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August 3, 2018

VIA ELECTRONIC FILING

Ms. Marlene Dortch
Secretary
Federal Communications Commission
The Portals
445 12th Street SW
Washington DC 20554

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

Dear Ms. Dortch:

Pursuant to the FCC's E911 Fourth Report and Order, and §20.18(i)(4)(ii) of the FCC's rules, AT&T is required to file a CMRS Provider 36-Month Progress Report () by August 3, 2018. Attached, please find AT&T's E911 Indoor Location Accuracy Progress Report.

Sincerely,

/s/ Joseph P. Marx
Assistant Vice President, AT&T Services, Inc.

E911 Indoor Location Accuracy Progress Report (36 Month Report)

1. Introduction

The FCC's Fourth Report and Order on Wireless E911 Location Accuracy requires that nationwide CMRS providers report to the Commission on progress toward improving indoor location accuracy (see 47 C.F.R. §20.18(i)(4)(ii)). This progress report will lay out the steps that AT&T has taken since the Initial Implementation Plan was filed on February 2, 2016 to improve location accuracy on its network. In addition, the plan will highlight details as to the implementation of National Emergency Address Database (NEAD) as required by the rule.

2. Update on the Test Bed

Shortly after the adoption of the Fourth Report and Order, CTIA established the 9-1-1 Location Technologies Test Bed, LLC (Test Bed LLC) as an independent company to administer and operate the indoor accuracy Test Bed consistent with the FCC rules. The Test Bed LLC selected the Alliance for Telecommunications Industry Solutions (ATIS) as the Test Bed program manager. And in March 2016 the Test Bed LLC selected LCC Design Services, a Tech Mahindra Company (LCC/TechM), to administer and execute the Test Bed. In June of 2016, ATIS ratified the *ATIS Standard on Test Bed and Monitoring Regions Definition and Methodology* (ATIS-0500031) that provides the guidelines regarding the Test Bed regions, morphologies, building types and construction materials (Test Cases).

One of the subcommittees of ATIS, the ATIS Emergency Services Interconnection Forum (ESIF), specifically recommended that the Test Bed should perform the testing in

stages, with Stage 1 designated to test wireless carriers' existing 9-1-1 location technologies and Stage 2 designated to test new technologies.

The Test Bed has been actively involved in performing various stages of testing over the past two years, including subsequent re-testing for carriers, testing emerging technologies, and other additional stages of testing.

As noted in Section 4, *Vertical Location Technologies,* of this report, the Test Bed completed testing of Z-axis technologies (Stage Z) in the first and second quarters of 2018. Limited Functionality Testing (LFT) for Dispatchable Location (DL) was also completed in the second quarter of 2018, and the Test Bed plans to perform full DL testing in third and fourth quarters of 2018.

AT&T has been actively supporting Apple in its testing of Hybridized Emergency Location (HELO) technology in the Test Bed as part of Stage 2a. Apple tested its HELO solution on the AT&T network using pre-configured SIMs. AT&T also provided daily network location logs to LCC/TechM as part of this testing.

AT&T has also been supporting both Polaris Wireless and NextNav for the Stage Z testing in the Test Bed. AT&T continues to work closely with both of these technology companies, providing network access and data connections in support of the testing and development of their solutions. AT&T also provided Polaris Wireless network information and cell databases for each eNode B (cell site) in the 3 test bed regions (Atlanta, the San Francisco Bay Area, and Chicago).

3. Horizontal Location

In the Order, the FCC adopted new rules that require wireless providers to generate either a Dispatchable Location or X/Y location information within 50 meters for a certain percentage of wireless calls to 9-1-1 within specific timeframes.[1] By the date of this report, wireless carriers are required to deliver 50% of all calls within 50m or provide a dispatchable location to satisfy the horizontal accuracy requirements and AT&T has certified compliance with this benchmark.

3.1 X/Y Coordinate Technologies

In the Initial E911 Indoor Location Accuracy Implementation Plan, AT&T shared the Horizontal Location Technologies that were tested as part of the Stage 1 testing. At that point, the primary X, Y location technology was still Assisted GPS for high accuracy and several network technologies for fallback (Cell ID, Enhanced Cell ID, and OTDOA) that provided less accurate location.

In that report, we discussed the availability of a new device-based hybrid functionality from Apple called Hybridized Emergency Location (HELO). We tested this functionality in the Stage 1 Test Bed and it showed excellent results even in dense urban indoor locations. Since the initial report, the HELO solution has been fully deployed throughout AT&T's network[2] and, consistent with its test results, is providing excellent indoor location information for subscribers placing 911 calls from an iPhone. In addition, Apple has announced the availability of the HELO solution with RapidSOS,[3] which has shown

[1] *See*, FCC, *Fourth Report & Order on Wireless E911 Location Accuracy Requirements* (rel. Feb. 3, 2015) (Order). The FCC's rules were based on the *Roadmap to Improve 911 Location Accuracy* developed by AT&T, Sprint, T-Mobile and Verizon, the Association of Public-Safety Communications Officials (APCO) and the National Emergency Number Association (NENA) available at http://apps.fcc.gov/ecfs/document/view?id=60000986637.

[2] See announcement at http://www.idownloadblog.com/2018/01/08/apple-helo-technology/.

[3] See announcement at https://www.apple.com/newsroom/2018/06/apple-ios-12-securely-and-automatically-shares-emergency-location-with-911/?utm_campaign=Circus&utm_source=hs_email&utm_medium=email&utm_content=63827402&_hsenc=p2ANqtz-

improvements in the time to first fix. This improved time to first fix should provide real value to first responders since the location will be available earlier in the call delivery. AT&T has tested with this capability and plans to enable that in our network as part of its release of iOS 12.

Google has also announced the availability of its equivalent device-based hybrid location functionality called Emergency Location Service (ELS). While AT&T was not directly involved with testing the ELS solution in the Test Bed, the accuracy results released to AT&T as part of the Technical Advisory Group showed that Google's solution is providing excellent location accuracy, including in difficult indoor locations. AT&T currently is working with Google to figure out how to integrate the Google ELS solution into AT&T's network, so we can take advantage of its accuracy performance improvements for AT&T customers using Android handsets.

And one additional area that AT&T highlighted in the initial implementation plan was improvements in the Assisted Global Positioning System (AGPS) Chipsets. We are now seeing next-generation AGPS chipsets that have improved sensitivity and include native almanac data that enables a warm-start for satellite acquisition. Initial testing with these devices shows significant improvements in location accuracy in deep urban and indoor locations. AT&T is now selling devices with these new AGPS chipsets and getting the benefit of the improved location for our Live 911 call data.

3.2 Dispatchable Location (NEAD)

This section provides a summary update of the National Emergency Address Database (NEAD) since the Initial Implementation Plan was filed in February 2017.

- The NEAD remains on track to meet the FCC's 2021 requirements
    - The FCC approved the NEAD Privacy & Security Plan (Nov. 2017)

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    - The National Emergency Address Manager (NEAM) began accepting production grade reference points from AT&T (June 2018) - see section below on NEAM Interface
    - The NEAD LLC established a website to educate and inform interested stakeholders about the NEAD at www.911nead.org
    - The NEAD LLC has engaged diverse group of reference point owners to meet FCC reference point requirements, including Bluetooth beacon service providers, Internet Service Providers and large enterprises.
- NEAD is operational for testing purposes
    - Testing of three nationwide wireless carriers' dispatchable location solutions will begin in the second half of 2018.
    - The NEAD, LLC is working with APCO, NENA and NASNA to identify PSAP implementation considerations, including an End-to-End evaluation of dispatchable location solutions by end of year 2018 or early 2019.

3.3 Deployment Progress on the NEAD Database through AT&T Network

3.3.1 Lab

AT&T has integrated a single NEAD instance with the evolved Serving Mobile Location Center (eSMLC) in the lab and has completed all functionality tests that could be accomplished with a single instance of the database. All failover testing that involved multiple instances of the NEAD were tested as part of the production network under controlled circumstances without affecting live 911 calls.

Figure 1 shows a high-level view of connectivity between the eSMLC and the NEAD.

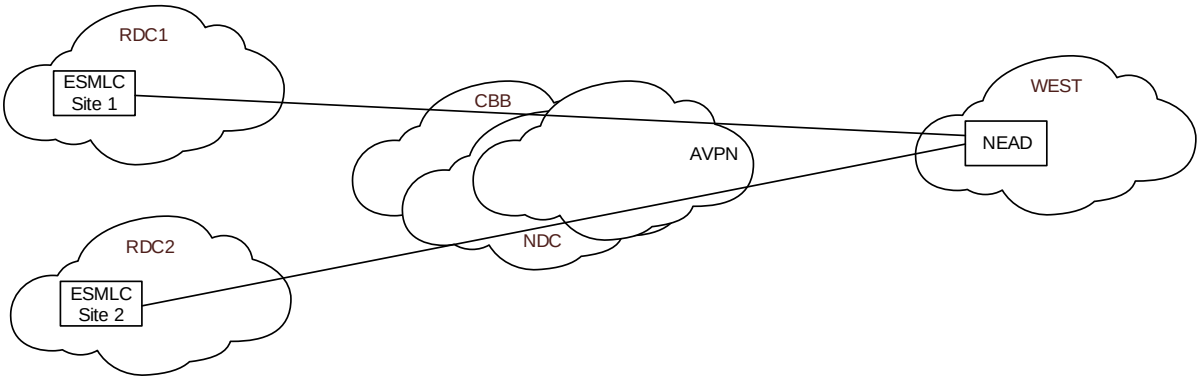

Figure 1: High-level Connectivity between lab eSMLC and NEAD (without NEAD redundancy)

Figure 2 shows the high-level redundancy between the eSMLC and the NEAD. Each SMLC blade connects to both NEAD sites, with the closest NEAD site being primary. The red lines illustrate a failover, in the event an NDC goes offline.

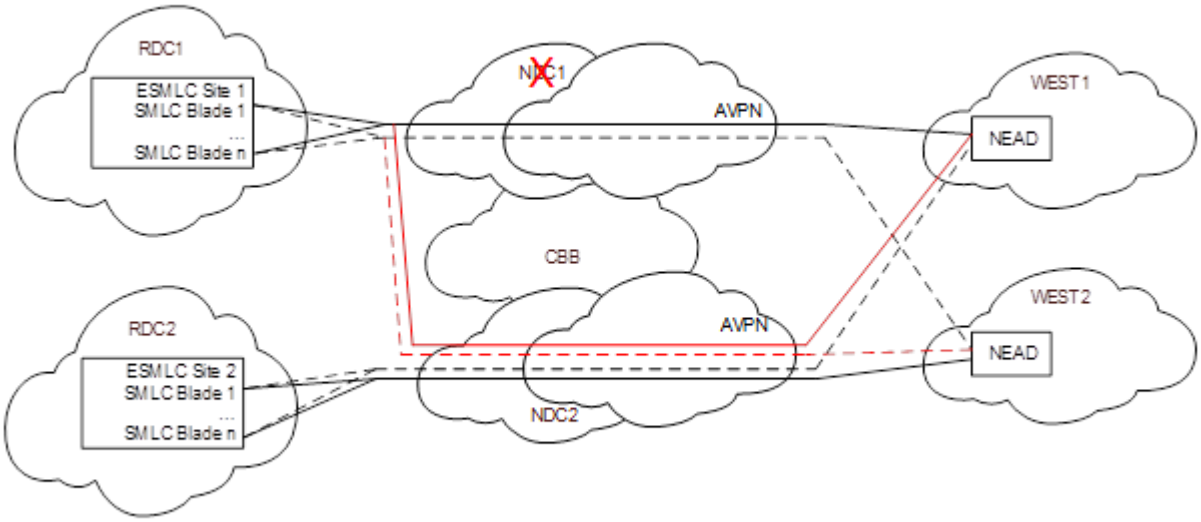

Figure 2: High-level Connectivity between lab eSMLC and NEAD (with redundancy)

3.3.2 Production

The AT&T eSMLC location servers supporting the San Francisco and Atlanta testbeds were fully integrated with and are pending approval to become Authorized Users (AU) of the NEAD platform. The remaining location servers are expected to be fully integrated with the NEAD platform by first quarter of 2019.

3.4 NEAD Privacy & Security Plan

Before AT&T can use the NEAD Platform for its Dispatchable Location solutions, the FCC's Order requires it (as well as the remaining national wireless providers) to certify that NEAD information will only be used for 9-1-1 purposes and conditions their ability to utilize the NEAD on the FCC's approval of a NEAD-specific privacy and security plan. (47 C.F.R. §20.18(h)(3)(i)(4)(iii)). AT&T filed its certification regarding the use of the NEAD at the FCC on June 1st of this year.

3.4.1 NEAD Interface Security

The interface between the AT&T Network and West Public Safety NEAD database (Nq interface) utilizes an existing DS3 serial TDM circuit. As a result, this circuit handles both the existing SLg Interface (between the PLRF and GMLC) and Nq Interface (between the eSMLC and NEAD). The two traffic types use separate virtual routing functions (VRFs). The eSMLC uses a secure TLS1.2 connection to communicate with the NEAD. West Public Safety provides the TLS certificate to AT&T, which is valid for three years. The secure connection is established, and heartbeats are exchanged, before any 911 Location Information (access point information is communicated to the NEAD).

3.5 AT&T Access Points and Interface to the NEAM

AT&T has two distinct customer domains to be used for access point data within the NEAD; consumer and commercial Wi-Fi. And each of these domains include multiple data sources and systems. As a result, the delivery of consumer and commercial Wi-Fi access points were separated into two different solutions. AT&T prioritized the consumer solution

ahead of the commercial Wi-Fi solution since reference address data was more readily available for these Access Points.

AT&T chose the Batch Provisioning Interface for our provisioning solution to solve the existing challenge of availability of key data points. Figure 3 shows the provisioning flow from the AT&T Network through the Nq interface to the NEAM/NEAD databases.

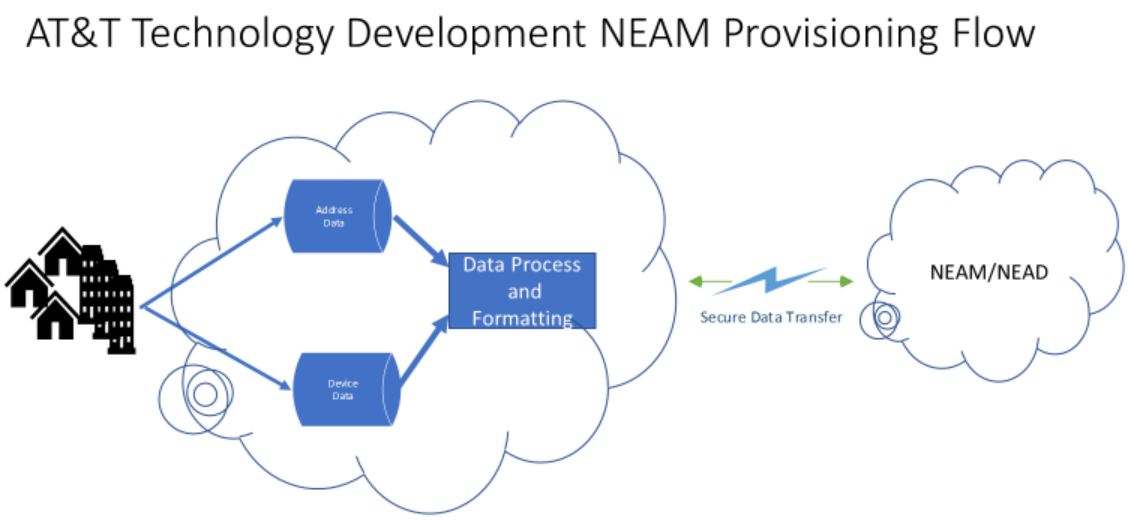

Figure 3: NEAM Provisioning Interface

AT&T has worked through several challenges to include MSAG validation, error clarity, provisioning optimization, and data integrity within its solution. The full provisioning interface with the NEAD for consumer access points was launched on June 26, 2018 and is now the primary contributor of APs to the NEAD.

The commercial Wi-Fi access point provisioning solution development is also in progress. AT&T will leverage consumer systems to optimize design and delivery since it is largely reusable. The target to complete the provisioning interface for the commercial access points is also at the end of the 3rd Quarter 2018.

4. Vertical Location Technologies

4.1 Uncompensated Barometric Pressure

AT&T is actively implementing Uncompensated Barometric Pressure (UBP) for new VoLTE compatible handsets. Implementation of this mandate requires modifications to the 3GPP standards, handsets, and several network elements (both internal to AT&T's network and Service Bureau network elements such as the GMLC). As defined and documented in the CTIA Z-axis working group's system analysis document, UBP-capable handsets must meet each of the following requirements:

1. The User Equipment (UE) shall contain a barometric pressure sensor, which sensor shall expose to control plane *at least* a UBP measurement.

2. The UE shall support control plane protocol to transfer UBP data between the UE and the Core Network.

4.2 Updates on Progress of UBP Implementation

As noted, above changes were required in multiple network elements in the core network to support delivery of UBP. In the core network, these changes were primarily in the Mobility Management Entity (MME) and the eSMLC.

The MME required changes to the standards as well as new functionality to support the delivery of UBP. These standards change requests were approved by 3GPP at the December 2015 plenary meeting to support conveyance of uncompensated barometric pressure on the SLs interface between the MME and eSMLC and SLg interfaces between the MME and GMLC.

AT&T requested this feature from each of our MME vendors in the first quarter of 2016. Once delivered, AT&T has successfully tested this feature in the lab and successfully verified the functionality testing and interworking with the eSMLC nodes.

At this point, AT&T has upgraded the MME Nodes in its commercial network to support delivery of UBP to PSAPs.

The eSMLC supports receipt of UBP information from the handset via the existing control plane interface used for E911, between the eSMLC and the UE. The UBP information and Wi-Fi information for DL is delivered via OMA v1.0 LPPe information element (IE) which is embedded within 3GPP LPP protocol. AT&T has performed interoperability device networking (IODT) with major chipset vendors and upgraded its eSMLC nodes to support receipt of UBP from compatible handset devices over the control plane interface between the eSMLC and the handset. AT&T has also performed interoperability with each of the GMLC vendors to receive UBP information from the SMLC and have fully deployed the eSMLC changes for UBP in the Commercial Network.

AT&T has also updated its device requirements for handsets to include delivery of UPB and Wi-Fi information for dispatchable location to the eSMLC via the standard control plane signaling interfaces between the eSMLC and the handset. Handset Support for LPPe and specific information elements for UBP and Wi-Fi AP information for dispatchable location are referenced in these device requirements. AT&T has received and tested commercial handsets that support the delivery of UBP.

AT&T has also performed lab interoperability with its external GMLC nodes to support receipt of UBP and dispatchable location along with the typical geodetic location. Rather than relying on specific PSAP requests for UBP information, AT&T will asynchronously forward UBP information received from any capable handsets to the GMLC nodes to be delivered to the PSAP. AT&T has completed field testing of this feature in the First Field Application (FFA) and Second Field Application (SFA) markets.

In addition, AT&T is also currently working with CTIA and reaching out to external stakeholders (public safety and system service providers) to upgrade their systems for DL/UBP support and perform PSAP end to end functional verification of this feature. Towards this end, AT&T is working with CTIA and reaching out to industry stakeholders to identify candidate PSAPs in the FFA markets (two test bed regions) that are capable of supporting receipt and display of UBP and Dispatchable location (DL) at the PSAP CPE.

4.3 Potential Z-Axis Solutions

AT&T is participating in the CTIA Z-axis working group, which has been tasked with developing a report and a proposal for a Z-axis performance metric to the FCC, via an independently-administered test bed process. The Z-axis working group is also closely working with the CTIA Test Bed working group to test emerging Z-axis technologies in the CTIA test bed. In September 2017, the Test Bed publicly solicited applications from vendors of Z-axis technologies to participate in Stage Z testing.

Only two companies, NextNav LLC and Polaris, participated in this round of the Stage Z testing. AT&T continues to work closely with each of these companies supporting development of these solutions, providing technical evaluations and testing support in the AT&T Lab as well as in the field. AT&T is also supporting these companies in testing their technology in the Test Bed by providing network access and data connections. The Z-axis testing was performed in Atlanta, the San Francisco Bay Area, and Chicago test bed regions in accordance with the test methodologies for indoor wireless testing specified by ATIS. The Test Bed LLC is developing a report with the details of the testing and analysis of the test results to the CTIA's Z-axis Working Group.

AT&T expects further progress on additional rounds of Stage Z testing in the CTIA test bed and is hopeful that additional z axis technology vendors will participate in subsequent phases of Z-axis testing in the CTIA test bed.

5 Standards Activity

AT&T has been actively involved in the standards development efforts related to 911 Location Accuracy and has participated in following standards groups.

- ATIS Emergency Services Interconnection Forum (ESIF) Emergency Services and Methodologies (ESM) Subcommittee
    - AT&T is the co-chair of the ATIS standards working group ESIF-ESM. ATIS ESIF-ESM is instrumental in driving the industry standards for E911 location technology. In the past 18 months, the Subcommittee has worked closely with the Test Bed LLC by defining the E911 indoor testing requirements for determining accuracy and performance of E911 location solutions, the methodologies for blending performance data, the clear definitions of morphology environments, and defining the Test Bed testing boundaries, morphology coverage, as well as the recommended building types to be used in testing. ATIS ESIF-ESM is also addressing the performance testing and reporting for localized E911 location solutions (*i.e.*, solutions designed for specific types of venues such as convention centers and sports arenas) as well as low energy beacon solutions. This Subcommittee is a long-standing public safety stakeholder forum with major successes in driving E911 standards, addressing current and potential future issues, and a history for delivering standards-based solutions within 12 months of issue adoption. The membership of the committee is comprised of diverse public safety stakeholders, including the national public safety associations, NENA & APCO, vendors of E911 technology solutions, as well as the wireless carrier community.
- ATIS Emergency Location (ELOC) Task Force
    - AT&T is the co-chair of the ELOC Task Force and also provides technical support and expertise to the Task Force in the form of working group staff. ELOC is a joint effort between two ATIS standards committees, (ESIF) & the

Wireless Technologies and Systems Committee (WTSC)), which is also comprised of public safety stakeholders (*e.g.*, NENA & APCO), vendors of E911 technologies, as well as wireline and wireless carriers. ELOC continues to work closely with the NEAD LLC in the development and delivery of the technical requirements and recommended architecture of the NEAD. The Task Force addresses the use of Wi-Fi access points and Bluetooth beacon technologies, along with a physical address database known as the NEAD, to identify the location of an E911 caller and provide dispatchable location information to the PSAP call taker. The Task Force's work has resulted in the publication of ATIS-07-00028v1.1, "Location Accuracy Improvements for Emergency Calls" (ELOC Phase 1), in September 2016. This document formed the basis for the requirements for the development of the NEAD and its interface to the originating wireless operator's network. The Task Force's work recently resulted in the publication of ATIS-0700039, "Guidelines for Emergency Call Location Selection and Reporting by Originating Networks" (ELOC Phase 1.2), in May 2018. This document provides guidance to wireless operator networks on how to determine dispatchable location based on potentially numerous inputs from various sources including the NEAD. The ELOC Task Force is currently working on a project for ELOC Phase 2 entitled "Requirements and Architecture for Accessing External Enterprise Location Services." The goal of the project is to "develop the interface, protocol, and database requirements enabling the NEAD architecture to support querying external (to the serving core network/NEAD) sources for the location of a 9-1-1 calling device in real-time." The Task Force has also begun studying the differing characteristics of Bluetooth beacon systems, some with static identifiers that can in a straightforward manner map to civic address information in the NEAD, and some with ephemeral rotating identifiers that

require additional coordination/processing before they can be reliably used with the NEAD. It is anticipated that ATIS ELOC Task Force will work with Bluetooth Special Interest Group, an international Bluetooth standards development organization, to develop a public safety profile for Bluetooth beacons that can be used to improve location accuracy results for emergency calls via the NEAD architecture.