

**Before the
Federal Communications Commission
Washington, DC 20554**

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

To: The Commission

**COMMENTS OF
THE BOULDER REGIONAL EMERGENCY TELEPHONE SERVICE AUTHORITY
ON VERTICAL (Z-AXIS) ACCURACY METRIC PROPOSED BY THE
NATIONWIDE WIRELESS CARRIERS**

The Boulder Emergency Telephone Service Authority (“BRETSA”),¹ by its attorney, hereby submits its Comments on the Commission’s March 15, 2019 Fourth Further Notice of Proposed Rulemaking in the above-captioned matter.

I. The Commission Should Expeditiously Adopt A Vertical Location Standard.

Adoption of a vertical location standard will benefit the public. Delay in favor of a higher standard of accuracy or additional testing should not delay provision of the public benefit.

A. The Perfect Should Not Be The Enemy Of The Good.

Even if the Commission were to adopt the *ridiculous* 5-meter accuracy standard proposed by the wireless providers,² it would be better than not adopting a standard. In the largest markets

¹ BRETSA is a Colorado 9-1-1 Authority which establishes, collects and distributes the Colorado Emergency Telephone Surcharge to fund 9-1-1 Service in Boulder County, Colorado. The BRETSA Board includes the Boulder County Sheriff, the City of Boulder Police Chief, representatives of the Boulder County Firefighters Association and the City of Longmont Division of Public Safety. The fifth seat of the Board is filled by representatives of the smaller cities and towns in Boulder County, Colorado on a rotating basis. These Comments are thus intended to represent the perspective of the entity responsible for funding 9-1-1 operations, *and* of the agencies and authorities responsible for PSAP operations and overall public safety services.

² NextNav has demonstrated that it can meet a sub 2-meter standard 80% of the time, both in the current tests and in CTIA’s 2016 testing in which NextNav did not have an opportunity to calibrate the handset pressure sensors. Stage Z Report, at 120, 126-127. Polaris has submitted information that it can meet a 3-meter standard 80% of the time if permitted to use active sensor bias compensation in the test. Stage Z Report, at 133-134. Polaris also proposes a

in which vertical location information will initially be required, even implementation of a 5-meter standard would substantially reduce the number of floors to be searched for a caller unable to provide his or her location, and reduce the time required to locate the caller. Vertical location data can also assist location of wireless 9-1-1 callers in open space areas. How many have perished while waiting for First Responders to locate them over the years that vertical locations systems have been tested and shown consistent and improving results? How many more will needlessly perish while waiting to be found if we dither with the further testing CTIA urges?

B. The Z Report And CTIA Unreasonably Seek Further Testing.

The Stage Z Report identifies a number of “error sources” which could affect vertical location accuracy,³ yet the Report shows remarkably consistent test results *notwithstanding these “error sources.”*⁴ NextNav also demonstrates that its test results have been consistent and improving over multiple tests over 6 years.⁵

The Stage Z Report and CTIA note that NextNav did not participate in the testing in Chicago, where it has not yet deployed its MBS network, and testing of Polaris technology in Chicago did not occur during the more extreme weather conditions that can occur there in winter.⁶ Neither demonstrate that building codes and construction methods in different areas of the country are sufficiently different to produce different results, given the consistency of results in the areas tested. Nor do they support the speculation that climactic extremes such as colder weather or higher winds could impact location accuracy, particularly in systems which use

hybrid solution using a NEAD-like 3D Wifi database, which it was not allowed to demonstrate in the Stage Z testing. Stage Z Report, at 131.

³ Stage Z Report, at 24-26.

⁴ Stage Z Report, at 120. Polaris also states that while not permitted to use active sensor bias compensation in the Stage Z tests, reprocessing actual test data to emulate performance with limited active sensor bias compensation provided 80 percentile aggregate accuracy of 2.8 meters. Stage Z Report, at 134.

⁵ Comments of NextNav in PS Docket No. 07-114 [*re* Stage Z Report], filed October 1, 2018, at 2-5, available at <https://ecfsapi.fcc.gov/file/100221441568/NextNav%20Z%20Axis%20Public%20Notice%20Comments%2010%201%202018%20final.pdf> (last checked May 16, 2019)(hereinafter, “NextNav October 1, 2018 Comments”).

⁶ CTIA Cover Letter to Stage Z Report, at 3-4.

compensated barometric data. Even 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.

The Stage Z Report states:

While the results of Stage Z testing provide helpful data and lessons learned, numerous key questions remain that could not be answered through Stage Z testing completed to date. For example, questions remain about how a barometric pressure-based altitude estimation system would perform in a real-world production deployment and how such a system would scale to hundreds of millions of devices across the U.S. Moreover, additional focus is needed to better understand the extent of mobile device barometric sensor biases, to then develop and test commercial Z-axis implementations, and to understand if Z-axis systems can make reliable and accurate floor level determinations in buildings – at scale.⁷

And:

A fundamental assumption is that the results of these proprietary vendor solutions are reflective of what can be achieved in a final production environment. However, these solutions are not commercially available for the purpose of E9-1-1 in their present state. The “at-scale” architecture for a universal E9-1-1 altitude determination capability was not tested in this exercise.⁸

CTIA states:

[B]arometric pressure sensor-based Z-axis solutions require further development, potentially including further standardization efforts, implementation into wireless network systems and production mobile devices, and then re-testing in a production configuration to determine whether the Stage Z results can be replicated and deployed ubiquitously in real-world production and live wireless 9-1-1 call environments.⁹

CTIA and the Stage Z Report thus seek to create a “chicken and egg” dilemma, essentially arguing that the Commission should not adopt a meaningful Z-axis metric until putative vertical location technology providers demonstrate that they can meet the standard if implemented nationwide, but providers cannot demonstrate that they will meet the standard when

⁷ Stage Z Report, at 5.

⁸ Stage Z Report, at 119.

⁹ CTIA Cover Letter, at 3-4.

implemented nationwide until a standard is adopted, CMRS providers are required to comply with the requirement, and the solutions are implemented nationwide. The more testing which is required, the more uneconomic the development of accurate and practical vertical location technologies becomes.

II. A Z-axis Accuracy Metric of Two-Meters for Eighty Percent of Calls Should Be Adopted.

NextNav, LLC has demonstrated that it can meet a sub 2-meter vertical accuracy standard for 80% of calls, and that it has done so in multiple tests over a period of years.¹⁰ Polaris has demonstrated that it can meet a sub 3-meter vertical accuracy standard for 80% of all calls, when using active sensor bias compensation *as intended*, and Polaris' overall vertical location solution is intended to include other components, *i.e.*, a NEAD-type database.¹¹

BRETSA understands that floor-level accuracy is a critical objective, and 3-meter accuracy is floor level accuracy. While BRETSA would not object to a 3-meter accuracy standard for 80% of all calls, BRETSA believes the Commission should *not* adopt a standard significantly less stringent than that which technology providers already meet. The Stage Z testing of NextNav's 2-meter standard for 80% of all calls results in a 3-meter standard for 94% of all calls.¹² It should also result in a lower margin of error.

Moreover, one would expect the accuracy of vertical location systems to improve as they are deployed "at scale" and additional experience with them is gained. As discussed at Section III below, wireless provider proofs-of-performance should be required, and test procedures should be published for Fire and other Public Safety Agencies to verify the accuracy of vertical location data they can expect in their jurisdictions, or in connection with preparation of pre-plans

¹⁰ See fn 2, *infra*.

¹¹ See fn 4, *infra*.

¹² NextNav October 1, 2018 Comments, at 7.

for significant structures in their jurisdictions. Depending upon the proof-of-performance and Public Safety Agency test procedures, ground truth data provided back to the location technology providers may allow refinement of the technology, or support the development of data sets supporting use of artificial intelligence to improve the location data.

Adoption of any standard would require grant of waivers if available technology cannot meet the standard in practice. Thus, if location technology providers are unable to meet the 2-meter vertical location standard in a particular market, temporary waiver of the vertical location requirement (reflecting a 3-meter standard or the accuracy which can be achieved) would be warranted. Extensions of such waivers would be warranted upon a showing of (i) the continued inability of location technology providers to meet the 2-meter standard, and (ii) reasonable efforts to implement available technology improvements to meet the 2-meter standard.

III. Provider Proof-of-Performance.

The Commission should require wireless providers to conduct and file proofs-of-performance of vertical location technology as deployed, and provide test procedures for First Responders to determine vertical location accuracy within their response areas.

A. Proof-of-Performance.

To determine whether wireless providers are meeting the vertical location accuracy standard, and provide First Responders data requiring the actual accuracy obtainable, the Commission should require wireless providers conduct proofs-of-performance in a specified (limited) number, location and types of structures in each market in which they are required to provide vertical location data.

The Stage Z vertical location tests demonstrate the accuracy of vertical location technologies developed by Polaris and NextNav. However the wireless providers themselves

have questioned whether test-bed results are applicable to all markets. In addition, the efficacy of location technologies which require deployment of facilities in the market, will depend upon the facilities deployed in each such market. Proof-of-performance tests in each market will thus establish whether a provider is capable of meeting the standard in that market. Indeed, BRETSA would expect that CMRS providers and location providers would cooperate in testing to assure that they are meeting the required location accuracy; the proof-of-performance requirement would simply establish standard test procedures and requirements, and require that the results of such tests be filed with the Commission.¹³

Proofs-of-performance will also have the salutary effects of (i) providing Public Safety Agencies a benchmark of the actual accuracy of vertical location information they can expect, and (ii) allowing providers or consumers to choose between competing vertical location information providers. Two vertical location information providers, Polaris and NextNav, have participated in test-bed evaluations of the performance of their solutions. NextNav's technology requires deployment of infrastructure in a market, but has provided more accurate vertical location data in test-bed evaluations. Polaris' solution does not require deployment of infrastructure, and is capable of providing floor-level accuracy using compensation data. It is possible that either of these or another solution may provide more accurate results than other solutions. If there are multiple solutions available, the most accurate solution in a market should be automatically or manually selectable.¹⁴

¹³ Building owner resistance to tests and voluntary submittal of elevation information may be promoted by development of a "Certified 9-1-1 Ready" program which would certify compliance with Kari's Law and that floor elevation AGL and AMSL had been provided local Public Safety Agencies for use with vertical location systems. A federal regulation requiring federal employees traveling on official business to stay in Certified 9-1-1 Ready hotels (similar to current regulations requiring stays in hotels with a minimum fire rating, which many states have adopted), and to only attend meetings in Certified 9-1-1 Ready buildings, would promote cooperation with proofs-of-performance and compilation of floor elevation data.

¹⁴ BRETSA does not believe latency of vertical location technologies is as critical as with horizontal location technologies. Horizontal location accuracy is critical to expeditious and correct routing of a 9-1-1 call to the PSAP

Both the Polaris and NextNav solutions were implemented in the Stage Z test-bed via software applications. This presents the prospect of development of additional smartphone applications for the purpose of providing vertical location data. It is important that location data, including vertical location data which accompanies a 9-1-1 call or text be hardware- and firmware-based to discourage location spoofing.

Proofs -of-performance should not require that test calls actually be delivered to a PSAP, to avoid interfering with ongoing PSAP and Emergency Response operations.

B. Public Safety Agency Testing of Vertical Location Accuracy.

In addition to requiring wireless providers conduct and file the results of proofs-of-performance in the markets in which they are required to deploy vertical location technology; the Commission should require wireless providers to publish procedures for First Responders to conduct tests of vertical location accuracy, and provide any required assistance in such tests, in *all* markets in which vertical location technology is available. Testing methodology and procedures should not require active participation of wireless or location provider personnel, to simplify the scheduling and completion of such testing.

Public Safety Agency testing of vertical location performance within their jurisdictions and within significant buildings in their jurisdiction will serve two purposes. First, it will provide the Agency with information on the level of accuracy actually achieved, and assist dispatchers and First Responders in interpreting the location data received with 9-1-1 calls.¹⁵

Second, barometric pressure-based and other vertical location technologies provide elevation above mean sea level (“AMSL”). To identify the floor of a multi-story building

which can dispatch the nearest First Responders to the caller’s correct location. However there will generally be a sufficient interval between receipt of a 9-1-1 call at a PSAP and arrival of First Responders on scene to allow for delayed provision of vertical location data to assist the First Responders in locating the caller.

¹⁵ Public Safety Agency testing of horizontal location data should also be provided for, for this same purpose.

corresponding with a specific elevation above AMSL, the elevation of the first floor AMSL, and the height of each floor must be known,¹⁶ so that the height above ground level (“AGL”) can be determined and correlated with a floor number. One would not expect the required information to be readily available to wireless providers. Terrain databases may not account for grading that occurred during building construction.

As states transition to NG9-1-1, they can be expected to create point-based GIS records for use in CAD and other GIS-based databases which may facilitate development of some of the data required to correlate elevation AMSL to building floor level. Municipal and county building departments generally have on file the building plans submitted with every application for a building permit, from which floor elevations above ground level (“AGL”) can be determined. Indeed, Fire Agencies generally take those building plans for significant structures, remove information extraneous to fire response and add or highlight information such as areas in which units should be staged or positioned during Emergency Response, the location of exterior valves for tankers to supply additional water and pressure to building sprinkler systems, etc., to develop “Pre-plans” for Emergency Response. As Fire Agencies develop and review Pre-plans, conduct fire inspections and perhaps verify wireless vertical location information, floor level AMSL data can be developed, verified and integrated into CAD data. Fire Agencies may use wireless vertical location data to validate, or if sufficiently repeatable, establish floor elevations for both pre-plans and CAD premises data for Emergency Response.¹⁷

Where wireless providers install roof-top or in-building CMRS sites, it would not be unreasonable to require they provide verified (i) geographic coordinates for the building, (ii)

¹⁶ Depending upon the applicable land use requirements at the time the building was erected, and the owner and architect’s design preferences, each floor may have 8-, 10-, 16-foot ceilings, etc., or the first floor may have a 16-foot ceiling and each additional floor a 12-foot height, for example.

¹⁷ Municipalities and counties should amend their land use regulations to require applications for new building permits to include ground level AMSL for the building and floor levels AGL.

elevation data for the building and each floor, and (iii) wireless vertical location information for each floor.

IV. Comments on “Dispatchable Location.”

BRETSA would prefer its PSAPs be provided with a GPS-like plot of wireless callers’ horizontal locations, with accuracy and confidence data, which could be displayed on a CAD mapping system. BRETSA would prefer vertical location information be presented as a height AGL and AMSL, with accuracy and confidence data. This would best provide dispatchers and First Responders an accurate picture of the area within which a caller may be located, and allow them to apply local knowledge, experience and CAD premises and incident data to estimate the caller’s location. Provision of a street and unit address derived from proximity to radio frequency emitters, *without* accuracy and confidence information, would be nothing more than Commission-sanctioned “Swatting,” exposing First Responders and the public to unnecessary risk.

Respectfully submitted,

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May 17, 2019