Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Wireless E911 Location Accuracy Requirements	)	PS Docket No. 07-114
	)	
	)	
Revision of the Commission's Rules to Ensure Compatibility with the Enhanced 911 Emergency Calling Systems	)	CC Docket No. 94-102
	)	
Association of Public-Safety Communications Officials-International, Inc. Request for Declaratory Ruling	)	
	)	
911 Requirements for IP-Enabled Service Providers	)	WC Docket No. 05-196

COMMENTS OF MOTOROLA, INC.

Motorola, Inc.
1455 Pennsylvania Avenue, NW
Suite 900
Washington, DC 20004
202.371.6899

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Motorola, Inc. ("Motorola") provides these comments in response to Part III B of the Notice of Proposed Rulemaking in the above-captioned dockets concerning changes to the Commission's requirements for enhanced 911 ("E911") location accuracy requirements ("Notice").[1]

I. INTRODUCTION AND SUMMARY.

To date, the wireless industry and public safety community have worked diligently to develop and implement technologies that provide the most meaningful and

[1] *Wireless E911 Location Accuracy Requirements, Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, Association of Public-Safety Communications Officials-International, Inc. Request for Declaratory Ruling, 911 Requirements for IP-Enabled Service Providers*, Notice of Proposed Rulemaking, 22 FCC Rcd 10609 (2007) ("*Notice*").

accurate location information practical. As a result, the United States has the best emergency call location system in the world today. The potential development of a single location accuracy standard for commercial mobile radio service ("CMRS"), which does not include VoIP, is a laudable goal that could encourage the entire wireless industry and public safety community to improve location information for E911.[2] As the Commission suggests, a single standard could provide clarity to first responders regarding the reliability of the E911 location information and ensure consumers that the most accurate available location information will be passed on to these first responders when dialing 911 calls.[3]

Neither the development nor the implementation of a single standard for CMRS, however, can be achieved over night. The accuracy of location information often varies

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[2] As the Commission, the industry, and the public safety community study this issue, they may find that this same single standard should be applied to wireless interconnected voice over internet protocol ("VoIP"). At this time, however, automatic location technologies for VoIP are too nascent to determine whether application of this standard to interconnected VoIP is feasible in the foreseeable future. VoIP may be offered on fixed, nomadic, or fully mobile devices or any combination. In addition to that, VoIP may be deployed by the broadband service provider or provided by any number of independent parties, especially if "open access" is considered. The challenges for addressing VoIP are many and these challenges have not been adequately addressed on the record. Thus, Motorola urges the Commission to defer consideration of whether this standard should be applied to VoIP until after this issue can be fully studied by all concerned parties.

While nomadic VoIP location technologies are being studied and developed, it is important to allow dual-mode wireless devices that offer the use of both CMRS networks and nomadic VoIP networks to try a 911 call first on the CMRS network. The call then could be tried on a VoIP network if the CMRS network is not available. Given that CMRS location technologies are currently more advanced than VoIP location technologies, operators should have the option of attempting 911 calls over the technology that is most likely to provide the most accurate location information while also ensuring that 911 calls will be attempted on all available networks, regardless of the availability of location information.

[3] *Notice* at ¶ 10.

based on the environment in which 911 calls are made. Currently available location technologies have significant limitations that inhibit their ability to provide more accurate location information in certain environments. While new technologies, including combined technologies, are being developed that may be able to provide more accurate location information across a variety of environments, these technologies remain in a very early stage of development. Furthermore, there is insufficient evidence to state that any combined solution consisting of GPS and one of the network-based location technologies will prove to be accurate enough for PSAP level compliance. Thus, in developing a single location accuracy standard, the Commission should acknowledge and consider the state of current technology in a variety of environments. Any standard must address the differences among the environments in which 911 location information must be gathered.

Moreover, there is insufficient information available today to determine what higher level of location accuracy is achievable, and when. Thus, Motorola encourages the Commission to create an industry working group to study this issue and develop recommendations regarding what this new standard should require. In addition, the Commission should delay the effective date of any new standard that will require use of new technologies until the wireless industry and public safety community have had adequate time to standardize, develop, test and deploy technologies capable of meeting whatever standard that will be recommended by the industry working group, and complete the testing that will be required to certify compliance.

II. AS A FIRST STEP, THE COMMISSION SHOULD CREATE A WORKING GROUP IN WHICH THE PUBLIC SAFETY COMMUNITY, FEDERAL COMMUNICATIONS COMMISSION, THE WIRELESS INDUSTRY, AND OTHER STAKEHOLDERS WORK TOGETHER TO CREATE AN ACHIEVABLE LONG-TERM 911 LOCATION ACCURACY GOAL.

The E911 automatic location issues facing CMRS and VoIP providers are numerous and complex. Currently, there is insufficient information available to establish an *achievable* 911 location accuracy standard on a forward-looking basis. The establishment of a working group would ensure that all technologies and limitations are considered, thus ensuring that (i) the established standard will be achievable and (ii) a universal testing method for confirming compliance is created. This working group should include the public safety community, wireless industry, the Commission, and representatives from other industries such as building contractors and the building alarm industries. Indeed, any revision to location accuracy standards may also require modifications to building codes and other standards, as well as the establishment of a national building database.

Many diverse parties have indicated their support for the establishment of a working group that will work together to create an achievable, forward-looking 911 location accuracy standard.[4] As multiple commenters have written, this forum would enable the Commission to obtain detailed information on currently available and future location technologies, thereby allowing the FCC to make the most informed decision

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[4] *See, e.g.*, NENA Comments, PS Docket No. 07-114, 4 (filed July 5, 2007); Washington Enhanced 911 Program Comments, PS Docket No. 07-114, 13 (filed July 5, 2007); TruePosition Comments, PS Docket No. 07-114, 7 (filed July 5, 2007); AT&T Comments, PS Docket No. 07-114, 3-6 (filed July 5, 2007); CTIA Comments, PS Docket No. 07-114, 6 (filed July 5, 2007); Texas 9-1-1 Alliance Comments, PS Docket No. 07-114, 8 (filed July 5, 2007).

possible.[5] This forum also would "provide an organizational framework to bring all parties together to assist the Commission in providing ongoing recommendations moving forward on how to best optimize location accuracy capabilities."[6] In addition, as the Texas 9-1-1 Alliance has noted, "building a cooperative consensus on location accuracy enhancements between the wireless industry and public safety would be beneficial."[7]

This working group should consider a wide variety of issues associated with improving E911 location accuracy and the variety of technologies that are currently available and under development that could be used to improve E911 location accuracy. Specifically, the working group should consider, among other things, the following issues:

- Whether a single location accuracy requirement for network- and handset-based technologies should be adopted;[8]
- Whether nomadic VoIP technologies should be required to provide automatic location information;[9]
- Whether a single location accuracy requirement for CMRS and mobile VoIP technologies should be adopted;[10]
- The variety of location technologies that are currently available and what

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5 *See, e.g.*, CTIA Comments, PS Docket No. 07-114, 6 (filed July 5, 2007); TruePosition Comments, PS Docket No. 07-114, 7 (filed July 5, 2007).

6 NENA Comments, PS Docket No. 07-114, 5 (filed July 5, 2007).

7 Texas 9-1-1 Alliance Comments, PS Docket No. 07-114, 8 (filed July 5, 2007).

8 *Notice* at ¶ 10.

9 *Id.* at ¶ 18.

10 *Id.*

their limitations are;[11]

- What factors influence how a particular location technology performs;[12]
- Whether hybrid technologies will provide greater location accuracy;[13]
- What accuracy standard should be adopted;[14]
- When should any new accuracy standard become effective;[15]
- Should carriers be required to modify legacy systems to meet any new accuracy standard;[16]
- What methodologies should be used to verify compliance;[17]
- What testing parameters should be imposed to ensure that testing accurately assesses consumer experiences;[18]
- How often should testing be required;[19]
- Should carriers automatically provide accuracy data to PSAPs and how; and[20]
- How roaming should be addressed in the E911 context.[21]

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11 *Id.* at ¶ 11.

12 *Id.*

13 *Id.*

14 *Id.* at ¶ 12.

15 *Id.* at ¶ 13.

16 *Id.*

17 *Id.* at ¶ 14.

18 *Id.*

19 *Id.* at ¶ 15.

20 *Id.* at ¶ 16.

21 *Id.* at ¶ 17. *See also infra* Section III.B.

III. IMPROVING E911 LOCATION ACCURACY WILL BE EXTREMELY DIFFICULT AND WILL REQUIRE SUBSTANTIAL TIME AND INVESTMENT BY BOTH THE WIRELESS INDUSTRY AND THE PUBLIC SAFETY COMMUNITY.

A. Achieving a Single E911 Location Accuracy Standard.

In developing an achievable standard that would be useful to the public safety community, the working group must consider the complexities associated with providing location information throughout the United States. First and foremost among these complexities is the variety of environments in which location information must be available. Providing location information in a rural area is very different from providing location information deep inside a high-rise building in the heart of a large city. Different location technologies therefore perform better in certain environments than others. No single technology has been developed to date that can provide highly accurate location information in both these and other environments. Indeed, it is Motorola's experience that the one absolute in the provisioning of 911 location information is that there is no one size fits all location accuracy solution.[22] Specifically, while the following technologies all hold promise for delivering accurate location information in certain environments, each also has significant limitations.

Global Positioning System ("GPS"). GPS is one of the primary technologies used today to provide location information. GPS provides an excellent, extremely accurate location information solution in outdoor environments in which a fairly large sky

[22] A number of entities have developed proprietary technologies that allegedly enhance location accuracy in certain situations. None of these technologies, however, have been proven to address all possible environmental challenges or solutions. In addition, none of these technologies has been subject to industry-wide critique or is clearly accepted by a majority of industry experts. Thus, prior to adopting standards that can allegedly be met by one or two proprietary technologies, it is important that a working group assess the true capabilities of such proprietary technologies and of all reasonable alternatives.

view is available.[23] GPS, however, does not typically work well in indoor environments, such as office buildings, homes, subways, and parking garages, or in downtown areas where large buildings tend to block satellites from view. In addition, there are rural areas where GPS signals may be effectively blocked due to terrain (canyons), heavy foliage, large man-made structures, tunnels, and other natural and man-made structures.

Wide Area Terrestrial Cell Signaling (e.g., Cell ID, AFLT, EOTD, UTDOA, RSSI, RF Signature, Angle-of-Arrival). The other primary technology used today to provide location information is cellular-signal-based multilateration and/or triangulation. These methods have the advantage that they rely on the native cellular Physical Layer signaling technology to determine the location. Like GPS, however, these technologies have limitations, although in different respects. Specifically, the feasibility of cell signaling is extremely dependent on the deployment on non-co-located cell towers. Thus, cell signaling works very well in areas where there are large numbers of cell towers (*e.g.*, street-level urban and suburban environments), but is less successful in rural areas where there are fewer cell towers, as well as indoors or in urban areas (where in some cases, only a single cell site may be received by a handset at any given time). Indoor limitations are common to GPS and these cell-signaling technologies; therefore, it cannot be concluded that combining GPS with a Cell Signaling location method will provide a complete solution. In addition, with many of the newer 3G and 4G RF technologies employing forward and reverse power control, the ability to locate a

[23] Because of the superior location information that GPS can provide in outdoor environments, the working group should consider ways in which GPS can be improved. For example, the working group should consider establishing a common set of GPS-assistance parameters so that GPS location can be delivered as effectively as possible.

handset close to a base station is diminished.[24]

Combined Solutions (GPS plus Wide Area Terrestrial Signaling). The Commission specifically asks whether the combination of GPS and TDOA technologies, could provide more accurate location information.[25] While such a solution may provide some coverage when either one technology may fail, it does not address the many instances where neither technology will provide accurate information. For this reason, it is not clear to what extent such a combined approach, as suggested by the Commission, would comply with the existing or a revised accuracy standard. Indeed, the effectiveness of this approach likely would depend on the mix of scenarios that would be included in any given test.

Short-Range Wireless Cell Sensing. The most robust method of identifying a handset's indoor location is by associating it with a wireless known-fixed-location emitter or a dedicated beacon. If the range of the fixed RF emission is small enough (*e.g.*, 100 feet), the accuracy of the identified location will be extremely high. This beacon approach could employ a multitude of short-range transmitters, each having a unique RF identity, and they could be installed in certain other battery-backed devices that are regularly found in a wide variety of environments and often mandated by regulation (*e.g.*, exit signs, smoke detectors, fire alarms). A beacon would continually advertise its

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[24] Specifically, as a handset approaches a base station, the handset transmit power is reduced to improve system capacity and reduce interference. While this is very effective at improving the system's capacity, it greatly limits the ability of the handset to be detected by other base stations in the area. *See, e.g.*, Physical Layer Standard for cdma2000 Spread Spectrum Systems, 3rd Generation Partnership Project 2, Section. 2.1.2.3.1 (July 1999), http://www.3gpp2.org/Public_html/specs/C.S0002-0_v1.0.pdf (last visited Aug. 15, 2007) (describing 3GPP2 Power Control).

[25] *Notice* at ¶ 11.

unique digital ID to its local small geographic area. The beacon's unique ID and the beacon's exact deployed location would have been previously catalogued in a national database, and a lookup of the beacon's ID would provide the calling device with the relevant location information. This approach would ensure that accurate location information is available in many locations where traditional location technologies have been unable to penetrate (*e.g.*, in-building, garages). These transmitters also could be relatively inexpensive.

There are several beacon technologies known today that could be considered, including RFID, 802.15.4 (*i.e.*, Zigbee), and Wi-Fi wireless access points ("WAPs"). It may be that WAPs would serve best as the beacon network, as many mobile devices are beginning to include 802.11 transceivers for their voice and data connectivity capabilities, and WAPs have already been extensively deployed in home, commercial, and enterprise settings. Furthermore, there is already some progress in location technologies based on WAPs. However, WAPs are frequently installed and operated by consumers. As a result, the likelihood of mistakes being made during the initial installation and location registration or upon moving the WAP is very high.

Regardless of beacon choice, the logistics of implementing such an approach could be extremely complicated. First, if exit signs or smoke detectors are determined to be the appropriate beacon position, mandating the inclusion of location beacons likely would require modifications to building codes. Similarly, if WAPs are determined to be the appropriate beacon, the Commission would need to re-evaluate and possibly change its current regulatory framework and equipment certification requirements for WAPs. The Commission would need to consider instituting location registration

requirements on enterprise, commercial, and residential WAP deployers.[26] Even if these modifications were made on a going-forward basis, one can assume that millions of these devices are already installed throughout the United States, so any change out of these devices, if also required as a retro-active requirement, would be a massive undertaking. Further, a centralized database of beacon locations would need to be created and maintained, a complex and labor-intensive task, and there would always exist the possibility that WAP deployers would not enter or update the WAP location correctly. Thus, this solution shows promise for its pervasiveness and level of accuracy, but should not be relied upon solely to provide accurate location information.

Given the limitations on each of these technologies, it is likely that a combined approach will need to be developed. By deploying combined technologies, the wireless industry will ensure that the most accurate location information is provided to first responders in a wide variety of environments. However, the capabilities of these technologies need to be assessed as do the possibilities for incorporating any given technology (or combination of technologies) into the broadband network and the wide variety of devices demanded by users. Device manufacturers and wireless operators are already challenged to add multi-band receivers and antennas as well as multiple technologies to devices that consumers will purchase. Adding components to devices significantly adds to the size and cost of devices and may degrade the performance of such devices in terms of battery life and power – all issues that are highly sensitive to consumers. Thus, adding significant components and capabilities to devices, such as PCMCIA cards, may prove impractical.

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[26] Any regulation should not chill or inhibit the deployment of Wi-Fi and other WAP services which have tremendous consumer and small business benefits.

Many of these individual technologies, as well as combined technologies, are still in the process of being developed. Thus, prior to being effectively deployed, standards governing these technologies must be developed,[27] devices and equipment must be tested to ensure effectiveness and safety, regulations may need to be modified, changes to network infrastructure may need to be made, new handsets may need to be developed, deployed, and replaced by consumers, and a standardized compliance testing method must be developed and accepted by all stakeholders, including manufacturers, regulatory bodies, and PSAP operators. Any meaningful and valid revised accuracy standard should and must be a result of this process and should not be defined before it is known how it can be achieved. Motorola believes that efforts to develop a nationwide strategy for wireless E911 will require the participation and support of other expert agencies, such as the National Institute of Standards and Technology ("NIST") who have a great deal expertise in dealing with a nationwide technology standards-based development strategy. Further, as noted above, state and local governmental groups, including those with oversight of local building codes, will need to be involved in the discussion and development of a national E911 strategy, if the Commission is determined to obtain location information within buildings. This process will take time and the Commission should delay the effective date of any new accuracy standard until all of the stakeholders have determined what technological solution is best and industry has had time to implement these new technologies.

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[27] The industry is in the process of developing standards for some of these technologies. For example, the IEEE 802.11 standards body currently is working on amendments that will address E911 concerns surrounding Wi-Fi CMRS standards bodies' efforts to address new location accuracy standards would need to be re-initiated to address further development and this will take time.

B. Implementing Full Roaming Capabilities.

Motorola clearly recognizes the value of seamless E911 roaming (*i.e.*, giving the user the same E911 expectation regardless of whether he has roamed to another carrier). Unfortunately, given the wide variety of location solutions that have been deployed, this cannot be achieved in the near term for carriers deploying disparate technologies for a variety of reasons. When the initial Phase 2 solutions were deployed, standards for transmitting GPS location assist and location data were not well defined. Thus, even for wireless handsets with GPS, the GPS messaging protocols between the handset and location server varied. Attempting to graft a common approach on legacy networks at this point would require massive amounts of resources for only a short-term benefit.

In addition, in the VoIP world, there are various location protocol standards emerging. The SUPL (*i.e.*, Secure User Plane for Location) protocol is being used for certain location-based services, but its feasibility for meeting the standards for emergency services is not settled. Protocols such as HELD (i.e., HTTP-Enabled Location Determination) and XML objects such as PIDF-LO, along with the NENA i2-5 and i3 architectures, are being advocated by IETF and NENA. These, however, are not fully harmonized with the 3GPP Emergency Services architecture defined by 3GPP TS 23.167. There are also diverse scenarios for mapping VoIP calls to legacy PSAP networks. Motorola encourages the Commission to refrain from mandating roaming in the VoIP arena, thus enabling it to see which protocols get the most traction before recommending a common denominator. Indeed, roaming should be a primary agenda topic for the industry working group recommended above.

C. Measuring Accuracy on a PSAP-by-PSAP Basis.

As Motorola detailed in its joint comments with Nokia in response to Part A of the *Notice*, measuring accuracy at a PSAP level is a substantive change that alters manufacturers' and service providers' understanding of the FCC's E911 location accuracy requirements and will be extremely difficult and costly to accomplish.[28] The Commission thus should defer adoption of PSAP-level accuracy testing until the working group has adequate time to determine what technological changes would be needed to achieve this and determine the time necessary to implement such changes.

If, however, the Commission does decide to require PSAP-level testing prior to completing its review of the issues raised in Part B of the *Notice*, it should, at a minimum, require PSAPs to utilize consistent and industry-approved test methods**.** Carriers and manufacturers in the wireless industry should be able to clearly understand the measuring requirements for location technology and not be faced with dealing with individualized requirements by each and every PSAP in the country. A consistent testing approach will allow all wireless industry parties, as well as public safety, to be provided comfort that E911 location technology is performing properly without rendering inconsistent results due to testing discrepancies in a particular market.

IV. CONCLUSION.

For these reasons, Motorola urges the Commission to establish a working group that is comprised of engineers from the wireless industry, the public safety community, the Commission, building code experts, NIST and other interested parties and

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[28] Comments of Motorola, Inc. and Nokia Inc., PS Docket No. 07-114 (filed July 5, 2007); Reply Comments of Motorola, Inc. and Nokia Inc., PS Docket No. 07-114 (filed July 11, 2007).

stakeholders to establish a forward-looking standard and test methodology for E911 location accuracy.

Respectfully submitted,

By: */s/ Mary E. Brooner*

Mary E. Brooner
Director, Telecommunications and Regulation
Motorola, Inc.
1455 Pennsylvania Avenue, NW
Suite 900
Washington, DC 20004
202.371.6899

Dated: August 20, 2007