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 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 POLARIS WIRELESS, INC.

Polaris Wireless, Inc. ("Polaris"), through its attorneys, hereby submits its Comments in response to the Federal Communications Commission's Notice of Proposed Rulemaking in the above-captioned proceeding.[1] Polaris encourages and supports the Commission's efforts to improve the performance of public safety E911 systems in general and to achieve greater location accuracy in particular. The goals outlined in the *NPRM* represent objectives that the entire wireless industry should strive to achieve in the interest of delivering the best possible information to the nation's first responders in emergency call scenarios. However, the wireless industry needs to address these goals consistent with the practical limitations of current and

[1] *See Wireless E911 Location Accuracy Requirements*, PS Docket 07-114, *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*, CC Docket No. 94-102, *911 Requirements for IP-Enabled Service Providers*, WC Docket No. 05-196, Notice of Proposed Rulemaking, FCC 07-108 (rel. Jun. 1, 2007) ("*NPRM*").

future technologies, as well as realistic cost constraints.[2] Therefore, the Commission should consider carefully the appropriate geographic scope of its location accuracy rules and related testing protocols in the context of what is achievable, and if it decides that Section 20.18(h) of its rules requires location accuracy measurement and testing at the public safety answering point ("PSAP") service level, it should defer enforcement of 20.18(h) so that carriers have sufficient time to implement viable, long-term hybrid solutions. Moreover, the Commission should consider staying the effective date of any new rule. The Commission should also facilitate stakeholder meetings and further discussions of E911 location accuracy issues in addition to its ongoing rulemaking proceedings to ensure the development of a full record on the best path forward.

***About Polaris*.** Polaris is a privately held company that was founded in 1999. Polaris has developed and commercialized a wireless location technology for the delivery of location services, including E911 Phase II public safety applications. Polaris currently employs approximately ninety full-time employees and outside contractors that are dedicated to developing its technology. Polaris's headquarters are located in Santa Clara, California, and it has additional offices in Seattle, Washington. Polaris's software products have been deployed extensively since 2003 by ten U.S. wireless carriers to meet their E911 Phase II emergency call location requirements and enhance their customers' safety.

Polaris's Wireless Location Signatures ("WLS") technology has several key advantages over technology alternatives: no modifications are required in the handset, as opposed to GPS/A-GPS; and the location algorithms are implemented on a standard computer server, which requires no hardware additions to the base stations, as opposed to other network-based

[2] Based on its E911 Phase II research, development and deployment experience, Polaris is in a unique position to comment on the questions raised by the Commission in both Sections III.A and III.B of the *NPRM*. Polaris limits its discussion in these Comments to the issues raised in Section III.A regarding the geographic area required for compliance (and the appropriate enforcement deferment period), but looks forward to submitting comments on Section III.B of the *NPRM* during the appropriate comment period because that section brings to light many critical questions about the future of E911 Phase II.

technologies such as U-TDOA (uplink time-difference-of-arrival) or AOA (angle-of-arrival) that require new radio hardware. In addition, the WLS system achieves high accuracy and reliability results due to its reliance on measurements that are made as a part of normal wireless network operations, such as handovers. Moreover, the initial investment to provide an E911 solution with WLS is a fraction of that required by alternate technologies, and deployment times are significantly faster than what is necessary to install new radio network equipment or to replace the installed base of wireless handsets in the marketplace.

Accurately identifying mobile callers' locations is the cornerstone for meeting wireless public safety mandates, and although no single technology alone meets the stringent needs of these vital applications across all environments, Polaris Wireless is developing and has trialed a hybrid solution for applications that demand accuracy across rural, urban, suburban, and indoor environments. By combining its commercially proven WLS technology with A-GPS into a hybrid combination, Polaris strives to make it possible to obtain significantly more consistent levels of location accuracy across the complete range of environments. The hybrid approach also has the critical advantage of significantly increasing the accuracy for calls placed indoors, which is an important problem (particularly in urban areas).

If the Commission requires location accuracy measurement and testing at the PSAP service area level for E911 Phase II, it should defer enforcement of the accuracy requirements until carriers have sufficient time to implement a hybrid solution. In the *NPRM,* the Commission seeks comment on its tentative conclusion that Section 20.18(h) should be clarified to require carriers to meet Phase II accuracy requirements at the PSAP service area level.[3] It also seeks comment on whether it should defer enforcement of 20.18(h) with regard to the PSAP-level accuracy requirement.[4] Although Polaris applauds the Commission's efforts to achieve

[3] *See NPRM* ¶ 5.
[4] *See id.* ¶ 6.

greater location accuracy, the Commission should adopt a technology-neutral approach that concentrates the wireless industry's efforts on long-term solutions. It would be preferable to adopt the appropriate geographic level for location accuracy and testing in the context of a full proceeding that considers the feasibility of deploying certain technologies. In any event, if the Commission adopts a PSAP-level requirement, it should defer enforcement until carriers have an opportunity to deploy hybrid solutions. Moreover, the Commission should consider staying the effective date of any new rule because currently deployed E911 location technologies cannot practically and economically meet a PSAP-level requirement everywhere.

Since first commercially launching its E911 technology in 2003, Polaris has made considerable progress in improving location accuracy performance. These improvements have come after dedicated and exhaustive research, development, and testing efforts, and the advances had to overcome many practical issues associated with today's complex and evolving wireless networks (*e.g.*, simultaneously operating in multiple frequency bands, on multiple air interface technologies, and with multiple vendors' equipment). Moreover, the accuracy improvements have occurred over time, rather than overnight, because of the complexities, upgrades and costs involved. There are numerous and considerable challenges that wireless carriers still must overcome to achieve PSAP-level accuracy in their networks, including those faced by network-based technologies in sparse rural areas and handset-based technologies in dense urban and indoor areas. Therefore, imposing a new E911 Phase II mandate alone will not solve the technical or funding challenges, which represent the difficult, practical issues in this proceeding.

As an initial matter, Polaris notes that the geographic compliance area and deferred enforcement questions raised by the Commission in Section III.A of the *NPRM* are inextricably linked to the underlying location technology, accuracy standards, and test methodology lines of inquiry contained in Section III.B. Thus, the compliance questions raised in Section III.A cannot be addressed independently from the technology and testing queries in Section III.B. It is not

viable for wireless carriers to deal with new compliance and testing standards without simultaneously understanding the roadmap ahead for technologies, accuracy standards, and testing. Such a short-sighted approach would likely lead to cost inefficiencies and considerable delays in reaching the end goals stated in the *NPRM*.

Polaris views a hybrid solution as the best long-term approach to improve location accuracy and consistency. Although there are many conceivable hybrid combinations of different technologies to improve accuracy, Polaris considers the ideal hybrid solution to be the pairing of a network-based and a handset-based technology. The foundation for improving location accuracy a hybrid system is the introduction of measurement diversity, which reduces the detrimental impacts of errors (particularly large outliers). The best diversity is achieved when the measurements are derived from systems in which the errors are not correlated. For example, combining one network-based technology with another would not optimally improve location accuracy because the errors would tend to be correlated. Network-based technologies have errors that depend on terrestrial cell site densities and geometries, so different network-based technologies may experience large errors in similar locations. However, handset-based technologies have errors that depend on satellite densities and geometries. Thus, combining a network-based technology with a handset-based technology results in better accuracy benefits because the terrestrial cell site and satellite configurations are independent of one another (*i.e.*, not correlated).

The Polaris hybrid solution leverages the strengths of two highly complementary technologies. The Polaris WLS system achieves its best accuracy in high cell density environments, such as urban outdoor and indoor locations. In contrast, A-GPS achieves its best performance in open sky conditions, such as outdoor suburban and rural settings, where several satellites are visible in line-of-sight to the handset. Polaris's hybrid system uses information from both WLS and A-GPS to provide maximally accurate position information, regardless of

where the user is located. The WLS system and unique hybrid approach has resulted in more than thirty patents that have been awarded or are pending.

As explained below, however, certain limitations beyond Polaris's control will delay the deployment of this technology in the marketplace.

The practical ability of a wireless carrier to advance toward the E911 Phase II accuracy requirements at the PSAP service area level depends heavily on the current Phase II location technology deployed by the carrier. For carriers currently using network-based solutions, it will not be possible to meet the proposed PSAP service area level accuracy requirements in some cases without prohibitively expensive spending on network build-out. In sparse rural areas, for example, a network-based E911 solution does not exist that would allow accuracy compliance at the PSAP service area level unless carriers significantly increase the density of their cellular networks. Existing network-based technologies have accuracy levels that are heavily dependent on cell site (base station) densities and geometries, meaning that even hybrid combinations of various network-based technologies would not practically achieve compliance in sparse rural environments. Thus, meeting Phase II accuracy requirements at the PSAP service area level in sparse rural areas would require the addition of a significant number of expensive new cell sites (or the addition of "location-only" sites) that would be added solely for E911 Phase II purposes and would be otherwise superfluous and unnecessary to the existing cellular networks. Moreover, the new sites will likely be a stranded investment—if and when these carriers eventually migrate to hybrid solutions combining network-based and handset-based technologies, the new sites would no longer be needed for E911 purposes. The funds used in these short-term

network-based build-outs would be better spent if invested directly in a long-term hybrid solution.[5]

As another example, wireless carriers that have deployed handset-based E911 Phase II solutions would have a relatively less complex upgrade path to move toward accuracy requirements at the PSAP service area level. These carriers face challenges predominantly in urban areas where satellite signals are obstructed by buildings, and there are practical options for implementing hybrid solutions in urban areas that combine the existing handset-based solution with a network-based component. The network-based component of the hybrid system can be a software-only solution that does not require new radio network hardware or changes to the existing handsets.[6] Therefore, the urban area problem can be addressed by upgrading the E911 Phase II system with a network-based server to create a hybrid system. Although such an upgrade path is not simple or inexpensive, it can be accomplished sooner and more cost-effectively than changing out the entire installed handset base of a wireless carrier.

The Commission should defer enforcement of the PSAP service area level accuracy requirements for E911 Phase II until carriers have sufficient time to implement a hybrid solution. Hybrid solutions are the ultimate answer for providing more consistent and reliable accuracy performance for E911 Phase II. Because hybrid systems are the appropriate end goal, it would be counter-productive for network-based carriers to spend capital extensively on interim improvements that would be rendered obsolete when carriers later implement a hybrid solution.[7] These increased costs would ultimately be a burden to wireless consumers because carriers would be constrained to pass the costs onto customers' bills. There may also be financial

[5] There are major costs associated with wireless carriers turning over their installed bases of handsets to roll out A-GPS handset devices in support of future hybrid solutions, particularly given the subsidized handset sales models prevalent in the industry.

[6] The network-based component could also be a hardware overlay solution, which would require additional cost and complexity to migrate to the hybrid solution.

[7] Such an approach would also not be technology-neutral because of its significant disparate impact on carriers using network-based (versus handset-based) solutions.

implications for states in which cost recovery is in effect because the increased costs may not have been budgeted. For carriers that are currently network-based, it will take a significant amount of time for commercial A-GPS handset devices to become available in sufficient quantities and varieties to support a hybrid system. As demonstrated by the numerous E911 Phase II handset deployment waiver requests filed by handset-based carriers, it also takes a significant amount of time to migrate new handsets into a carrier's customer base through the supply chain. The Commission should encourage the wireless industry to adopt hybrid solutions rather than spend money on short-term network technology investments (that would later be stranded), and should therefore defer enforcement of the PSAP-level accuracy requirement for E911 Phase II so that carriers have sufficient time to implement hybrid technologies.

The Commission should also facilitate stakeholder meetings to discuss location accuracy issues. Polaris continues to believe that the wireless industry and public safety community should collaborate closely with vendors to achieve the goals clearly set forth in the *NPRM*. There are substantial challenges to realizing high-accuracy location estimates across all environments in a realistic manner and at a reasonable cost. Carriers encounter tremendously diverse situations across the different PSAPs in this vast country (*e.g.*, geographic size and shape, road layouts, terrain features, man-made structures, and foliage). Polaris reiterates its support for a series of industry stakeholder meetings to assess the best methods of improving accuracy (in both the short- and long-term) and promoting public safety and homeland security. Polaris has conducted extensive field test activities as part of its efforts to improve accuracy, but it also realizes that there are many different opinions and methodologies regarding how best to test accuracy. These industry stakeholder meetings could also be instrumental to providing agreed test methods and forums for sharing test data.

Significant industry effort has already gone into E911 test methods and procedures, such as the work done by the Emergency Services Interconnect Forum and the National Reliability &

Interoperability Council. To make rapid and efficient progress, the Commission should also incorporate these previous work products into the overall E911 accuracy improvement process.

Conclusion. Polaris appreciates the Commission's efforts in the *NPRM* to seek public comment on these crucial E911 Phase II matters and feels strongly that the hybrid solution combining network-based and handset-based technologies is by far the best approach to achieving the desired outcome of consistent accuracy across urban, suburban, rural, outdoor, and indoor scenarios. Any rules resulting from the *NPRM* should drive the wireless industry toward the most efficient methods of directly implementing hybrid systems without wasting resources on interim methods that do not achieve the Commission's ultimate objectives. Based on these intimate technology linkages, the compliance issues raised in *NPRM* Section III.A cannot be evaluated separately from the technology and testing lines of inquiry in Section III.B, and the Commission should determine the appropriate geographic area for E911 Phase II accuracy and testing requirements in the context of the broader proceeding.

As discussed above, the practical ability of a wireless carrier to approach the E911 Phase II accuracy requirements at the PSAP service area level depends on the current status of the carrier. For carriers currently using network-based solutions, it will not be possible to meet the PSAP service area accuracy requirements in sparse rural areas without prohibitively expensive spending. Meeting Phase II accuracy requirements at PSAP service area levels in these rural areas would require the addition of a significant number of expensive new cell sites or location-only sites. Wireless carriers starting with handset-based solutions would have a relatively less complex upgrade path to move towards accuracy requirements at the PSAP service area level by overcoming the primary challenges in urban and indoor areas where satellite signals are obstructed. Although options exist for implementing hybrid solutions in urban areas by combining the existing handset-based solution with a network-based component

as an upgrade, even these solutions will take some time to implement, and carriers will need to make the necessary expenditures and operational changes.

Due to the fact that currently deployed E911 Phase II location technologies cannot practically and economically meet the Commission's goal of compliance at the geographical service area level of a PSAP in some cases, it will take time for wireless carriers to bring new technologies, such as hybrid approaches, to bear on the problem at hand. Therefore, if the Commission determines that Section 20.18(h) requires E911 measuring and testing at the PSAP service area level, it should defer enforcement of the PSAP-level accuracy requirements until carriers have an opportunity to deploy hybrid networks. Moreover, the Commission should consider staying the effective date of any new rule because currently deployed E911 location technologies will require time to be upgraded to hybrid systems. It should also facilitate stakeholder meetings to discuss location accuracy issues and assess the best methods of improving accuracy and promoting public safety and homeland security.

Respectfully submitted,

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