

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

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

**COMMENTS OF APCO INTERNATIONAL**

The Association of Public-Safety Communications Officials-International, Inc. (APCO)<sup>1</sup> submits the following comments in response to the Further Notice of Proposed Rulemaking in the above-captioned proceeding.<sup>2</sup> The Commission proposes to adopt a vertical location (z-axis) accuracy metric of +/- 3 meters for wireless 9-1-1 calls.<sup>3</sup> APCO opposes the proposed z-axis metric and urges the Commission to proceed without adopting a metric altogether.

Adopting the proposed z-axis metric would be a bad outcome for public safety professionals and the communities they serve. Consistent with the path laid out by the 2015 Order,<sup>4</sup> the Commission should forgo adoption of a metric and thereby require carriers to rely on dispatchable location solutions to comply with the vertical location rules. Should the

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<sup>1</sup> Founded in 1935, APCO is the nation’s oldest and largest organization of public safety communications professionals. APCO is a non-profit association with over 31,000 members, primarily consisting of state and local government employees who manage and operate public safety communications systems – including 9-1-1 Emergency Communications Centers (ECCs), emergency operations centers, radio networks, and information technology – for law enforcement, fire, emergency medical, and other public safety agencies.

<sup>2</sup> In the Matter of Wireless E911 Location Accuracy Requirements, PS Docket No. 07-114, *Fourth Further Notice of Proposed Rulemaking*, FCC 19-20 (rel. Mar. 18, 2019) (“FNPRM”).

<sup>3</sup> *Id.* at para. 11.

<sup>4</sup> See Wireless E911 Location Accuracy Requirements, PS Docket No. 07-114, *Fourth Report and Order*, 30 FCC Rcd 1259, para. 45 (2015) (“2015 Order”) (explaining that “[i]n the absence of an approved z-axis metric alternative, CMRS providers will be obligated to rely on dispatchable location.”). See also *id.* at para. 116 (“Any such z-axis metric approved, and, *if adopted* by the Commission, will serve as an alternate six- and eight-year benchmark for vertical location should dispatchable location not be utilized by a CMRS provider for compliance.”) (emphasis added).

Commission proceed with adopting a z-axis metric, it should at a minimum be delivered with a floor number.

I. Adopting the Z-Axis Proposal Would Be a Bad Outcome for Public Safety

In its 2015 Order, the Commission adopted rules that required carriers to ensure that wireless 9-1-1 callers could be located indoors with a vertical location component by providing 1) dispatchable location – the gold standard for public safety – or 2) z-axis information.<sup>5</sup> As the Commission explained, “by providing a z-axis metric as a backstop to dispatchable location for identifying floor level of 911 calls from multi-story buildings, we ensure that vertical location accuracy is achieved.”<sup>6</sup> APCO supported an alternative approach to the Commission’s original location accuracy proposal in 2014 based on the understanding that the rules provided incentives for carriers to achieve dispatchable location and that the z-axis would serve as an effective backstop.<sup>7</sup>

The proposed metric will not serve as an effective backstop to dispatchable location and will not meet the Commission’s goal “[t]o 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.”<sup>8</sup> While the Commission acknowledges that the proposed metric is imperfect,<sup>9</sup> the real-world implications for 9-1-1 callers and public safety professionals are actually much worse. The proposed z-axis metric fails to account for public safety operations and would be difficult to enforce.

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<sup>5</sup> *Id.* at para. 117.

<sup>6</sup> *Id.* at para. 162.

<sup>7</sup> *See id.* (“by providing a z-axis metric as a backstop to dispatchable location for identifying floor level of 911 calls from multi-story buildings, we ensure that vertical location accuracy is achieved.”).

<sup>8</sup> FNPRM at para. 2.

<sup>9</sup> *Id.* at para. 12 (“We acknowledge that a 3-meter metric is not always certain to yield floor level accuracy.”).

#### A. The Proposed Z-Axis Metric Fails to Account for Public Safety Operations

The Commission asks whether it should require carriers to provide the same type of information (e.g. height above mean sea level (MSL), height above ground level (AGL), or floor level) to avoid potential confusion at the ECC.<sup>10</sup> Allowing carriers to deliver z-axis information as either MSL or AGL would be a mistake that would cause confusion among ECCs and field responders, as well as difficulty developing common training and educational materials about the use of z-axis information. The only way to avoid this confusion for the type of information would be to require carriers to provide the z-axis with a specific floor level, but that would not resolve several other impracticalities for public safety professionals.

The proposed metric fails to account for the real-world practice of using the z-axis information to locate 9-1-1 callers. Presumably, first responders in the field would need to have a device enabling them to try matching the 9-1-1 caller's z-axis measurement. It is unclear whether first responders would use personal or department-provided devices to match a caller's z-axis measurement without needing to purchase new devices or software. Additionally, CTIA's Stage Z Test Report suggests that the vertical search area for 9-1-1 callers will be larger than the +/- 3 meters specified in the metric due to variation and sensor bias in field responders' devices. According to the Report, "Active calibration of individual mobile devices seems essential to achieve consistent, usable Z-axis measurements for indoor wireless 9-1-1 calls because handset barometer biases significantly affect the accuracy of barometric pressure-based estimation systems."<sup>11</sup> The results in the test bed "relied on calibration of the barometric sensor in the mobile devices, which had been performed by the applications provided by [the technology

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<sup>10</sup> *Id.* at para. 14.

<sup>11</sup> CTIA, 911 Location Test Bed, LLC Report on Stage Z, at 120 (Aug. 3, 2018) ("Report").

vendors].”<sup>12</sup> Thus, the proposed 3 meter z-axis metric for 9-1-1 is misleading, if not unworkable, if using the metric during an emergency entails comparing the 9-1-1 caller’s vertical measurement to first responder devices that have not benefited from active calibration at all or from the same system as the 9-1-1 caller’s device.

The proposed z-axis metric also fails to address whether or how carriers would provide confidence and uncertainty (C/U) data for z-axis location information. In contrast, the Commission requires carriers to provide C/U data for horizontal location information on a per call basis, with a uniform confidence level of 90% and the uncertainty radius expressed in meters from the reported position.<sup>13</sup> Unless the Commission similarly defines C/U requirements for the z-axis metric, ECCs would receive inconsistent C/U data or none at all. As a result, public safety professionals would lack information that is essential when deciding whether to break down a door or how to develop a search strategy.

#### B. It Is Unclear How the Proposed Z-Axis Metric Would Be Enforced

The Commission asks whether the z-axis metric should apply only to calls from devices capable of delivering barometric pressure sensor-based altitude estimates, only devices manufactured after a date certain, or for 80% of wireless calls as the Commission proposes.<sup>14</sup> Two key principles of the Commission’s 2015 Order were a technology neutral approach and extension of location accuracy rules to *all* wireless calls to 9-1-1.<sup>15</sup> Limiting applicability of the z-axis metric to devices capable of delivering barometric pressure sensor-based altitude estimates

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<sup>12</sup> *Id.* at 59.

<sup>13</sup> *See* 47 C.F.R. § 20.18(j). *See also* 2015 Order at para. 184 (explaining that if the uncertainty of the location fix is within a reasonable margin, the public safety telecommunicator should have enough assurance to dispatch emergency services).

<sup>14</sup> FNPRM at para. 14.

<sup>15</sup> 2015 Order at para. 89 (“These elements are consistent with our strong preference for flexible and technologically neutral rules”). *Id.* at para. 8 (“our ultimate objective is 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 emergency.”).

or new devices would violate these principles. The Commission has not explained, however, how its proposed metric – 3 meters for 80% of wireless calls – would be enforced. Carriers would have to demonstrate the performance of a z-axis technology in the test bed using a set of devices compatible with that technology but not necessarily representative of the devices being used in the real world.<sup>16</sup> For example, if the carriers choose to deploy a z-axis technology that is dependent upon a barometric sensing capability, the test bed would arguably entail only devices capable of delivering barometric pressure sensor-based altitude estimates. How then would the carriers be able to claim compliance with a Commission-mandated metric that applies to 80% of all wireless calls (regardless of whether the calls are from devices that have barometric sensors)?<sup>17</sup> It is unclear how to reconcile a technology-neutral metric with this technology-specific process.

## II. The Commission Should Forgo Adoption of the Z-Axis Proposal and Thereby Require Dispatchable Location

The Commission explained in its 2015 Order that appropriate incentives were in place for the carriers to improve location accuracy promptly and effectively, and that “[i]n the absence of an approved z-axis metric alternative, CMRS providers will be obligated to rely on dispatchable location.”<sup>18</sup> Dispatchable location technologies have been demonstrated to be viable. Thus, there is no need for the z-axis metric to serve as a backstop.

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<sup>16</sup> FNPRM at para. 11. *See also* 47 C.F.R. § 20.18(i)(2)(iii)(A) (“All CMRS providers must 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.”).

<sup>17</sup> Hypothetically, the carriers might attempt to demonstrate compliance by testing a set of devices that are supposedly representative of devices in circulation (including some with and some without barometric pressure sensors). If approximately 80% of calls to 9-1-1 are made from devices with barometric pressure sensors, would the carriers need to deploy a z-axis technology capable of achieving 3-meter accuracy 100% of the time to comply with the Commission’s metric of 3 meters for 80% of calls?

<sup>18</sup> 2015 Order at para. 45. *See also id.* at para. 116 (“Any such z-axis metric approved, and, *if adopted* by the Commission, will serve as an alternate six- and eight-year benchmark for vertical location should dispatchable location not be utilized by a CMRS provider for compliance.”) (emphasis added).

The Commission would be justified in forgoing adoption of a z-axis metric and has the authority to base its decision on the carriers' initial proposal without revision. Nothing in the Commission's rules or the 2015 Order specifies that the Commission could alter the carriers' proposal. CTIA proposed an unjustified metric of +/- 5 meters, while both of the test bed's participating technology providers indicated support for a more accurate, but readily-achievable metric.<sup>19</sup> Considering all available information when developing the metric would have been entirely appropriate, especially if the intent was to ensure that public safety is provided with an actionable location fix for indoor callers.<sup>20</sup> CTIA has acknowledged that "other approaches to Z-axis location estimates are emerging,"<sup>21</sup> and entities outside the test bed have reported on technologies that demonstrate that a much higher degree of vertical location accuracy – presented as a floor level – is achievable.<sup>22</sup> Because the carriers failed to propose an acceptable

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<sup>19</sup> Ex Parte Letter of Polaris Wireless, Inc., PS Docket No. 07-114, at 4 (filed Sept. 10, 2018) ("Polaris Wireless recommends that the FCC proceed with in establishing a vertical location benchmark metric of 3 meters on 80% of fixes for E9-1-1."); Ex Parte Letter of NextNav, LLC, PS Docket No. 07-114, at 7 (filed Aug. 16, 2018) ("the results of the recently concluded z-axis test bed, combined with the results of multiple other test beds conducted by CTIA, CSRIC and other independent and expert administrators, clearly demonstrate that technologies are available today (and others are being developed) that can provide floor level vertical accuracy of within 3 meters for at least 80 percent of wireless calls."). Further, as the Commission notes, "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." FNPRM at para. 24.

<sup>20</sup> Further, as the Commission recognized, "wireline-equivalent location accuracy is of particular importance to individuals who are deaf, hard of hearing, deaf-blind, and/or have speech disabilities." 2015 Order at para. 63.

<sup>21</sup> Z-Axis Metric Proposal of CTIA, PS Docket No. 07-114, at 5 (filed Aug. 3, 2018) ("CTIA Proposal").

<sup>22</sup> For example, an academic paper described a system capable of predicting the correct floor level with 100% accuracy that does not require the use of beacons, prior knowledge of the building infrastructure, or knowledge of user behavior. See William Falcon & Henning Schulzrinne, *Predicting Floor Level for 911 Calls with Neural Networks and Smartphone Sensor Data* (2018), <https://arxiv.org/pdf/1710.11122.pdf>. See also *Indoor Positioning*, Carbyne, <https://carbyne911.com/indoor-positioning/> (describing Carbyne's indoor positioning technology "that is capable of pinpointing a user's location to within a one-meter radius, including indoor and elevation"). Additionally, the carriers were uniquely positioned to evaluate vertical location solutions that leverage their own carrier-provisioned WiFi access points, small cell deployments, and 5G network technologies. News reports indicate that carriers are planning in-home 5G services, which could provide a dispatchable location or a floor level indication at a minimum. See Mike Dano, *New T-Mobile's plans for in-home, fixed wireless internet services begin to take shape*, Fierce Wireless (Sept. 21, 2018), <https://www.fiercewireless.com/5g/new-t-mobile-s-plans-for-home-fixed-wireless-internet-services-begin-to-take-shape>; *5G is Here*, Verizon (Sept. 11, 2018), <https://www.verizon.com/about/news/5g-here>.

z-axis metric, the Commission should forgo adopting a z-axis metric and thereby obligate the carriers to provide dispatchable location.

III. If a Z-Axis Metric Is Approved, It Must Include a Floor Number

The Commission's 2015 rules were aimed at "identifying floor level" of 9-1-1 callers.<sup>23</sup> ECCs do not have the resources to convert AGL or MSL data to a floor number, nor do they have three-dimensional maps to visualize raw z-axis information. If the Commission fails to specify that the z-axis information must include a floor level (not just floor level accuracy), ECCs will be left without actionable vertical location information. For public safety professionals attempting to locate a cardiac arrest victim in a large hotel, for example, the guesswork and additional response time needed to search the correct floor based on an estimate of AGL or MSL could mean the difference between life and death.

Identifying the floor level is technically feasible today.<sup>24</sup> Carriers and location technology providers have commercial purposes to convert a measurement to a specific floor number, and it would be more efficient for them to perform the conversion than for each ECC to pursue solutions individually. Making the carriers responsible for delivering z-axis information with a floor number would be consistent with the 2015 Order and the carriers' own commitments to leverage the most advanced commercial location technologies available.<sup>25</sup> Further, the Commission's rules already require carriers to provide uncompensated barometric pressure data to ECCs. Surely the additional time afforded to the carriers for developing z-axis as a backstop

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<sup>23</sup> See *supra* note 7.

<sup>24</sup> See *supra* note 22.

<sup>25</sup> Ex Parte Letter of CTIA, PS Docket No. 07-114, at 2 (filed Apr. 26, 2019) ("As envisioned by the Commission in the *Fourth Report and Order*, 9-1-1 location solutions are more closely aligning with evolving and innovative commercial location solutions. CTIA and its member companies expressed support for a shared goal among the Commission and the public safety community to enhance 9-1-1 location accuracy, particularly indoors, using the most advanced commercial technologies available.").

to dispatchable location was not for technology development and testing to move from uncompensated barometric pressure to AGL or ASL.

IV. Conclusion

Adopting the proposed z-axis metric would be a bad outcome for public safety. APCO urges the Commission to forgo adoption of a metric and thereby require carriers to rely on dispatchable location solutions to comply with the vertical location rules. Alternatively, should the Commission proceed with adopting a z-axis metric, it should at a minimum be delivered with a floor number.

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