Before the
Federal Communications Commission
Washington, DC 20554

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

To: The Commission

PETITION FOR RECONSIDERATION OF THE FIFTH REPORT AND ORDER

The Boulder Emergency Telephone Service Authority ("BRETSA"),[1] by its attorney, hereby respectfully seeks reconsideration of the November 25, 2019 Fifth Report and Order[2] in the above-captioned matter.

I. Reconsideration Sought.

BRETSA seeks reconsideration of the Fifth Report and Order in two respects.

In its May 17, 2019 Comments on the Fourth Further Notice of Rulemaking in the above-captioned proceeding ("BRETSA Comments"), BRETSA stated:

> 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.[3]

And:

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[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.

[2] *Wireless Location Accuracy Requirements*, Fifth Report and Order and Fifth Further Notice of Proposed Rulemaking, FCC 19-124 (November 25, 2019)("*Fifth Report and Order*") https://ecfsapi.fcc.gov/file/11250618222682/FCC-19-124A1.pdf.

[3] BRETSA Comments, at 5 (Emphasis added). https://ecfsapi.fcc.gov/file/10518530015254/BRETSA%201905170Comments%204th%20FNPRM%20Vertical%20Accuracy%20Metric%20PS%20Docket%2007-114.pdf.

> 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.[4]

The Commission declined to adopt proof-of-performance testing, stating:

> 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.[5]

BRETSA submits that it was arbitrary and capricious, and an abuse of discretion, for the Commission to have declined to adopt proof of performance testing at limited locations in the 50 markets in which carriers will be required to provide Z-axis location data, on the grounds that it would be impractical and burdensome. The Carriers themselves have stated that additional testing is required, including in additional morphologies and in a production environment, and cited difficulties in securing test buildings in the test-bed cities. It is inappropriate for the Commission to reject a new proposal as inconsistent with a prior Commission decision, when the accuracy of the assumptions underlying the prior decision have been drawn into question by the very parties implementing that decision.

Second, in its Comments BRETSA stated that the Commission should require wireless providers to publish procedures for First Responders to conduct tests of vertical location

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[4] BRETSA Comments, at 6.

[5] *Fifth Report and Order*, para. 45 at 21. The Commission cited T-Mobile's Reply Comments at 3-4, "describing BRETSA's approach as 'clearly infeasible' because 'the impracticability of conducting indoor test calls in each market is what led the Commission…to direct the wireless carriers to establish a representative Test Beed [sic] to validate technologies for indoor location." *Fifth Report and Order*, fn. 178 at 25.

accuracy, and provide any required assistance in such tests. BRETSA did not anticipate active participation in the testing by wireless providers would be required.

In support of this recommendation, BRETSA stated:

> 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.
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> 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 corresponding with a specific elevation above AMSL, the elevation of the first floor AMSL, and the height of each floor must be known, 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.[6]

BRETSA noted that the information necessary to correlate elevation AMSL to floor number of a building will not likely be available to wireless providers,[7] and BRETSA recognizes the burden and impracticality of requiring wireless providers to correlate elevation data with floor numbers for buildings from which 9-1-1 calls are placed. BRETSA stated that such correlation will likely fall upon, and require a community effort by, local governments and public safety agencies. BRETSA discussed data sources for local governments and public safety agencies to gather information on ground level AMSL at a building location, and floor level elevation AMSL or AGL in order to correlate Z-axis location information with floor numbers.[8] The sources discussed included use of "wireless vertical location data to validate, or if

[6] BRETSA Comments, at 7-8 (footnote omitted).
[7] BRETSA Comments, at 8.
[8] BRETSA Comments, at 7-8. BRETSA June 18, 2019 Reply Comments, at 6-7. https://ecfsapi.fcc.gov/file/106192161600796/BRETSA%20190618%20Reply%20Comments%204th%20FNPRM%20Vertical%20Accuracy%20Metric%20PS%20Docket%2007-114.pdf.

sufficiently repeatable, establish floor elevations…."[9] The Commission failed to address this proposal.

The wireless carriers, through the Test Bed, have already developed standards, methods and procedures for determining elevation of floor levels for testing the accuracy of Z-axis technologies. This should enable the wireless providers to develop standard procedures for public safety agencies and others to correlate elevations AMSL to floor level, and test the accuracy of Z-axis locations provided as relevant to development of protocols for 9-1-1 call processing, dispatch and Emergency Response.

II. Wireless Carriers Should Conduct Proof-of-Performance Testing To Benchmark The Accuracy Which Can Be Expected In Each Market.

As stated, wireless carriers have themselves established the need for additional testing of barometric pressure-based and other Z-axis technologies, including in all regions and morphologies. They have also reported the difficulty and cost of acquiring test points in the selected Test Beds.

A. The Wireless Carriers Demonstrate The Need To Establish Performance Benchmarks In Each Market.

The wireless carriers themselves have demonstrated the need for additional Z-axis testing in each market. CTIA stated:

> Comprehensive testing of Z-axis solutions in all regions and morphologies is necessary to confirm performance in live 9-1-1 calling environments.[10]

CTIA also stated:

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[9] BRETSA Comments, at 8.

[10] August 3, 2018 letter from Scott K Bergmann, Senior Vice President, Regulatory Affairs, CTIA, *et al*., to Marlene H. Dortch, Secretary, Federal Communications Commission, re Wireless E9-1-1 Location Accuracy Requirements (PS Docket No. 07-114) Submission of Z-axis Metric and Report (47 C.F.R. §20.18(i)(2)(ii)(B)) ("CTIA Cover Letter for Stage Z Report") at 2 https://ecfsapi.fcc.gov/file/10803074728956/Cover%20Letter%20for%20Stage%20Z%20Report%20and%20Metric.pdf.

> Barometric 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.[11]

Further, the Test Report stated:

> While reasonably comprehensive, the number of regions, buildings and test points used in this testing does not capture every possible indoor environment. Likewise, while the weather conditions encountered in the testing were reasonably diverse, extreme weather conditions were not encountered in this testing.[12]

The wireless carriers have themselves established that additional testing is required, including in different regions and morphologies, different climates and indoor environments (building standards) and as Z-axis location is deployed in real-world production and live wireless 9-1-1 call environments. This coincides with the First Responder operational and practical requirements that proof of performance tests be conducted in each of the markets in which wireless providers are required to deploy Z-axis location data to benchmark expected performance in a production environment.

PSAPs and First Responders need to know whether Z-axis accuracy achievable in a particular market will be +/- 2 meters, 3 meters, 5 meters or more, including during moderate and severe climactic conditions. First Responders and PSAPs need to know whether there will be a bias towards higher or lower elevations, and the likelihood of the caller being located nearer the elevation provided. The search area, the number of units assigned to search for the caller (if available), and the distribution and search-area priorities for the First Responders may be impacted by this information.

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[11] Id, at 4.

[12] 9-1-1 Location Technologies Test Bed, LLC, Report on Stage Z at 119 (2018) (Stage Z Test Report) https://www.fcc.gov/ecfs/filing/10803074728956.

B. The Testing BRETSA Proposes Would Not Be Overly Burdensome To Providers.

As stated above, the wireless carriers themselves have stated that additional testing of Z-axis technology is required, including in a production environment. "CTIA and the Carriers *encourage[d]* the Commission to support additional Stage Z testing within the next calendar year, covering [barometric pressure-based] technologies and other approaches including enhanced WiFi positioning technologies, prior to adopting a final Z-axis metric." CTIA Cover Letter for Stage Z Report, at 6.

The Stage Z Test Report discussed the difficulty of acquiring 120 test points in each of San Francisco and Atlanta, and 75 in Chicago. It attributed the difficulty and cost in acquiring test points to the unwillingness of building owners, managers and tenants to cooperate in the process.[13] The Stage Z Test Report further states that testing in Chicago was limited to the urban and dense urban morphologies in order to limit the costs of test building acquisition and test point surveying. [14] Spreading the number of buildings required to participate in the additional testing CTIA and the wireless carriers have stated will be required, across the 50 markets in which Z-axis location will be required to be provided over time, will greatly increase the number of buildings which are candidates for inclusion in such tests, and increase the likelihood that cooperative building owners, managers and tenants can be located.

Commission adherence to an earlier decision to rely solely upon Test-Bed testing of Z-axis technologies, in spite of the new evidence provided by the wireless carriers themselves of the need for additional testing and the difficulty and expense of finding test locations within the Test Beds, is inappropriate.

[13] Stage Z Test Report, at 57.
[14] Stage Z Test Report, at 21.

As will be discussed below, wireless benchmarking of Z-axis location accuracy in each market is also pertinent to any expectation that local governments and public safety agencies, rather than wireless providers, will correlate Z-axis elevation data to floor levels.

III. The Commission Failed To Address BRETSA's Proposed Requirement That Wireless Carriers Cooperate With Public Safety Stakeholder Accuracy Testing and Correlation Of Test Results to Floor Numbers.

Correlation of elevation information to building floor levels is necessary for Z-axis information to be actionable. BRETSA does not understand there to be any commercial value for wireless providers in the massive undertaking of correlating elevation AMSL information to floor levels for all of the multi-story buildings in the top 50 markets. It seems unlikely the Commission will require wireless providers to undertake this task. BRETSA expects that this burden will fall on local governments and public safety agencies, and perhaps on developers and building owners or managers if local governments pass ordinances or development codes requiring provision of this information as a condition of issuance of zoning or building approvals, or otherwise.

Local governments and public safety agencies should not each have to research and establish standards, methods and procedures for testing Z-axis data accuracy and correlating elevations AMSL to floor levels, particularly when the wireless providers and Test Bed, LLC have already established standards such standards, methods and procedures, and gained experience relevant to these tasks.

A. Lack Of Correlation Of Z-Axis Elevation Data To Building Floor Levels Vitiates The Utility Of Z-Axis Information.

Z-axis location technologies based on barometric pressure, such as those implemented by NextNav LLC and Polaris Wireless, Inc., will provide elevation of a caller's device AMSL.

Unless this information is correlated with floor numbers, or at least the ground level at the location of the building concerned,[15] it is of no use in locating a 9-1-1 caller.

There does not appear to be a means of utilizing elevation data AMSL without a manpower-intensive correlation of elevation AMSL to floor number. As stated, BRETSA believes it will fall to local governmental and other resources, rather than wireless providers, to correlate floor levels of buildings within public safety agency response areas to elevations AMSL and make Z-axis data actionable and useful.

B. Public Safety Agency And Local Government Correlation Of Floor Levels to Elevation Above-Mean-Sea-Level Requires Wireless Carrier Assistance.

BRETSA anticipates that First Responders assigned to light duty while recovering from injuries, citizen volunteers, Fire Inspectors in the course of their routine duties, building owners or managers, or others without special training in location testing which would be assigned or required to calibrate determine elevation above AMSL of individual building's floor level levels. Although some agencies might engage surveyors to provide this information, many agencies with limited budgets would likely opt for less costly alternatives. Methods may be as simple as going to a building location with a variety of commercially available devices (upon deployment of Z-axis technology and delivery of Z-axis data to PSAPs) placing test calls to 9-1-1 with each device, and recording the x, y and z values reported and the building address and floor number from which the call was made. The floor-level elevation data might be added to CAD premises information. The viability of this most basic correlation method will, of course, rely upon the

[15] If ground level AMSL is known, a First Responder could stand in the street in front of a building, estimate the height of the floors and count windows up from street level to estimate the caller's location and narrow the search area. However, floor heights differ between buildings, and even within buildings. Buildings may be built into grades, such that the ground level of entrances on different sides of the building are at different elevations. The time required to make an educated guess as to the floor level on which a caller is located, and the additional error in location accuracy, would limit any benefit of Z-axis information even with a known ground level AMSL.

consistency of elevation data provided by the barometric sensors included in wireless devices across brands and models and over time.[16]

It should not be up to each local government or public safety agency to research and develop its own standards, methods and practices for (i) determination of ground level AMSL at a building site, including where the building is built into a slope with entrances at different grades, (ii) determination floor level AMSL and/or AGL, (iii) determining whether to place test calls with the calling device at floor level (assuming the caller is incapacitated and prone on the floor), and/or at the average height of a caller in a sitting or standing position, and/or midway between floor and ceiling, (iv) whether a standard commercial wireless device should be calibrated before testing, etc.

As BRETSA suggested in its Reply Comments, fn. 18 at 9, the wireless providers should also provide assistance in the form of (i) an alternate number than 9-1-1 for test calls and calls to correlate provided elevations AMSL to floor levels, if possible, in order to avoid tying up 9-1-1 lines, (ii) user and agency codes for use in making the test calls, and (iii) a web interface to retrieve test results. BRETSA also suggested equivalent support x,y and dispatchable address locations.

BRETSA questions whether a smartphone application could be developed and provided by the wireless carriers for testing/correlation purposes, which could guide a user through the testing or correlation process with minimal training, and transmit data to a carrier to populate the relevant databases without the need for the user to place test calls to 9-1-1 or an alternative

[16] Proof-of-performance testing in the market by wireless providers (Test Bed, LLC) against determined ground-truth, will determine the general accuracy and consistency of Z-axis data across devices and over time (day-parts). It will provide a location where assigned First Responders, volunteers or others might complete a limited "practice run" before conducting tests to correlate reported Z-axis AMSL to floor levels in other buildings, and provide monitoring over-time (seasons and release of new generations of technology and devices) of accuracy of elevation information as compared to ground truth.

number. This would also provide delivery of additional types of data (*e.g.*, brand and type of barometric sensor incorporated in the user device) with the resulting test database serving broader purposes, including assessing consistency of device barometric sensor information, for example.[17, 18]

Respectfully submitted,

BOULDER REGIONAL EMERGENCY TELEPHONE SERVICE AUTHORITY

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[17] *See* Stage Z Test Report, at 123 ("Measuring a mobile device's barometric sensor bias is a relatively simple matter of taking a single pressure reading using an app, then comparing this reading to true barometric pressure measured with a lab-grade instrument at the same physical location. This operation could be repeated for several hundred to a thousand real-world devices, allowing generation of a real-world bias distribution. From this distribution, an estimate of achievable altitude error without any calibration could be modeled, leveraging the results from this test.")

[18] The Commission should open a proceeding to consider call data or data-sets which device manufacturers, wireless and other providers should pass for collection by providers, SSPs and/or CAD systems, so that reports could be extracted which would allow public safety authorities, service providers and the Commission to assess and monitor call routing accuracy, location time-to-first-fix, location accuracy, etc. This may include requirements for information to be noted by First Responders and entered into CAD or records system data fields, recognizing the priorities of First Responders during Emergency Response. This could include biasing of particular barometric sensors or versions of wireless devices using specific barometric sensors, which would allow adjustment of Z-axis data for elevation reporting. Abundant data is available which could be analyzed to improve 9-1-1 call performance, 9-1-1 call-handling and dispatch protocols, and Emergency Response protocols, if the data was transmitted, recorded and compiled in a manner facilitating its analysis, particularly in a digital environment.