Before the
Federal Communications Commission
Washington, D.C. 20554

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

REPLY COMMENTS OF POLARIS WIRELESS, INC.

Polaris Wireless, Inc. ("Polaris"),[1] through its attorneys, hereby submits its Reply Comments in response to the Federal Communications Commission's ("FCC" or "Commission") Public Notice seeking to refresh the record in the above-captioned proceeding regarding location accuracy standards for wireless Enhanced 911 ("E911") calls.[2] Polaris encourages the Commission to take advantage of continued technology and industry advancements affecting what is achievable with E911 Phase II systems, and maintain the technical innovation and leadership of the United States in this area.

Polaris strongly supports the efforts of the Commission, public safety groups, wireless carriers, and vendors to improve the accuracy and reliability of E911 Phase II systems. The proposals in the record to achieve compliance at the county level clearly indicate that continued progress is possible,[3] but they fail to take full advantage of the hybrid solutions that have been

---

[1] Founded in 1999, Polaris is a privately held company that has developed and commercialized a wireless location software technology for the delivery of location services, including E911 Phase II. Polaris's software products have been deployed extensively since 2003 in 20 GSM and IS-136 networks covering 39 states to meet E911 Phase II emergency call location requirements and enhance customer safety. As deployed, Polaris's software-only location systems provide E911 Phase II services to about 1,000 PSAPs nationwide and process more than 10,000 emergency call locates daily. In addition, Polaris's location systems have been deployed on three carriers' UMTS networks in the Asia-Pacific region for lawful interception applications.

[2] *Public Safety and Homeland Security Bureau Seeks to Refresh the Record Regarding Service Rules for Wireless Enhanced 911 Phase II Location Accuracy and Reliability*, PS Docket No. 07-114, Public Notice, DA 09-2397 (rel. Nov. 6, 2009) ("*Public Notice*"). All filings referenced herein were submitted in PS Docket No. 07-114.

[3] Letter from APCO and NENA to Derek Poarch, Chief, Public Safety and Homeland Security Bureau (July 14, 2008); Letter from NENA, APCO, and Verizon Wireless to Kevin J. Martin, Chairman (Aug. 20, 2008); Letter from Sprint Nextel to Kevin J. Martin, Chairman (Aug. 21, 2008); Letter from NENA, APCO, and AT&T to Kevin J. Martin,

trialed and are readily available to more rapidly address the current challenges in urban and indoor areas. Many of the comments filed in response to this Public Notice recognize Assisted-Global Positioning System ("A-GPS") as a fundamental element of future E911 systems. Polaris agrees that A-GPS can and should play a fundamental role going forward, but only when implemented as part of a hybrid system combining handset-based A-GPS with network-based technologies, not as a standalone handset-based location technology. As a standalone location technology, A-GPS faces severe challenges, particularly in urban and indoor scenarios. Polaris notes that hybrid systems combining A-GPS with network-based technologies, such as Polaris's Wireless Location Signatures ("WLS"), can be applied in the near term to: (1) realize county-level accuracy in urban areas; and (2) achieve better indoor performance in urban areas. These goals cannot be achieved with A-GPS on its own.

Throughout this proceeding, Polaris has consistently advocated that hybrid systems should play a significant role in improving the accuracy and reliability of the nation's vital E911 Phase II system. Hybrid approaches have the potential to deliver more consistent accuracy performance across the wide range of environments in which E911 calls are made because of the diversity benefit achieved from combining network-based technologies, which typically work best in high cell density environments (*e.g.*, dense urban), with handset-based technologies that tend to work best in open sky environments. A hybrid approach incorporates the best of both worlds.

A-GPS location systems face severe challenges in obstructed environments, particularly in urban and indoor areas where many citizens make wireless calls. A-GPS systems rely on wireless handsets receiving weak signals from distant satellites in orbit. These signals are often obstructed, reflected, or completely blocked in urban and indoor situations. With market trends

---

Chairman (Aug. 25, 2008); Letter from AT&T to Marlene H. Dortch, Secretary (Sept. 5, 2008); Letter from Verizon Wireless to Marlene H. Dortch, Secretary (Sept. 5, 2008); Letter from APCO and NENA to Marlene H. Dortch, Secretary (Sept. 9, 2008).

indicating continued wireless replacement of wireline telecom services (*i.e.*, wireline replacement), such urban and indoor usage cases are of major and growing importance.

In order to understand better the GPS signal levels which might be received inside of typical buildings, Polaris commissioned a measurement campaign and research study by an independent GPS research group affiliated with a major university. The goal was to assess whether usable GPS signal levels could be received inside multi-story buildings, such as those that exist in real-world urban, commercial, and suburban areas.

The test equipment used for the GPS signal data collection during the measurement campaign is shown in Figure 1 below. The equipment consists of a laboratory-grade GPS receiver setup, including a large pinwheel receiving antenna (physically much larger than an entire wireless handset) connected to a sophisticated vector signal analyzer and a laptop computer running signal analysis software. The GPS receiver setup determined the detection probabilities of the various GPS satellites, indicating how likely it was to receive a particular satellite at each in-building location. If too few satellite signals were detectable by a GPS receiver, then a GPS location fix could not be computed.

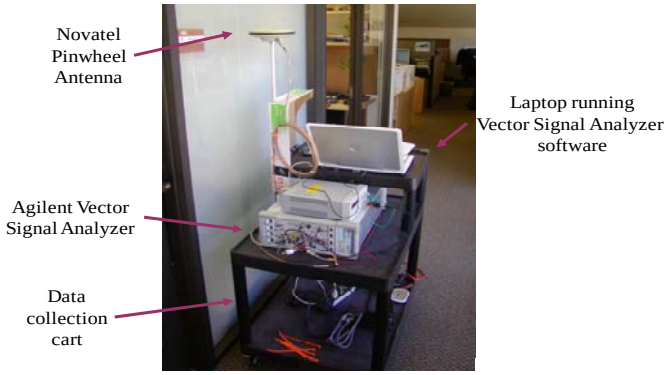

Figure 1. GPS satellite signal measurement test equipment setup used for in-building survey campaign.

GPS signal levels were surveyed in several different sample buildings on a university campus in a predominantly suburban environment. Results from one sample building are shown in

Figure 2 below. The sample building is a 12-story apartment building of reinforced concrete construction, without any other major structures located in the vicinity. GPS signal levels were surveyed on all floors of the building. The resulting GPS satellite detection probabilities (using the sophisticated GPS receiver setup) were then plotted for each floor. The detection probability measures the ability of the receiver to successfully detect the presence of the GPS satellite signal.

The plot shows the detection probability versus floor number in this high-rise building. The GPS satellite space-vehicles (S/V) were categorized based on their elevation angle relative to the building location, with low-elevation satellites near the horizon represented by the black line, medium-elevation satellites as the red line, and high-elevation satellites overhead as the blue line. From the measurement results, it is clear that the detection probabilities are extremely low for all floors in the building except the upper two floors. For example, the GPS satellite detection probability is 0% for satellites at all elevations on floors two through six and ten, indicating that the GPS satellite signals are completely undetectable on those floors. On floors one and seven through nine, the detection probabilities were far less than 20% across all GPS satellite elevations.

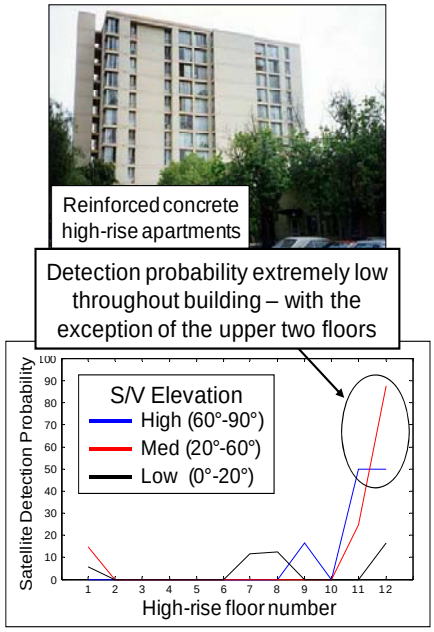

Figure 2. Example of GPS satellite signal detection probability (%) on each floor of a multi-story building.

The results of this GPS signal measurement campaign in buildings illustrate just how challenging it is to receive usable satellite signals inside multi-story buildings. Even with a laboratory-grade receiver connected to a physically large antenna, satellite detection probabilities are exceedingly low on all except the upper-most floors. In fact, the GPS satellite signals are completely undetectable on many floors. The example illustrated herein is for an isolated building on a university campus, and results would be expected to be far worse for typical urban high-rise buildings that are surrounded by other buildings of similar or greater heights.

Conclusion. The comments filed in response to the Public Notice reflect continued progress in this proceeding but, after evaluating the comments, Polaris observes that the proposals contained therein fall short of achieving the maximum benefit in county-level urban accuracy and in achieving better indoor performance. A hybrid solution that combines network-based and handset-based technologies is by far the best approach to achieving consistent accuracy – for emergency callers both outdoors and indoors. Yet the proposals under review only address half of the problem, creating a 50% solution. The field trial results and publications referenced in Polaris's comments, including blind tests conducted by major wireless carriers in multiple cities and on various air interface protocols, demonstrate that urban and indoor performance can be dramatically improved beyond current levels by employing hybrid systems.[4] With such options readily available, documented in the literature, and demonstrated in field trials, the FCC should

[4] *See* Comments of Polaris Wireless, Inc., PS Docket No. 07-114 (filed Nov. 20, 2009).

consider adopting new requirements for indoor location performance and earlier effective dates for its county-level urban accuracy rules.

Respectfully submitted,

POLARIS WIRELESS, INC.

By: /s/ *Michele C. Farquhar*
Michele C. Farquhar
Mark W. Brennan
Hogan & Hartson, LLP
555 Thirteenth Street, NW
Washington, DC 20004
Telephone: (202) 637-5663
E-Mail: mcfarquhar@hhlaw.com

Its Attorneys

Manlio Allegra
Chief Executive Officer
Martin J. Feuerstein, Ph.D.
Chief Technical Officer
Polaris Wireless, Inc.
5201 Great America Parkway
Suite 440
Santa Clara, CA 95054

December 4, 2009