FEDERAL COMMUNICATIONS COMMISSION

47 CFR Part 9

[PS Docket No. 07–114; FCC 19–124; FRS 16358]

Wireless E911 Location Accuracy Requirements

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: In this document, the Federal Communications Commission (the FCC or Commission) adopts a z-axis (vertical) location accuracy metric of plus or minus 3 meters for 80 percent of indoor wireless E911 calls for z-axis capable handsets. The Commission also requires nationwide commercial mobile radio service (CMRS) providers to deploy dispatchable location or z-axis technology that meets this metric in the top 25 markets by April 3, 2021 and in the top 50 markets by April 3, 2023. The Commission also extends privacy protections to z-axis data conveyed with 911 calls.

DATES:

Effective date: March 16, 2020.

Compliance date: Compliance will not be required for § 9.10(i)(2)(ii)(C) and (D), (i)(4)(v), and (j)(4) until the Commission publishes a document in the **Federal Register** announcing the compliance date.

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SUPPLEMENTARY INFORMATION: This is a summary of the Commission's Fifth Report and Order, FCC 19–124, adopted on November 22, 2019 and released on November 25, 2019. The complete text of this document is available for inspection and copying during normal business hours in the FCC Reference Information Center, Portals II, 445 12th Street SW, Room CY–A257, Washington, DC 20554. To request materials in accessible formats for people with disabilities (Braille, large print, electronic files, audio format), send an email to *FCC504@fcc.gov* or call the Consumer & Governmental Affairs Bureau at (202) 418–0530 (voice), (202) 418–0432 (TTY). The complete text of the order also is available on the Commission's website at *http://www.fcc.gov.*

Synopsis

I. Introduction

1. All Americans using mobile phones—whether they are calling from urban or rural areas, buildings or outdoor venues—should have the capability to dial 911 and receive the support they need in times of an emergency. Consumers make 240 million calls to 911 each year, and in many areas 80% or more of these calls are from wireless phones. While advances in technology have improved the overall ability of first responders to locate 911 callers, challenges remain particularly for locating 911 callers in multi-story buildings.

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 adopt 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. This action will more accurately identify the floor level for most 911 calls, reduce emergency response times, and save lives.

II. Background

3. The Commission has been working with the public safety community and industry partners to ensure the accurate delivery of 911 vertical location information for the better part of a decade. In 2011, the Commission tasked the Communications Security, Reliability, and Interoperability Council (CSRIC) with testing indoor location accuracy technologies, including barometric pressure sensors, in a test bed. CSRIC conducted tests on a variety of technologies in 2012, and the results showed that at least one vendor—NextNav LLC (NextNav)—could locate a caller's vertical location within 3 meters more than 67% of the time in dense urban, urban, and rural morphologies. 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. Accordingly, in 2014, 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 2015, the Commission adopted rules for improving E911 wireless location accuracy. Under these rules, CMRS providers must meet a series of accuracy benchmarks by either conveying dispatchable location (*e.g.,* street address, floor level, and office or apartment number) or coordinate-based location information to the appropriate PSAP. For vertical location, the Commission required wireless providers to provide either dispatchable location using the National Emergency Address Database (NEAD) or vertical (z-axis) location information in compliance with the FCC-approved metric. If dispatchable location is used, there must be a density of NEAD reference points distributed throughout the cellular market area (CMA) equivalent to 25% of the population in that CMA. If z-axis location technology is used, it must be deployed to cover 80% of the CMA population. Nationwide CMRS providers must meet these benchmarks in each of the top 25 CMAs by April 3, 2021 and in each of the top 50 CMAs by April 3, 2023. Non-nationwide CMRS providers that serve any of the top 25 or 50 Cellular Market Areas have an additional year to meet these benchmarks. In addition, the Commission required the nationwide CMRS providers to test and develop a proposed z-axis accuracy metric and submit the proposed metric to the Commission for approval by August 3, 2018.

5. 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. 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. Two vendors, NextNav and Polaris Wireless, Inc. (Polaris), participated in Stage Z. 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. 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.''

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

7. In March 2019, the Commission released the Fourth Further Notice of Proposed Rulemaking (Fourth Further NPRM) in this proceeding (84 FR 13211 (April 4, 2019)). There, we proposed a z-axis metric of 3 meters relative to the handset for 80% of indoor wireless E911 calls for each of the benchmarks and geographic requirements previously established in the Commission's E911 wireless location accuracy rules. Based on existing test data from the two vendors that participated in the industry test bed, we tentatively concluded that achieving this standard was technically feasible. We also tentatively concluded that unlike the 5-meter standard originally proposed by the wireless carriers, a 3-meter standard would provide sufficient accuracy to identify the caller's floor level in most cases. We sought comment on adopting a stricter 2-meter metric but tentatively concluded that it was not yet technically achievable on a consistent basis, although it could become achievable in the longer term as technology continues to evolve.

8. In response to the Fourth Further NPRM, the Commission received 20 comments and 11 reply comments, filed by public safety entities, vendors, wireless carriers, technology companies, and industry associations.

III. Fifth Report and Order

9. We adopt a 3-meter z-axis 911 location accuracy metric to be implemented by the April 2021 and 2023 vertical accuracy deadlines as proposed in the Fourth Further NPRM. Numerous commenters, including public safety entities, vendors, and carriers, agree that implementing the proposed 3-meter metric within existing timelines will benefit public safety and is technically feasible. Although some industry commenters contend that we should take a phased approach or delay adopting a metric pending further testing, and some public safety commenters advocate adopting stricter accuracy standards for the 2021 and 2023 deadlines, we find these arguments unpersuasive.

A. The 3-Meter Metric

10. We agree with commenters who conclude that a 3-meter metric will bring real public safety benefits to the American public and is technically feasible in the near term. A broad cross-section of public safety commenters agree that, in the near term, a 3-meter metric will meet public safety needs and will provide actionable information to first responders. Public safety organizations in support of the 3-meter metric include the International Association of Fire Chiefs (IAFC), the International Association of Chiefs of Police (IACP), the National Association of State EMS Officials (NASEMSO), the National Sheriffs' Association (IAFC et al.); International Association of Fire Fighters (IAFF); NENA: The 9–1–1 Association (NENA); State of Florida Department of Management Services, Division of Telecommunications, Bureau of Public Safety (Florida); and Texas 9–1–1 Alliance, the Texas Commission on State Emergency Communications (CSEC), and the Municipal Emergency Communication Districts Association (Texas 911 Entities). The Boulder Emergency Telephone Service Authority (BRETSA) notes that ''floor-level accuracy is a critical objective, and 3-meter accuracy is floor level accuracy.'' The International Association of Fire Fighters states that the Commission was ''correct in concluding that a 3 meters vertical accuracy requirement 'will significantly narrow the scope of the search and can provide a reasonable basis for identifying the correct floor in most cases.' '' For example, in-building tests that International Association of Fire Fighters conducted in July 2014 using NextNav technology showed significant improvement in search time compared to searching without any vertical location information component. The International Association of Fire Fighters asserts that ''vertical altitude information can provide a substantial improvement in search effectiveness in multistory structures, even without a precise floor number or a dispatchable address.'' Texas 911 Entities supports immediate adoption of a 3-meter metric on the grounds that ''the 'perfect' should not be the enemy of the 'good.' '' The International Association of Fire Chiefs similarly supports adopting a 3 meter metric and then narrowing the metric ''over a timeframe as technology develops.''

11. What is more, we find that implementing the 3-meter metric on schedule is technically feasible. Two vendors have consistently shown in testing that they can meet or surpass this standard. Since 2012, NextNav has repeatedly achieved 3-meter accuracy in multiple independently-conducted tests. In the Stage Z test bed, NextNav's technology was accurate within 1.8 meters or better for 80% of indoor fixes and 3 meters or better for 94% of indoor fixes. In other words, NextNav's technology is capable of ''consistent performance within an accuracy metric of 3 meters or less.''

12. Polaris too can achieve accuracy within 2.8 meters for 80% of test calls by using additional available location data to recalibrate and refine its Stage Z data. Although Polaris did not employ active calibration of the barometric sensors during Stage Z testing, the Stage Z Report acknowledges that the test results for Polaris ''may underestimate the performance results that might be achieved'' if a calibration approach had been employed. We agree with Polaris that its technology can deliver 3-meter accuracy, and with NextNav that ''the Stage Z test process confirmed, once again, that existing location technologies available from multiple vendors can reliably achieve floor level vertical accuracy within +/− 3 meters for at least 80 percent of indoor wireless calls to E911 emergency services.''

13. The record suggests that other technological options for vertical location accuracy are emerging, and that, as T-Mobile describes, the market is driving innovation in location accuracy technology for E911. Airwave Developers LLC (AWD) submits that Citizens Broadband Radio Service (CBRS) technology low cost antennas installed on each floor of a building will generate data allowing for the PSAP to pinpoint the floor from which the wireless call was made. In 2018, CTIA announced nationwide wireless providers AT&T, Sprint, T-Mobile and Verizon were adding new location-based tools with existing wireless 9–1–1 location technologies by the end of that year. Two device based approaches are Apple's delivery of Hybridized Emergency Location (HELO) data and Google's Android Emergency Location Service (ELS). Apple has announced that it will use new technology to quickly and securely share Hybridized Emergency Location information with 911 call centers. The HELO ''solution has offered z- axis estimates and uncertainties beginning in 2013, and those estimates have been consumed by carriers since its first adoption in 2015.'' Apple has committed to improving its vertical, as well as horizontal, location accuracy and will participate in CTIA's

z-axis testing by the end of 2020. Google in turn has described its Emergency Location Service solution, which can record and report z-axis information, as a feature fully integrated in the operating system on 99% of Android handsets that makes handset location known when the user initiates an emergency call or text. Google plans to test the vertical accuracy capabilities of its Emergency Location Service solution in Stage Za. In short, companies are actively exploring new types of cellular air interfaces for location accuracy ''including 5G interfaces, additional satellite constellations, and other wireless infrastructure, such as Wi-Fi access points, Bluetooth beacons and small cells, as well as information provided by sensors within today's smartphones.''

14. We further conclude that adopting the 3-meter metric will keep deployment of z-axis information to public safety officials on schedule. Public safety commenters support the current 2021 and 2023 deadlines for applying the z-axis metric and oppose delay for further testing. The International Association of Fire Fighters finds it ''inconceivable . . . that either the Commission or the public safety community would allow themselves to get this close to achieving a historic benefit in the capabilities of emergency services and so much as hesitate in taking the next step.'' BRETSA maintains that ''[a]doption of a vertical location standard will benefit the public'' and ''additional testing should not delay provision of the public benefit.'' Vendors also support adoption of a z-axis metric without further delay. NextNav states ''[n]ot only would further delay pose a continued risk to public safety, but it is also unclear whether it would appreciably improve the information that is currently available to the Commission.'' AWD notes that current technology is able to meet the 3-meter metric.

15. We disagree with commenters that raise a number of objections. To start, we disagree with commenters like Google, who argue for a ''phased'' approach that would involve setting a 4-meter metric initially and tightening the metric to 3 meters by 2023. Google argues that ''[w]hile major progress has been made, consensus has not been reached on the appropriate z-axis metric, and the full capabilities of alternative technologies cannot yet be determined,'' so that a phased approach would ''better reflect[ ] the current abilities and future promise of vertical location technologies.'' We believe sufficient testing that has already occurred and that the technology trends that Google itself cites validate our conclusion that 3 meters is already technically feasible and provides the appropriate metric for the development of alternative new technologies.

16. Similarly, we disagree with commenters who ask us to delay action for further testing. To start, we note that these arguments ring hollow when several CMRS providers—those who bear direct responsibility for complying with the 3-meter metric on schedule—are on record as supporting adoption of the 3-meter metric without further testing. For example, AT&T favors the Commission's proposal because ''it will give the industry certainty and advance the development process necessary to meet the 2021 and 2023 vertical location accuracy benchmarks in the Fourth Report & Order [80 FR 11806 (March 4, 2015)].'' CTIA reiterates that it supports the proposed z-axis metric without changes, having previously stated that ''[t]he Fourth Further [NPRM] offers a reasoned approach to the definition of floor level accuracy as part of the proposed z-axis metric: within 3 meters above or below the vertical location provided by the phone.'' And Verizon supports the Commission's proposed metric, stating that it is ''a good target for 9–1–1 calls from devices with the necessary capability.'' Google also supports a 3 meter metric and asks that our approach remain technology neutral so that CMRS providers may select the technology to meet their location accuracy obligations.

17. More specifically, we disagree with Google and Qualcomm that there has been insufficient testing of barometric sensor-based technologies in extreme cold-weather conditions. Although CTIA and Qualcomm note that NextNav was unable to participate in Stage Z winter testing in Chicago, we do not consider this to be sufficient reason to delay our decision. Polaris did participate in Stage Z winter testing in Chicago and achieved results that were comparable to the results it achieved in the other test bed locations in more moderate weather conditions. Moreover, as BRETSA states, ''[e]ven if vertical location results would be less accurate during episodes of climactic extremes; that cannot justify delaying adoption of a standard and deployment of vertical location technologies which have been proven in common weather conditions.'' Finally, despite its own complaints about a lack of cold weather data, CTIA waited to conduct Stage Za testing to conclude in late 2019, so it will be unable to provide winter test data for at least another year. We cannot accept such a long delay in adopting a metric, given that two vendors can meet the metric and there are emerging device-based solutions.

18. We disagree with Google that additional testing is needed in rural morphologies. The rural morphology is ''the sparsest environment overall'' and is mostly residential, with most structures between 1 and 2 stories high. As Verizon notes, urban areas are important for vertical location accuracy because ''[i]t is in these areas where multi-story buildings are concentrated, so service providers should focus their deployments on urban and dense urban areas within the covered CMAs.'' In these morphologies, the test bed shows that NextNav's solution would meet a 3-meter metric. 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. In the Addendum to the Stage Z Report, Polaris explains that its results in all morphologies would fall below 3 meters had it used limited active calibration during the Stage Z test. The Stage Z Test Report acknowledges that Polaris did not employ continuous calibration during the test and that Polaris' results ''may underestimate the performance results that might be achieved using an effective continuous (background) calibration algorithm for each individual mobile device.''

19. We also disagree with Apple's suggestion that we should delay action based on concerns that the test bed did not adequately test z-axis solutions under real-world conditions. Apple states that results were obtained in the test bed ''only under conditions that deviate significantly from realistic user patterns and constraints'' and ''do not necessarily mean that a ±3 meter accuracy metric is achievable by April 2021 in real-world circumstances.'' In fact, the testing was conducted in multiple regions, morphologies, and building configurations in order to assess how z-axis technology would perform in a variety of real-world environments. Test bed procedures were based on the recommendations of the Commission's fourth Communications, Security, Reliability & Interoperability Council (CSRIC IV), and testing followed guidelines developed by the Alliance for Telecommunications Industry Solutions' (ATIS) Emergency Services Interconnection Forum (ESIF), including ESIF's Emergency Services and Methodologies (ESM) subcommittee. As the Stage Z Test Report states, ''ATIS provided guidelines on test building and test point selection and oversaw implementation of the Test Bed by the

Administrator-Executor. In addition, Test Bed, LLC receives guidance from the TAC, which includes representatives of the nationwide wireless service providers, as well as the Association of Public-Safety Communications Officials International (APCO) and the National Emergency Number Association (NENA).'' Although it is not possible for any test bed to replicate every conceivable real world scenario, we find the test bed results to be sufficiently representative and robust to support our establishment of the 3-meter metric. We also agree with NextNav that ''not only would further delay pose a continued risk to public safety, but it is also unclear whether it would appreciably improve information that is currently available to the Commission.''

20. We also disagree with T-Mobile that further testing is first needed with a wider variety of handsets, including older handsets. NextNav and Polaris each tested six handsets, for a total of twelve handsets, in Stage Z. These handsets were selected by the test bed administrator, not the vendors, and the Report states that they were selected ''to ensure variety between sensor manufacturers, the age of handsets (within limits) and their overall use characteristics.'' 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. Thus, we adopt our tentative conclusion from the Fourth Further NPRM that a sufficient variety of devices have been tested to support moving forward with our proposed 3-meter metric at this time.

21. We also decline to adopt a 2-meter metric, as suggested by BRETSA, at this time. The record confirms that a 2-meter metric is not technically feasible under the existing timelines, although it may become achievable in the long term as technology continues to evolve.

22. Finally, we need not address APCO's suggestion in its comments that the Commission proceed without adopting a metric. In a recent ex parte filing, APCO stated that based on the record and its discussions with stakeholders, it ''does not recommend that the Commission decline to adopt a z-axis metric altogether.'' APCO's revised position aligns with the views of all other public safety commenters that adopting a z-axis metric remains an essential measure to ensure that first responders receive important location information when providing dispatchable location is not feasible. We agree.

B. Deployment

23. In the Fourth Further NPRM, we proposed that the 3-meter z-axis metric apply to 80% of calls from all handsets, *i.e.,* that to comply with the metric, z-axis technologies would have to be demonstrated in the test bed to provide 3-meter accuracy for 80% of wireless calls. We asked whether applying the metric to 80% of wireless calls was appropriate, and if not, what percentage of calls would be appropriate. We also noted that CTIA had proposed that its 5-meter metric apply only to ''mobile devices capable of delivering barometric pressure sensor-based altitude estimates.'' We asked whether the z-axis metric should only be applied to devices with barometric pressure sensors, or to devices manufactured after a date certain, or whether it should apply to all handsets, as we proposed. We observed that 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. We observed that 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 sought comment on this assessment and its underlying factual assumptions. We also sought 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.

24. As proposed, we apply the 3-meter accuracy metric to 80% of wireless E911 calls. This is consistent with our approach to E911 horizontal accuracy, which requires wireless carriers to meet horizontal accuracy requirements for 80% of calls by April 2021. Thus, as the basis for validation of any z-axis technology, we require wireless carriers to demonstrate in the test bed that the technology achieves 3-meter accuracy for 80% of wireless E911 calls.

25. We also conclude that application of the 3-meter metric should apply to all handsets that have the capability to support vertical location, regardless of technology, not just new handsets or barometric pressure sensor capable handsets. We thus clarify that a device will be considered ''z-axis capable'' so long as it can measure and report vertical location without a hardware upgrade. Thus, devices that can be modified to support vertical location by means of a firmware or software upgrade will be considered z-axis capable. This definition makes clear that any device technically capable of measuring and reporting vertical location information without a change in hardware must be enabled to do so—and actions by carriers, device manufacturers, operating system providers, chipmakers, or z-axis vendors that would prohibit technically capable devices from actually and effectively measuring and reporting z-axis information put the public and emergency personnel at unacceptable risk. We expect to closely monitor the roll-out of z-axis capable devices to the American public over the next two years and take all appropriate action against any company that obstructs the effective deployment of such technologies in a timely manner.

26. The record reflects that z-axis capable devices are widely available. NENA concludes that ''it is safe to assume that a comparatively small portion of modern phones lack [barometric pressure] sensors.'' NENA also states that market trends suggest an increase in barometric pressure sensor prevalence ''as applications such as fitness apps and small electronic devices like standalone GPS and fitness trackers increasingly incorporate altitude measurements, driving incentives to include [barometric pressure] sensor hardware.'' As Google points out, the Fourth Report & Order ''established benchmarks and timetables clear enough to signal that development of z-axis capability should be a top priority.'' Google states that ''industry has risen to the challenge with manifold options to enable z-axis capability,'' including the barometric pressure sensor-based solutions developed by NextNav and Polaris and ''handset-based solutions like ELS [that] have been widely deployed around the world.'' Google credits this rapid and widespread availability of z-axis capable devices to the Commission's flexible and evolutionary approach to location accuracy.

27. What is more, both NextNav and Polaris have software-based solutions. Thus, if carriers choose either of these solutions, hardware upgrades to handsets are not required and solutions can be implemented by means of software modifications that are readily achievable ahead of the 2021 deadline. The record describes scalable methods of implementation for barometric-based solutions that do not require hardware changes.'' As Polaris states, ''[o]ne method is to implement adopted 3GPP [3rd Generation Partnership Project] and OMA [Open Mobile Alliance] standards for barometric compensation'' which is

a ''firmware-based approach [that] is achievable through cooperation among carriers, device manufacturers, and chipmakers.'' Another method Polaris describes is to ''place necessary functionality on devices,'' which is a ''software-based approach [that] is achievable through cooperation among carriers, location vendors, and device Operating System providers.'' Polaris maintains that it ''can support a variety of implementation methodologies and remains committed to work with carriers and other involved parties to implement any agreed upon methodology.'' NextNav also states handsets can be made z-axis compliant with over-the-air updates.

28. We disagree with some commenters that suggest that old handsets should be categorically excluded from the rules; they do not propose or provide a clear rationale for a specific cutoff. Instead, we apply the metric to all z-axis capable devices, as supported by commenters like AT&T.

29. We also disagree with CTIA who suggests we apply the metric only to devices ''equipped with barometers and any other functionality necessary to support barometric pressure-based altitude estimation solutions.'' As APCO argues, this approach would violate the principle of technological neutrality. We have previously recognized that no single technological approach will solve the challenge of indoor location, and we have consistently favored technologically neutral rules ''so that providers can choose the most effective solutions from a range of options.'' Although both technologies tested in Stage Z relied on barometric pressure sensor capable handsets, and it is possible that the carriers could adopt barometric-based solutions exclusively, other vertical location technologies may develop that do not require a barometric sensor in the handset. In fact, Google has stated that its Stage Z testing will include solutions that do not use barometric pressure sensors. Therefore, in order to preserve the technological neutrality of the rules and encourage development of the broadest possible array of vertical location technologies, the metric will not be limited to barometric pressure sensor capable handsets.

30. Qualcomm and Google raise a concern that vertical location technology needs to be standardized so it can be ''economically implemented.'' However, Verizon states that ''extensive standardization work on vertical location solutions has already been completed,'' and further work is under way. Apple states that ''vertical location accuracy performance requirements should be evaluated in the context of solutions that must be implemented at large scale, subject to real world operational considerations,'' and ''[t]echnologies that depend on the deployment of new infrastructure in every major city to achieve even less-stringent performance metrics also raise significant questions about the viability of the tested approaches.'' BRETSA also comments that ''one would expect the accuracy of vertical location systems to improve as they are deployed ''at scale'' and additional experience with them is gained.'' We also recognize that if carriers use barometric sensor based solutions, they will depend to some extent on third parties to support proper installation and calibration of barometric sensors in user devices, and that solutions will only work if the systems are compatible and information is correctly relayed between providers, the handset and operating system providers, and the PSAPs. However, while we acknowledge CMRS providers' concerns about their ability to compel handset manufacturers and operating system providers to cooperate, we believe CMRS providers are capable of negotiating requirements with such third parties and establishing contractual timelines that will enable timely deployment of z-axis solutions in time to meet the deadlines in the rules. Moreover, the flexible, technology-neutral approach to location requirements adopted in this order removes uncertainty and will give carriers greater leeway to negotiate with competing vendors and to leverage location solutions already being developed by handset manufacturers and operating system providers.

C. Reporting Z-Axis Location Information

31. In the Fourth Further NPRM, we sought comment on how CMRS providers should report vertical location information, noting that several measurement methods exist. Specifically, we sought comment on whether reporting vertical location information as height above ground level (AGL) would be preferable to reporting height above mean sea level (MSL), and whether to require CMRS providers to use one measurement standard exclusively. We asked commenters to address whether CMRS providers should be required to identify the floor level when reporting z-axis information. Alternatively, we asked whether we should decline to specify this level of detail so that entities developing z-axis solutions have more flexibility.

32. We require CMRS providers to report z-axis information as Height Above Ellipsoid (HAE). In this regard, NENA and several other commenters point out that while vertical location information can be reported in multiple ways, *e.g.,* HAE, MSL, or AGL, global standards are being developed around the measurement of such information as a value in HAE in meters, as defined in the World Geodetic System 1984 (WGS–84). NENA notes that 3GPP is developing standards relating to representation of vertical location information that are based on HAE, and industry commenters generally agree with NENA that HAE has emerged as the globally recognized standard for generating z-axis measurements.

33. There is a general consensus around using HAE as the baseline for measuring vertical location, but we recognize that the issue of how vertical location information should be reported to PSAPs is complex. ATIS ESIF argues that individual PSAPs may have different requirements for the processing and formatting of vertical location information, and that CMRS providers should not be required to convert location data into multiple formats. ATIS, AT&T, and T-Mobile suggest that CMRS providers should be responsible only for providing raw location data that meets the z-axis metric, and that PSAPs should be responsible for translating that data into a floor number or other actionable information. APCO counters that PSAPs do not have the resources to convert raw z-axis data to a floor number, ''nor do they have three-dimensional maps to visualize raw z-axis information.'' APCO argues that PSAPs ''will be left without actionable vertical location information'' unless CMRS providers are required to convert z-axis data to a floor level that is reported to the PSAP.

34. In arguing for floor level, APCO says that the Commission should also require carriers to provide floor level identification. Given the need for timely deployment on our existing timeline, we disagree. While public safety commenters broadly support the delivery of floor level information, the record is clear that it is not now technically feasible to reliably convert z-axis information to an identified floor level. ATIS states that ''there currently exists no data source that correlates any form of z-axis data to a floor index or floor label.'' CTIA recognizes public safety's desire for the most actionable information, but states that it ''is not aware of any z-axis technology solutions that can produce specific floor level information.'' Apple observes ''that providing the ''floor level'' information

alongside a z-axis estimate would necessarily require information on the geodetic position of floors and knowledge of the labels applied to individual floors (*e.g.,* ''mezzanine'', ''courtyard''),'' and Apple is ''not aware of any sources for this information.'' Apple also states that it is ''unclear how uncertainty information could be effectively conveyed under such a regime,'' and that ''both horizontal and vertical uncertainty would be relevant to floor level information, as buildings implement floor levels in different ways.'' In support of its argument, APCO cites an academic paper and trade press reports on emerging floor level reporting technologies, stating that they prove providing floor level is already technically feasible. Other commenters take issue with APCO sources, and CTIA points out that APCO claims are not supported by testing. While the sources cited by APCO suggest potential floor level location solutions may be on the horizon, the record here reflects that such solutions are untested and not yet sufficiently mature to support a comprehensive floor level requirement. Further, as NENA and BRETSA recognize, floor heights are not standard and an authoritative database for the mapping of floors in a given building does not yet exist, while building characteristics themselves vary greatly and floor numbering is not always consistent. Verizon notes that ''floor level accuracy may depend at least in part on participation by not only service providers and vendors but third party building owners and tenants—which would have technical feasibility and jurisdictional implications beyond the scope of the rules contemplated in this proceeding based on test bed performance to date.''

35. Current vertical location technology does not support floor level identification, and some public safety commenters, including the International Association of Fire Fighters and the International Association of Fire Chiefs, state that, contrary to APCO's view, z-axis data can provide actionable information to first responders. As they put it: ''Unlike x/y data, which must be translated from lengthy coordinates to an approximate street address, Height Above Ellipsoid (HAE) altitude data is transmitted in digestible numbers, extending no more than two decimal points. While technologies exist that allow an Emergency Communications Center to translate vertical data from HAE to Height Above Ground Level, emergency responders can act upon the data when it is delivered in either format by simply matching altitude information on their own equipment using an HAE-capable application, device or dedicated wearable display.'' And other public safety organizations like NENA agree.

36. We agree and reject the notion that the only ''actionable'' data we can mandate today is a floor estimate. Many buildings, including the Commission's headquarters, have non-standard floor numbering schemes, which may not begin on Floor 1 but, instead, ''Lobby,'' ''Main,'' or ''Ground.'' Some buildings skip Floor 13. There is significant risk of error to solutions that assume ground-level floor numbers or standard floor numbering patterns. The record does not show that this risk can be mitigated sufficiently in the near-term such that we could proceed immediately with a decision that requires a floor-level solution. Besides, to first responders, a true height measurement may be more valuable than floor level information. Floors can collapse, rendering a floor estimate less useful. Floor numbering can be difficult to track in an emergency. First responders may not know on what floor they are entering a building, or they may become disoriented during a lengthy search. They may not know whether ''Floor X'' is above or below them, but by attaching a true height device to their gear, they may be able to learn how close they are to a victim as they approach the origin of a 911 call. This functionality may prove very useful to first responders who try to locate downed or disoriented teammates in an emergency. And a true height measurement is useful (unlike a floor estimate) to a first responder searching outside for a person in need of help.

37. For all these reasons, we decline to require CMRS providers to report floor level where it is not technically feasible to do so and instead require that they deliver z-axis information in HAE. However, we agree with Texas 911 Entities that in cases where the carrier has reliable information about the caller's floor level, they should provide it.

38. We require CMRS providers to deliver z-axis information in HAE, and we do not require CMRS providers to translate from HAE to other formats. The record suggests that translation mechanisms can be developed using HAE as a baseline reference, and that for the time being we should afford industry and public safety flexibility to develop solutions that are cost-effective for both sides. Finally, we agree with public safety commenters that providing a floor level is a priority and therefore seek comment below on the feasibility of ensuring emergency personnel have access to floor level information in the longer term.

D. Confidence and Uncertainty Data

39. In the Third Further NPRM in this proceeding (79 FR 17820 (March 28, 2014)), the Commission proposed to require provision of confidence and uncertainty data for the location information provided with all wireless 911 calls, whether outdoor or indoor, on a per-call basis at the request of a PSAP, with a uniform confidence level of 90%. The Commission anticipated that any requirements adopted regarding standardization of the delivery and format of confidence and uncertainty data would apply in conjunction with the delivery of both indoor and outdoor location information. In the Fourth Report and Order, the Commission adopted specific confidence and uncertainty requirements for horizontal (x- and y-axis) data for all wireless 911 calls. The rules require that the data specify ''[t]he caller's location with a uniform confidence level of 90 percent'' and ''[t]he radius in meters from the reported position at that same confidence level.'' Because the Fourth Report and Order deferred the adoption of a z-axis metric, it also deferred action on extending confidence and uncertainty requirements to z-axis data.

40. We amend our rules to extend the equivalent confidence and uncertainty requirements to z-axis data. As commenters point out, it is just as important for PSAPs to be able to assess the reliability of vertical location information as it is to assess the reliability of horizontal location information. APCO states that without uncertainty data ''public safety professionals would lack information that is essential when deciding whether to break down a door or how to develop a search strategy.'' NENA asserts that it is critical that all location information, including z-axis, include detailed uncertainty information. BRETSA supports the provision of confidence and uncertainty data along with z-axis information to help public safety assess data that may include sources of error. NextNav and Polaris support extending confidence and uncertainty requirements to z-axis data and indicate that their technologies can generate vertical confidence and uncertainty data for each call that can be provided to the PSAP.

41. In light of the public safety benefits of confidence and uncertainty data, we require CMRS providers to provide vertical confidence and uncertainty data on a per call basis to requesting PSAPs. As with horizontal

confidence and uncertainty data, providers must report vertical confidence and uncertainty data using a confidence level of 90%, *i.e.,* they must identify the range above and below the estimated z-axis position within which there is a 90% probability of finding the caller's true vertical location. For the same reasons, where available to the CMRS provider, floor level information must be provided with associated C/U data in addition to z-axis location information.

E. Compliance Certification and Call Data Reporting

42. Under our existing rules, CMRS providers, within 60 days after each horizontal and vertical location benchmark, ''must certify that they are in compliance with the location accuracy requirements applicable to them as of that date.'' The rules require CMRS providers to ''certify that the indoor location technology (or technologies) used in their networks are deployed consistently with the manner in which they have been tested in the test bed.'' In the Fourth Further NPRM, we proposed to use this same certification mechanism to validate provider compliance with the 3-meter metric.

43. We adopt our proposal. In order to be deemed in compliance under our existing rules, nationwide CMRS providers electing to use z-axis technology for vertical location shall certify for purposes of the April 2021 and April 2023 compliance deadlines that z-axis technology is deployed consistent with the manner in which it was tested in the test bed. Commenters generally support this proposed compliance mechanism. As CTIA outlines, ''the Test Bed would validate that a given technology solution can meet the proposed z-axis metric of ± 3 meters for 80 percent of indoor wireless calls in the Test Bed, and a wireless provider would then certify that the z-axis technology in its network is deployed consistently with how it was tested in the Test Bed.'' Verizon states that requiring compliance through the test bed process ensures ''that solutions perform as vendors contend, and that they are technically feasible,'' and it is also consistent with the Commission's approach to horizontal accuracy.

44. APCO notes that in Stage Z, only barometric sensor-based technologies were tested in the test bed, and questions whether the test bed is configured to test all vertical location technologies on a technology-neutral basis. We believe the test bed is configured to support technology neutral testing. The Commission has previously stated that the core purpose of the test bed is to provide a means to evaluate ''the accuracy of different indoor location technologies across various indoor environments.'' Thus, the test bed is not limited to testing barometric sensor solutions, but is designed to test all vertical location solutions in a uniform set of indoor test environments. We also note that Google's testing in Stage Za includes testing of technologies that are not barometric sensor-based.

45. BRETSA recommends that instead of using the test bed, the Commission should establish a ''proof-of-performance'' method of compliance with live call testing in each market. CTIA urges the Commission to reject this approach. We decline to require live call proof-of-performance testing. In establishing the test bed approach, the Commission found it to be ''the most practical and cost-effective method for testing compliance with indoor location accuracy requirements.'' Indeed, the purpose of the test bed program is to provide a reliable mechanism for validating the performance of indoor location technologies without the need for the provider to conduct indoor testing in all locations where the technology is actually deployed, which would be impractical and highly burdensome. Accordingly, we decline to adopt or require proof of performance testing.

46. CTIA recommends that we add the language ''as measured in the test bed'' at the end of proposed § 9.10(i)(2)(ii)(C)&(D), ''thus making explicit in the rules what is in the Fourth Further [NPRM].'' We find that the existing rules already clearly identify the test bed as the basis for certifying compliance of all indoor location technologies, horizontal and vertical, making CTIA's proposed amendment unnecessary.

47. In addition, to more fully inform the Commission's understanding of location accuracy progress, we expand the live call data reporting obligations in our existing rules to include z-axis data and, where available, floor level information. The Commission's live call data reporting rules require nationwide CMRS providers to file quarterly reports of their aggregate live 911 call use of each location technology in four geographic morphologies within six representative cities (Test Cities). Non-nationwide CMRS providers must report aggregate live 911 call data collected in one or more of the Test Cities or the largest county in their footprint, depending on the area served by the provider.

48. To date, CMRS providers have only reported on horizontal location technologies used for live 911 calls. However, we conclude that it is equally appropriate to require CMRS providers to report on live call use of vertical location technologies. The Commission's live call data reporting requirements established in the Fourth Report and Order require CMRS providers to ''identify and collect information regarding the location technology or technologies used for each 911 call in the reporting area during the calling period,'' without distinguishing between reporting of horizontal and vertical location information. Moreover, in the indoor location technologies context, a key purpose of the reporting requirement is to ''augment our understanding of the progress of such technologies.'' Although our vertical location requirements do not include live call compliance metrics, reporting on the use of z-axis and floor level technologies in live calls will provide important real-world data on how frequently z-axis and floor level location is provided, the types of technologies being used, and trends in such usage over time. We emphasize, however, that live call data reported by CMRS providers relating to the use of live call and floor level technologies will be used solely for informational purposes, not compliance purposes.

F. Z-Axis Privacy and Security

49. In the Fourth Further NPRM, we sought comment on the appropriate data privacy and security framework for z-axis data. We noted that in establishing rules in 2015 governing CMRS provider usage of the NEAD, the Commission had stated that '''certain explicit requirements on individual CMRS providers are necessary to ensure the privacy and security of NEAD data and any other information involved in the determination and delivery of dispatchable location.' '' We asked whether use of z-axis data should be limited to 911 calls except as otherwise required by law, and if such a limitation should be implemented and codified in a manner similar to the explicit limitations applicable to the NEAD.

50. We amend our rules to make explicit that CMRS providers and the vendors upon which they rely for z-axis information may only use 911 call z-axis information for 911 purposes, except with prior express consent or as required by law. This approach is consistent with our long-standing approach to protection of 911 location data. Section 222 of the Communications Act requires CMRS

providers, among others, to protect the confidentiality of Customer Proprietary Network Information (CPNI) without the customer's express prior authorization, but provides an exception for the provision of a customer's call location information to a PSAP or other emergency response authority in connection with a 911 call. CTIA also states that it ''shares the Commission's view that location information derived from wireless 9–1–1 calls, including Z axis location data, should only be used for 9–1–1 purposes, except as otherwise provided by law.'' And we agree with Apple that other parties—such as device manufacturers and third-party location technology vendors—on whom carriers rely for z-axis information should be similarly subject to the same privacy protections and restrictions on non-911 use as data stored or used by CMRS providers. For the same reasons as we relied on in the dispatchable location context, we believe that CMRS providers are already responsible for third-party use of personal location information in support of the carrier's delivery of E911 location data to the PSAP. To ensure compliance, we agree that a certification requirement is appropriate. CMRS providers must therefore certify that neither they nor any third party they rely on to obtain z-axis information for 911 purposes will use such information for any non-911 purpose, except with prior express consent or as required by law. We also make clear that such a certification should not be construed to ''significantly impede location technology vendors by preventing them from having access to z-axis information for such valid purposes as system calibration and accuracy verification.'' Such a reading of these requirements that would impede the swift development and widespread deployment of z-axis technologies for use in emergency calls would be contrary to the very purpose of this proceeding.

51. We also conclude that any 911-related z-axis or floor level information that is stored before or after the 911 call should be subject to the same privacy and security protections that apply to NEAD data. We agree with Public Knowledge that all 911 location data should be treated consistently from a privacy and security perspective, and that stored coordinate-based data, including z-axis data, should not be subject to lesser consumer privacy and data protection than NEAD data. As Precision Broadband puts it, we should ''not decouple the choice of deploying z-axis technology from dispatchable location,'' as z-axis data is part of a holistic, multifaceted approach ''to solving the vertical location problem.'' Consistent with the 2015 Fourth Report and Order, however, the practical application of this principle in the geolocation context may be dissimilar is some ways from its application in the dispatchable location context. For example, coordinate-based geolocation does not necessarily rely on previously stored customer location information in a database, and geolocation information generated at the time of a 911 call may be discarded rather than stored for later use. Therefore, we conclude that any 911 geolocation data that is stored by a CMRS provider should be subject to the same level of privacy and security protection as NEAD data. Thus, if a CMRS provider intends to store such data for 911 location purposes (like any other stored data not covered by a NEAD privacy and security plan), it ''should file an addendum to ensure that the protections outlined in the NEAD plan will cover the provider's [coordinate-based] location transactions end-to-end.'' For 911 geolocation data that is not stored, our CPNI requirements continue to apply and prohibit unauthorized use of such data for any purpose other than emergency location.

52. We also clarify that we are in no way altering or addressing existing privacy or security rules or policies that apply to location data outside the 911 context. We agree with CTIA that such issues are outside the scope of this proceeding.

G. Comparison of Benefits and Costs

53. In the Fourth Further NPRM, we sought comment on ''which z-axis metric would allow [the Commission] to achieve the anticipated level of benefits in the most cost-effective manner.'' We tentatively concluded that ''a z-axis metric of 3 meters for 80% of calls strikes the best balance between benefits and costs'' because ''some public safety commenters identify a 3-meter metric as providing sufficient accuracy to identify the caller's floor level in most cases.'' We also tentatively concluded that ''the value of a 3-meter metric exceeds that of a 5-meter metric because the latter would result in a significant reduction'' in benefits. 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. 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 concluded that a 3-meter metric provided greater value and sought comment on the conclusion. We also tentatively concluded that the ''value of a 3-meter metric exceeded that of a 2-meter metric.'' We also sought comment on how the benefits and costs of ''requiring CMRS providers to identify floor level when reporting z-axis information would compare to the benefits and costs of providing z-axis information as AGL or MSL height.'' We sought ''comment on this analysis and tentative conclusions as to the comparative value of the z-axis metrics.''

54. We conclude that a 3-meter z-axis metric is technically achievable and can be implemented successfully by CMRS providers by the April 2021 and 2023 deadlines in the top 25 and 50 CMAs, respectively. As the record reflects, a 3-meter metric will provide a substantial benefit to public safety because it will ''identify the correct floor of wireless callers to E911 in most instances.'' Additionally establishing a 3-meter metric will afford certainty that will drive innovation to create more z-axis location technological options for CMRS providers and lower technology costs. We now address the benefits and costs of the 3-meter metric.

55. Implementation benefits. In assessing the benefits of adopting a 3-meter metric, our analysis begins with the analysis presented in the Fourth Report and Order in this proceeding. There, the Commission sought to reduce emergency response time to improve patient outcomes and, ultimately save lives. In the Salt Lake City analysis referenced in the Third Further NPRM, the Commission found that a one minute increase in response times increases mortality, and that a one minute decrease in response times decreases mortality. The Commission further found that reducing response times would result in an annual saving of 746 lives as reflected in the Salt Lake City analysis, which could amount to 10,120 lives annually when extrapolated across the United States.

56. No commenter disputes the benefits of reduced emergency response times on patient outcomes, but NextNav suggests that the ''Commission's analysis made very conservative assumptions and still arrived at an overwhelming economic benefit to the nation.'' Additionally, the International Association of Fire Fighters and NextNav emphasize that compelling evidence exists in the record in this proceeding that the provision of vertical

location information to first responders with an accuracy of 3 meters would reduce response times as compared to not specifying a vertical metric or a less granular metric. NextNav observes that San Francisco emergency first responder field tests in 2014 ''revealed dramatic reductions of between 4 and 17 minutes in search times with the addition of vertical information with an accuracy of +/−3 meters.'' We agree with NextNav's assertion that due to these ''substantial'' emergency response time improvements, the Commission's factoring of a one minute response time in its benefits analysis underestimates ''by a substantial amount the quantifiable benefits of providing emergency first responders with z-axis information with an accuracy of 3 meters.''

57. The record reflects ''increasing use of wireless phones by the public, thus further increasing the benefits that can be expected from the adoption of a 3 meter vertical metric.'' As we stated in the Third Further NPRM, the addition of vertical location information—like the further refinement of horizontal location information—plays a major role in achieving the $92 billion benefit floor for improving wireless location accuracy. As we affirmed in the Fourth Further NPRM, this addition of new vertical information—together with the refinement of existing horizontal information—has the potential of saving ''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.'' Due to U.S. Department of Transportation updates for value of a statistical life, we presently estimate this annual benefit floor at $97 billion.

58. Implementation costs. The record indicates that software and hardware implementation costs are low, if not negligible. 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. 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.'' Polaris' solution also is ''instantly available and deployable throughout a carrier's nationwide network.'' As the Commission noted in the Fourth Report and Order, we continue to expect that these costs ''will decline as demand grows.'' Existing smartphone devices with installed barometric pressure sensors, can be further calibrated over-the-air with calibration signals from weather stations. Such calibration software is available ''with no additional premium costs.'' NextNav estimates that given these factors, 3-meter compliant z-axis services can be provided ''at a nominal cost (in aggregate, less than a penny per month per handset).'' Moreover, with the emergence of handset-based solutions we expect costs to provide vertical location to further decrease. In addition to the barometric pressure sensor-based solutions developed by NextNav and Polaris, ''handset-based solutions like ELS have been widely deployed around the world.''

59. Beyond software solutions, hardware solutions are additionally nominal, as ''nearly all smartphones on the market appear to be equipped with barometric pressure sensors.'' One commenter notes that adding barometric sensors to phones does and will entail additional costs, but the cost of those sensors continues to drop. We clarify that we amend our rules today to apply our 3 meter metric to z-axis capable devices—in other words, we are not mandating retrofitting of older devices with barometric sensors, thus obviating such costs or, as technological developments unfold, retrofitting older devices in any manner to make such devices z-axis capable.

60. Cost/benefit comparison. We reaffirm our earlier decision that implementation of a 3-meter metric for vertical location accuracy will account for a large share of the total annual benefit floor, which we presently estimate to be a total of $97 billion. Because that estimate includes only the value of statistical lives saved, we expect that there will be many additional benefits—which we are unable to quantify—from the reductions in human suffering and the reduced property losses due to crime and uncontrolled fires. We derive our cost from an estimated annual handset cost of ''a penny per month per handset'' or $0.12 per year. Assuming there are some 300 million handsets presently in use, we apply the per-year handset cost to estimate a cost ceiling of approximately $36 million per year. Accordingly, we find that the estimated benefits of this instant rules far outweigh the estimated costs.

IV. Procedural Matters

61. *Final Regulatory Flexibility Analysis.* As required by the Regulatory Flexibility Act of 1980, as amended (RFA), the Commission has prepared a Final Regulatory Flexibility Analysis (FRFA) of the possible significant economic impact on small entities of the policies and rules adopted in the Fifth Report and Order. The FRFA is set forth in Appendix C of the Fifth Report and Order.

62. *Paperwork Reduction Act Analysis.* The requirements in § 9.10(i)(2)(ii)(C) and (D), (i)(4)(v), and (j)(4), constitute modified information collections. These requirements solicit information for a certification of z-axis information use, and confidence and confidence and uncertainty data, respectfully. They will be submitted to the Office of Management and Budget (OMB) for review under section 3507(d) of the PRA. OMB, the general public, and other Federal agencies will be invited to comment on the new information collection requirements contained in this proceeding. In addition, we note that, pursuant to the Small Business Paperwork Relief Act of 2002, we previously sought, but did not receive, specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees. The Commission does not believe that the new or modified information collection requirements in § 9.10(i)(2)(ii)(C) and (D), (i)(4)(v), and (j)(4), will be unduly burdensome on small businesses. Applying these new or modified information collections will promote 911 service and emergency response, to the benefit of all size governmental jurisdictions, businesses, equipment manufacturers, and business associations by providing greater confidence in 911 location accuracy and greater consistency between the Commission's horizontal and vertical location rules. We describe impacts that might affect small businesses, which includes most businesses with fewer than 25 employees, in the Final Regulatory Flexibility Analysis.

63. *Congressional Review Act.* The Commission has determined, and the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, concurs that this rule is ''major'' under the Congressional Review Act, 5 U.S.C. 804(2). The Commission will send a copy of this Fifth Report and Order to Congress and the Government Accountability Office pursuant to 5 U.S.C. 801(a)(1)(A).

64. *Further Information.* For further information, contact Nellie Foosaner, Attorney-Advisor, Policy and Licensing Division, Public Safety and Homeland Security Bureau, (202) 418–2925 or via email at *Nellie.Foosaner@fcc.gov;* or

Alex Espinoza, Attorney-Advisor, Policy and Licensing Division, Public Safety and Homeland Security Bureau, (202) 418–0849 or via email at *Alex.Espinoza@fcc.gov.*

V. Final Regulatory Flexibility Analysis

65. As required by the Regulatory Flexibility Act of 1980, as amended (RFA), an Initial Regulatory Flexibility Analysis (IRFAs) was incorporated in the Fourth Further Notice of Proposed Rulemaking (Fourth Further NPRM) adopted in March 2019. The Commission sought written public comment on the proposals in the Notice including comment on the IRFA. No comments were filed addressing the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.

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

66. The Fifth Report and Order 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.'' In the Fifth Report and Order, the Commission adopts a metric to more precisely identify the location of a 911 wireless caller located in a multi-story building. More specifically, the Commission amends its rules to require the provisioning of vertical location (z-axis) information that would help enable first responders to identify the caller's floor level within 3 meters for 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, the Fifth Report and Order adopts a z-axis location accuracy metric of 3 meters above or below a handset for 80 percent of wireless Enhanced 911 (E911) indoor calls from z-axis capable devices as demonstrated in the test bed used to develop and test proposed z-axis accuracy metrics. CMRS providers must deliver z-axis information in Height Above Ellipsoid (HAE). Where available to the CMRS Provider, CMRS providers must deliver floor level information with z-axis location. The Commission will also apply its current Confidence and Uncertainty (C/U) data requirements for x/y location information to z-axis and, where available, floor level information that will be collected and provisioned by CMRS providers. The Commission extends to z-axis location and, where available, floor level information existing compliance certification and live call data reporting requirements applicable to CMRS providers. Additionally, the Commission extends consumer privacy and data security protections to 911 calls that convey z-axis location and, where available, floor level information in the Fifth Report and Order.

67. For z-axis compliance, the Fifth Report and Order requires CMRS providers to use a technology proven to meet the 3-meter metric in the test bed. The adopted metric should 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. It also implements the final element of the Commission's existing indoor location accuracy regime, which already includes a timetable for CMRS providers to deliver vertical location information by deploying either dispatchable location or z-axis technology in specific geographic areas. The adopted z-axis metric provides certainty to all parties and establishes a focal point for further testing, development, and implementation of evolving z-axis location technologies. The Fifth Report and Order also clarifies that z-axis location and, where available, floor level information may only be used for 911 purposes except as required by law. In addition, the Fifth Report and Order amends the location accuracy rules to require CMRS providers to deliver confidence and uncertainty data along with z-axis information and, where available, floor level information.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

68. There were no filed comments that specifically addressed the proposed rules and policies presented in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

69. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.

70. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules Will Apply

71. 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 rule changes. The RFA generally defines the term ''small entity'' as having the same meaning as the terms ''small business,'' ''small organization,'' and ''small governmental jurisdiction.'' In addition, the term ''small business'' has the same meaning as the term ''small business concern'' under the Small Business Act. 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.

72. *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. 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. These types of small businesses represent 99.9% of all businesses in the United States which translates to 28.8 million businesses.

73. 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.'' 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).

74. 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.'' U.S. Census Bureau data from the 2012 Census of Governments indicate that there were 90,056 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States. Of

this number there were 37,132 General purpose governments (county, municipal and town or township) with populations of less than 50,000 and 12,184 Special purpose governments (independent school districts and special districts) 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. Based on this data we estimate that at least 49,316 local government jurisdictions fall in the category of ''small governmental jurisdictions.''

1. Telecommunications Service Providers

a. Wireless Telecommunications Providers

75. Pursuant to 47 CFR 20.18(a), the Commission's 911 service requirements are only applicable to 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.

76. 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.

77. 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. This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems. Establishments providing internet services or voice over internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry. 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. For this category, U.S. Census Bureau data for 2012 shows that there were 1,442 firms that operated for the entire year. 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. Thus, the Commission estimates that the majority of ''All Other Telecommunications'' firms potentially affected by our action can be considered small.

78. *AWS Services (1710–1755 MHz and 2110–2155 MHz bands (AWS–1); 1915–1920 MHz, 1995–2000 MHz, 2020–2025 MHz and 2175–2180 MHz bands (AWS–2); 2155–2175 MHz band (AWS–3)).* For the AWS–1 bands, the Commission has defined a ''small business'' as an entity with average annual gross revenues for the preceding three years not exceeding $40 million, and a ''very small business'' as an entity with average annual gross revenues for the preceding three years not exceeding $15 million. For AWS–2 and AWS–3, although we do not know for certain which entities are likely to apply for these frequencies, we note that the AWS–1 bands are comparable to those used for cellular service and personal communications service. The Commission has not yet adopted size standards for the AWS–2 or AWS–3 bands but proposes to treat both AWS–2 and AWS–3 similarly to broadband personal communications services (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.

79. *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. U.S. Census Bureau data for 2012 indicate that 3,117 firms operated during that year. Of that number, 3,083 operated with fewer than 1,000 employees. 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. Of these 1,442 carriers, an estimated 1,256 have 1,500 or fewer employees. 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. Also, 72 carriers have reported that they are Other Local Service Providers. Of this total, 70 have 1,500 or fewer employees. 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.

80. *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 applicable NAICS Code category is Wired Telecommunications Carriers. Under the applicable SBA size standard, such a business is small if it has 1,500 or fewer employees. U.S. Census Bureau data for 2012 indicate that 3,117 firms operated the entire year. Of this total, 3,083 operated with fewer than 1,000 employees. 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. Of this total, an estimated 1,006 have 1,500 or fewer employees. Thus using the SBA's size standard the majority of incumbent LECs can be considered small entities.

81. *Narrowband Personal Communications Services.* Two auctions of narrowband 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 (65 FR 35843 (June 6, 2000)). Through these auctions, the Commission has awarded a total of 41 licenses, out of which 11 were obtained by small businesses. 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.

82. *Offshore Radiotelephone Service.* This service operates on several ultra-high frequency (UHF) television broadcast channels that are not used for television broadcasting in the coastal areas of states bordering the Gulf of Mexico. The closest applicable SBA size standard is for Wireless Telecommunications Carriers (except Satellite), which is an entity employing no more than 1,500 persons. U.S. Census Bureau data in this industry for 2012 show that there were 967 firms that operated for the entire year. Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more. 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).

83. *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. Examples of products made by these establishments are: Transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment. The SBA has established a small business size standard for this industry of 1,250 employees or less. U.S. Census Bureau data for 2012 shows that 841 establishments operated in this industry in that year. 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. Based on this data, we conclude that a majority of manufacturers in this industry are small.

84. *Rural Radiotelephone Service.* The Commission has not adopted a size standard for small businesses specific to the Rural Radiotelephone Service. A significant subset of the Rural Radiotelephone Service is the Basic Exchange Telephone Radio System (BETRS). The closest applicable SBA size standard is for Wireless Telecommunications Carriers (except Satellite), which is an entity employing no more than 1,500 persons. For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year. Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1000 employees or more. 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 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 herein.

85. *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. The SBA has approved these small business size standards. 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.

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

87. *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). Under the SBA small business size standard, a business is small if it has 1,500 or fewer employees. For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year. Of this total, 955 firms had fewer than 1,000 employees and 12 firms had 1000 employees or more. 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. Of these, an estimated 261 have 1,500 or fewer employees and 152 have more than 1,500 employees. Therefore, more than half of these entities can be considered small.

88. *700 MHz Guard Band Licensees.* In 2000, in the 700 MHz Guard Band Order (65 FR 17594 (April 4, 2000), 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. 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. 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. SBA approval of these definitions is not required. An auction of 52 Major Economic Area licenses commenced on September 6, 2000, and closed on September 21, 2000. 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.

89. *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. 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. 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. 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. The SBA approved these small size standards. 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. 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. 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. 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.

90. In 2007, the Commission reexamined its rules governing the 700 MHz band in the 700 MHz Second Report and Order (72 FR 48814 (Aug. 24, 2007)). 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. Twenty winning bidders, 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.

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

92. *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. 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. Establishments in this industry resell telecommunications; they do not operate transmission facilities and infrastructure. Mobile virtual network operators (MVNOs) are included in this industry. Under the SBA's size standard, such a business is small if it has 1,500 or fewer employees. U.S. Census Bureau data for 2012 show that 1,341 firms provided resale services for the entire year. Of that number, all operated with fewer than 1,000 employees. 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. Of these, an estimated 211 have 1,500 or fewer employees. Consequently, the Commission estimates that the majority of Wireless Resellers are small entities.

b. Equipment Manufacturers

93. *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. Examples of products made by these establishments are: Transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment. The SBA has established a small business size standard for this industry of 1,250 employees or less. U.S. Census Bureau data for 2012 show that 841 establishments operated in this industry in that year. 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. Based on this data, we conclude that a majority of manufacturers in this industry can be considered small.

94. *Semiconductor and Related Device Manufacturing.* This industry comprises establishments primarily engaged in manufacturing semiconductors and related solid state devices. Examples of products made by these establishments are integrated circuits, memory chips, microprocessors, diodes, transistors, solar cells and other optoelectronic devices. 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. U.S. Census Bureau data for 2012 show that there were 862 establishments that operated that year. Of this total, 843 operated with fewer than 1,000 employees. Thus, under this size standard, the majority of firms in this industry can be considered small.

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

95. The Fifth Report and Order enacts a z-axis (vertical) location accuracy metric that will affect the reporting, recordkeeping and/or other compliance requirements of small and other size CMRS providers—both nationwide and non-nationwide. Under the current E911 location accuracy rules, by 2021, nationwide CMRS providers must deploy either (1) dispatchable location, or (2) z-axis technology that achieves the Commission-adopted z-axis metric in each of the top 25 Cellular Market Areas. If z-axis technology is used, CMRS providers must deploy z-axis technology to cover 80 percent of the Cellular Market Areas population. By 2021, nationwide CMRS providers must deploy dispatchable location or z-axis technology complying with the Commission-adopted z-axis metric in each of the top 50 Cellular Market

Areas. Small entities that are 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 Cellular Market Areas and 2024 for the top 50 Cellular Market Areas). CMRS providers must deliver z-axis information in Height Above Ellipsoid. Where available, CMRS providers must deliver floor level information with z-axis location.

96. The Fifth Report and Order requires nationwide and non-nationwide CMRS providers that deploy z-axis technology to provide vertical location information within a 3 meters metric under the Commission's existing location accuracy requirements timelines. While the Commission does not mandate a specific technology for z-axis compliance, we require CMRS providers to use a technology proven to meet the 3-meters metric in the test bed. In order to be deemed in compliance, CMRS providers using z-axis technology for vertical location must certify that the z-axis technology is deployed consistently with the manner in which it was tested in the test bed. The Fifth Report and Order also requires CMRS providers to comply with the Commission's current confidence and uncertainty (C/U) requirements for x/y location information for z-axis location information in addition to horizontal location, for 911 calls in the top 50 CMAs. As we stated in the Fifth Report and Order, we anticipate this data ''can be furnished to PSAPs at minimal cost to CMRS providers given that they already provide C/U data for x/y calls.'' Where available, CMRS providers must provide floor level information and associated C/U data in addition to z-axis location information.

97. In order to be deemed in compliance under our existing rules, we clarify that nationwide CMRS providers electing to use z-axis technology for vertical location shall certify for purposes of the April 2021 and April 2023 compliance deadlines that z-axis technology is deployed consistent with the manner in which it was tested in the test bed. Non-nationwide providers will have an additional year to make each certification. In addition, to more fully inform the Commission's understanding of location accuracy progress, we extend the live data calling reporting obligations existing in the rules to z-axis. The Commission live call data reporting rules require nationwide CMRS providers to file quarterly reports of their aggregate live 911 call location data for each location technology used within four geographic morphologies within six representative cities (Test Cities). Non-nationwide CMRS providers must report the aggregate live 911 call data collected in one or more of the Test Cities or the largest county in their footprint, depending on the area served by the provider. We extend these reporting requirements to include z-axis information and, where available, floor level information in the live call data reporting already in the Commission's rules for our informational purposes.

98. The Commission clarifies in the Fifth Report and Order that CMRS providers may only use z-axis location and floor level information for 911 purposes except with prior express consent or as required by law. Prior to use of z-axis information and floor level information contained in the NEAD, CMRS providers are required to certify that they will not use z-axis, floor level, or associated data for any non-911 purpose, except with prior express consent or as otherwise required by law. The certification must state that the CMRS provider will provide z-axis location and floor level information privacy and security protection equivalent to the NEAD. This requirement is necessary to ensure the privacy and security of any personally identifiable information that may be collected in generating z-axis and floor level data. Additionally, we require CMRS providers to certify that neither they nor any third party they rely on to obtain z-axis and floor level information for 911 purposes will use such information for any non-911 purpose, except with prior express consent or as required by law.

99. In the Fourth Further NPRM, the Commission tentatively concluded based on the z-axis solution test results and other comments, that a metric of 3 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 E911 location accuracy rules. We also tentatively concluded that the cost of compliance with the 3-meter metric is relatively low. We affirm these conclusions with our adoption of the 3-meters metric requirement in the Fifth Report and Order. In order to comply with the 3-meters metric requirement, small entities may incur costs associated with software and/or hardware changes and may need to employ engineers or other experts. While the Commission cannot quantify the cost of compliance with the requirements, the technology solution a small entity chooses to implement the requirement will ultimately determine the nature of the costs it incurs.

100. Evidence in the record indicates that small entities have a choice of vendors with z-axis technology solutions, which will allow them to manage their costs. Moreover, having a competitive market for such solutions should lessen the costs for small entities to comply with the rules. In the proceeding, parties provided examples of various technology solutions that are currently available to small entities and other CMRS providers and general information on the implementation requirements. NextNav a vendor that participated in Stage Z testing indicated that its z-axis solution which only requires 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, indicated that its solution is instantly available and deployable throughout a carrier's nationwide network. Polaris also asserted 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.'' Google who announced development and deployment of its Emergency Location System (ELS) in the U.S. for Android devices and testing in Stage Za, indicated 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 indicated that ELS is part of the Android operating system and does not require any special hardware or updates. Apple has announced that it will use new technology to quickly and securely share Hybridized Emergency Location information with 911 call centers. The HELO ''solution has offered z-axis estimates and uncertainties beginning in 2013, and those estimates have been consumed by carriers since its first adoption in 2015.'' Apple has committed to improving its vertical, as well as horizontal, location accuracy and will participate in CTIA's z-axis testing by the end of 2020. With the addition of other vertical location technologies and vendors into the market, the Commission expects small entities will have more implementation options and that technology costs will decline as demand grows, which could further reduce their cost of compliance.

101. The Commission does not believe that the new or modified information collection requirements in § 9.10(i)(2)(ii)(C) and (D), (i)(4)(v), and (j)(4), will be unduly burdensome on small businesses. Applying these new or

modified information collections will promote 911 service and emergency response, to the benefit of all size governmental jurisdictions, businesses, equipment manufacturers, and business associations by providing greater confidence in 911 location accuracy and greater consistency between the Commission's horizontal and vertical location rules. We provide the following analysis:

102. The Commission amends § 9.10(i)(2)(ii)(C) and (D) to require the provisioning of dispatchable location or z-axis location information. As stated in the Fifth Report and Order, where available to CMRS Providers, floor level information must be reported with z-axis location information. The Commission adopts § 9.10(i)(4)(v) to require all CMRS providers to certify that they will not use z-axis information or associated data for any non-911 purpose, except with prior express consent or as otherwise required by law. The certification must state that CMRS providers will provide z-axis location information privacy and security protection equivalent to the NEAD. Additionally, under § 9.10(i)(4)(v), we require CMRS providers to certify that neither they nor any third party they rely on to obtain z-axis location information for 911 purposes will use such information for any non-911 purpose, except with prior express consent or as required by law. This requirement is necessary to ensure the privacy and security of any personally identifiable information that may be collected in generating z-axis data. The Commission adopts § 9.10(j)(4) to extend confidence and uncertainty (C/U) requirements to wireless E911 calls that provide z-axis and floor level information in the top 50 CMAs, for CMRS providers, in addition to horizontal location. As we stated in the Fifth Report and Order, we also anticipate this data ''can be furnished to PSAPs at minimal cost to CMRS providers given that they already provide C/U data for x/y calls.'' The Commission anticipates the burden and cost levels of these requirements to be similar to the existing collections which OMB approved under OMB Control No. 3060–1210, ICR Reference No: 201801–3060–010. Additionally, the Commission anticipates extending the burden and cost burdens associated with extending the existing compliance certification and live call data report requirements to CMRS Providers that deploy z-axis information to be similar to the existing collections which OMB approved under OMB Control No. 3060–1210, ICR Reference No: 201801–3060–010. The Commission seeks comment on these costs in its upcoming Paperwork Reduction Act comment periods.

F. Steps Taken To Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

103. The RFA requires an agency to describe any significant, specifically small business alternatives that it has considered in reaching its approach, which may include the following four alternatives (among others): (1) The establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for such 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.

104. Based on a comparison of the benefits and costs to alternatives metrics, the Commission believes that the 3-meter metric adopted in the Fifth Report and Order is the most cost-effective option for achieving the Commission's location accuracy and public safety objectives in this proceeding while avoiding placing undue burdens on small entities and other CMRS providers. While the rules adopted in the Fifth Report and Order will apply to all nationwide and non-nationwide CMRS in the same manner, the Commission has taken steps to accommodate non-nationwide CMRS providers by supplying additional time to comply with the adopted vertical location accuracy benchmarks. Non-nationwide CMRS providers which tend to be small entities have an additional year to comply with the Commission's z-axis benchmarks. The Commission also declined to mandate a specific technological solution but instead, nationwide and non-nationwide CMRS providers may choose to provide a dispatchable location solution or deploy z-axis technology. Thus, small entities have the freedom to choose a solution that best fits their financial situation rather than being subjected to a specific z-axis technology solution, which should minimize the economic impact on these entities.

105. In implementing the z-axis metric, there were several alternatives considered by the Commission but not adopted that may have presented an increased economic impact for small entities. Specifically, the Commission declined to adopt a more stringent z-axis metric or a requirement to convey ''floor level'' information. Small entities will benefit as a result of the certainty provided by the Commission's adoption of 3 meters metric requirement. The Commission also declined to mandate the application of the 3-meters for barometric pressure sensor capable handsets but instead applied the requirement only to z-axis capable devices. This action by the Commission will allow small entities and other CMRS providers to avoid having to retrofit older devices that may not have barometric sensors and avoid incurring the associated costs. Additionally, the Commission declined to adopt a less stringent 5 meter metric, which could increase emergency response time. Lastly, the Commission declined to adopt a specific measurement standard that must be used to report vertical location information and declined to adopt or require proof of performance testing to measure compliance with the z-axis metric.

106. The Commission believes the adoption of the 3 meters metric and allowing CMRS providers the flexibility to choose a compliant technology solution rather than mandating a one size fits all solution is the best approach to meet its public safety and location accuracy objectives and should minimize some economic impact for small entities. The Commission's action also provides CMRS providers a level of certainty which should benefit providers in their selection of a complaint technology solution. In addition, by adopting a single metric, small entities and other CMRS providers should benefit from the economies of scale equipment manufacturers will incur from the ability to provision devices uniformly using 3-meters standard.

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

VI. Ordering Clauses

108. 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. 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. 111–260, 47 U.S.C. 615c, that this Fifth Report and Order, is hereby *adopted.*

109. *It is further ordered* that the amendments of the Commission's rules as set forth in Appendix A of the Fifth Report and Order *are adopted,* effective sixty days from the date of publication in the **Federal Register**. Section 9.10(i)(2)(ii)(C) and (D), (i)(4)(v), and (j)(4) contain new or modified information collection requirements that require OMB review under the PRA. The Commission directs the Public Safety and Homeland Security Bureau (Bureau) to announce the effective date of those information collections in a document published in the **Federal Register** after the Commission receives OMB approval, and directs the Bureau to cause § 9.10(s) to be revised accordingly.

110. *It is further ordered* that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, *shall send* a copy of this Fifth Report and Order, including the Initial and Final Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

111. *It is further ordered* that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, *shall send* a copy of this Fifth Report and Order, including the Initial and Final Regulatory Flexibility Analysis, to Congress and the Government Accountability Office pursuant to the Congressional Review Act, see 5 U.S.C. 801(a)(1)(A).

List of Subjects in 47 CFR Part 9

Communications Common carriers, Communications equipment, Radio.

Federal Communications Commission.

Cecilia Sigmund,

Federal Register Liaison Officer, Office of the Secretary.

Final Rules

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 part 9 as follows:

PART 9—911 REQUIREMENTS

■ 1. The authority citation for part 9 continues to read as follows:

Authority: 47 U.S.C. 151–154, 152(a), 155(c), 157, 160, 201, 202, 208, 210, 214, 218, 219, 222, 225, 251(e), 255, 301, 302, 303, 307, 308, 309, 3 10, 316, 319, 332, 403, 405, 605, 610, 615, 615 note, 615a, 615b, 615c, 615a–1, 616, 620, 621, 623, 623 note, 721, and 1471, unless otherwise noted.

■ 2. Section 9.10 is amended by revising paragraphs (i)(2)(ii)(C) introductory text and (i)(2)(ii)(D) introductory text, adding paragraph (i)(4)(v), revising paragraph (j)(1) introductory text, adding paragraph (j)(4), and revising paragraph (s) to read as follows:

§ 9.10 911 Service.

* * * * *

(i) * * *

(2) * * *

(ii) * * *

(C) By April 3, 2021: In each of the top 25 cellular market areas (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 made from the z-axis capable device. CMRS providers must deliver z-axis information in Height Above Ellipsoid. Where available to the CMRS provider, floor level information must be provided in addition to z-axis location information. CMRS providers that deploy z-axis technology must also comply with the compliance certification and call data reporting requirements of paragraphs (i)(2)(iii) and (i)(3) of this section.

* * * * *

(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 made from the z-axis capable device. CMRS providers must deliver z-axis information in Height Above Ellipsoid. Where available to the CMRS provider, floor level information must be provided in addition to z-axis location information. CMRS providers that deploy z-axis technology must also comply with the compliance certification and call data reporting requirements of paragraphs (i)(2)(iii) and (i)(3) of this section.

* * * * *

(4) * * *

(v) *Z-axis use certification.* Prior to use of z-axis information to meet the Commission's 911 vertical location accuracy requirements in paragraph (i)(2)(ii) of this section, CMRS providers must certify that neither they nor any third party they rely on to obtain z-axis information will use z-axis information or associated data for any non-911 purpose, except with prior express consent or as otherwise required by law. The certification must state that CMRS providers and any third party they rely on to obtain z-axis information will provide z-axis location information privacy and security protection equivalent to the NEAD.

(j) *Confidence and uncertainty data.* (1) Except as provided in paragraphs (j)(2) through (4) of this section, CMRS providers subject to this section shall provide for all wireless 911 calls, whether from outdoor or indoor locations, x- and y-axis (latitude, longitude) and z-axis (vertical) confidence and uncertainty information (C/U data) on a per-call basis upon the request of a PSAP. The data shall specify:

* * * * *

(4) Upon meeting the timeframes pursuant to paragraphs (i)(2)(ii)(C) and (D) of this section, CMRS providers shall provide with wireless 911 calls that have dispatchable location or z-axis (vertical) information the C/U data required under paragraph (j)(1) of this section. Where available to the CMRS provider, floor level information must be provided with associated C/U data in addition to z-axis location information.

* * * * *

(s) *Compliance date(s).* Paragraphs (i)(2)(ii)(C) and (D), (i)(4)(v), (j)(4), and (q)(10)(v) of this section contain information-collection and recordkeeping requirements. Compliance with paragraphs (i)(2)(ii)(C) and (D), (i)(4)(v), (j)(4), and (q)(10)(v) will not be required until after approval by the Office of Management and Budget. The Commission will publish a document in the **Federal Register** announcing compliance dates with those paragraphs and revising this paragraph(s) accordingly.

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