Before the

FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
Revision of the Commission's Rules	)	CC Docket No. 94-102
To Ensure Compatibility with	)	RM-8143
Enhanced 911 Emergency Calling Systems	)	

THIRD REPORT AND ORDER

Adopted: September 15, 1999 **Released: October 6, 1999**

By the Commission: Commissioner Tristani issuing a statement.

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I. INTRODUCTION

1. In this Order, the Commission takes another significant step towards enabling wireless callers to obtain emergency assistance more rapidly and efficiently by dialing 911. Wireless phones can be a vital, life-saving way to call for assistance in emergency situations. Indeed, the ability to reach 911 in an emergency is one of the most important reasons Americans give for purchasing wireless phones.[1] But, unlike most wireline phones, which are connected to Enhanced 911 (E911) service that automatically reports the caller's location, when a 911 call is placed using a wireless handset, the dispatcher at the 911 Public Safety Answering Point (PSAP) does not know where the caller is.

2. The life-saving advantage of being able to know accurately and quickly the location of an emergency is obvious. Emergency police, fire, and medical teams cannot assist a person they cannot find. Less obviously, automatic location identification (ALI) also allows PSAPs and emergency response teams to operate more efficiently. Wireless calls may be received by the carrier at an antenna some distance away from where the call is actually placed, because of the vagaries of radio transmission, terrain, or network congestion. ALI can be applied to route these calls immediately to the proper PSAP, normally that nearest the scene. ALI also allows PSAPs to handle wireless calls more quickly and efficiently, because the dispatcher need not question the caller about his or her location. Finally, ALI can help PSAPs deal with sudden bursts of calls, which often occur after incidents such as highway accidents. Knowing the location of the incoming calls, the PSAP can better distinguish redundant calls about a particular accident from calls concerning a different emergency.

3. Wireless subscribership continues to grow rapidly. From year end 1996 to year end 1998, the number of wireless subscribers grew from 44 million to 67 million, an increase

[1] Polk Public Opinion Strategies, National Survey, July 31-August 4, 1997 (last viewed Sept. 20, 1999) <http://www.wow-com.com/consumer/highway/reference/e911poll.cfm>.

of 52 percent. During that same period, wireless 911 calls grew even more rapidly, from 1.805 million per year (59,180 per day) in 1996 to 2.943 million (98,097 per day) in 1998, an increase of 63 percent.[2] The growing use of wireless phones to make 911 calls clearly represents an important advance in public safety. However, the growing number of wireless 911 calls exacerbates the limitations of wireless 911 service, in particular the continuing inability to automatically locate those calls. While most PSAP operators immediately know the location of wireline callers, because wireline E911 has been widely deployed, PSAPs do not know the location of wireless callers, except in a very general way in those PSAPs where Phase I (providing cell site or cell sector information) has been deployed. As a result, PSAP dispatchers must question all wireless callers to try to determine their location before any help can be sent. This process can delay significantly the arrival of help, especially if the call must be transferred to another PSAP that actually serves the location or if the caller does not know his or her location.

4. These 911 call location difficulties represent a significant public safety problem. Nearly 70 percent of auto accident fatalities occur within two hours after a crash and, according to a conservative estimate, 1,200 lives are lost each year because of delay in discovering accidents.[3] Addressing this problem is especially important for rural areas. According to National Highway Traffic Safety Administration data, for example, emergency communications are most valuable, and improvements are most needed, in rural areas. In 1996, motor vehicle crashes in rural areas accounted for 59 percent of total motor vehicle fatalities that year, 25,000. The fatality rate is also twice as high on rural interstate highways as on urban ones per miles driven, and rural crashes are more severe, more likely to involve both multiple fatalities and severe vehicle damage.[4] Overall, a person is as much as three times as likely to suffer a fatality in a rural crash.[5]

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[2] CTIA, Cellular Carriers Association of California, California Highway Patrol, New York State Police, and others, Wireless 911 and Distress Calls (last viewed Sept. 20, 1999) <http://www.wow-com.com/statsurv/e911>.

[3] American College of Emergency Physicians' Scientific Assembly, Cell Phones a Threat to 911 (Oct. 16, 1997) <http://www.erwatch.com/cell.html>.

[4] National Highway Traffic Safety Administration (NHTSA), Traffic Safety Facts 1996, Rural Areas (last viewed Sept. 21, 1999) <http://www.nhtsa.dot.gov/people/ncsa/FactPrev/Rural/96.html>. According to the Department of Transportation Fatal Accident Reporting System (FARS), the average Emergency Medical Service (EMS) crash notification time is almost twice as long in rural areas (8.95 minutes) as in urban areas (4.85 minutes). In addition, the average response time for rural areas, 11.47 minutes, is also almost twice that of urban areas (based on 1992 data).

[5] NHTSA, Research Note, Rural and Urban Crashes - A Comparative Analysis, Aug. 1996, at 2. <http://www.nhtsa.dot.gov/people/ncsa/reports.html#1996>.

5. To improve public safety and extend ALI to wireless callers, the Commission has established a schedule, subject to certain conditions, for deployment of E911 features by wireless carriers. In Phase I, which began on April 1, 1998, PSAPs were to receive a rough estimate of a caller's location and a dialable call-back number. In Phase II, scheduled for October 1, 2001, or six months after the service is requested, whichever is later, PSAPs are to receive a much more precise location identification, within 125 meters or about 410 feet of the caller's location.[6]

6. When the Commission adopted its Phase II rules in 1996, it was believed that location information could only be effectively provided by technologies based in or overlaid on carrier networks, using approaches such as triangulation of the handset's signal. Since that time, advancements in location technologies that employ new or upgraded handsets have demonstrated important progress. Competition in the development of network and handset-based technologies has yielded significant results. While it does not appear that any single network-based or handset-based location technology is perfect in all situations or for all wireless transmission technologies, both network and handset-based solutions may provide location information by 2001 that meets or exceeds our accuracy requirements.[7] Each type of solution has its advantages and limitations. Each may also be improved or combined with other technologies in the future to support further improvements in 911 service and public safety.

7. The Commission's current rules, however, as a practical matter only permit network-based solutions to meet our Phase II requirements, because they require that ALI be provided for all 911 calls in a requesting PSAP's area as of a fixed date. It is not, we believe, economically or logistically feasible to expect or require that all current handsets be upgraded or replaced to meet that date. Rather, some form of phase-in of new or upgraded handsets is necessary if handset-based solutions are to be a viable competitor for initial deployment under Phase II. The statistical method the Commission adopted to measure location accuracy and reliability, Root Mean Square (RMS), also appears to be unworkable in some respects for both network-based and handset-based solutions.

8. In order to address these issues, we revise our rules in this Order to permit handset-based solutions, or hybrid solutions that require changes both to handsets and wireless networks, to compete in a reasonable way with network-based solutions in providing Phase II ALI. While we believe that the public safety is advanced by the actions we take today, we recognize that these rule revisions involve several trade-offs. Allowing a phase-in for handsets potentially can delay the full availability of Phase II location information for callers

[6] 47 C.F.R. § 20.18(d).

[7] *Id.*

and PSAPs. To offset this drawback, we require that handset-based solutions be held to a higher accuracy standard, which will help locate callers more quickly and assist PSAPs in handling 911 calls more efficiently. We also require that handset deployment begin earlier than the current October 1, 2001 deployment date and that this deployment occur, for wireless carriers employing a handset solution, regardless of whether the PSAP has requested Phase II. These steps should promote the rapid rollout of handset-based solutions through normal handset turnover and growth. In addition, we require that wireless carriers employing handset-based solutions take additional steps to provide location information for roamers and callers with non-ALI capable handsets. Finally, we require that carriers take action to ensure that any phase-in for handset-based solutions is brief and complete, so that, so far as possible, all callers and PSAPs will benefit from accurate, automatic location information in emergencies without undue delay.

9. We also replace the RMS reliability methodology with a more workable and understandable standard. This revised standard sets levels of accuracy that must be achieved for 67 percent and 95 percent of all calls. To recognize that handset approaches will generally require a longer phase-in period, we establish, as a compensating factor, a tighter accuracy standard for handset-based solutions (50 meters for 67 percent of calls) than for network-based solutions (100 meters for 67 percent of calls). Further, in view of the likelihood that installing equipment throughout a carrier's network will often require more time than the six months currently allowed under the Commission's Rules, we will allow wireless carriers employing network-based location technology to reach 50 percent coverage within six months of a PSAP request for Phase II services and 100 percent coverage eighteen months after a PSAP request.

10. Taken together, we expect that this revised program for Phase II deployment will encourage the deployment of the best and most efficient technologies, speed actual implementation of E911, and promote competition in E911 location technology and service. We expect that our actions today will provide the clear guidance needed to enable the many necessary participants in wireless E911 deployment to implement Phase II as soon as possible. This Commission will, in other orders in the near future, resolve the remaining issues before it concerning the deployment of Phase II.

11. We recognize that the actions we take today to spur the deployment of Phase II implementation are ambitious and that we may confront challenges as we move forward. The substantial benefits of wireless E911 to the public interest and safety, however, make it crucial that those challenges be met and overcome without undue delay.

II. EXECUTIVE SUMMARY

12. Specifically, we adopt the following revisions to our wireless E911 rules:

- Wireless carriers who employ a Phase II location technology that requires new, modified or upgraded handsets (such as Global Positioning Systems (GPS)-based technologies) may phase-in deployment of Phase II subject to the following requirements:

  - Without respect to any PSAP request for Phase II deployment, the carrier shall:

    1. Begin selling and activating ALI-capable handsets no later than March 1, 2001;

    2. Ensure that at least 50 percent of all new handsets activated are ALI-capable no later than October 1, 2001; and

    3. In addition to the 50 percent requirement, ensure that at least 95 percent of all new digital handsets activated are ALI-capable no later than October 1, 2002.

  - Once a PSAP request is received, the carrier shall, in the area served by the PSAP:

    1. Within six months or by October 1, 2001, whichever is later:

       a. Ensure that 100 percent of all new handsets activated are ALI-capable;

       b. Implement any network upgrades or other steps necessary to locate handsets; and

       c. Begin delivering to the PSAP location information that satisfies Phase II requirements.

    2. Within two years or by December 31, 2004, whichever is later, undertake reasonable efforts to achieve 100 percent penetration of ALI-capable handsets in its total subscriber base.

  - For roamers and other callers without ALI-capable handsets, carriers shall, at a minimum, support Phase I ALI and shall implement other available best practice methods of providing the location of the handset to the PSAP.

  - To be allowable under our rules, an ALI technology that requires new, modified, or upgraded handsets shall conform to general standards and be

interoperable, allowing roaming among different carriers employing handset-based location technologies.

- For carriers employing network-based location technologies, we replace our current plan, which requires that implementation be fully accomplished within 6 months of a PSAP request, with a revised rule requiring the carrier to deploy Phase II to 50 percent of callers within 6 months of a PSAP request and to 100 percent of callers within 18 months of such a request.

- We adopt the following revised standards for Phase II location accuracy and reliability:

  - For network-based solutions: 100 meters for 67 percent of calls, 300 meters for 95 percent of calls;

  - For handset-based solutions: 50 meters for 67 percent of calls, 150 meters for 95 percent of calls.

- We direct wireless carriers to report their plans for implementing E911 Phase II, including the technology they plan to use to provide caller location, by October 1, 2000. This report shall provide information to permit planning for Phase II implementation by public safety organizations, equipment manufacturers, local exchange carriers, and this Commission, in order to support Phase II deployment by October 1, 2001.

III. BACKGROUND

13. In the *E911 First Report and Order* adopting the wireless E911 rules in 1996, the Commission stated that its decisions reflected its "longstanding and continuing commitment to manage use of the electromagnetic spectrum in a manner that promotes the safety and welfare of all Americans."[8] The rapid, effective, and efficient deployment of wireless E911 remains one of the most important ways of fulfilling this commitment. The wireless 911 rules seek both to improve the reliability of wireless 911 services and to provide the enhanced features generally available for wireline calls. To further these goals, the Commission has required wireless carriers to implement Enhanced or E911 service, subject to certain conditions and schedules. With E911 service, a dialable number accompanies each call, which allows the PSAP dispatcher to call back if the call is disconnected or to obtain additional information. Of greatest importance, wireless E911 service allows the dispatcher to

[8] Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, Report and Order and Further Notice of Proposed Rulemaking, 11 FCC Rcd 18676, 18678 (1996) [hereinafter *E911 First Report and Order* and *E911 Second NPRM*].

immediately know where the caller is located, a capability called Automatic Location Identification or ALI.

14. In adopting the rules and schedule for wireless ALI in 1996, the Commission sought to apply a general policy of technological and competitive neutrality to encourage innovation and efficiency, while continuing to consider the possibility of further improvements in ALI.[9] In the 1997 *E911 Reconsideration Order*, the Commission took note of inquiries with respect to whether non-network-based technologies, such as handset-based technologies using the GPS satellite system, could comply with the wireless E911 rules. In reaffirming its policy of technological and competitive neutrality, the Commission made clear its willingness to consider waiving or revising its rules to ensure that they permitted and fostered the deployment of the best, most effective and efficient methods of achieving Phase II compliance.[10] CTIA sought clarification of issues raised by handset-based ALI technologies in a petition for further reconsideration of this Order.[11] Further, in a Public Notice released in December 1998, the Wireless Telecommunications Bureau (Bureau) established a schedule to assist those interested in filing waivers for handset-based approaches to the Phase II ALI requirements, and requested comment on guidelines that should apply to such waivers.[12] A number of parties filed waiver requests and other pleadings responding to the *Waiver Public Notice* and the waiver requests.[13]

15. To further supplement the record, the Bureau released a second Public Notice on June 1, 1999, seeking more targeted comment on specific issues relating to whether the

[9] *See E911 First Report and Order*, 11 FCC Rcd 18714 (emphasizing that the intention is to adopt general performance criteria rather than extensive technical standards); Revision of the Commission's Rules to Ensure Compatibility With Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, Memorandum Opinion and Order, 12 FCC Rcd at 22665, 22724-25 (1997) (in setting deadlines and benchmarks for ALI, Commission policy has been to be technologically and competitively neutral) [hereinafter *E911 Reconsideration Order*].

[10] *E911 Reconsideration Order*, 12 FCC Rcd at 22724-25.

[11] CTIA Comments II at 1.

[12] Public Notice, Wireless Telecommunications Bureau Outlines Guidelines for Wireless E911 Rule Waivers for Handset-Based Approaches to Phase II Automatic Location Identification Requirements, 13 FCC Rcd 24609 (1998) [hereinafter *Waiver Public Notice*].

[13] A list of pleadings is included in Appendix A. Abbreviations used in this Order in citing to pleadings also are included in Appendix A.

Commission should grant waivers or otherwise modify the ALI requirements.[14] These issues included schedules for handset-based solutions, problems in providing ALI to roamers, the likely pace of handset turnover, and the reliability methodology that should be used. It also sought specific comment on submissions by SnapTrack and APCO proposing phased-in implementation schedules for handset-based solutions.[15] In addition, the Bureau asked for further consideration of E911 implementation issues by parties to a 1996 Consensus Agreement, in a Public Notice released June 9, 1999.[16]

16. On June 28, 1999, the Commission's Office of Engineering and Technology (OET), in cooperation with the Bureau, hosted a roundtable discussion of technical issues involved in implementing the performance and accuracy standards for E911 Phase II ALI technologies.[17] Roundtable participants included representatives of network-based solution technologies, handset-based solution technologies, manufacturers, wireless carriers, and public safety representatives.[18]

IV. DISCUSSION

A. ALI Deployment

[14] Public Notice, Wireless Telecommunications Bureau Requests Targeted Comment on Wireless E911 Phase II Automatic Location Identification Requirements, DA 99-1049, rel. June 1, 1999 [hereinafter *Targeted Public Notice*]. A list of pleadings in response to the June 1 Public Notice is included in Appendix A. Abbreviations used in this Order in citing to pleadings also are included in Appendix A.

[15] *See* SnapTrack Reply Comments I; APCO Further Comments I.

[16] Public Notice, Commission Seeks to Facilitate Wireless E911 Implementation and Requests a Report, CC Docket No. 94-102, FCC 99-132, rel. June 9, 1999 (requesting a report on E911 implementation schedule, choice of technology, and cost recovery issues to be filed by August 9, 1999). For background on the Consensus Agreement and its role in the E911 rulemaking, see para. 17 *infra*. Parties who filed comments in these stages of the proceeding are listed in Appendix A.

[17] Public Notice, Technical Roundtable On Implementation Of Automatic Location Identification ("ALI") For Enhanced 911 ("E911") Technologies To Be Held June 28, 1999, DA 99-1141 (June 9, 1999); Public Notice, Commission Announces Details of Technical Roundtable on Implementation of Automatic Location Identification for Enhanced 911 Technologies, DA 99-1243 (released June 23, 1999).

[18] The following entities were represented at the roundtable: Aerial Communications, AirTouch, APCO, AT&T Wireless, Ericsson, GTE Wireless, IDC, KSI, Motorola, NENA, Nextel, Nokia, Nortel Networks, Omnipoint Communications, QUALCOMM, SigmaOne, Sirf Technology, SnapTrack, TruePosition, U.S. Wireless Corporation, Western Wireless.

17. **Background**. In initially proposing and adopting the rules for Phase II ALI, the Commission intended and expected that those rules would be technologically and competitively neutral. For example, the Commission anticipated in the 1994 Notice of Proposed Rulemaking that either handset-based or network-based ALI technologies might be deployed.[19] Similarly, in the *E911 Second NPRM* accompanying the *E911 First Report and Order*, the Commission emphasized the importance of expediting the introduction of new technology that would substantially advance the quality of E911 service to the public,[20] particularly through more accurate and reliable location information.[21] However, at the time of the adoption of the *E911 First Report and Order*, the record indicated that handset-based ALI technologies were subject to several deficiencies that made them impractical for E911 deployment. The 1996 Consensus Agreement among representatives of both the wireless industry and the public safety community, which helped form the basis for the Commission's wireless E911 rules, was effectively based on the assumption that handset-based technologies would not be able to provide ALI. As the Commission stated in the *E911 First Report and Order*, "[i]t appears from the Consensus Agreement comments that E911 will generally be implemented by network-based technology, rather than by modification of handsets."[22] The Phase II ALI schedule, which was identical to that proposed in the Consensus Agreement, reflected this assumption, notably in its setting of a flash-cut implementation date. While the Commission set general technical standards for the ALI capabilities that must be achieved, rather than extensive technical standards, it did not consider the possibility of rules or rule modifications that would recognize the specific characteristics of technologies that required new or upgraded handsets.

18. After the rules were adopted, it became apparent that technological advances in handset-based and hybrid[23] ALI technologies were being made, suggesting that those

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[19] Revision of the Commission's Rules To Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, Notice of Proposed Rulemaking, 9 FCC Rcd 6170 (1994) [hereinafter *E911 First NPRM*].

[20] *E911 First Report and Order*, 11 FCC Rcd at 18745.

[21] *E911 First Report and Order*, 11 FCC Rcd at 18743-44. We proposed an accuracy level of 40 feet for both horizontal and vertical coordinates, with a reliability of 90 percent, after the end of the five year Phase II period.

[22] *E911 First Report and Order*, 11 FCC Rcd at 18732.

[23] By hybrid solutions, we mean ALI solutions that require both upgrades or replacement of handsets and assistance from hardware or software in the wireless network or from some separate facilities. ALI solutions proposed by SnapTrack and Lucent are examples of what we would consider hybrid solutions, because both involve upgraded handsets with GPS capability and information provided by a network infrastructure. See, e.g., Lucent Press Release, "Bell labs geolocation technology pinpoints wireless 911 calls within 15 feet," June 30,

technologies could be effective alternatives to network-based approaches. The Commission specifically addressed this development in the *E911 Reconsideration Order,* reaffirming the policy of technological and competitive neutrality while inviting petitions for rulemaking or waiver requests that would allow us to consider modifications to the implementation deadline, accuracy standards, or other rules.[24] The Commission suggested, for example, that it would consider phased-in implementation of ALI, especially to the extent a proposal also helps achieve the further improvements in ALI capabilities the Commission anticipated in the *E911 Second NPRM.*[25] The Bureau, in its Public Notices, sought further comment on both the possible advantages of handset-based solutions (*e.g.*, the possibility of significantly higher accuracy and of earlier implementation) as well as the concerns such solutions raise.[26] The Bureau pointed out, for example, the concern that carriers employing handset-based ALI technologies might not be able to provide reliable ALI service to "roamer" customers whose home carriers adopt network-based solutions.[27] The Bureau sought guidance on steps to minimize problems associated with non-ALI capable handsets and to address roamer situations.[28] In response, the Commission received multiple requests to revise or waive the rules to permit the use of handset-based ALI technologies, as well as oppositions to such changes.

19. **Discussion.** We conclude that the public safety and welfare support revising our current rules to permit the broadest range of technical solutions to be employed to achieve ALI compliance, including handset-based and hybrid solutions. As revised, our rules for Phase II will allow other ALI technologies to be deployed as effective competitors to network-based solutions. This expanded range of technological options should stimulate greater competition and innovation, helping to improve ALI services while lowering prices and spurring the rapid, universal, and efficient deployment of 911 ALI for wireless callers. It also should make it possible to provide 911 ALI more rapidly and efficiently for rural areas.

1999, (last viewed Sept. 20, 1999) <http://www.lucent.com/press/0699/990630.bla.html>. In general, when we refer in this Order to handset-based solutions, we include all solutions that require upgrade or replacement of current handsets, including hybrid solutions, unless we indicate otherwise.

[24] *E911 Reconsideration Order*, 12 FCC Rcd at 22725 (para. 124).

[25] *Id.*

[26] *Waiver Public Notice,* 13 FCC Rcd 24609 (1998); *Targeted Public Notice*, DA 99-1049, rel. June 1, 1999.

[27] *Waiver Public Notice* at 24611-12; *Targeted Public Notice* at 5.

[28] *Targeted Public Notice* at 5-6.

20. Commenters that urge us to modify our rules to accommodate handset-based solutions claim that handset-based solutions represent the most realistic methods for implementing Phase II ALI by the October 1, 2001, deadline, but that these solutions can only be deployed if the Commission rapidly revises its rules to preserve the handset alternative as a viable approach.[29] Specifically, they contend that ALI technologies that can out-perform the Phase II benchmarks and save lives will not be deployed until the Commission gives unequivocal direction that a phased-in approach to compliance is acceptable.[30] Opponents of revised rules or waivers for handset-based technologies contend, on the other hand, that network-based technology is available today that meets, and in some cases exceeds, the Commission's accuracy and performance standards. Opponents also contend that serious questions surround the timing and ultimate viability of handset-based approaches, especially their effects on users of current, non-ALI capable handsets and roamers.[31] They argue that a phase-in for handset-based solutions would represent a delay in the Phase II implementation schedule that is not in the public interest.[32]

21. Any delay in deployment and effective, universal operation of E911 ALI is undesirable. The sooner ALI information is available and used by PSAPs the more rapidly and efficiently emergency help can be sent. We have set an aggressive schedule in order to deploy ALI as soon as reasonably possible and we seek to avoid and minimize any delay. We also believe, under the circumstances here, however, that the benefits of a reasonable a phase-in approach for handset-based ALI solutions justify and outweigh the drawbacks, including any possible additional delays in ALI deployment.

22. As an initial matter, the extent of any actual delay from a phase-in for handset-based solutions is speculative and handset-based solutions may well speed actual ALI deployment in important cases. As APCO and other commenters point out,[33] the current October 1, 2001 start date is conditional - it comes into effect only if PSAPs that are able to

[29] SnapTrack Comments II at 2; IDC Comments II at 17-18.

[30] SnapTrack Comments II at 3.

[31] Allen Telecom Reply Comments II at 2; KSI Comments II at 7-8; Metrocom.com Comments II at 2-3; NENA Comments II at 7-8; TX-ACSEC Comments II at 2-4; TruePosition Comments II at 2-3; U.S. Wireless Comments II at 4-8.

[32] Allen Telecom Comments II at 2; NENA Comments II at 6-7; TruePosition Comments II at 4; U.S. Wireless Comments II at 6-7.

[33] *See, e.g.*, APCO Additional Reply Comments II at 2.

use the information request Phase II from carriers and a funding mechanism is in place.[34] Until these conditions are satisfied, carriers are not required to provide ALI. Of equal importance, until PSAPs have taken the necessary steps to upgrade their facilities and processes to receive and use ALI information, the benefits of ALI to public safety will not be realized. Permitting several technologies to compete to provide ALI is likely to spur innovation, lower costs and prices, and encourage the development of ALI systems that can meet the needs of carriers and PSAPs across the range of geographical and operational environments.

23. Rural areas provide one instance where allowing additional ALI technologies may speed rather than delay ALI deployment. Network-based solutions relying on triangulation methods typically require the addition or upgrade of equipment at each transmission tower in order to provide the two or three fixes necessary to furnish an accurate location report.[35] Even this level of additional investment might prove inadequate in some cases, for example, when towers are aligned in a straight line along a highway (a geometry making triangulation difficult or inaccurate) or are at the edge of the area served by the carrier. Hills or other features of the terrain may also prevent more than one tower from receiving the handset's signal. Adequate location accuracy and coverage by network-based solutions may require supplemental towers and equipment in those situations.[36] The cost of such network upgrades, combined with the relatively low number and density of customers in rural areas, could impose high per customer costs for network-based solutions in such rural areas. These costs may discourage PSAPs from requesting ALI or raise subscriber rates substantially, impeding cost recovery. For these reasons, the Rural Cellular Association contends that network-based solutions may not be feasible in many rural wireless markets.[37]

24. By contrast, handset-based solutions seem well-suited to rural areas. Operationally, GPS satellites will usually be easily visible by the handset, in contrast, for example, to the problems handset-based systems may encounter within tall buildings. Handset-based solutions, even hybrid solutions which require some additional support facilities, should

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[34] 47 C.F.R. § 20.18(f).

[35] According to information provided at the technology forum, network-based Angle of Arrival (AOA) systems, such as KSI's, require two sites and Time Difference of Arrival (TDOA) systems, such as TruePosition's, require three sites.

[36] *See, e.g.*, ALLTEL *Ex Parte* Presentation, August 31, 1999 at 2. ALLTEL also concluded that multipath mapping solutions, such as the U.S. Wireless Location Fingerprinting approach, face similar limitations because it would require mapping and extensive calibration which might be difficult in rural areas with few roads.

[37] Rural Cellular Association Comments II at 2.

also require far less investment in network upgrades and prove overall to be less costly on a per customer basis. In large part, such lower costs would also be recovered when the handset is sold or when a service contract is signed. This should make it easier to develop effective cost recovery mechanisms for rural areas, reducing the problem of recovering the high start-up costs of network-based systems as well as of upgraded PSAPs.[38]

25. We recognize, of course, that network solutions are being improved and may well be able to provide acceptable accuracy at a reasonable cost in rural areas. KSI, for example, claims it is developing a single site location capability.[39] U.S. Wireless has tested its system in rural areas around Billings, Montana and reports positive results.[40] Conversely, some handset-based solutions appear to work more effectively with digital networks which, at the present time, are less extensively deployed in rural areas. Our discussion of the current strengths and weaknesses of each approach is not intended as a judgment that one technology is, or will prove over time to be, superior to the other in rural or other particular environments. Rather, in our view, this analysis simply underscores the public safety and overall public policy benefits from crafting our rules to permit both approaches to continue to develop and to be available to carriers and PSAPs as they proceed with E911 implementation.

26. In addition to possible problems in rural areas, providing location information for Code Division Multiple Access (CDMA), the most rapidly growing air interface, may present particular problems for network-based solutions because of its "reverse power control"

[38] Actual costs of any solution are uncertain. For example, proponents of each solution cite various reasons for claiming lower costs. Network-based solutions based on triangulation may have a cost advantage in some cases because they do not require the replacement of the existing base of handsets; those solutions require substantial investment costs, however, estimated at $10,000 to $30,000 for each of the 70,000 current cell sites and for any future sites. Network-based solutions based on multipath mapping, such as the U.S. Wireless Radio Camera approach, also do not require replacement of handsets, but do require frequent mapping of interference patterns and additional equipment at numerous cell sites. The actual costs of this solution are unclear, as are the applications in which it may prove effective. In some circumstances, network-based solutions may also require authorizations from local governments to add equipment to cell sites, a process that could add substantially to the expense of deployment. Handset-based solutions involve far lower network costs, but would involve some cost for each new handset and eventually for each of the anticipated base of 100 million handsets by the year 2001 and for each new handset thereafter. While it is reasonable to expect that the costs per handset will decline over time, in line with declines in costs of computer chips and software, the actual initial and future costs of ALI-capable handsets are not clear.

[39] KSI Additional Comments II at 10.

[40] U.S. Wireless Comments II at 3 n.2.

characteristic.[41] These signals may not be easily received or monitored at more than one base station, an apparent requirement for most network-based solutions. CDMA handsets also incorporate greater processing capability, which may facilitate handset-based location technologies. Although providers of some network-based technologies claim they can provide effective ALI for CDMA or will soon be able to,[42] wireless carriers generally claim that existing network-based technologies are unproven for CDMA.[43] Reports presented at the Bureau's June 28, 1999, roundtable discussion on ALI technologies indicated that proponents of network-based solutions are working on CDMA applications, but that no CDMA application has to date been subjected to independent testing in trials.[44]

27. Handset-based and hybrid CDMA location identification solutions, on the other hand, appear further along. CDMA handset and network manufacturers have begun planning to incorporate GPS-based location technology in handsets. Qualcomm has announced development agreements with Lucent to use its location technology and stated that it will be incorporating GPS-based location capability in its handsets in 2000, with plans to include this technology in all handsets it manufactures soon thereafter. It states that is has allocated resources to ensure, if carriers desire, that all new handset models introduced after October 2001 are ALI-capable.[45] Carriers using CDMA technology, such as Sprint, GTE, and AirTouch have expressed particular interest in handset-based technologies. In addition, IDC's test of its handset-based GPS solution in King County, Washington, yielded significant results, providing accurate location for CDMA calls, the majority of the calls in the test.[46] Other questions have been raised as to when network-based solutions will be commercially available

[41] By design, CDMA networks automatically reduce the transmitting power of a handset as the handset moves closer to a nearby base station. When this occurs, the power from the handset can be reduced to such a low level that its signal can only be heard by that base station -- and no others. Because network-based ALI systems generally *require* a handset to be heard at multiple base stations, handset solutions for CDMA systems are considered by some to be problematic. *See, e.g.*, ALLTEL Ex Parte Presentation at 2 (August 31, 1999).

[42] *See* Radix *Ex Parte* Comments (Aug. 5, 1999); Allen Telecom *Ex Parte* Comments (Sept. 10, 1999).

[43] *See* US West Comments II at 2.

[44] About a month and a half after the roundtable, Cell-Loc, Inc. issued a press release claiming that it had successfully completed a test of a network-based CDMA location method in Canada, with accuracy of 90 meters RMS, and was initiating a second trial with the intent of much better accuracy. Cell-Loc Inc. *Ex Parte* filing, August 16, 1999. The actual trial data have not been submitted to us and do not appear to have been independently reviewed or verified. Network-based provider U.S. Wireless indicates that it is planning to add digital CDMA to its Baltimore test later this year. U.S. Wireless Press Release (March 29, 1999).

[45] Qualcomm *Ex Parte* filing, July 30, 1999, at 10.

[46] IDC, Report of Findings, Prepared for King County Washington E911 Program Office, at pp. 7-13, 7-20.

for Time Division Multiple Access (TDMA) and Global System For Mobile Communication (GSM) technologies, and whether those solutions will be superior to handset-based solutions.

28. The record contains substantial evidence that a handset-based solution may be the most rapid and effective method of providing 911 ALI in many important applications. To the extent that a phase-in is a practical necessity for such solutions, however, the flash-cut requirement in our current rules would prevent such solutions from being considered. Thus, in many ways, the record indicates that accommodating handset-based solutions through a reasonable phase-in is likely to speed ALI deployment rather than delay it, by allowing carriers and PSAPs the flexibility to deploy the most effective and efficient available technology and, possibly, the only affordable and available technology in certain circumstances.

29. Moreover, to the extent that a phase-in might delay ALI implementation, handset-based solutions may well generate offsetting benefits. For example, it appears that handset-based solutions may achieve greater accuracy. In the six month King County trial, the handset-based technology provided by IDC, based on GPS chips in handsets, located 100 percent of calls from a variety of environments with an average accuracy of about 70 feet or 23 meters; 94 percent of calls were located within 125 meters.[47] Such improvement in accuracy assists in locating the scene of the emergency more quickly, a benefit to both the caller and to emergency service providers. It may also support more reliable selective routing, helping direct calls more consistently to the correct PSAP.

30. In addition, in both rural and other areas, we think that competition among a broad range of technologies and providers will stimulate actual deployment of efficient systems. King County notes that the benefits of the handset-based technology tested in its trials should continue to improve significantly as developments in GPS chips continue; indeed, improved chip sets with higher accuracy levels were already available during the course of the trial.[48] The spur of competition can be expected to help bring down ALI costs and thus reduce cost recovery problems everywhere, in urban and suburban as well as rural areas. To the extent that this occurs, carriers and PSAPs will increasingly be able and willing to move quickly to deploy ALI solutions, spurring ALI deployment.

[47] King County reports that this GPS technology was able to locate 31 percent of the calls within 40 feet, 51 percent of calls within 70 feet, 75 percent of calls within 150 feet, and 94 percent of calls within the required 125 meters or 406 feet. Comments of the King County E911 Program at 2.

[48] Comments of the King County E911 Program at 2. *See also* IDC, Report of Findings, Prepared for King County Washington E911 Program Office at 8-1.

31. We recognize that handset-based solutions present problems in achieving universal coverage, because callers without ALI-capable handsets, such as roamers and those using older handsets, might not receive Phase II ALI. This is a significant concern, because over 70 million handsets are currently in use in the United States and handset usage continues to grow rapidly. One hundred million handsets or more may be in use by the end of 2001. The fact that a handset-based solution requires the replacement or upgrading of these handsets represents a real and substantial disadvantage to any handset-based solution. However, it appears likely that retrofits of existing handsets will be feasible, such as replacement battery packs with GPS capability.[49] Since handset batteries need to be replaced periodically, such retrofits may prove an affordable way to provide ALI to those who prefer to keep their current handsets. In addition, as we discuss in more detail below, we also believe that concerns associated with non-ALI-capable handsets and roamers can be addressed and minimized or eliminated within a reasonable time.

32. We reiterate that in revising our rules to permit handset-based solutions to meet our Phase II requirements our intent is not to mandate the use of any particular technology, only to allow the broadest range of technologies a reasonable opportunity to compete while taking appropriate steps to enhance public safety. Network-based, handset-based, hybrid, or some other new or combined ALI technology may prove to be most effective generally or in specific situations. Specific solutions may, for example, differ in their accuracy and reliability or in their performance on other significant operational criteria. The relative costs of each type of solution may also change.

33. Overall, based on the current record, and what we believe is a reasonable assessment of future trends, it appears that there is no single perfect ALI solution. Each has its advantages and limitations. Each may be improved in the future. Under these circumstances, we believe that the public interest and public safety will best be served by allowing a broad range of technologies, including handset-based opportunities, a reasonable opportunity to compete in providing 911 ALI. Significantly, this is also the conclusion of many in the public safety community. APCO urges, for example, that "facilitating handset-based technologies as an option may actually speed delivery of Phase II capability."[50] The King County E911 Program's overall assessment of a handset-based technology, based on its lengthy trial, is that "[t]his technology has proven to be highly accurate and reliable, and has the capability of providing PSAPs with the tools they need to accurately locate and provide emergency service to wireless 911 callers."[51] Thus, King County encourages the Commission

[49] Comments of the King County E911 Program at 4.

[50] APCO Reply Comments II at 3.

[51] *Id.*

to ensure that all Phase II location technologies, including handset solutions, be given an equal opportunity to be used in complying with the Commission's E911 rules, and asserts that the benefits to the public and public safety agencies who provide 911 service would "far outweigh slight delays in the implementation schedule."[52] We agree with this assessment. As we discuss below, we also believe that the concerns expressed by NENA, that Phase II might be delayed indefinitely, can be adequately addressed by requirements that should overall speed ALI deployment.

34. In sum, in adopting the E911 rules, the Commission did not reach an affirmative decision to disqualify handset-based solutions; instead, the effect of those rules on handset-based ALI technologies was, in fact, an unintended consequence, as the Commission subsequently recognized and sought to remedy in the *E911 Reconsideration Order* and in subsequent actions by the Bureau. The Commission's rules were intended and expected to be technologically and competitively neutral. The revisions to those rules that we implement today are aimed at ensuring that the Commission's intent is realized and that we move forward with the deployment of ALI as quickly as possible, recognizing that the public safety will be benefitted by permitting differing technologies to be used to achieve compliance as facts and circumstances dictate.[53]

1. Handset-Based Solutions

35. **Background.** In response to the *Waiver Public Notice,* we received several proposals for ALI phase-ins for handset-based solutions. SnapTrack proposed that carriers electing a handset-based approach be required to begin deploying handsets by January 1, 2001 and deploy only ALI-capable handsets by December 31, 2001.[54] Similarly, APCO proposed that deployment begin by January 1, 2001, that 80 percent of handsets sold be ALI-capable by December 31, 2001, and 100 percent by December 31, 2002; it further proposed that carriers meet penetration levels for all handsets in service: (December 31, 2002: 25 percent; December

[52] *Id.* at 4.

[53] A number of entities have conducted trials of a variety of ALI solutions. *See generally* IDC, Report of Findings, Prepared for King County Washington E911 Program Office (reporting results of trial conducted in King County, Washington); SnapTrack Ex Parte Presentation (October 31, 1998) (summarizing results of trials conducted in the San Francisco Bay area; Denver, Colorado; Tokyo; and Kyoto); QUALCOMM/Lucent Technologies Press Release, "QUALCOMM and Lucent Technologies Announce Wireless Location Development Project" (July 15, 1999) (announcing agreement to jointly develop a hybrid approach combining GPS, CDMA and PCS technologies).

[54] SnapTrack Comments I at 4.

31, 2002: 50 percent; December 31, 2004: 75 percent; December 31, 2005: 99 percent).[55] The Bureau sought comment on these proposed schedules in its June 1, 1999, Public Notice.[56] In response, a coalition of handset-based technology providers and others, the Advanced E911 Coalition, proposed that carriers electing a handset based solution achieve a 50 percent activation rate for ALI-capable digital handsets within 24 months of a Commission order setting revised rules and a 95 percent activation rate within 36 months of that order.[57] These obligations would apply whether or not a PSAP had requested Phase II.[58] A number of carriers and carrier organizations argued that, rather than prescribing a detailed implementation schedule, the Commission should rely upon the good faith efforts of carriers to implement Phase II E911.[59]

36. **Discussion**. We conclude that we should revise the deployment schedule established in the Commission's Phase II rules to accommodate a broader range of technical options for ALI compliance, consistent with our goals of implementing accurate and reliable Phase II services as quickly and ubiquitously as possible. Although we recognize that the phase-in for handset-based solutions we adopt here represents a slight delay in the deployment schedule for the handset-based methods of implementing ALI, we have sought to minimize this delay, promote full ALI coverage to the extent possible, improve ALI accuracy and reliability, and encourage competition and innovation that should lower costs and improve performance. Taken together, we believe that the public safety benefits of this plan outweigh the slight delay the phase-in permits. Moreover, carriers who employ a handset-based approach will be required to initiate compliance steps sooner and locate calls more accurately than under our present rules. We believe these additional requirements also serve to mitigate any adverse effects from the practical necessity of employing a phase-in approach to handset implementation.

37. For handset-based approaches and hybrid solutions, both of which require new or upgraded ALI-capable handsets, a near term, fixed deadline by which ALI must be provided for all 911 calls is not a realistic, practical possibility. Commenters universally agree that some transition past October 1, 2001, is necessary to deploy a handset-based or hybrid

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[55] APCO Further Comments (May 25, 1999) at 2-3.

[56] *Targeted Public Notice* at 2-5.

[57] Advanced E911 Coalition *Ex Parte* Presentation (Aug. 19, 1999).

[58] *See id.*

[59] AirTouch Comments II at 12; ALLTEL Comments II at 3; Ameritech Comments II at 4; AT&T Wireless Comments II at 2; BellSouth Comments II at 4-7; PCIA Comments II at 3-6; PrimeCo Comments II at 4-5; US West Comments II at 4-7; Nextel Reply Comments II at 8-11; NTCA Reply Comments II at 2-4.

technology, so that manufacturers have sufficient time to increase production of ALI-capable handsets and customers can begin to purchase and to use them.[60] Although some handset manufacturers are expected to begin producing ALI-capable handsets beginning in early or mid-2000, the rapid replacement or upgrading of any significant portion of the approximately 70 million handsets in use on a nationwide basis,[61] while at the same time meeting current and anticipated demand, would be extremely difficult and disruptive, and may not even be logistically possible, for handset manufacturers.

38. Any "crash" handset replacement program also would be extremely expensive, for at least two reasons. First, it would force rapid deployment of current ALI technology at current costs, though the technology is likely to improve and the costs are likely to decline.[62] Second, such a schedule may be difficult for all manufacturers to meet, reducing competition, and, by artificially stimulating demand, inflating prices. Consumers would ultimately pay the price of such a handset-replacement program.

39. Of greater importance, it is far from clear that the higher costs of "crash" handset replacement would result in corresponding public safety benefits. The expense and practical infeasibility of such a program would likely preclude many carriers from choosing a handset approach even when, in their circumstances, it might prove to be the best way to provide reliable and accurate location information. Such a "crash" program would also result in the untimely interruption of technical progress in the development of ALI capabilities and technologies in order to begin producing massive numbers of handsets. Both network and handset-based approaches are still being improved significantly in many respects.

40. Moreover, the benefits of ALI to public safety will be realized only to the extent that PSAPs upgrade their systems to receive and use the additional information ALI provides for 911 calls. We expect to take further steps to encourage Phase II deployment. Nonetheless, in light of the pace of Phase I deployment and the limited steps that have been taken by PSAPs and other necessary participants to implement Phase II, we conclude that a requirement that carriers employing a handset-based solution accelerate the replacement of

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[60] *See, e.g.,* Aerial Comments II at 2-3; AirTouch Comments II at 3-4; Ameritech Comments II at 2-3; APCO Comments II at 4-5; GTE Wireless Comments II at 5; IDC Comments II at 7; King County E911 Program Comments II at 4; Nortel Comments II at 3-4; PCIA Comments II at 3; SnapTrack Comments II at 11; Sprint PCS Comments II at 3; US West Comments II at 2-4; Lucent Reply Comments II at 1-2; Nextel Reply Comments II at 2-3; PrimeCo Reply Comments II at 2; Southern Reply Comments II at 5.

[61] An additional 30 million handsets are expected to be bought and placed into service before the October 1, 2001 deadline.

[62] The proposed upgrades generally involve new chip sets and software, which are expected to benefit from the continuing improvements in chip technology.

current handsets to meet an October 1, 2001 deadline would be of limited benefit to public safety, particularly if that requirement is not linked to actual PSAP upgrades and requests for Phase II service.

41. In adopting our revisions, we have considered the various proposed phase-in schedules. The schedule we adopt is intended to promote public safety while recognizing the practical realities of handset-based and hybrid approaches. The requirements that ALI-capable handsets begin to be sold before both October 1, 2001, and before any PSAP request will ensure that handsets are available to customers, particularly customers who might use the handsets while roaming in areas served by carriers and PSAPs that have upgraded to Phase II. Moreover, we expect that the phase-in schedule will spur other ALI-based services and create an awareness and constituency for Phase II E911. Early introduction is also likely to lead to reduced ALI costs over time as a result of competition, economies of scale, and technological improvements.

42. Specifically, we permit wireless carriers who employ a Phase II location technology that requires new, modified or upgraded handsets (such as GPS-based technologies) to phase-in deployment of Phase II subject to the following requirements. First, without respect to any PSAP request for Phase II deployment, the carrier must (1) begin selling and activating ALI-capable handsets no later than March 1, 2001; (2) ensure that 50 percent of all new handsets activated are ALI-capable no later than October 1, 2001;[63] and (3) in addition to the 50 percent requirement, ensure that at least 95 percent of all new digital handsets activated are ALI-capable no later than October 1, 2002. Second, once a PSAP request is received, we require the carrier, in the area served by the PSAP, to ensure that 100 percent of all new handsets activated are ALI-capable and to implement any network upgrades or other steps necessary to locate handsets, within six months of the PSAP request or by October 1, 2001, whichever is later. The carrier is also obligated to actually begin delivering to the PSAP 911 call location information that satisfies our Phase II requirements. Third, within two years or by December 31, 2004, whichever is later, the carrier must undertake reasonable efforts to achieve 100 percent penetration of ALI-capable handsets in its total subscriber base.

43. On the basis of the record before us, we conclude that the requirements we adopt today represent an achievable program for rolling-out the ALI technology using a

[63] A new handset activation may either be an activation by a new customer, or by an existing customer changing to a different handset.

handset-based solution that is consistent with the goals of public safety.[64] Indeed, the revisions to our rules reflect, in large measure, a combination of recommendations made by the Advanced E911 Coalition, an industry group interested in handset-based solutions, including handset and network equipment manufacturers and major wireless carriers,[65] and by APCO, a major public safety organization.

44. We expect our rule revisions that require that carriers begin activating ALI-capable handsets sooner than October 1, 2001, and to proceed to 95 percent activation for new digital handsets, even without a PSAP request, to have a number of important benefits. First, we expect the revisions to spur efforts by PSAPs and other necessary participants to implement Phase II, while not imposing the substantial costs and economic losses of a flash-cut requirement. Second, the rule changes should spur competition between and among carriers and technologies, as customers become aware of the availability of the ALI feature. Moreover, by applying the requirement to carrier activation of handsets, we intend to provide substantial incentives to carriers to encourage their customers to purchase ALI-capable handsets. Third, we believe these rule revisions will assure that wireless customers can acquire ALI-capable handsets that will be capable of providing ALI when they are roaming, because the ALI feature will be interoperable. This will assist PSAPs that have upgraded their systems to provide ALI capability to roamers.

45. While we accept and adopt some of the proposals of the Advanced E911 Coalition, we also believe that additional steps to promote ALI deployment are warranted. The Coalition requested that the phase-in apply only to new digital handsets, not to all new handsets. We believe that carriers employing a handset-based solution should be under a reasonable obligation to provide, and minimize the phase-in period for Phase II, for all their subscribers. The requirement that the initial 50 percent benchmark apply to all handsets, not solely to digital, should help accomplish this.[66] We also decline to adopt a proposal from

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[64] A number of parties support the schedule we are prescribing, or favor an even more aggressive schedule. *See* APCO Further Comments at 2-3; Advanced E911 Coalition *Ex Parte* Presentation (Aug. 19, 1999); IDC Comments II at 7; SnapTrack Comments at 4; Aerial Comments II at 2-3.

[65] *Ex parte* presentation by Advanced E911 Coalition, August 19, 1999. The members of the Advanced E911 Coalition are: AT&T Wireless Services, Inc.; U.S. WEST, Inc.; SiRF; Sprint PCS, SnapTrack; Aerial Communications, Inc.; Qualcomm Incorporated; AirTouch Communications; and Integrated Data Communications, Inc. (IDC).

[66] The ALI-capable handsets a carrier begins deploying should be consistent with the handset approach the carrier intends to implement on a long-term basis. Thus, if a carrier is implementing a handset-based approach that must work in analog mode to satisfy our requirements (*see, infra*, note 70), it would be expected to provide ALI capability for the analog mode of dual and multimode handsets. We would not apply the same requirement to carriers whose long term plans anticipate that digital operation would be ubiquitous within its operating area, with the analog mode used only for roaming.

Nextel that we allow carriers, especially those like Nextel with a sole source supplier, additional flexibility such as authorization of temporary waivers or the option of meeting only the October 2002 deadline, to upgrade handsets in a more cost efficient manner.[67] While aggressive, we believe the initial handset deployment schedule we are requiring for such solutions is achievable for wireless carriers. Handset deployment under that schedule is not required for 17 months and the deadline for 50 percent ALI-capable activation is two years away. Moreover, this schedule tracks the schedule proposed by a coalition of handset solution proponents. While such early deployment will impose costs, unnecessary delay in ALI-capable handset deployment would diminish the public safety benefits of handset-based ALI approaches. Overall, we believe the benefits of the schedule we are adopting outweigh the possible costs, especially because the public safety benefits are clear; the extent of higher costs directly attributable to E911, on the other hand, is speculative. We also believe that granting preferential treatment to a carrier because it uses a sole source supplier would unfairly favor one competitor and business model over others.[68] We find no basis in the current record for authorizing waivers of the rules we are adopting today.

46. Further, we remain concerned that the proposed schedule not result in unnecessary delay in full implementation of ALI for many 911 calls and that it adequately encourage PSAPs to take the necessary steps to upgrade their own facilities and request Phase II from carriers. Where the local PSAP is capable of using ALI information and to take advantage of this information to operate more efficiently, any delay in Phase II implementation on the wireless industry's part raises significant questions as a matter of public policy. Once a local PSAP can actually use the location information provided by ALI, each non-ALI call represents an avoidable instance of potential delay in providing emergency assistance, a delay that might prove life-threatening.

47. For these reasons, we believe it is reasonable and appropriate to require carriers employing a handset-based or hybrid solution to undertake heightened efforts to fulfill their E911 responsibilities where PSAPs are capable of making use of ALI. Accordingly, we adopt additional requirements similar in concept to those proposed by APCO, a public safety organization.[69] Specifically, we adopt a more aggressive handset deployment requirement where a PSAP has requested Phase II and is ready and able to use ALI information. APCO persuasively argues that public safety needs justify obligating carriers to ensure that ALI is

[67] Letter to Magalie Salas, FCC, from Laura Holloway, Nextel, in CC Docket No. 94-102 at 2 (Sept. 8, 1999) (Nextel *Ex Parte* Letter).

[68] Indeed, a sole source provider may well find it easier to meet our schedule, as it is less likely to depend upon the work of standards bodies.

[69] Further Comments of APCO (May 25, 1999).

available to virtually all a carrier's customers. Our requirement that carriers sell or activate only ALI-capable handsets in regions where the PSAP has presented a valid request for Phase II, with six months notice, will help accomplish this. The requirement that carriers sell only ALI-capable handsets once a local PSAP is ready and able to use the ALI information should speed the use of ALI-capable handsets for 911 calls in those areas. Normal turnover of handsets has been rapid as handsets improve and customers shift to new carriers; ALI-capable handsets should represent a rapidly increasing proportion of all handsets.

48. In requiring that carriers sell only ALI-capable handsets by as early as October 1, 2001, in response to PSAP requests, we expect that the practical effect of our rule will be that, as ALI-capable handsets are manufactured, carriers will give priority to marketing and selling them in areas where PSAPs are ready and able to use Phase II ALI. Based on current experience and trends, we believe it is likely that some PSAPs will be ready to request Phase II sooner than others. Implementation of Phase II will require PSAPs, for example, to acquire funds, deploy new equipment, and train 911 attendants. Thus, in practice, Phase II is likely to be phased-in geographically as different PSAPs serving different geographic regions develop the ability to make use of ALI information. By linking the requirement of 100 percent ALI-capable handset activation to the receipt of PSAP requests, we expect that those handsets will be allocated and used first and most quickly in regions where the PSAP and callers will most often benefit. We believe this approach promotes the public safety, because it helps focus deployment of ALI-capable handsets where they can do the most good.

49. We also find it appropriate to link PSAP requests to the completion by the carrier of any other steps needed to provide acceptable Phase II ALI. To the extent that hybrid ALI approaches are deployed, any non-handset based equipment or operations that are needed should be in place when the PSAP has satisfied the applicable conditions and is ready to use ALI information. This requirement is identical to those that we apply to purely network-based technologies and subject to the same conditions.

50. Finally, our requirement that carriers employing a handset-based solution undertake reasonable efforts to ensure complete Phase II coverage for all their customers, by the end of 2004 or within two years of a PSAP request, is intended to limit the phase-in to a reasonable period.[70] The requirements we are adopting for ALI-capable handset deployment are likely to stimulate a substantial level of coverage as a result of normal handset turnover

[70] Some carriers currently have deployed digital networks in parts of, but not throughout, their operating areas. If such a carrier decides on a handset solution for Phase II, it must either select one that works in analog mode, or provide digital coverage throughout its operating area by the end of 2004 (or within two years of a PSAP request, whichever is later). But in either case, the carrier must be providing E911 service to all of its subscribers throughout its operating area by the end of the transition period. Alternatively, the carrier could select a network-based approach for part of its operating area and a handset approach for the other parts.

and growth. TruePosition, a network-based ALI vendor, estimates annual churn of wireless subscribers at 25.63 percent and, by adding in expected growth in customers, projects that after four years, 73 percent of handsets would be ALI-capable.[71] More optimistically, handset-based technology provider IDC estimates slightly lower annual churn of 24 percent but, based on projections of new sales, churned handsets, and retrofits, projects that almost 100 percent of handsets would be ALI-capable within less than 3 years without extraordinary measures being taken by carriers.[72]

51. Deployment of ALI-capable handsets may well be rapid and complete, as commenters such as IDC predict. ALI is likely to be an attractive feature for the many wireless customers who especially value the safety provided by wireless phones as well as for the commercial services they provide. Improvements in digital technology, falling prices, and new services may also spur further growth and handset replacements. Methods of upgrading existing handsets are also in development and may further increase the rate of ALI-capable handset deployment. Thus, normal market forces may generate almost complete penetration by ALI-capable handsets within three years or less as IDC predicts.[73] In this case, there will be no need for carriers to do more than comply with the schedule we set for ALI-capable handset activations -- normal market forces will have produced full deployment. However, such predictions are not guarantees. For any of several reasons, (*e.g.*, a recession, declining growth rates, or early deployment of non-ALI-capable digital phones that customers elect not to replace), the actual pace of ALI-capable handset deployment could lag and may take several years. Some customers will undoubtedly elect to economize by keeping their handsets for much longer than average, despite the advantages of ALI-capable handsets. If one or more of these scenarios occurs, delaying full deployment of ALI-capable handsets, it would represent a continuing, possibly lengthy gap in this important public safety program.

52. For these reasons, while we seek largely to rely on market forces, coupled with the requirement that new activations be ALI-capable, to replace or upgrade handsets, we will also adopt additional steps to ensure that the public safety goals of this proceeding are achieved within a reasonable period regardless of normal handset churn. Our requirement that carriers make reasonable efforts to ensure that, to the greatest extent possible, 100 percent of their customers' handsets are ALI capable within two years of the PSAP request or by December 31, 2004, is intended to ensure that Phase II extends to all wireless callers as quickly as is reasonably possible. APCO has suggested that turnover rates could change

[71] TruePosition Additional Comments, Exhibit A at 3, citing data and projections from a spring 1998 report on the wireless industry by Donaldson, Lufkin & Jenrette.

[72] IDC Additional Comments II at 8 and Exhibit 2.

[73] *Id.*

dramatically depending upon market conditions and the pace of new feature offerings, and proposes that we set a "guaranteed rate" of turnover with the goal of quickly reaching a point at which nearly 100 percent of subscribers have location capable phones.[74] APCO also proposes that we set yearly requirements for penetration rates, concluding on December 31, 2005, when penetration of ALI capable handsets would be required to be 99 percent.[75] Other commenters propose that penetration be left to normal turnover or that carriers be held to a standard of best practices or reasonable efforts.[76]

53. In setting a date of December 31, 2004, we recognize that we are imposing an aggressive schedule for carriers. However, we believe this schedule is achievable and in the public interest. This deadline implies a phase-in period of at least 3 years and 10 months from the required March 1, 2001, starting point for ALI-capable handset deployment, and at least 3 years and 3 months from the time the carrier begins activating only ALI-capable handsets, where there is a PSAP request. This is longer than the period IDC, itself a handset-based technology provider, estimates as necessary.[77] Moreover, this minimum period will apply only in regions where a PSAP request has been made. This should serve as additional incentive for carriers to begin selling and activating ALI-capable handsets even earlier and more aggressively than our rules require, further focusing ALI-capable handset deployment in regions where they will be most beneficial to public safety organizations. Where a PSAP request is delayed beyond December 31, 2002, the carrier will have additional time to comply. During that delay, normal market forces of handset turnover and growth would continue to move ALI-capable usage closer to 100 percent so that a substantial proportion of handsets would be ALI-capable when the PSAP request takes effect.

54. We also are requiring reasonable efforts by the carriers. These could include lower rates for customers using ALI-capable handsets, rebates or generous allowances to encourage trade-ins of non-capable handsets, or actual handset exchanges or retrofitting. We recognize that carriers do not have complete control over their customers' handset choices or over handset manufacturers and that it will likely be impossible to literally achieve 100 percent penetration of ALI-capable handsets, since some subscribers may simply choose to keep their non-ALI handsets. Further, as APCO suggests, we will not require that carriers apply these programs to handsets owned by non-customers, even though those handsets can be used to make 911 calls. Nonetheless, requiring good faith, reasonable efforts should be

[74] APCO Reply Comments II at 6.

[75] *Id.*

[76] *See, e.g.*, Primeco Reply Comments II at 2-6; U.S. West Wireless Reply Comments II at 8-10.

[77] IDC Additional Comments II at 8 and Exhibit 2.

sufficient to conclude deployment except for what is likely to be a small remaining percentage of handsets. To the extent necessary, we will clarify or provide additional guidance on what we believe constitutes reasonable efforts based on our monitoring of progress in ALI deployment.[78]

55. **E911 for roamers and non-ALI-capable handsets.** One concern presented by a phase-in for handset-based ALI solutions is that those callers who do not have ALI-capable handsets will not receive Phase II service. Those callers include both the carrier's own customers who do not yet have an ALI-capable handset and roamers from carriers who employ network-based solutions. Moreover, in the case of roamers, there is no assurance that carriers in different parts of the country will adopt the same Phase II technology. If they do not, there is the potential that some roamers could be indefinitely deprived of Phase II ALI. Proponents of handset-based solutions contend that this is a relatively small and temporary problem, because ALI-capable handsets will quickly achieve almost 100 percent penetration and carriers using the same air interfaces are likely to use the same or similar ALI technologies and thus be able to provide service to roamers comparable to what they provide to their own customers. They also note that carriers will be able to provide Phase I location information for these callers.[79]

56. To address these concerns in a reasonable way, we will require that carriers employing a handset-based ALI solution also take a "best practice" approach to providing ALI to callers who do not have ALI-capable handsets where the PSAP is able to receive and use Phase II ALI. This obligation could take several forms, depending upon the transmission technology the carrier uses and the location technologies available to it in particular locations. For example, where only Phase I location is reasonably available, as several commenters suggest, this admittedly rough level of accuracy should be supported and provided to all the carrier's 911 callers. In other cases, a somewhat more accurate form of location information may be available. Sprint and Lucent have indicated that it may be possible to upgrade software in CDMA systems to provide ALI with an accuracy of about 285 meters.[80] This level of accuracy would not satisfy our Phase II rules but would be far more accurate than Phase I cell site location information and should be of far greater assistance to public safety organizations. Other forms of ALI, less accurate than the Phase II standard but superior to Phase I, may also be possible.

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[78] This proceeding could be similar to that proposed by the Advanced E911 Coalition. *See* Advanced E911 Coalition *Ex Parte* Comments (August 19, 1999).

[79] Aerial Comments II at 6; AirTouch Comments II at 17; GTE Wireless Comments II at 6; IDC Comments II at 12.

[80] Sprint Comments II at 7.

57. In other cases, a wireless carrier in the area may have deployed a network-based system that can also be used to provide ALI for other carriers. Network-based ALI providers have claimed that this will often be the case.[81] To the extent such a system is available in a particular area, and a carrier employing a handset-based solution has not implemented other effective means of locating roamers, we believe that it is reasonable and in the public interest to expect the carrier to take steps necessary to make use of this capability as a backup, in order to provide Phase II ALI to its callers whenever its own ALI solution cannot. This could include callers without ALI-capable handsets, roamers, and callers from locations where the handset-based technology fails but the network solution is available, as might happen in tall buildings or tunnels.[82]

58. We do not intend that this "best practice" obligation extend to requiring that carriers employing handset-based solutions must also deploy their own network-based solutions. Such a requirement could be extremely expensive and provide only a marginal benefit to the public safety. But use of other available systems as a backup should be a relatively inexpensive improvement in public safety that would help remedy the shortcomings of handset-based solutions, especially as the backup would largely be temporary, superseded as handset-based solutions improve and become more widely deployed.

59. **Interoperability.** Handset-based solutions also present another concern for roamers. Several handset-based and hybrid ALI solutions have been proposed and are under development. Others may emerge in the future. It appears quite possible, perhaps likely, that carriers will employ a number of different handset-based solutions. Overall, this potential competition should benefit public safety, encouraging innovation and lower prices. However, it potentially could lead to incompatible ALI formats, such that a caller using a handset that is compatible with his or her home carrier's ALI system could find the handset incompatible with the system used by other carriers when roaming. Incompatibility of this sort would defeat the benefits of the handset in an emergency both for the roaming caller and public safety organizations.

60. To prevent the development of any such gap in 911 ALI, we will further require that, to satisfy our Phase II rules, all handset-based Phase II ALI solutions must be generally interoperable. This means at a minimum that the solution must conform to general standards that permit the system employed by the carrier to provide 911 ALI for any ALI-

[81] *See, e.g.*, TruePosition Comments II at 9, n.15.

[82] It does not appear that the reverse is feasible in the short term, *i.e.*, a caller on a network-based system making use of a handset-based system when the network technology fails. However, in the future, if GPS capability becomes widely deployed, we would consider applying a similar requirement to network-based solutions, so that the best available location information is provided to the PSAP.

capable handset that complies with the general standard, regardless of whether the handset uses the same ALI solution as that employed by the carrier. For example, if SnapTrack, IDC, and Lucent all develop and market separate ALI systems, for a particular air interface, handsets using any of these solutions must be interoperable with the others, such that a carrier using any one of the solutions can and does provide ALI for calls coming from a handset using any other solutions.

61. We recognize that the level of accuracy and other performance criteria may be somewhat lower for these roamers, at least initially, and that a carrier's system may not be optimized for other handset solutions. Here again, we expect carriers to meet a good faith, "best practice" standard in providing ALI to roamers. It is our understanding that standards work is well underway toward achieving interoperability among handset-based solutions.[83] We do not believe that this requirement will require any delay or change in the deployment schedules for handset-based solutions.

2. Network-Based Solutions

62. **Background**. While network-based ALI providers have generally supported retaining the current deployment schedule without change, network-based provider KSI has suggested that any phase-in the Commission adopts should apply to network-based as well as handset-based ALI solutions.[84] Under its proposal, in an approach said to be similar to cellular build-out rules, wireless carriers would be required to provide 50 percent ALI coverage in 2001; 75 percent coverage in 2002; and 95-100 percent coverage in 2003 for all technologies.

63. **Discussion**. For carriers employing network-based location technologies, we are replacing our current plan, which permits delay if a carrier requests an individual waiver and gives a revised schedule, with a general rule permitting the carrier to deploy Phase II to 50 percent of callers within 6 months of a PSAP request and to 100 percent of callers within 18 months of a PSAP request.

64. Network-based solutions may not require the same phase-in as handset-based solutions, because they do not face the same problems with the embedded base of existing handsets. Nonetheless, it does appear likely that in many cases it will not be possible to

[83] SnapTrack Additional Comments II at 20, n. 44 (reporting that an initial CDMA standard sufficient for E911 location had been produced and the first ballot of the text completed).

[84] KSI Comments II at 5.

deploy network-based solutions within the six-month period permitted in our current rules.[85] Network-based technologies that require installation of new equipment at transmission towers or other sites may require negotiation of contracts and technical issues, review and approval by local authorities, and other administrative steps in addition to the actual time needed to train installation teams and perform the actual installation. Perhaps most importantly, coordination with the wireless carrier's system and testing must be performed before the system is "turned on." In view of the importance of accurate and reliable information for 911 service, we wish to be sure that adequate time is allowed for these essential efforts. Such efforts are especially likely to require longer than six months in situations where a large PSAP, or a group of PSAPs, request Phase II deployment for a large geographic area.

65. Currently, our orders allow wireless carriers to request waivers of the six months rule, and we have anticipated receiving such waivers, especially for rural areas and large geographic areas with a substantial number of cell sites. In view of the fact that we are adopting an express rule setting a transitional, phase-in approach for handset-based technologies, rather than addressing the handset deployment issue through individual waiver requests, we believe this is an appropriate time to extend and apply a similar general rule to network-based solutions. This will provide greater assurance that these solutions can in fact be deployed in compliance with the Phase II rules and reduce substantially the need for and possible delays associated with waiver requests.

B. Accuracy and Reliability Standards

66. **Background**. In the 1996 *E911 First Report and Order*, the Commission adopted a Phase II accuracy standard of 125 meters using longitude and latitude, as recommended by the parties to the Consensus Agreement.[86] It also adopted the reliability methodology recommended by the Consensus Agreement, Root Mean Square (RMS). The combined accuracy and reliability standard, 125 meters RMS, was expected to mean that 67 percent of calls would be located within 125 meters.[87] At the same time, the Commission stated that one of its objectives was to ensure that wireless E911 continues to benefit from improvements in location information technology.[88] In order to spur continuing efforts to develop improved location information technologies, the Commission thus proposed, in the accompanying *Second NPRM*, a standard setting a higher degree of ALI accuracy -- 40 feet

[85] IDC Reply Comments II at 4-7.

[86] *E911 First Report and Order*, 11 FCC Rcd at 18712.

[87] *Id.*

[88] *Id.*

for longitude, latitude, and vertical location with 90 percent accuracy -- to take effect after the initial five year period, *i.e.*, after October 1, 2001.[89] Further, in the *E911 Reconsideration Order*, the Commission took note of technological advances, such as those in handset-based technologies, and indicated that, while it did not expect to delay the 2001 deadline, it would consider proposals to phase in implementation, especially to the extent a proposal also helps achieve the further improvements in ALI capabilities discussed in the *Second NPRM*, such as higher accuracy.[90]

67. In the *E911 Reconsideration Order*, however, Section 20.18(e) was amended to clarify that licensees subject to the section must provide to the designated PSAP "the location of all 911 calls by longitude and latitude such that the accuracy for all calls is 125 meters or less using a Root Mean Square (RMS) methodology."[91] The Commission explained that 125 meters RMS "would represent approximately a 67 percent to 75 percent probability that the reported location would be within a 125 meter radius of the caller's actual location."[92]

68. A number of parties have urged the Commission to reexamine the reliability standard applicable to E911 ALI, citing practical difficulties and situations in which the RMS methodology would not operate as intended.[93] Specifically, they point out that calculations using an RMS methodology can be skewed by the inclusion of a small number of inaccurate measurements, thus preventing a carrier from being compliant, despite a vast majority of accurate measurements. A single case of failure to deliver any location information might also be interpreted as infinite error, negating all other measurements, however accurate.[94]

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[89] *Id.* at 18743-44.

[90] *E911 Reconsideration Order*, 12 FCC Rcd at 22725.

[91] 47 C.F.R. § 20.18(e).

[92] *E911 Reconsideration Order*, 12 FCC Rcd at 22726.

[93] Several parties have stated that the rule should be interpreted to require a standard of accuracy to within 125 meters in 67 percent of all calls routed toward a PSAP. *See generally* Ericsson *Ex Parte* Presentation in CC Docket No. 94-102 dated March 20, 1998 (Ericsson March 20, 1998 *Ex Parte*); Ericsson *Ex Parte* Presentation in CC Docket No. 94-102 dated April 6, 1998 (Ericsson April 6, 1998 *Ex Parte*); Letter to Magalie Roman Salas, FCC, from James R. Hobson, National Emergency Number Association, acting for WEIAD, CC Docket No. 94-102, dated November 25, 1998 (WEIAD *Ex Parte*); AT&T Wireless Comments II at 3; BellSouth Comments II at 8-9; Ericsson Comments II at 7; PCIA Comments II at 6-7; SnapTrack Comments II at 21-22.

[94] *See* ALLTEL Comments II at 3; Omnipoint Communications Comments II at 5; Omnipoint Technologies Comments II at 2-5; SnapTrack Comments II at 22; Ericsson March 20, 1998 *Ex Parte* at 6-10 (unpaginated); Ericsson April 6, 1998 *Ex Parte* at 3-5 (unpaginated); WEIAD *Ex Parte* at 3-4.

69. **Discussion**. We believe that public safety and the public interest will be improved by revising the accuracy levels, including setting a tighter accuracy standard for handset-based solutions and by replacing the RMS reliability methodology Since the 125-meter accuracy standard was set, substantial progress has been made in improving location information accuracy. Handset-based solutions have reported far better accuracy in trials. For example, IDC's trial in King County produced an accuracy of 150 feet for 74 percent of calls, and IDC claims that the following generation of GPS chips yields still better accuracy in all environments.[95] Lucent claims its handset-based, network-assisted GPS technology can provide accuracy of 15 feet outdoors and 100 feet within buildings.[96] In a trial in Denver, SnapTrack reported accuracy of 4 to 84 meters, depending on the environment, for 68.3 percent of calls for its own handset-based, network-assisted GPS technology and has proposed an accuracy standard of 90 meters at 67 percent Circular Error of Probability (CEP).[97] Providers of network-based technologies also report improved accuracy. KSI states that its network-based approach can do better than the current accuracy requirements and has suggested a 100 meter accuracy standard.[98] U.S. Wireless is reported to have achieved an accuracy of 50 to 59 meters for its network-based "radio fingerprinting" technology.[99] Cell-Loc claims its network-based system can locate callers within 55 meters and can be refined to achieve accuracies as good as 15 meters on many occasions.[100]

70. With respect to the reliability standard, some parties continue to favor RMS,[101] but most commenters favor one of several alternative methodologies. Several parties advocate the use of Circular Error Probability (CEP) because CEP would avoid the drastic

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[95] *See* IDC Reply Comments II at 10.

[96] QUALCOMM/Lucent Technologies Press Release, "QUALCOMM and Lucent Technologies Announce Wireless Location Development Project" (July 15, 1999).

[97] SnapTrack *Ex Parte* Presentation (Oct. 31, 1998).

[98] KSI Comments II at 6.

[99] U.S. Wireless Press Release, "U.S. Wireless Corporation Presents 'Real Time' Live Multiple-Cities Trials of its RadioCamera Wireless Caller-Location Technology for the Opening of the CTIA Location Implementation Conference for Phase II E9-1-1 Location Technologies" (Aug. 26, 1999) (reporting results of trials in Oakland, CA; Baltimore, MD; and Billings, MT, which ranged in accuracy from 50 to 59 meters in 90 percent of cases).

[100] Cell-Loc *Ex Parte* Presentation, filed August 13, 1999, attachment at 1.

[101] *See* Cell-Loc Comments II at 3-4; IDC Comments II at 20; TruePosition Comments II at 12-13. *See also* KSI Comments II at 12-13 (advocating use of an RMS of the "90th percentile sub-ensemble" as a means of avoiding the biased results that can occur with considering the full ensemble of data); Ericsson April 6, 1998 *Ex Parte* (same).

impact of occasional erroneous readings associated with RMS.[102] CEP essentially establishes a threshold of 67 percent beyond which "outliers" would not be included in the calculation. CEP has been criticized, however, because it fails to consider the impact of 33 percent of 911 call locations, possibly hiding unlocated calls or large errors and providing carriers with a greater margin of error than may be needed.[103] One possible remedy for this is to adopt a CEP methodology, along with a probability contour somewhat greater than 67 percent to account for a larger number of location measurements.[104]

71. Other parties propose other methods. Motorola suggests the use of Mean Radial Error (MRE), which would calculate accuracy based on the average radial error of location attempts.[105] Lucent proposes adoption of the Cumulative Distribution Function (CDF) methodology and specification of 67 percent and 90 percent requirements over a large sample space consisting of data from various geographical environments.[106] TechnoCom argues that the Commission should either require a large percentage of attempts to be included in the RMS calculation, or establish a two-tiered criterion for accuracy based on percentage thresholds similar to CEP.[107]

72. We conclude that the RMS reliability standard should be replaced, as we discuss below, and the base accuracy standard for network-based solutions should be revised to conform to the new reliability standard. Specifically, we conclude that network-based technologies should achieve an accuracy of 100 meters for 67 percent of all calls. In addition,

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[102] *See* AirTouch Comments II at 18; ALLTEL Comments II at 3; Ameritech Comments II at 5; AT&T Wireless Comments II at 3; BellSouth Comments II at 8-9; GTE Wireless Comments II at 7; Omnipoint Technologies Comments II at 2; PCIA Comments II at 6-7; PrimeCo Comments II at 7; SnapTrack Comments II at 20-22; US WEST Comments II at 9-10; WCA Comments II at 4.

[103] *See* Cell-Loc Comments II at 6-7; IDC Comments II at 20; METROCOM Comments II at 4; Texas PUC Reply Comments II at 3.

[104] *See* Southwest Research Institute Comments II at 1 (proposing definition of CEP in terms of a 90 percentile probability contour).

[105] Motorola Comments II at 5-6, App. A. To ensure that MRE does not relax the RMS requirement, Motorola proposes adjustment of the MRE accuracy goal to 110 meters, which it says would be equivalent to the corresponding accuracy of 125 meters RMS. *Id.* at 5.

[106] Lucent Reply Comments II at 3. *See also* Aerial Comments II at 6-7 (advocating methodology that considers various coverage and service situations); RTG Comments II at 2 (methodology should give consideration to rural environments, such as indexing accuracy and reliability to population density); SnapTrack Comments II at 22 (CDF is an acceptable method that would avoid anomalies and inaccuracies of RMS).

[107] TechnoCom Comments II at 4.

we will require an accuracy level of 300 meters for 95 percent of all calls. This outer level of accuracy recognizes that network-based solutions may not always be able to provide the higher level of accuracy, especially in rural areas. The 300 meter level of accuracy should nonetheless provide a very useful indication of location, particularly in those rural areas. While the new accuracy standard may appear more rigorous than the current standard based on RMS, it is in fact generally comparable because, in contrast to the RMS methodology, this "dual ring" standard ignores the 5 percent of calls with the largest errors, or with no location information at all. The dual ring methodology also does not square the errors, a procedure in RMS that gives greater weight to larger errors. These changes in the reliability methodology effectively reduce the accuracy requirement.[108] KSI, for example, estimates that the current 125 meter RMS standard would be equivalent to 105 meters under its slightly different methodology, which would retain RMS but ignore 10 percent of calls with the greatest errors. Similarly, the revised reliability standard we adopt here is roughly equivalent to the current 125 meter RMS standard in our rules, depending upon the actual distribution of errors. To the extent that this standard is somewhat more stringent than the current standard as the Commission has sometimes described it, 125 meters for 67 percent of calls, the record indicates that the new standard should be achievable by network-based solutions.[109] We are also allowing a phase-in for network-based solutions, which will permit more time to test and fine-tune network-based systems and to improve accuracy.

73. For handset-based solutions, still higher levels of accuracy appear possible. IDC's King County, Washington trial, in association with the King County E-911 Program office, located wireless handsets within 40 to 70 feet, 70 to 80 percent of the time, from a variety of environments.[110] This is a significantly higher level of accuracy than 50 meters, which is about 152 feet. Moreover, these tests were conducted with earlier generation GPS chips and IDC claims newer generation chips are already available that are substantially more accurate.[111] Lucent claims its GPS technology is accurate within 15 feet outdoors and 100 feet indoors.[112] SnapTrack also reported accuracy substantially better than 50 meters in its Denver trial.[113] While these results do not represent actual tests of commercially available handsets

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[108] *See infra* para. 75.

[109] *See infra* para. 68.

[110] Letter from King County E-911 Program Office to Nancy Boocker, Deputy Bureau Chief, Wireless Bureau, FCC, November 24, 1998 at 2.

[111] *See* IDC Comments II at 10.

[112] Lucent Press Release, *supra* note 23.

[113] SnapTrack *Ex Parte* Presentation (Oct. 31, 1998).

and systems, they strongly indicate that the 50 meter standard should be achievable, especially since this technology is likely to improve by 2001 when our rules require implementation to begin.

74. Moreover, we believe that it is appropriate and reasonable to expect that solutions taking advantage of a longer phase-in to achieve full ALI deployment should provide compensating advantages in performance. As the Commission recognized in the *E911 Reconsideration Order*, and as parties such as APCO have stressed in their comments, achieving a higher level of accuracy is such an advantage. More accurate ALI will reduce the area that must be searched to locate the emergency situation while also making the selective routing of calls to PSAPs more accurate and reliable. Accordingly, for handset-based solutions, by which we mean any Phase II ALI solution that requires replacement, modification, or upgrades of current handsets, we will require an accuracy of 50 meters for 67 percent of all calls employing the handset-based solution.[114] This is a substantially more stringent standard than the 100 meter standard we are adopting for network-based solutions, especially in reducing the area in which the call should be located. The 100 meter radius standard implies a circular area of 31,416 square meters. Under the 50 meter standard, the area enclosed would be only a quarter the size, 7,854 square meters. Having this smaller expected search area should significantly facilitate and speed emergency response. For the outer, 95 percent accuracy ring, we will set an accuracy requirement of 150 meters. The record indicates that this should be achievable and reasonable for handset-based solutions.[115]

75. The dual ring methodology we are adopting for reliability effectively corrects the problems in the current RMS standard. Under RMS, all calls would be included in the calculation and a single failure or a very small number of relatively large errors would result in a failing grade despite very high levels of accuracy for other calls. While we continue to believe the goal of our original reliability methodology was worthy in that it sought to assure accurate locations for all 911 calls, we recognize that any location system may fail or provide highly erroneous readings occasionally. This is especially true because these systems are based on radio technologies, which confront inherent difficulties in achieving 100 percent reliability.

[114] This standard is to be met for all calls using the solution's ALI-capable handset. Calls from non-ALI capable handsets are subject to the phase-in and "best practice" rules we discuss elsewhere in this Order.

[115] *See, e.g.*, Report of Findings, King County Washington E911 Program at 1-3, 1-4.

76. The approach we are adopting, which is similar to proposals by TechnoCom[116] and Lucent,[117] combines several elements that have been proposed and offers advantages over either a strict RMS methodology or a single CEP method. This "dual ring" system maintains the intent of our current standard, by requiring that virtually all calls be included in the accuracy calculation, while at the same time recognizing the likelihood that location attempts for some calls may fail or result in a small proportion of relatively large errors. Permitting 5 percent of calls to be ignored in the calculation represents a reasonable accommodation to technical and operational realities. This standard does not, however, permit carriers to ignore an unacceptable and unnecessary 33 percent of all 911 calls, as would the 67 percent CEP standard proposed by some commenters. In contrast to RMS, the dual ring standard does not exaggerate relatively large errors and can also be easily understood by those applying it. Alternative methods appear unnecessarily complex and more difficult to understand, especially for public safety personnel in the field, and do not appear to provide any offsetting advantages.

77. In addition, the dual ring approach encourages the development and use of location technologies that may not be accurate enough to satisfy the more stringent original standard but could provide valuable backstop and adjunct capabilities in a cost-effective manner, for example, in rural areas for network-based solutions or in certain urban settings for handset-based solutions. Overall, this new approach to ALI reliability will clarify the accuracy requirements and ultimately enhance carriers' ability to meet their E911 public safety obligations while correcting the practical problems which resulted from our original standard.

C. Technological and Competitive Neutrality

78. **Background**. Several parties to this proceeding urge the Commission not to revise its E911 Phase II rules to allow a phase-in for handset-based solutions, arguing that the current rules are technologically neutral as written. Proponents of network-based solutions argue, for example, that the current rules were carefully crafted, after much time and attention, and should not be changed.[118] On the other hand, WCA proposes that the Commission mandate GPS chips in all handsets because handset solutions present a more accurate, less expensive means of providing ALI than network-based solutions.[119]

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[116] *See* TechnoCom Comments II at 4 (proposing a 67 percent threshold with an associated error limit and a second threshold of 95 percent with a larger error limit).

[117] Lucent Reply Comments II at 3.

[118] Comments of the Phase II Working Group at 6; KSI Comments II at 9.

[119] WCA Petition to Modify, filed June 1, 1999; WCA Comments II at 2.

79. **Discussion**. In formulating these revised ALI rules, we have sought to promote so far as practicable the rapid, universal, and efficient provision of Phase II ALI. We continue to believe that a policy of technological and competitive neutrality will help achieve this goal. Over time, we anticipate that vigorous competition in ALI services will lead to further innovation and efficiencies in the provision of 911 location information. The commenters generally agree. Thus, we do not adopt WCA's proposal to mandate a handset-based solution by requiring that all new handsets include GPS capability. We believe it would be premature at best to interfere with the current competition in location technologies and select a single ALI technology for all wireless air interfaces and all conditions or to mandate a particular technology that may not be the most effective and efficient choice in all cases.

80. We also cannot agree with claims, primarily from network-based technology vendors, that our current rules are in fact technology neutral as they apply to handset-based and hybrid solutions.[120] We did, of course, give careful consideration to the record at hand when we adopted the wireless E911 rules in 1996. That record did not contain any substantial basis for considering a phase-in approach. Nor did it contain any information suggesting that a flash-cut approach would impose substantial costs, or suggest that a phase-in would provide substantial benefits. When information of such a nature was presented to the Commission, however, we clearly indicated our willingness to consider appropriate rule revisions or waivers, consistent with our goal of encouraging improvements in the quality of E911 and our policy of technological and competitive neutrality. We note that while the Consensus Agreement recommended the flash-cut approach and schedule the Commission adopted in 1996, several of its signatory organizations, as well as many individual members of those organizations, now support phase-ins and other rule changes that would allow the consideration and use of handset-based and hybrid approaches to providing Phase II ALI.[121]

81. We reaffirm, consistent with the views of the majority of commenting parties, that a policy of technological and competitive neutrality best promotes the public safety and welfare goals of this proceeding, especially in the critical area of ALI. Although numerous ALI technologies have been proposed and tested since the adoption of our Phase II rules,[122]

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[120] *See, e.g.*, KSI Comments II at 5; Comments of the Phase II Working Group at 6.

[121] APCO Reply Comments II at 2-4; CTIA Comments II at 2-3.

[122] In a recent Commission technology forum, seven different technologies were presented, all of which claimed to be able to satisfy or exceed our current standards, each of which has its own advantages and limitations. Three of these were handset-based or hybrid technologies. Other technologies are also being developed. Lucent Technologies, for example, announced its own ALI technology solution two days after the forum and claimed a much higher level of accuracy than our current standards, within 15 feet outdoors and 100 feet within buildings. Lucent Press Release, *supra* note 23. Several of these new technologies involve adding

each has advantages and disadvantages. We believe that continued competition among various rival providers and technologies will be an effective spur to continued improvement in the quality of ALI and will lower costs.

82. At the same time, we also do not believe that public safety or the policy of neutrality require that the rules we adopt be identical for both network-based and handset-based technologies.[123] As we have discussed throughout this Order, each type of technology has its advantages and limitations in meeting public safety needs. In our revised rules we have sought to take these differences into account because it appears that each may effectively contribute to improving public safety. We have adopted accuracy standards and a phase-in that will, we believe, permit the deployment of network-based solutions to meet these public safety needs. We do not believe, on the other hand, that public safety would be advanced by allowing a longer phase-in for network-based solutions, as KSI suggests, in order to achieve ostensible parity. Rather, the phase-in we adopt here is limited to what appears reasonably necessary and achievable, to minimize delay in ALI deployment. Similarly, our rules for handset-based solutions are structured to realize the potential benefits of greater accuracy and, possibly, better service for rural areas and air interfaces such as CDMA, while addressing the specific problems of current handsets and roamers. Those rules as revised today seek to promote the public safety so far as reasonably possible by both types of technologies, as they are now and as they may be improved in the future. These rules also, we believe, achieve our policy of technological and competitive neutrality, not through being identical, but by taking into account the differences in these types of technologies in ways that promote public safety. We believe that these rules will successfully promote public safety while allowing the broadest possible range of technologies, and mixes of technologies, to compete in providing 911 ALI.

D. Compliance Verification

GPS chips or software to handsets. In the case of a pure GPS system, such as that described at the forum by IDC, little or no additional equipment or software changes are necessary on the part of wireless carriers. For other technologies, the GPS capability in the handset is assisted by other equipment. SnapTrack and Lucent's technologies are examples of these sorts of hybrid systems.

[123] The Commission has, in the past, adopted different rules for different technologies in order to preserve technological and competitive neutrality. *See, e.g.*, Amendment of Part 15 of the Rules and Regulations with Regard to All-Channel Television Broadcast Receivers, Report and Order, Docket No. 18433, 21 FCC 2d 245 (rel. Feb. 2, 1970) (adopting rules requiring that all TV receivers manufactured after a specific date have comparable tuning capabilities for both VHF and UHF channels to eliminate differences between UHF and VHF channels and "thereby make a significant and realistic contribution toward achieving a truly competitive nationwide all-channel television system"); Fostering Expanded Use of UHF Television Channels, Second Report and Order, Docket No. 14229, 25 Rad.Reg. 1551 (rel. July 29, 1963) (adopting proposals to relax technical requirements in order to encourage more extensive use of UHF television channels).

83. **Background**. The development of technical and operational standards to effectuate E911 services largely has been undertaken through the cooperative efforts of a number of parties. Under these circumstances, the Commission concluded in the *E911 First Report and Order*, the best way to ensure implementation of E911 services is to determine what capabilities must be achieved, rather than micromanaging the process by prescribing detailed technical and operational standards.[124] As a result, the Commission declined to adopt specific methods for measuring compliance with the E911 rules, relying instead upon the parties to resolve technical issues in good faith.[125]

84. Parties have responded by working collaboratively to resolve a number of technical issues associated with Phase II E911. Specific methods for verifying compliance are currently being explored by standards-setting and other technical bodies.[126] Parties are also working together to develop technical standards aimed at achieving interoperability among various technologies.[127]

85. **Discussion**. We recognize that the entities subject to our rules need guidance on appropriate methods for determining compliance with the location accuracy requirements. Accordingly, we are tasking the Office of Engineering and Technology (OET) and the Bureau to expeditiously develop and publish methods that may be used for verifying compliance with our rules governing Phase II. In developing appropriate compliance verification methods, OET and the Bureau should work along with all interested parties, including equipment manufacturers, system operators, public safety organizations, standards groups, and organizations with relevant expertise in performing such measurements. In developing these methodologies, OET and the Bureau are expected to take into account the practical and technical realities. For example, we recognize that in some instances, calls cannot be completed and ALI cannot be provided. Also, the methodology may need to give appropriate weight to the variety of conditions and locations in which wireless equipment is used.

E. Advance Carrier Reports of E911 Plans

86. **Background**. The Commission's current rules require wireless carriers to deploy Phase II by October 1, 2001, provided certain conditions are met, but do not require

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[124] *E911 First Report and Order*, 11 FCC Rcd at 18712-13.

[125] *Id.* at 18714.

[126] Motorola *Ex Parte* Presentation, July 20, 1999 at 10; Qualcomm *Ex Parte* Presentation, July 30, 1999 at 13.

[127] *See* AirTouch Comments II at 14, n. 26; SnapTrack Comments II at 20.

any particular advance planning to meet that goal. It is clear, however, that in order to be in a position to comply with the October 1, 2001, deadline, advance planning is essential. Possible delays in carrier planning for implementation of Phase II could, in turn, complicate the planning of the various other necessary participants in Phase II implementation -- PSAPs, providers of location technology, investors, manufacturers, local exchange carriers and others. Thus, timely planning and communication among the parties involved in Phase II is critical for successful deployment of these capabilities.

87. **Discussion**. We conclude that to encourage carrier planning efforts and discussions with other necessary participants, all wireless carriers subject to the E911 rules must prepare and submit a report on their plans for implementing Phase II no later than October 1, 2000.[128] The report should include basic information concerning the carrier's Phase II plans, including the technology it plans to employ and whether this technology requires replacement or upgrades of any wireless handsets. If the carrier employs a handset-based or hybrid approach, the carrier should also report its plans to provide location information to roamers under the best practice obligations. We find that the October 1, 2000, deadline will permit carriers sufficient time to consider available technologies, plans and preferences of PSAPs, and other relevant considerations. We also find that it will allow interested parties a reasonable time in which to respond to carriers' reports, without interfering with the October 1, 2001, deployment deadline.

88. The required advance notification of the manner in which carriers expect to achieve Phase II compliance is intended to further several goals. First, we expect that the advance reports will provide helpful, if not essential, information for coordinating carrier plans with those of manufacturers and PSAPs. Second, they will assist our efforts to monitor Phase II developments and to take necessary actions to maintain the Phase II implementation schedule. Third, the requirement underscores that carriers may not defer consideration and decision on Phase II, but must develop targeted plans to implement Phase II consistent with the Phase II schedule. Finally, we believe that the reports will increase the likelihood of cooperative discussions between public safety organizations and carriers, based on an understanding of carrier plans. In view of the expanded options for ALI compliance that this Order permits, we believe that it is essential that all parties and this Commission have early notice of carriers' plans, including ALI technology plans, prior to the October 1, 2001 implementation date. The report also should provide important information for the earlier deployment schedule we adopt for carriers employing handset-based solutions.

[128] The reporting requirement we adopt here reflects, in part, the recommendation of a wireless industry group interested in handset-based approaches, including wireless carriers who would be subject to the reporting requirement. Advanced E911 Coalition *Ex Parte* Presentation, August 20, 1999.

89. We believe that the requirement to provide an advance report should not impose substantial new burdens on carriers. To this end, we permit the electronic filing of the reports, which will be placed on the Commission's E911 web site for ease of accessibility. We also encourage joint filings to the extent possible, for example, filings on behalf of all carriers using a specific air interface or ALI technology. In requiring these reports, we clarify that carriers may make good faith changes in their plans even after the report is filed. We require, however, that carriers file updates notifying the Commission of any changes to their filed plans within thirty days of the adoption of any such change.

V. PROCEDURAL MATTERS

A. Regulatory Flexibility Act

90. As required by the Regulatory Flexibility Act, 5 U.S.C. § 604, the Commission has prepared a Final Regulatory Flexibility Analysis of the possible economic impact on small entities of the policy and rules adopted in this Third Report and Order. The Final Regulatory Flexibility Analysis is set forth in Appendix C.

B. Paperwork Reduction Act of 1995 Analysis

91. This Report and Order contains a new information collection. As part of its continuing effort to reduce paperwork burdens, we invite the general public and the Office of Management and Budget (OMB) to take this opportunity to comment on the information collections contained in this Order, as required by the Paperwork Reduction Act of 1995, Pub. L. No. 104-13. Public and agency comments are due 60 days after publication of this decision in the Federal Register. OMB comments are due 60 days after this date. Comments should address:

- Whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility.
- The accuracy of the Commission's burden estimates.
- Ways to enhance the quality, utility, and clarity of the information collected.
- Ways to minimize the burden of the collection of information on the respondents, including the use of automated collection techniques or other forms of information technology.