

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

In the Matter of

Phase II E911 Implementation Waiver)	CC Docket No. 94-102
Requests filed by Nextel Communications,)	
Inc. and Hawaiian Wireless, Inc.)	

COMMENTS OF MOTOROLA

Motorola, Inc. (“Motorola”) respectfully provides these comments in response to the *Waiver Public Notice* released by the Wireless Telecommunications Bureau.¹

Motorola, as the developer and sole manufacturer of Integrated Digital Enhanced Network (“iDEN”) products, is in a position to discuss the status of efforts to provide enhanced 911 location services for this product line and limits its comments to Nextel’s waiver request.

As is discussed in detail below, no technology has been fully integrated and tested with iDEN products at this time. However, it is readily apparent from simulations and other testing that assisted global positioning system (“A-GPS”) location solutions can be expected to provide accuracy levels in compliance with the Commission requirements. Further, Motorola discusses its simulation efforts surrounding use of enhanced observed time difference (E-OTD) and its limitations. Finally, Motorola addresses the effects of attempting an interim deployment of E-OTD technology on the rollout of A-GPS-capable handsets. With Commission approval of Nextel’s waiver, Motorola is committed to

¹ See *Public Notice*, “WTB Seeks Comment on Phase II E911 Implementation Waiver Requests Filed by Nextel Communications, Inc. and Hawaiian Wireless, Inc.” DA 00-2704, released December 4, 2000 (“*Waiver Public Notice*”).

supporting the A-GPS deployment and penetration rates offered in Nextel's waiver request.

I. INTRODUCTION AND BACKGROUND

Since the FCC began the process of enhanced 911 access for wireless systems in 1994, Motorola has consistently been an active participant. In addition to comments in the proceeding, Motorola has provided a tutorial to the FCC during the 1999 roundtable discussion of location technology² and participated in the multiparty roundtable fora in the summer of 2000.³ Additionally, Motorola is unique in that it provides equipment that covers the gamut of digital technology (iDEN, CDMA, TDMA and GSM) and has attempted to provide the Commission with meaningful technical information about each of these particular technologies and the location solutions being considered for each.

As such, in the July 2000 roundtable, Motorola informed the Commission that hybrid location technologies such as E-OTD and Advanced Forward Link Trilateration (A-FLT) would not meet the FCC's accuracy standards for enhanced 911 location.⁴ With this understanding, Motorola has been actively working with Nextel to establish a location technology that would work with iDEN technology, meet the Commission's accuracy requirements, and be deployed in accordance with the FCC's timing and penetration requirements. E-OTD was a promising technology for iDEN, and indeed has been embraced by the Global System for Mobile ("GSM") platform.⁵ Due to the differences between iDEN and GSM, Motorola has determined that E-OTD will not

² See Motorola Tutorial presented at the June 28, 1999 roundtable discussion of location technology found at <http://www.fcc.gov/e911/mottutorial.pdf>

³ See FCC June 30, 2000 and July 6, 2000 Meetings *Ex Parte* Summaries found at <http://www.fcc.gov/e911/meetingsummary062900.pdf> and <http://www.fcc.gov/e911/meetingminutes070600.pdf>

⁴ See July 6, 2000 Meeting *Ex Parte* Summary at 4.

provide the location accuracy required by the Commission's rules for iDEN technology. Therefore, Motorola has focused its iDEN efforts on the development and production of handsets enabled with an A-GPS function that will meet the accuracy requirements. As described herein, the accuracy capabilities of A-GPS appear promising, but Motorola can only commit to delivering handsets by October 1, 2002.

II. Assisted GPS Implementation Schedule

As stated in Nextel's waiver request,⁶ Motorola is committed to supporting A-GPS deployment and penetration rates in iDEN handsets. However, implementation of A-GPS into iDEN requires significant design, development, and testing efforts that will encompass both infrastructure and handset production. At Nextel's request, Motorola is working to incorporate A-GPS technology in iDEN handsets and infrastructure. The first commercially available iDEN handset that incorporates A-GPS technology is expected to be available October 1, 2002. After this initial deployment, Motorola will continue to incorporate A-GPS technology in the design of new iDEN handsets in order to support the penetration rates included in Nextel's filing.⁷

Further time beyond the FCC's mandated date of October 1, 2001 for equipment manufacturers and carriers to provide E911 location services is required for Nextel and Motorola. This information has been consistently disclosed by Motorola.⁸ In the June 14

⁵ See Aerial May 2 *Ex Parte* Comments; VoiceStream June 15 *Ex Parte* Comments; AT&T Supplemental E911 Report dated December 6, 2000.

⁶ See Nextel Communications, Inc. and Nextel Partners, Inc. Joint Report on Phase II Location Technology Implementation and Request for Waiver at 9 ("*Nextel Waiver Request*").

⁷ See *Nextel Waiver Request* at 4; initial deployment of A-GPS would begin October 1, 2002; 10% of all new iDEN handsets sold beginning December 31, 2002; 50% of all new iDEN handsets sold by December 1, 2003; 100% of all new iDEN handsets sold by December 1, 2004; and 95% of Nextel's entire iDEN customer base by December 31, 2005.

⁸ See e.g., Motorola *Ex Parte* Comments dated June 14, 2000; Motorola Comments in July 6, 2000 multiparty meetings.

presentation to the Wireless Telecommunications Bureau, Motorola technical staff explained in detail the steps required for actual product development of location-enabled products, including iDEN products. Further, Motorola disclosed that for ALI-capable handsets there have been a significant number of unknowns, such as how accuracy would be measured and that testing of location technology did not provide conclusive data upon which operators, including Nextel, could make earlier sound decisions. Further complicating matters, the Commission also decided to tighten the accuracy requirement, in effect eliminating some solutions which Motorola and Nextel had under active consideration.⁹ Quite simply, the unknowns have increased the complexity of the development process and therefore the timeline for product readiness. In view of these circumstances, Nextel has requested a waiver and Motorola supports the timeline for product availability set forth by Nextel.

Despite the availability of A-GPS capable iDEN handsets, customer acceptance likely will be limited by the near term effects on handset size and cost. Until A-GPS has been integrated into the baseband processor of the handset, A-GPS equipped handsets will suffer a size and cost penalty relative to non-A-GPS handsets. It is expected that handsets with A-GPS integrated into the baseband processor will be available in mid-2003, thus reducing handset size, lowering the price of the handset, and thereby enhancing customer acceptance. As customers more readily accept the new handsets, penetration rates should increase.

While A-GPS has not yet been integrated into an iDEN handset, A-GPS field trials using other technologies have shown good results. Motorola believes that similar

⁹ See Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, *Third Report and Order*, 14 FCC Rcd 17388 (1999) at ¶ 74.

results are achievable on iDEN. Therefore, we agree with Nextel that A-GPS technology will be able to meet the FCC accuracy requirements for handset-based solutions (50 meters 67% of the time and 150 meters 95% of the time), and support Nextel's waiver request and its associated deployment timeline and penetration rates.

III. Use of E-OTD For iDEN Location Technology

As previously stated in the multi-party meetings, Motorola does not believe that E-OTD employed with iDEN technology will meet the FCC accuracy requirements for E-911 phase II.¹⁰ Motorola has reached this conclusion after conducting simulations of E-OTD on iDEN technology in a lab environment, which should produce results even more favorable than in a real-world environment. These accuracy projections are based on mathematical models and computer simulations that take into account the following factors that impact accuracy: multipath environment, user speed, indoor vs. outdoor use and site geometry. Multipath environment factors included dense urban, urban (two separate urban environments), suburban and rural. User speed factors ranged from standing still to vehicular speeds. Site geometry factors included core (full ring of neighbor sites surrounding the serving site), fringe (all sites on one side of the handset) and highway (sites aligned along a straight highway configuration).

A. Simulation Results

The first simulation model examined a deployment of E-OTD technology utilizing iDEN with no significant changes to the iDEN infrastructure hardware. In this model, the accuracy of E-OTD technology utilizing iDEN is dominated by the current site synchronization capability. The results of this model resulted in a weighted average accuracy 382 meters, 67% of the time and 1327 meters, 95% of the time. The simulated

accuracy utilizing the current timing synchronization does not meet the FCC E-911 Phase II requirements.

A second simulation model examined an E-OTD technology utilizing iDEN that involved installing additional hardware at each cell site to improve the timing synchronization. This model resulted in a weighted average accuracy 147 meters, 67% of the time and 643 meters, 95% of the time. Although an improvement over the initial simulation, this E-OTD iDEN solution still does not meet the FCC E-911 Phase II requirements.

B. Simulation Parameters and Factors

Multipath Effects. These simulations are a weighted average of the varying multipath environments where a location is attempted. Each multipath environment yields a different level of accuracy and the overall E-OTD accuracy is a weighted average of each of these environments. The weighted average was determined by the population distribution across these multipath environments based on 1990 U.S. Census data. For the initial simulation (without any changes to the infrastructure timing synchronization) accuracy levels of 372 meters in dense urban, 257 to 262 meters in urban, 294 meters in suburban and 693 meters in rural environments were found. The weighted average accuracy of 382 meters, 67% of the time is a result of these varying environments.

In the second simulation, with enhanced timing synchronization, the accuracy levels were 328 meters in dense urban, 134 to 159 meters in urban, 122 meters in suburban, and 174 meters in rural environments were found. The weighted average accuracy of 147 meters, 67% of the time is a result of these varying environments.

¹⁰ See July 6, 2000 Meeting *Ex Parte* Summary at 4.

System Loading. In addition to multipath effects, there are additional factors that can impact accuracy. The most important factor is system loading. E-OTD technology utilizing iDEN is dependent on the use of known data patterns in idle slots (i.e. unused for control or traffic payloads) for the time of arrival (TOA) measurement. The impact of system loading has not been fully simulated under all of the conditions included in the simulation model, but it can be expected that an iDEN system that is more fully loaded would have its E-OTD accuracy levels adversely affected. System loading also has an impact on call setup delay to complete the necessary measurements. Because E-OTD measurements must be made prior to call completion, it would be necessary to delay the setup of 911 calls until the TOA measurements are completed. Call setup time could be increased by as much as three seconds.

iDEN vs. GSM. The simulated accuracy data presented applies only to iDEN technology and is not representative of accuracy that can be achieved by other technologies, such as GSM. Theoretically, the “Cramér-Rao Bound” governs achievable accuracy.¹¹ Prominent in this relationship is bandwidth, such that accuracy improves (if all other factors are held constant) with increasing signal bandwidth. iDEN channel sizes are one-eighth the size of GSM. The smaller iDEN channel size provides operators with greater flexibility of spectrum utilization but the smaller iDEN bandwidth results in lower expected accuracy of E-OTD technology on iDEN as compared to GSM.

IV. Interim Deployment of E-OTD

In its waiver request, Nextel discusses the effects that any interim deployment of E-OTD, such as being done by VoiceStream, would have on implementation of A-GPS

for iDEN.¹² Motorola also is concerned about the effect of any interim deployment requirement. The infrastructure development of an E-OTD solution for E-911 will have an impact on the delivery of the A-GPS solution. The E-OTD infrastructure solution has significant differences with the A-GPS solution thus minimizing the opportunity of reuse between the two solutions. The RF resources are utilized differently and the assist data varies between the two solutions. Due to these differences, each solution is a unique development effort. If Motorola were to deliver an interim E-OTD solution, an A-GPS solution would be delayed from October 2002 to the second quarter 2003. A nationwide deployment of the A-GPS solution could take up to six months and result in a commercial solution by the fourth quarter 2003. Motorola believes that such an effort would not be in the public interest and that dedicated efforts to deployment of a single location technology solution for iDEN would be the most beneficial scenario.

V. CONCLUSION

As Motorola has consistently discussed with the Commission, the implementation of location technology is far from a trivial matter. Each particular digital technology has particular differences and requirements to be met for a location solution to work. As has been demonstrated by Nextel, and echoed here by Motorola, the lone technical location solution for the iDEN platform is the utilization of A-GPS. Motorola asks that the

¹¹ The Cramér-Rao Bound dictates that the possible accuracy of a system is directly proportional to the system bandwidth deployed. *See e.g.*, “Introduction to Radar Systems,” by Merrill L. Skolnik (McGraw-Hill, Second Edition) at page 405 for derivation of this formula.

¹² *See Nextel Waiver Request* at 18.

Commission grant Nextel its requested waiver and is committed to meeting the timelines and production requirements associated with this request.

Respectfully submitted,

/s/ Mary E. Brooner

Mary E. Brooner
Director, Telecommunications Strategy
and Regulation
MOTOROLA, INC.
1350 I Street, N.W.
Washington, D.C. 20005
202-371-6900

January 5, 2001