while not as precise as they might like, would nevertheless be a worthwhile step to take.⁵³ Although we tentatively conclude that the benefits of further testing are insufficient to warrant any more delay in the progress of this proceeding, to the extent that the proponents of additional testing conduct tests or studies that yield more accurate and efficient vertical location solutions, we encourage these stakeholders to file them in this docket.

⁴⁹ Jen Chai, Product Manager, Android, Expanding Emergency Location Service in Android to the U.S. (Sept. 19, 2018), <https://www.blog.google/products/android/expanding-emergency-location-service-android-us/>; Google, Helping our Partners Provide Faster, More Accurate Location for Emergency Services, <https://crisisresponse.google/emergencylocationservice/faqs/> (last visited January 31, 2019). Google explains that location is computed on the device and delivered directly to emergency providers—without passing through Google servers, and only when a user explicitly calls an emergency number. See Jen Chai, Product Manager, Android, Expanding Emergency Location Service in Android to the U.S. (Sept. 19, 2018), <https://www.blog.google/products/android/expanding-emergency-location-service-android-us/>.

⁵⁰ See Google, Helping our Partners Provide Faster, More Accurate Location for Emergency Services, <https://crisisresponse.google/emergencylocationservice/faqs/> (last visited Jan. 31, 2019).

⁵¹ Report at 65. According to the Report, the dense urban morphology is the densest scenario for testing and is characterized by large population and/or building density within a small area. It is reserved for city centers, which have many high-rise buildings that tend to create urban canyons. The dense urban environment is typically a business district, with a mix of residential properties as well. See *id.* at 23.

⁵² CTIA Dec. 19, 2018 *Ex Parte* Letter at 2.

⁵³ See, e.g., NextNav Nov. 7, 2018 *Ex Parte* Letter at 2-3; NextNav Comments at 7-8; Polaris Reply Comments at 2-3; NENA Comments at 2, 3; NENA Reply Comments at 1-2; IACP et al. Comments at 1-3; Florida Comments at 1; NPSTC Comments at 4; APCO Comments at 1-3-6; IAFF Comments at 3; Texas 911 Entities Reply Comments at 2-3; NASNA Reply Comments at 1.

(continued....)

21. We also tentatively conclude based on our own assessment of the Report that the limitations on testing described therein do not preclude us from adopting a 3-meter metric without requiring additional testing. We seek comment on this tentative conclusion.

22. For example, in Stage Z, Chicago was added as a test region to provide a more extreme cold-weather environment for evaluating z-axis technologies, but NextNav was unable to test there.⁵⁴ NextNav also did not test its solution in rural morphologies. We do not believe that the lack of NextNav test data in either environment is a sufficient reason to delay consideration of a z-axis metric.

23. In particular, with respect to extreme cold-weather testing, the Report states that very cold weather was not available during testing and that this is likely because the test campaign started in late February. Accordingly, the test results would not have been conclusive even if NextNav had participated.⁵⁵ In addition, if we were to require additional cold-weather testing, it could not be scheduled before next winter, which would entail at least a year's delay in adopting a metric.

24. Similarly, we do not believe that the absence of NextNav test data in rural morphologies warrants a delay in our consideration of a z-axis metric. The Report notes that the rural morphology is "the sparsest environment overall" and is mostly residential, with most structures between 1 and 2 stories high.⁵⁶ Moreover, the Commission's vertical location accuracy requirements apply only to the top 50 Cellular Market Areas, which are most likely to feature the urban and dense urban morphologies. In these morphologies, the test bed shows that NextNav's solution would meet a 3-meter metric.⁵⁷ Additionally, NextNav's technology was tested for vertical accuracy in rural areas during the original CSRIC Test Bed conducted in 2012, and NextNav's results from that testing fell within 3 meters for 80% of all calls.⁵⁸

25. We also do not believe that testing of additional devices, such as older and lower-end devices, is needed prior to adoption of a z-axis metric. NextNav and Polaris each tested six handsets, for a total of twelve handsets, in Stage Z.⁵⁹ The Report states that handsets were selected "to ensure variety

⁵⁴ See Cover Letter at 3. CTIA notes that NextNav has not deployed its MBS technology in Chicago. *Id.*

⁵⁵ Report at 25, 109. NextNav also notes that "Polaris' location technology was tested in Chicago, and . . . the test results for Polaris' indoor location technology in Chicago were consistent with—if not slightly better than—Polaris' test results for San Francisco." NextNav Comments at 9.

⁵⁶ Report at 24.

⁵⁷ Report at 19.

⁵⁸ In 2012, NextNav tested its indoor location technology for vertical location accuracy in the CSRIC Test Bed. NextNav's technology located a caller's vertical location within 3 meters more than 67% of the time in dense urban, urban, and rural morphologies. See CSRIC III WG3, Indoor Location Test Bed Report at 36 (Mar. 14, 2013) http://transition.fcc.gov/bureaus/pshs/advisory/csric3/CSRIC_III_WG3_Report_March_%202013_ILTestBedReport.pdf. In 2013, NextNav conducted additional testing on the second generation of its location technology and reported that it provided callers' vertical location within 3.2 meters 80% of the time, across all morphologies. See Letter from Bruce A. Olcott, Counsel, NextNav, LLC, to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114 at 8 (filed Aug. 14, 2013) (NextNav Aug. 14, 2013 *Ex Parte* Letter); see also *Third Further Notice*, 29 FCC Rcd at 2401-02, para. 71; NextNav Comments at 24; Letter from Bruce A. Olcott, Counsel to NextNav, LLC to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114, at 2 (filed Aug. 16, 2018) (NextNav Aug. 16, 2018 *Ex Parte* Letter).

⁵⁹ NextNav tested the following handsets: Samsung Galaxy S8, Samsung Galaxy 8 Plus, iPhone 7, iPhone 7 Plus, iPhone 8 and iPhone 8 Plus. Report at 48. Polaris tested the following handsets: Essential PH-1, Huawei Mate 9, Motorola Z2 Force, Samsung Galaxy Note 8, Samsung Galaxy S8, and Sony Xperia XZ1 Compact. Report at 52. The Report notes that Polaris did not test iOS (i.e., Apple iPhone) devices. See Report at 52; Cover Letter at 3. Polaris responds that while the application it tested in the Stage Z test bed was developed only for Android devices, its barometric sensor-based solution is supported on iOS devices, and it has developed and tested a test application for iOS devices. Letter from James Arden Barnett, Jr., Counsel to Polaris Wireless, Inc., to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114, at 3 (filed Sept. 10, 2018) (Polaris Sept. 10, 2018 *Ex Parte* Letter); Polaris

(continued....)

between sensor manufacturers, the age of handsets (within limits) and their overall use characteristics,”⁶⁰ and that the handsets used in testing were “the same production-ready handsets sold by wireless carriers and available to the general public” and did not contain any hardware modification that would favor these handsets over any commercially available handsets.⁶¹ NextNav points out that the Stage Z results showed a high level of consistency between different models of handsets and that these results were consistent with the results of prior independent tests conducted on its technology. Although we encourage additional testing on a greater variety of devices, we believe that a sufficient variety of devices have been tested to support moving forward with our proposed 3-meter metric at this time. We seek comment on this assessment. We also seek comment on the potential turnover rates for wireless handsets and the features of devices likely to be available and in use by the compliance dates established in our rules. Those data points would influence the extent to which difficulties in achieving the metric over older and lower-end devices may pose an impediment to meeting the proposed requirements.

D. Deployment

26. We believe our proposed 3-meter z-axis metric will support the development of scalable vertical location solutions that can be deployed in time to meet the carriers’ 2021 and 2023 deadlines. To the extent that CMRS providers elect to use solutions that rely on barometric pressure readings, nearly all smartphones on the market appear to be equipped with barometric pressure sensors.⁶² In addition, both NextNav and Polaris state that calibration of the barometric sensors in their z-axis solutions would be software-based and thus would scale readily for widespread use.⁶³ Polaris and NextNav also state that industry standards necessary to implement the barometric sensor-based solutions tested in Stage Z are already adopted and that implementation of these standards is in the hands of carriers and device manufacturers.⁶⁴ Based on these comments, we believe barometric sensor-based solutions are likely to be scalable and can be made readily available to wireless consumers within the timeframes required by the rules. We seek comment on this assessment and its underlying factual assumptions.

27. We also seek comment on the potential for development and deployment of other new or emerging vertical location solutions that could be used to meet the proposed z-axis metric. The Commission has previously recognized that no single technological approach will solve the challenge of

Nov. 30, 2018 *Ex Parte* Letter at 1-2. Polaris submits that its technology “can achieve a vertical location benchmark metric of 3 meters on 80% of fixes for E9-1-1 calls, including iPhones.” *Id.* at 1-2.

⁶⁰ Report at 26.

⁶¹ Report at 26. By agreement between the Test Bed, LLC and the z-axis technology vendors, the Report adds, “only relatively new handsets, released more recently than mid-2016, were tested.” *Id.*

⁶² For the third quarter of 2018, the U.S. smartphone shipments showed Apple with a 39% market share, Samsung with a 25% share, LG with a 17% share, and Motorola with an 8% share. See Counterpoint Research, U.S. Smartphone Market by Quarter (Nov. 20, 2018), <https://www.counterpointresearch.com/us-market-smartphone-share/>. Since 2014, the iPhone 6 and later models have had a barometer, while Samsung Galaxy smartphones have had barometers since 2011. See Kaveh Wadell, How Phones can Help Predict Thunderstorms (Aug 11, 2016) (last visited Feb. 15, 2019) <https://www.theatlantic.com/technology/archive/2016/08/how-phones-can-help-predict-thunderstorms/495389/>. See also *Fourth Report and Order*, 30 FCC Rcd at 1299, para. 107 (noting that barometric sensors are increasingly common in handsets, and some analysts project that the number of smartphones equipped with such sensors will increase to 681 million new units per year in 2016).

⁶³ Polaris Nov. 30, 2018 *Ex Parte* Letter at 3; NextNav Comments at 14-15. See also NextNav Nov. 7, 2018 *Ex Parte* Letter at 7 (noting that because only software elements are required in each handset, no incremental cost burdens are imposed on new handsets).

⁶⁴ See Polaris Reply Comments at 2; see also NextNav Comments at 14-15 (noting that the appropriate signaling to support barometric based altitude determination from the device to the network is already standardized by 3rd Generation Partnership Project (3GPP) (Release 13/14) and Open Mobile Alliance (OMA)).

(continued....)

indoor location, and it adopted requirements applicable to CMRS providers that are technically feasible and technologically neutral “so that providers can choose the most effective solutions from a range of options.”⁶⁵ We continue to believe that this approach should guide the adoption of any metric in this proceeding. CTIA states that other vertical location technologies and vendors will likely be ready for testing in 2019.⁶⁶ We seek comment on the potential for widespread deployment and adoption of these or other alternatives within the timeframes required by the rules, as well as their likely performance in real-world conditions. Are there issues associated with implementing these solutions into wireless network systems and production mobile devices, or scaling them for widespread use?

E. Comparison of Benefits and Costs

28. We now seek comment on which z-axis metric would allow us to achieve the anticipated level of benefits in the most cost-effective manner. Specifically, because the alternative metrics have an effect on both costs and benefits, we seek comment on how the benefits and costs of the proposed z-axis metric of 3 meters for 80% of calls compares to the benefits and costs of alternative metrics. We seek comment on the expected number of lives saved by adopting a 3-meter metric, versus a 2-meter or 5-meter metric. In the *Fourth Report and Order*, the Commission concluded that the location accuracy rules, including the z-axis accuracy metric, would improve emergency response times, which, in turn, would improve patient outcomes and save lives.⁶⁷ The Commission found that the location accuracy improvements that it adopted had the potential to save approximately 10,120 lives annually at a value of \$9.1 million per statistical life, for an annual benefit of approximately \$92 billion or \$291 per wireless subscriber.⁶⁸ The Commission characterized this \$92 billion as an annual benefit floor value because it also expected substantial, unquantifiable benefits from the reduction of human suffering and loss of property.⁶⁹ The Commission further found that the costs of implementing the available solutions to achieve the indoor wireless location accuracy standards were far less than the \$92 billion benefit floor, with the costs further declining as demand grew.⁷⁰

29. We now seek comment on how the benefits and costs of the proposed z-axis metric of 3 meters for 80% of calls compares to the benefits and costs of alternative metrics. We tentatively conclude that a z-axis metric of 3 meters for 80% of calls strikes the best balance between benefits and costs. As noted above, some public safety commenters identify a 3-meter metric as providing sufficient accuracy to identify the caller’s floor level in most cases.⁷¹ Accordingly, a 3-meter metric would manifest the

⁶⁵ See *Fourth Report and Order*, 30 FCC Rcd at 1260, para. 4.

⁶⁶ See Cover Letter at 5.

⁶⁷ *Fourth Report and Order*, 30 FCC Rcd at 1319, para. 162.

⁶⁸ *Fourth Report and Order*, 30 FCC Rcd at 1320, para. 166. These values are based on a study examining emergency incidents during 2001 in the Salt Lake City area, which found that a decrease in ambulance response times reduced the likelihood of mortality. *Fourth Report and Order*, 30 FCC Rcd at 1317, para. 160. The \$9.1 million value referenced in the *Fourth Report and Order* was based on the United States Department of Transportation’s (DoT) 2013 memorandum on the value of a statistical life (VSL). *Id.* at note 402. DoT presently estimates the VSL at \$9.6 million. See Memorandum from Molly J. Moran, Acting General Counsel, and Carlos Monje, Assistant Secretary for Transportation Policy, to Secretarial Officers and Modal Administrators, U.S. Department of Transportation, “Guidance on Treatment of the Economic Value of a Statistical Life (VSL) in U.S. Department of Transportation Analyses” (Aug. 8, 2016), <https://www.transportation.gov/sites/dot.gov/files/docs/2016%20Revised%20Value%20of%20a%20Statistical%20Life%20Guidance.pdf>.

⁶⁹ *Fourth Report and Order*, 30 FCC Rcd at 1320, para. 166.

⁷⁰ *Id.* at 1322, para. 170.

⁷¹ See *supra* para. 12.

(continued....)

benefits of location accuracy described in the *Fourth Report and Order*. The record contains evidence that supports a finding that the costs of implementing a 3-meter metric are themselves low, at least on a per-handset basis. NextNav asserts that its z-axis solution, which requires only software changes to be made to each handset, could be made available for a nominal cost that amounts to significantly less than a penny per month per handset and would impose no incremental cost burdens on new handsets.⁷² Polaris states that its z-axis solution is “objectively affordable” because it is software-based, does not require hardware in networks or markets, and “does not require anything special in devices beyond implementation of adopted 3GPP and OMA standards.”⁷³ Polaris’ solution also is “instantly available and deployable throughout a carrier’s nationwide network.”⁷⁴ As the Commission noted in the *Fourth Report and Order*, we continue to expect that these costs will decline as demand grows.⁷⁵

30. We tentatively conclude that the value of a 3-meter metric exceeds that of a 5-meter standard because a 5-meter metric would result in a significant reduction in the benefits described above. As commenters have indicated, a 5-meter metric could indicate a location up to 2 floors below, or up to 2 floors above, the actual floor where a 911 caller may be located.⁷⁶ This large search range would make it far more likely that first responders would need to search 2 or more additional floors, significantly increasing average emergency response times and consequently degrading patient outcomes. Due to the likely degradation of patient outcomes with a 5-meter metric, we tentatively conclude that a 3-meter metric provides greater value. We seek comment on this tentative conclusion, including on the marginal benefits and costs of a 3-meter metric versus a 5-meter metric.

31. We also tentatively conclude that, at this time, the value of a 3-meter metric exceeds that of a 2-meter metric. We acknowledge that a 2-meter metric would further improve the accuracy of 911 calls by increasing the likelihood that the caller’s floor level could be identified with certainty, which would further improve emergency response times and patient outcomes. In other words, while the margins of both the 2-meter and 3-meter search ranges could extend one level above and below a caller’s floor level, a greater portion of the 2-meter search range is likely to be concentrated at the correct floor level. However, because we tentatively conclude that existing solutions are unlikely to achieve 2-meter accuracy for 80% of E911 calls prior to the deadlines established by our rules,⁷⁷ we expect that adopting a 2-meter metric would likely cause developers of z-axis solutions to incur substantial development, testing, and implementation costs, without any guarantee of achieving the 2-meter metric before the deadline. Rather than force these expenditures in pursuit of additional benefits that may not materialize on-schedule, we tentatively conclude that there is greater value in adopting the certain benefits of the achievable 3-meter metric. In addition, we observe that any delay in deployment of z-axis solutions necessitated by a 2-meter metric would also delay realization of the benefits of improved location accuracy—i.e., improved emergency response times, better patient outcomes, and lives saved. We seek comment on this tentative conclusion, including on the marginal benefits and costs of a 2-meter metric versus a 3-meter or 5-meter metric.

32. We seek comment on our analysis and tentative conclusions as to the comparative value of these z-axis metrics. Are there ways to more precisely quantify the differences in patient outcomes that would arise from the adoption of 2-, 3-, and 5-meter metrics? For example, under each of these metrics, in what percentage of calls would the floor reported to first responders be the correct one? How much additional time is necessary for first responders to search additional floors of a building if the 911 caller is

⁷² NextNav Nov. 7, 2018 *Ex Parte* Letter at 2.

⁷³ Polaris Nov. 30, 2018 *Ex Parte* Letter at 3.

⁷⁴ *Id.*

⁷⁵ *Fourth Report and Order*, 30 FCC Rcd at 1322, para. 170.

⁷⁶ *See supra* para. 134.

⁷⁷ *See supra* para. 19.

not on the first floor that they search? How much more time would be required for a first responder to find a 911 caller if a 5-meter metric were adopted, as compared to adoption of a 3-meter metric? How much less time would be required for a first responder to find a 911 caller if a 2-meter metric were adopted? What costs would arise from implementing z-axis solutions to meet a 3-meter metric that would not exist when implementing a 5-meter metric? What is the projected amount of those costs? Are there z-axis solutions for which the cost of satisfying a 3-meter metric is the same or negligible when compared to the costs of implementing a 5-meter metric? Are there any alternative z-axis metrics that have not been addressed that we should consider?

IV. PROCEDURAL MATTERS

33. *Ex Parte* Presentations. The proceeding shall be treated as a “permit-but-disclose” proceeding in accordance with the Commission’s *ex parte* rules.⁷⁸ Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within 2 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.

34. *Comment Filing Procedures*. 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 on or before the dates indicated on the first page of this document. Comments and reply 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://apps.fcc.gov/ecfs/>.
- Paper Filers: Parties who 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

⁷⁸ 47 CFR §§ 1.1200 *et seq.*

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 9050 Junction Drive, Annapolis Junction, MD 20701.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th Street, SW, Washington DC 20554.

35. **People with Disabilities:** 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).

36. *Regulatory Flexibility Analysis.* As required by the Regulatory Flexibility Act of 1980, *see* 5 U.S.C. § 603, 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 on the IRFA. These comments must be filed in accordance with the same filing deadlines as comments filed in response to this *Notice of Proposed Rulemaking* as set forth herein, and they should have a separate and distinct heading designating them as responses to the IRFA.

37. *Initial Paperwork Reduction Act Analysis.* This *Fourth Further Notice of Proposed Rulemaking* does not contain proposed new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In addition, therefore, it does not contain any new or modified information collection burden for small business concerns with fewer than 25 employees, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4).

38. *Further Information.* For further information, contact Brenda Boykin, Attorney-Advisor, Policy and Licensing Division, Public Safety and Homeland Security Bureau, (202) 418-2062 or via e-mail at Brenda.Boykin@fcc.gov; Nellie Foosaner, Attorney-Advisor, Policy and Licensing Division, Public Safety and Homeland Security Bureau, (202) 418-2565 or via e-mail at Nellie.Foosaner@fcc.gov.

V. ORDERING CLAUSES

39. Accordingly, IT IS ORDERED, pursuant to Sections 1, 2, 4(i), 7, 10, 201, 214, 222, 251(e), 301, 302, 303, 307, 309, 316, 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, 307, 309, 316, 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, that this *Further Notice of Proposed Rulemaking*, is hereby ADOPTED.

40. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this *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
Proposed Rules**

The Federal Communications Commission proposes to amend chapter I of title 47 of the Code of Federal Regulations as follows:

PART 20 – COMMERCIAL MOBILE SERVICES

1. The authority citation for part 20 continues 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, 610, 615, 615a, 615b, 615c, unless otherwise noted.

2. Section 20.18 is amended by revising paragraph (i)(2)(ii)(C) and (D) to read as follows:

§ 20.18 911 Service.

* * * * *

(i) * * *

(2) * * *

(ii) * * *

(C) By April 3, 2021: In each of the top 25 CMAs, nationwide CMRS providers shall deploy either dispatchable location, or z-axis technology in compliance with the following z-axis accuracy metric: within 3 meters above or below (plus or minus 3 meters) the handset for 80% of wireless E911 calls.

(1) * * *

(2) * * *

(D) By April 3, 2023: In each of the top 50 CMAs, nationwide CMRS providers shall deploy either dispatchable location, or z-axis technology in compliance with the following z-axis accuracy metric: within 3 meters above or below (plus or minus 3 meters) the handset for 80% of wireless E911 calls.

* * * * *

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 Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies and rules proposed in the *Fourth Further Notice of Proposed Rule Making (Notice)*. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines in this *Notice*. The Commission will send a copy of the *Notice*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).² In addition, the *Notice* and IRFA (or summaries thereof) will be published in the *Federal Register*.³

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

2. The *Notice* advances the Commission's goal of ensuring "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."⁴ In the *Notice*, the Commission proposes to adopt a metric to more precisely identify the location of a 911 wireless caller located in a multi-story building. More specifically, we propose to require the provisioning of vertical location (z-axis) information that would enable first responders to identify the caller's floor level for many if not most wireless calls to 911 from multi-story buildings, which represents a critical element to achieving the Commission's indoor location accuracy objectives. Consistent with the regulatory framework established in the last major revision of the Commission's wireless location accuracy rules in 2015 and the information developed in the associated docket, this *Notice* proposes a z-axis location accuracy metric of three meters above or below a handset for 80 percent of wireless Enhanced 911 (E911) indoor calls. Our proposed metric, if adopted, could augment the ability of Public Safety Answering Points (PSAPs) and first responders to more accurately identify the floor level for most 911 calls made from multi-story buildings, reduce emergency response times, and, ultimately, save lives.

B. Legal Basis

3. The proposed action is authorized under Sections 1, 2, 4(i), 7, 10, 201, 214, 222, 251(e), 301, 302, 303, 307, 309, 316, 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, 307, 309, 316, 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.

¹ 5 U.S.C. § 603. The RFA, 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 *id.*

⁴ *Third Further Notice*, 29 FCC Rcd at 2377, para. 6.

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

4. The RFA directs agencies to provide a description of and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.⁵ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”⁶ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.⁷ 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 SBA.⁸

5. *Small Businesses, Small Organizations, Small Governmental Jurisdictions.* Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three broad groups of small entities that could be directly affected herein.⁹ First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the SBA’s Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.¹⁰ These types of small businesses represent 99.9% of all businesses in the United States which translates to 28.8 million businesses.¹¹

6. Next, the type of small entity described as a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”¹² Nationwide, as of August 2016, there were approximately 356,494 small organizations based on registration and tax data filed by nonprofits with the Internal Revenue Service (IRS).¹³

⁵ 5 U.S.C. § 603(b)(3).

⁶ 5 U.S.C. § 601(6).

⁷ 5 U.S.C. § 601(3) (incorporating by reference the definition of “small business concern” in Section 3 of the Small Business Act, which is codified at 15 U.S.C. § 632). Pursuant to the RFA, 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 term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.” 5 U.S.C. § 601(3).

⁸ 15 U.S.C. § 632.

⁹ See 5 U.S.C. § 601(3)-(6).

¹⁰ See SBA, Office of Advocacy, “Frequently Asked Questions, Question 1 – What is a small business?” https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016)

¹¹ See SBA, Office of Advocacy, “Frequently Asked Questions, Question 2- How many small businesses are there in the U.S.?” https://www.sba.gov/sites/default/files/advocacy/SB-FAQ-2016_WEB.pdf (June 2016).

¹² 5 U.S.C. § 601(4).

¹³ Data from the Urban Institute, National Center for Charitable Statistics (NCCS) reporting on nonprofit organizations registered with the IRS was used to estimate the number of small organizations. Reports generated using the NCCS online database indicated that as of August 2016 there were 356,494 registered nonprofits with total revenues of less than \$100,000. Of this number, 326,897 entities filed tax returns with 65,113 registered nonprofits reporting total revenues of \$50,000 or less on the IRS Form 990-N for Small Exempt Organizations and 261,784 nonprofits reporting total revenues of \$100,000 or less on some other version of the IRS Form 990 within 24 months of the August 2016 data release date. See <http://nccs.urban.org/sites/all/nccs-archive/html/tablewiz/tw.php> where the report showing this data can be generated by selecting the following data fields: Report: “The Number and Finances of All Registered 501(c) Nonprofits”; Show: “Registered Nonprofits”; By: “Total Revenue Level (years 1995, Aug to 2016, Aug)”; and For: “2016, Aug” then selecting “Show Results”.

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7. Finally, the small entity described as a “small governmental jurisdiction” is defined generally as “governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”¹⁴ U.S. Census Bureau data from the 2012 Census of Governments¹⁵ indicate that there were 90,056 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.¹⁶ Of this number there were 37, 132 General purpose governments (county¹⁷, municipal and town or township¹⁸) with populations of less than 50,000 and 12,184 Special purpose governments (independent school districts¹⁹ and special districts²⁰) with populations of less than 50,000. The 2012 U.S. Census Bureau data for most types of governments in the local government category show that the majority of these governments have populations of less than 50,000.²¹ Based on this data we estimate that at least 49,316 local government jurisdictions fall in the category of “small governmental jurisdictions.”²²

¹⁴ 5 U.S.C. § 601(5).

¹⁵ See 13 U.S.C. § 161. The Census of Government is conducted every five (5) years compiling data for years ending with “2” and “7”. See also Program Description Census of Government <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=program&id=program.en.COG#>.

¹⁶ See U.S. Census Bureau, 2012 Census of Governments, Local Governments by Type and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG02.US01>. Local governmental jurisdictions are classified in two categories - General purpose governments (county, municipal and town or township) and Special purpose governments (special districts and independent school districts).

¹⁷ See U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01>. There were 2,114 county governments with populations less than 50,000.

¹⁸ See U.S. Census Bureau, 2012 Census of Governments, Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States – States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01>. There were 18,811 municipal and 16,207 town and township governments with populations less than 50,000.

¹⁹ See U.S. Census Bureau, 2012 Census of Governments, Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01>. There were 12,184 independent school districts with enrollment populations less than 50,000.

²⁰ See U.S. Census Bureau, 2012 Census of Governments, Special District Governments by Function and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG09.US01>. The U.S. Census Bureau data did not provide a population breakout for special district governments.

²¹ See U.S. Census Bureau, 2012 Census of Governments, County Governments by Population-Size Group and State: 2012 - United States-States - <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG06.US01>; Subcounty General-Purpose Governments by Population-Size Group and State: 2012 - United States–States - <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG07.US01>; and Elementary and Secondary School Systems by Enrollment-Size Group and State: 2012 - United States-States. <https://factfinder.census.gov/bkmk/table/1.0/en/COG/2012/ORG11.US01>. While U.S. Census Bureau data did not provide a population breakout for special district governments, if the population of less than 50,000 for this category of local government is consistent with the other types of local governments the majority of the 38, 266 special district governments have populations of less than 50,000.

²² *Id.*

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1. Telecommunications Service Providers

a. Wireless Telecommunications Providers

8. Pursuant to 47 CFR § 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. *All Other Telecommunications.* The "All Other Telecommunications" category is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation.²³ 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.²⁴ Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry.²⁵ The SBA has developed a small business size standard for All Other Telecommunications, which consists of all such firms with annual receipts of \$ 32.5 million or less.²⁶ For this category, U.S. Census Bureau data for 2012 shows that there were 1,442 firms that operated for the entire year.²⁷ Of those firms, a total of 1,400 had annual receipts less than \$25 million and 42 firms had annual receipts of \$25 million to \$49, 999,999.²⁸ Thus, the Commission estimates that the majority of "All Other Telecommunications" firms potentially affected by our action can be considered small.

11. *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,²⁹ 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. 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

²³ See U.S. Census Bureau, 2017 NAICS Definitions, NAICS Code "517919 All Other Telecommunications", <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?input=517919&search=2017+NAICS+Search&search=2017>.

²⁴ *Id.*

²⁵ *Id.*

²⁶ See 13 CFR § 121.201, NAICS code 517919.

²⁷ U.S. Census Bureau, 2012 *Economic Census of the United States*, Table EC1251SSSZ4, Information: Subject Series - Estab and Firm Size: Receipts Size of Firms for the United States: 2012, NAICS code 517919, https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ4//naics~517919.

²⁸ *Id.*

²⁹ The service is defined in section 90.1301 *et seq.* of the Commission's Rules, 47 CFR § 90.1301 *et seq.*

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AWS-3 bands but proposes 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.³⁰

12. *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 NAICS Code category is Wired Telecommunications Carriers and under that size standard, such a business is small if it has 1,500 or fewer employees.³¹ U.S. Census Bureau data for 2012 indicate that 3,117 firms operated during that year.³² Of that number, 3,083 operated with fewer than 1,000 employees.³³ Based on these data, the Commission concludes that the majority of Competitive LECs, CAPs, Shared-Tenant Service Providers, and Other Local Service Providers, are small entities. 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.³⁴ Of these 1,442 carriers, an estimated 1,256 have 1,500 or fewer employees.³⁵ 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.³⁶ Also, 72 carriers have reported that they are Other Local Service Providers.³⁷ Of this total, 70 have 1,500 or fewer employees.³⁸ Consequently, based on internally researched FCC data, 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.

13. *Incumbent Local Exchange Carriers (LECs).* Neither the Commission nor the SBA has developed a small business size standard specifically for incumbent local exchange services. The closest

³⁰ See *Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, Report and Order, 18 FCC Rcd 25162, Appx. 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, Appx. C (2005); *Service Rules for Advanced Wireless Services in the 1915–1920 MHz, 1995–2000 MHz, 2020–2025 MHz and 2175–2180 MHz Bands; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, Notice of Proposed Rulemaking, 19 FCC Rcd 19263, Appx. B (2005); *Service Rules for Advanced Wireless Services in the 2155–2175 MHz Band*, Notice of Proposed Rulemaking, 22 FCC Rcd 17035, Appx. (2007).

³¹ See 13 CFR § 121.201. The Wired Telecommunications Carrier category formerly used the NAICS code of 517110. As of 2017 the U.S. Census Bureau definition shows the NAICS code as 517311 for Wired Telecommunications Carriers. See, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517311&search=2017>.

³² See U.S. Census Bureau, *2012 Economic Census of the United States*, Table No. EC1251SSSZ5, *Information: Subject Series - Estab & Firm Size: Employment Size of Firms: 2012* (517110 Wired Telecommunications Carriers). https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517110.s

³³ *Id.*

³⁴ See Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division, Trends in Telephone Service at Table 5.3 (Sept. 2010) (*Trends in Telephone Service*), https://apps.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf.

³⁵ *Id.*

³⁶ *Id.*

³⁷ *Id.*

³⁸ *Id.*

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applicable NAICS Code category is Wired Telecommunications Carriers.³⁹ Under the applicable SBA size standard, such a business is small if it has 1,500 or fewer employees.⁴⁰ U.S. Census Bureau data for 2012 indicate that 3,117 firms operated the entire year.⁴¹ Of this total, 3,083 operated with fewer than 1,000 employees.⁴² Consequently, the Commission estimates that most providers of incumbent local exchange service are small businesses that may be affected by our actions. According to Commission data, one thousand three hundred and seven (1,307) Incumbent Local Exchange Carriers reported that they were incumbent local exchange service providers.⁴³ Of this total, an estimated 1,006 have 1,500 or fewer employees.⁴⁴ Thus using the SBA's size standard the majority of incumbent LECs can be considered small entities.

14. *Narrowband Personal Communications Services.* Two auctions of narrowband personal communications services (PCS) licenses have been conducted. 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. Through these auctions, the Commission has awarded a total of 41 licenses, out of which 11 were obtained by small businesses.⁴⁵ 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.⁴⁶

15. *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.⁴⁷ The closest applicable SBA size standard is for Wireless Telecommunications Carriers (except Satellite), which is an entity employing no more than 1,500 persons.⁴⁸ U.S. Census Bureau data in this industry for 2012 show that there were 967 firms that operated for the entire year.⁴⁹ Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or

³⁹ See 13 CFR § 121.201. The Wired Telecommunications Carrier category formerly used the NAICS code of 517110. As of 2017 the U.S. Census Bureau definition shows the NAICS code as 517311 for Wired Telecommunications Carriers. See <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517311&search=2017>

⁴⁰ *Id.*

⁴¹ See U.S. Census Bureau, *2012 Economic Census of the United States*, Table No. EC1251SSSZ5, *Information: Subject Series - Estab & Firm Size: Employment Size of Firms: 2012* (517110 Wired Telecommunications Carriers). https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517110.

⁴² *Id.*

⁴³ 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*).

⁴⁴ *Id.*

⁴⁵ *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).

⁴⁶ See Letter from Aida Alvarez, Administrator, SBA, to Amy Zoslov, Chief, Auctions and Industry Analysis Division, Wireless Telecommunications Bureau, FCC (filed Dec. 2, 1998) (*Alvarez Letter 1998*).

⁴⁷ This service is governed by Subpart I of Part 22 of the Commission's Rules. See 47 CFR §§ 22.1001-22.1037.

⁴⁸ 13 CFR § 121.201, NAICS codes 517210.

⁴⁹ U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ5, *Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210* (rel. Jan. 8, 2016). https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~5172100.

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more.⁵⁰ Thus, under this SBA category and the associated small business size standard, the majority of Offshore Radiotelephone Service firms can be considered small. There are presently approximately 55 licensees in this service. However, the Commission is 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).

16. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment.⁵¹ 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.⁵² The SBA has established a small business size standard for this industry of 1,250 employees or less.⁵³ U.S. Census Bureau data for 2012 shows that 841 establishments operated in this industry in that year.⁵⁴ Of that number, 828 establishments operated with fewer than 1,000 employees, 7 establishments operated with between 1,000 and 2,499 employees and 6 establishments operated with 2,500 or more employees.⁵⁵ Based on this data, we conclude that a majority of manufacturers in this industry are small.

17. *Rural Radiotelephone Service.* The Commission has not adopted a size standard for small businesses specific to the Rural Radiotelephone Service.⁵⁶ A significant subset of the Rural Radiotelephone Service is the Basic Exchange Telephone Radio System (BETRS).⁵⁷ The closest applicable SBA size standard is for Wireless Telecommunications Carriers (except Satellite), which is an entity employing no more than 1,500 persons.⁵⁸ For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year.⁵⁹ Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more.⁶⁰ Thus under this category and the associated size standard, the Commission estimates that the majority of Rural Radiotelephone Services firm are small entities. There are approximately 1,000 licensees in the Rural

⁵⁰ *Id.* Available census data does 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 "1000 employees or more."

⁵¹ The NAICS Code for this service is 334220. 13 CFR § 121.201. *See also* U.S. Census Bureau, 2012 NAICS Definitions, "334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing" <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.334220#>.

⁵² *Id.*

⁵³ 13 CFR § 121.201, NAICS Code 334220.

⁵⁴ U.S. Census Bureau, 2012 *Economic Census of the United States*, Table EC1231SG2, Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2012, NAICS Code 334220, https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/31SG2//naics~334220.

⁵⁵ *Id.*

⁵⁶ The service is defined in 47 CFR § 22.99.

⁵⁷ BETRS is defined in 47 CFR §§ 22.757 and 22.759.

⁵⁸ 13 CFR § 121.201, NAICS codes 517210.

⁵⁹ U.S. Census Bureau, 2012 *Economic Census of the United States*, Table EC1251SSSZ5, Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210. https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

⁶⁰ *Id.* Available census data does 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 "1000 employees or more."

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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 proposed herein.

18. *Wireless Communications Services.* This service can be used for fixed, mobile, radiolocation, and digital audio broadcasting satellite uses. 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.⁶¹ The SBA has approved these small business size standards.⁶² In the Commission’s auction for geographic area licenses in the WCS there were seven winning bidders that qualified as “very small business” entities, and one that qualified as a “small business” entity.

19. *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 services, paging services, wireless internet access, and wireless video services.⁶³ The appropriate size standard under SBA rules is that such a business is small if it has 1,500 or fewer employees.⁶⁴ For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year.⁶⁵ Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more.⁶⁶ Thus under this category and the associated size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities.

20. *Wireless Telephony.* Wireless telephony includes cellular, personal communications services, and specialized mobile radio telephony carriers. The closest applicable SBA category is Wireless Telecommunications Carriers (except Satellite)⁶⁷ and the appropriate size standard for this category under the SBA rules is that such a business is small if it has 1,500 or fewer employees.⁶⁸ For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year.⁶⁹ Of this total, 955 firms had fewer than 1,000 employees and 12 firms had 1000 employees

⁶¹ *Amendment of the Commission’s Rules to Establish Part 27, the Wireless Communications Service (WCS)*, Report and Order, 12 FCC Rcd 10785, 10879, para. 194 (1997).

⁶² See Letter from Aida Alvarez, Administrator, SBA, to Amy Zoslov, Chief, Auctions and Industry Analysis Division, Wireless Telecommunications Bureau, FCC (filed Dec. 2, 1998) (*Alvarez Letter 1998*).

⁶³ U.S. Census Bureau, 2012 NAICS Definitions, “517210 Wireless Telecommunications Carriers (Except Satellite),” See <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.517210>.

⁶⁴ 13 CFR § 121.201, NAICS code 517210.

⁶⁵ U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ5, Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210. https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

⁶⁶ *Id.* Available census data does 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 “1000 employees or more.”

⁶⁷ 13 CFR § 121.201, NAICS code 517210.

⁶⁸ *Id.*

⁶⁹ U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1251SSSZ5, Information: Subject Series: Estab and Firm Size: Employment Size of Firms for the U.S.: 2012 NAICS Code 517210 (rel. Jan. 8, 2016). https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/51SSSZ5//naics~517210.

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or more.⁷⁰ Thus under this category and the associated size standard, the Commission estimates that a majority of these entities can be considered small. According to Commission data, 413 carriers reported that they were engaged in wireless telephony.⁷¹ Of these, an estimated 261 have 1,500 or fewer employees and 152 have more than 1,500 employees.⁷² Therefore, more than half of these entities can be considered small.

21. *700 MHz Guard Band Licensees.* In 2000, 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.⁷³ 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.⁷⁴ 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.⁷⁵ SBA approval of these definitions is not required.⁷⁶ An auction of 52 Major Economic Area licenses commenced on September 6, 2000, and closed on September 21, 2000.⁷⁷ 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 on February 13, 2001, and closed on February 21, 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.⁷⁸

⁷⁰ *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 “1000 employees or more.”

⁷¹ See Federal Communications Commission, Wireline Competition Bureau, Industry Analysis and Technology Division, Trends in Telephone Service at Table 5.3 (Sept. 2010) (*Trends in Telephone Service*), https://apps.fcc.gov/edocs_public/attachmatch/DOC-301823A1.pdf.

⁷² *Id.*

⁷³ See *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) (*746–764 MHz Band Second Report and Order*). 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).

⁷⁴ See *id.* at 5343, para. 108.

⁷⁵ See *id.*

⁷⁶ See *id.* at 5343, para. 108 n.246 (for the 746–764 MHz and 776–794 MHz bands, the Commission is exempt from 15 U.S.C. § 632, which requires Federal agencies to obtain SBA approval before adopting small business size standards).

⁷⁷ See *700 MHz Guard Bands Auction Closes: Winning Bidders Announced*, Public Notice, 15 FCC Rcd 18026 (WTB 2000).

⁷⁸ See *700 MHz Guard Bands Auction Closes: Winning Bidders Announced*, Public Notice, 16 FCC Rcd 4590 (WTB 2001).

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22. *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.⁷⁹ The Commission defined a “small business” as an entity that, together with its affiliates and controlling principals, has average gross revenues not exceeding \$40 million for the preceding three years.⁸⁰ 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.⁸¹ 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.⁸² The SBA approved these small size standards.⁸³ 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)) commenced on August 27, 2002, and closed on September 18, 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 a total of 329 licenses.⁸⁴ A second auction commenced on May 28, 2003, closed on June 13, 2003, and included 256 licenses: 5 EAG licenses and 476 Cellular Market Area licenses.⁸⁵ Seventeen winning bidders claimed small or very small business status and won 60 licenses, and nine winning bidders claimed entrepreneur status and won 154 licenses.⁸⁶ On July 26, 2005, the Commission completed an auction of 5 licenses in the Lower 700 MHz band (Auction No. 60). There were three winning bidders for five licenses. All three winning bidders claimed small business status.

23. In 2007, the Commission reexamined its rules governing the 700 MHz band in the *700 MHz Second Report and Order*.⁸⁷ An auction of 700 MHz licenses commenced January 24, 2008, and closed on March 18, 2008, which included: 176 Economic Area licenses in the A-Block, 734 Cellular Market Area licenses in the B-Block, and 176 EA licenses in the E-Block.⁸⁸ Twenty winning bidders,

⁷⁹ 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*).

⁸⁰ See *id.* at 1087-88, para. 172.

⁸¹ See *id.*

⁸² See *id.*, at 1088, para. 173.

⁸³ See Letter from Aida Alvarez, Administrator, SBA, to Amy Zoslov, Chief, Auctions and Industry Analysis Division, Wireless Telecommunications Bureau, FCC (filed Dec. 2, 1998) (*Alvarez Letter 1998*).

⁸⁴ See *Lower 700 MHz Band Auction Closes*, Public Notice, 17 FCC Rcd 17272 (WTB 2002).

⁸⁵ See *id.*

⁸⁶ See *id.*

⁸⁷ *Service Rules for the 698–746, 747–762 and 777–792 MHz Band; Revision of the Commission’s Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems; Section 68.4(a) of the Commission’s Rules Governing Hearing Aid-Compatible Telephones; Biennial Regulatory Review—Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services; Former Nextel Communications, Inc. Upper 700 MHz Guard Band Licenses and Revisions to Part 27 of the Commission’s Rules; Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band; Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communications Requirements Through the Year 2010; Declaratory Ruling on Reporting Requirement under Commission’s Part 1 Anti-Collusion Rule*, WT Docket Nos. 07-166, 06-169, 06-150, 03-264, and 96-86, PS Docket No. 06-229, CC Docket No. 94-102, Second Report and Order, 22 FCC Rcd 15289, 15359 n.434 (2007) (*700 MHz Second Report and Order*).

⁸⁸ See *Auction of 700 MHz Band Licenses Closes*, Public Notice, 23 FCC Rcd 4572 (WTB 2008).

(continued....)

claiming 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) won 49 licenses. Thirty-three 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) won 325 licenses.

24. *Upper 700 MHz Band Licenses.* In the *700 MHz Second Report and Order*, the Commission revised its rules regarding Upper 700 MHz licenses.⁸⁹ 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.⁹⁰ 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.

25. *Wireless Resellers.* The SBA has not developed a small business size standard specifically for Wireless Resellers. The SBA category of Telecommunications Resellers is the closest NAICS code category for wireless resellers.⁹¹ The Telecommunications Resellers industry comprises establishments engaged in purchasing access and network capacity from owners and operators of telecommunications networks and reselling wired and wireless telecommunications services (except satellite) to businesses and households.⁹² Establishments in this industry resell telecommunications; they do not operate transmission facilities and infrastructure. Mobile virtual network operators (MVNOs) are included in this industry.⁹³ Under the SBA's size standard, such a business is small if it has 1,500 or fewer employees.⁹⁴ U.S. Census Bureau data for 2012 show that 1,341 firms provided resale services for the entire year.⁹⁵ Of that number, all operated with fewer than 1,000 employees.⁹⁶ Thus, under this category and the associated small business size standard, the majority of these resellers can be considered small entities. According to Commission data, 213 carriers have reported that they are engaged in the provision of local resale services.⁹⁷ Of these, an estimated 211 have 1,500 or fewer employees.⁹⁸ Consequently, the Commission estimates that the majority of Wireless Resellers are small entities.

b. Equipment Manufacturers

26. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* This industry comprises establishments primarily engaged in manufacturing radio and

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

⁹⁰ *See Auction of 700 MHz Band Licenses Closes*, Public Notice, 23 FCC Rcd 4572 (WTB 2008).

⁹¹ *See* 13 CFR § 121.201; NAICS Code 517911.

⁹² U.S. Census Bureau, *North American Industry Classification System, 2017 NAICS Definition, 517911 Telecommunications Resellers*, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517911&search=2017> (last visited Dec. 7, 2018).

⁹³ *Id.*

⁹⁴ 13 CFR § 121.201; NAICS Code 517911.

⁹⁵ *See* U.S. Census Bureau, *North American Industry Classification System, 2017 NAICS Definition, 517911 Telecommunications Resellers*, <https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517911&search=2017> (last visited Dec. 7, 2018).

⁹⁶ *Id.*

⁹⁷ *See Trends in Telephone Service*, at tbl. 5.3.

⁹⁸ *Id.*

(continued....)

television broadcast and wireless communications equipment.⁹⁹ 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.¹⁰⁰ The SBA has established a size standard for this industry of 1,250 employees or less.¹⁰¹ U.S. Census data for 2012 shows that 841 establishments operated in this industry in that year.¹⁰² Of that number, 828 establishments operated with fewer than 1,000 employees, 7 establishments operated with between 1,000 and 2,499 employees and 6 establishments operated with 2,500 or more employees.¹⁰³ Based on this data, we conclude that a majority of manufacturers in this industry can be considered small.

27. *Semiconductor and Related Device Manufacturing.* This industry comprises establishments primarily engaged in manufacturing semiconductors and related solid state devices.¹⁰⁴ Examples of products made by these establishments are integrated circuits, memory chips, microprocessors, diodes, transistors, solar cells and other optoelectronic devices.¹⁰⁵ The SBA has developed a small business size standard for Semiconductor and Related Device Manufacturing, which consists of all such companies having 1,250 or fewer employees.¹⁰⁶ U.S. Census Bureau data for 2012 show that there were 862 establishments that operated that year.¹⁰⁷ Of this total, 843 operated with fewer than 1,000 employees.¹⁰⁸ Thus, under this size standard, the majority of firms in this industry can be considered small.

⁹⁹ The NAICS Code for this service is 334220. 13 C.F.R 121.201. *See also* U.S. Census Bureau, 2012 NAICS Definitions, “334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing” <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.334220#>.

¹⁰⁰ The NAICS Code for this service is 334220. 13 CFR 121.201. *See also* U.S. Census Bureau, 2012 NAICS Definitions, “334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing” <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.334220#>.

¹⁰¹ 13 CFR § 121.201, NAICS Code 334220.

¹⁰² U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1231SG2, Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2012, NAICS Code 334220, https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/31SG2//naics~334220.

¹⁰³ http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_31SG2&prodType=table.

¹⁰⁴ *See* U.S. Census Bureau, 2017 NAICS Definition, NAICS Code 334413 “Semiconductor and related device Manufacturing,” <https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.xhtml?lang=en&type=ib&id=ib.en./ECN.NAICS2012.334413#>.

¹⁰⁵ *Id.*

¹⁰⁶ 13 CFR § 121.201.

¹⁰⁷ U.S. Census Bureau, *2012 Economic Census of the United States*, Table EC1231SG2, Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2012 https://factfinder.census.gov/bkmk/table/1.0/en/ECN/2012_US/31SG2//naics~334413.

¹⁰⁸ *Id.* Available census data does not provide a more precise estimate of the number of firms that have employment of 1,250 or fewer employees; the largest category provided is for firms with “1000 employees or more.”

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

28. The Notice proposes and seeks comment on a z-axis (vertical) location accuracy metric that will, if adopted, affect the reporting, recordkeeping and/or other compliance requirements of nationwide and non-nationwide CMRS providers, including small businesses. Under the current rules, by 2021, nationwide CMRS providers must deploy either (1) dispatchable location, or (2) z-axis technology that achieves the Commission-approved z-axis metric, which metric is yet to be adopted, in each of the top 25 CMAs. CMRS providers must deploy z-axis technology to cover 80 percent of the CMA population if z-axis technology is used. By 2021, nationwide CMRS providers must deploy dispatchable location or z-axis technology pursuant to the metric that will be adopted by the Commission in each of the top 50 CMAs. Non-nationwide carriers, including resellers, that serve any of the top 25 or 50 CMAs will have an additional year to meet the two benchmarks (i.e., until 2022 for the top 25 CMAs and 2024 for the top 50 CMAs). Thus, under the Commission's proposal, CMRS nationwide and non-nationwide CMRS providers that deploy z-axis technology will be required to provide vertical location information within three meters under the Commission's existing timelines.

29. We have tentatively concluded, based on the z-axis solution test results and other comments, that a metric of three meters for 80% of indoor calls is technically achievable and that z-axis solutions capable of meeting this metric can be deployed within the timeframes established in the rules. As described further below, we also have tentatively concluded that the cost of compliance with the three-meter metric is relatively low. Small entities may incur costs associated with software and/or hardware changes and may need to employ engineers or other experts in order to comply with the proposal in the *Notice*. However, the technology solution a small entity chooses to implement the requirement will determine the nature of the costs it incurs.

30. We anticipate that small entities would have a choice of vendors with z-axis technology solutions, which will lessen their costs to comply with the proposed rule, if adopted. One of the vendors that participated in Stage Z testing, NextNav, asserts that its z-axis solution requires only software changes to be made to each handset could be made available for a nominal cost that amounts to significantly less than a penny per month per handset. Another test vendor, Polaris, asserts that its solution is instantly available and deployable throughout a carrier's nationwide network. Polaris also asserts that its solution is "objectively affordable" because it is software-based, does not require hardware in networks or markets, and "does not require anything special in devices beyond implementation of adopted 3GPP and OMA standards." Further, with the addition of vertical location technologies and vendors into the market, small entities will have more implementation options, which could further reduce their cost of compliance. As noted above, Google has announced that it has developed and is deploying its Emergency Location System (ELS) in the U.S. for Android devices. Google states that ELS is "a supplemental service that sends enhanced location directly from Android handsets to emergency services when an emergency call is placed." Google also states that ELS is part of the Android operating system and does not require any special hardware or updates. Moreover, as the Commission noted in the *Fourth Report and Order*, we continue to expect that these technology costs will decline as demand grows.

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

31. The RFA requires an agency to describe any significant 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) an exemption from coverage of the rule, or any part thereof, for small entities.¹⁰⁹

32. Based on a comparison of the benefits and costs to alternatives metrics, the Commission believes that the three-meter metric that it proposes to adopt is the most cost-effective option for achieving the Commission's objectives in this proceeding while avoiding undue burdens on all entities. The metric should benefit all entities by giving certainty in selecting an option for complying with the Commission's rules. While the rule proposed in the *Notice* would apply to all nationwide and non-nationwide CMRS in the same manner, the Commission has already taken steps to accommodate smaller non-nationwide CMRS providers by supplying additional time to comply with any vertical location accuracy benchmarks ultimately adopted by the Commission. The rules also already establish that nationwide and non-nationwide CMRS providers may choose to provide dispatchable location or deploy z-axis technology; and they give non-nationwide CMRS providers an additional year to comply with the Commission's z-axis benchmarks. In addition, the proposed rule gives small entities the freedom to choose a solution that best fits their financial situation, rather than imposing a specific z-axis technology solution, which should minimize the economic impact on these entities. The Commission does not believe that the costs and/or administrative burdens associated with the proposed rule would unduly burden small entities and expects to more fully consider the economic impact and alternatives for small entities following the review of comments filed in response to the Notice. The metric the Commission proposes to adopt should benefit all entities by giving certainty in selecting an option for complying with the Commission's rules. Many CMRS providers likely would be able to avoid unnecessary costs by knowing that the Commission has chosen an accuracy metric of three meters, which means they don't have to make an expensive attempt to satisfy a two-meter metric by the implementation date specified in the rules. All CMRS providers, including small entities, should benefit from the scale economies provided to phone manufacturers who would be able to provision all phones to the same three-meter standard adopted by the Commission.

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

33. None.

¹⁰⁹ See 5 U.S.C. § 603(c)(1)-(4).