

**VERIZON – INDOOR 911 LOCATION ACCURACY
SECOND PROGRESS REPORT
PS DOCKET NO. 07-114
AUGUST 3, 2018**

I. INTRODUCTION

This document provides an update on the status of Verizon’s original February 3, 2017 Implementation Plan (the “Plan”) for meeting the Commission’s rules for indoor location accuracy, together with the status of Verizon’s progress toward meeting each element. As explained in its February 3rd report, the Plan has necessarily evolved in response to improvements (and unforeseen challenges) in technology, and to the capabilities and plans of critical vendors in the communications ecosystem.¹

II. HORIZONTAL REQUIREMENTS

Verizon has met and exceeded the 50 meter accuracy milestones through location accuracy solutions based on their Test Bed performance. And in addition to its strong support for development and launch of the National Emergency Access Database, Verizon continues to work diligently with others in the communications ecosystem to develop and deploy solutions that further improve the accuracy of solutions that use an x, y geographic coordinate. But as Verizon recommended in February 2017, *all* players in the communications ecosystem should embrace services and products that accommodate the use of both dispatchable location *and* x, y location methods, and where possible multiple reliable solutions to achieve both.² And as Verizon explained in its recent July 20th letter, this and other important principles should guide the broader ecosystem as service providers approach the NEAD’s launch and as handset manufacturers and chipset vendors increasingly look to incorporate E911 location solutions into their products.³

A. Dispatchable Location

National Emergency Access Database (“NEAD”). Industry’s development and implementation of the NEAD remains on track to meet the Commission’s 2021 milestone. Industry timely submitted the NEAD’s Privacy and Security Plan to the Commission in early 2017, and the Commission approved it in November 2017. Verizon has already committed to provide access point information, and has been working with the NEAD National Emergency Address Manager to establish a secure interface between Verizon’s commercial systems and the NEAD. The NEAD itself is operational for test purposes, and Verizon participated in preliminary functional testing in May-June 2018 and is optimizing its systems based on those

¹ See Verizon – Indoor 911 Location Accuracy Implementation Plan and Progress Report, PS Docket No. 07-114, at 1 (Feb. 3, 2017) (“*February 2017 Report*”).

² See Verizon Letter to Marlene H. Dortch, Secretary, FCC, PS Docket No. 07-114, at 2 (“*July 20th Letter*”), incorporated by reference here; *Wireless E911 Location Accuracy Requirements*, Fourth Report and Order, 30 FCC Rcd 1259, ¶ 94 (2015) (“*Fourth Report and Order*”).

³ See *July 20th Letter* at 2-3.

tests. Verizon expects to begin testing dispatchable location solutions on its network in Fall 2018 and to fully participate in the NEAD's soft launch scheduled for February 2019. Verizon supports industry-wide efforts to promote handset and chipset manufacturers' support for the NEAD in their products, which will be necessary to maximize the availability of dispatchable location for wireless 9-1-1 callers.

Consumer Home Products. Verizon continues to develop and has introduced a few new wireless consumer home products that could provide additional methods of delivering dispatchable location independent of the NEAD. These include the most recent releases of the 4G Wireless Home Phone, SmartHub, and the home/office-based component of the wireless One Talk service. Verizon is also working to enhance the location capabilities for certain VoLTE and voice over Wi-Fi 911 calls so that dispatchable location information can be delivered to PSAPs independent of the NEAD. In these cases, a user's registered location associated with a consumer home product would be corroborated with dynamically calculated location from the device to send a reliable MSAG address to the PSAP, rather than an x/y coordinate or an uncorroborated registered location. Subject to the outcome of testing and provided that reliability can be assured, we hope to include this capability with certain consumer home products and other devices offered as early as 4Q2018.

Small Cell Positioning Solutions. Verizon has incorporated E911 location capabilities into its product and network specifications for promising small cell technologies and remains focused on Enterprise Radio Access Network ("E-RAN") based solutions. The underlying dispatchable location functionality has been deployed in Verizon's E-RAN facilities, and field personnel have been trained on the necessary provisioning requirements for dispatchable location. ESIF has also established the necessary test guidelines to ensure that small cell technologies reliably meet dispatchable location standards.⁴ Once infrastructure and device vendors have been able to test commercially available products in the Test Bed, Verizon will be prepared to deliver dispatchable location for 911 calls from these systems.

B. Improving the Accuracy of X, Y Coordinates.

In addition to incorporating dispatchable location capabilities into its network and consumer products, Verizon will improve the accuracy of x, y coordinates delivered to PSAPs by supplementing its existing Assisted-GPS ("A-GPS") solution already deployed ubiquitously throughout its CDMA and VoLTE networks.

Test Bed. Verizon remains a co-chair of Test Bed LLC's Technical Advisory Committee (TAC). Since the *February 2017 Report*, the Test Bed has completed carrier testing for Stages 1a and 1b, and vendor testing in Stages 2 and 2a for a number of solution vendors. ("Stage Z" testing of vertical location testing is complete and discussed below.) Solutions that

⁴ See ATIS Emergency Services Interconnection Forum, *Guidelines for Testing Dispatchable Location*, ATIS 0500035 (July 2017).

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Verizon has implemented and that have completed testing are (or will be) reflected in Verizon's quarterly live 911 call data.

Observed Time Difference of Arrival (OTDOA). Verizon completed its testing of OTDOA in the Test Bed in January 2017 and OTDOA fixes are reflected in the quarterly live 911 call data figures Verizon has reported to the Commission in 2017-2018. In addition, Verizon completed implementing important enhancements to OTDOA, including "PRS Muting" nationwide by January 2018, and by expanding the maximum number of sites used for OTDOA trilateration to above the basic 24.

Crowd Sourced Wi-Fi Positioning. An update on Verizon's plans to use crowd-sourced Wi-Fi positioning solutions for Android devices is provided below in the section describing different device-based location solutions.

Assisted GNSS. Verizon's A-GPS solution currently uses one GNSS satellite constellation for E911 location accuracy, the U.S. government-operated Global Positioning System (GPS). Enhancing A-GPS through the addition of additional GNSS constellations will help improve the accuracy of satellite-based location fixes, including for indoor 911 calls in many cases. While the Commission's *Fourth Report and Order* still precludes use of this enhancement pending further testing and U.S. government coordination to address broader issues concerning the use of non-U.S. GNSS constellations, the Commission is currently considering the use of the European Galileo system in the U.S.⁵ Verizon is hopeful that the necessary government coordination efforts needed to enable service providers and their vendors to use approved non-US GNSS satellite constellations for 911 location accuracy purposes could enable use of those systems in the near future.

Device Based Hybrid (DBH) and other Device-Level Solutions. Verizon updated the Commission regarding its plans for DBH and other handset-based E911 location solutions in a July 20th letter.⁶ As Verizon explained, there are two principal methods of using device-level location information for E911: "Mobile Station Based" ("MSB") location, which, like many commercial LBS applications, relies solely on the location calculation derived by the handset's internal operating system, without action by the service provider; and "Mobile Station Assisted" ("MSA"), which integrates the handset-level GPS and Wi-Fi capabilities with the wireless provider's existing Assisted-GPS ("A-GPS") functionality and uses the mobile network to calculate the location fix. And consistent with Commission guidance, Verizon's plan is, whenever possible, to deliver *both* MSA and MSB information to its location server which, in turn, will choose the better of the horizontal location estimates to send to the PSAP, whether MSB, MSA, dispatchable location or other. Verizon has worked diligently over the past several months with solution providers and will implement MSA and MSB across its handset portfolio as follows:

⁵ See *FCC Seeks Comment on Waiver of Part 25 Licensing Requirement for Receive-Only Earth Stations Operating with the Galileo Radionavigation-Satellite Service*, Public Notice, IB Docket No. 17-16, FCC 17-18 (IB 2017).

⁶ See *July 20th Letter* at 1-2.

- *iOS*. Verizon-branded devices launched in 2017 or earlier (iPhone5-iPhoneX) use MSA. Apple Watches currently in market use MSB. MSB using Apple's HELO solution will be available for new iOS-enabled devices going forward. And Verizon hopes that future models will include both MSB *and* MSA, but that will depend in large part on handset and chipset manufacturers' willingness to implement both.
- *Android*. Verizon has contracted with a third party Wi-Fi access point aggregator to proactively develop its own Wi-Fi solution for devices that pass Wi-Fi access point information, such as Android devices. This MSA-based solution will use the Wi-Fi access point information and the location sources already in use today (e.g. GPS and OTDOA), and is targeted for introduction in Verizon's network for the fall of 2018. Preliminary testing of the solution is encouraging. Verizon looks forward to working with vendors to incorporate reliable MSB-based methods into Android devices.

III. VERTICAL LOCATION ACCURACY REQUIREMENTS

The Commission's requirements for vertical location accuracy are designed to give wireless service providers incentive to deploy solutions that deliver a 911 caller's vertical location to those geographic areas where 911 callers are more likely to benefit from those capabilities. Service providers may comply with these requirements through two alternative means: maintaining a sufficient number of dispatchable location access points in the most populous service areas; or deploying an accurate vertical "Z-axis" solution across sufficient coverage within those service areas. In addition to pursuing dispatchable location solutions through the NEAD and other methods, Verizon is working with vendors and taking internal steps to facilitate the development and possible use of viable Z-axis solutions as well.

A. Uncompensated Barometric Data

The rules require that by August 2018, wireless providers "make uncompensated barometric data available to PSAPs with respect to any 911 call placed from any handset that has the capability to deliver barometric sensor information." Verizon has completed implementing the LPPE protocol in its 911 server, which will enable a handset to transmit available Uncompensated Barometric Pressure (UBP) on the device back to Verizon's network for delivery to the PSAP. Verizon has also completed the necessary measures to install software on its 911 server that will enable this capability by parsing the LPPE message from the handset and extract the UBP reading to send to the PSAP, and will deliver UBP from capable devices to capable PSAPs by August 3, 2018. Verizon understands that some devices will have that capability as of that date.

B. Dispatchable Location

Dispatchable location, by definition, will include vertical information where needed (e.g. the floor, suite, etc., of the 911 caller). Thus, all of the measures described above relating to development and deployment of technologies and solutions for dispatchable location are also

attributable to Verizon's efforts to comply with the Commission's vertical location accuracy rules.

C. Z-Axis Vertical Requirements

CTIA is filing a detailed report on the results of testing of NextNav and Polaris Wireless barometric pressure-based Z-axis solutions in the Test Bed, together with a recommended vertical location of +/- 5 meters for 80% of fixes. While the tested solutions show promise, the recommendations are necessarily based on the parameters of the Test Bed methodology and the extent to which vendors who opted to participate were able to meet the full scope of the Test Bed across a representative cross-section of their device offerings, and the proof-of-concept status of their products. Verizon co-chaired CTIA's Z-Axis working group and supports additional testing in the next 12 months, both to enable NextNav and Polaris to participate more comprehensively in the Test Bed, and to test other emerging Z-axis solutions that rely primarily on enhanced Wi-Fi positioning technologies, such as 3D Wi-Fi. A few vendors of the 3D Wi-Fi positioning approach have indicated the availability of their solutions for testing within the next 12 months.

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