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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	)	

SECOND REPORT AND ORDER

Adopted: May 13, 1999 **Released:** June 9, 1999

By the Commission: Commissioner Tristani is issuing a statement.

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I. SUMMARY

1. In this Report and Order we seek to improve the ability of analog cellular phone users to successfully complete wireless 911 calls. We believe this action will have a significant positive impact on the security and safety of analog cellular subscribers, especially in rural and suburban areas, and result in the successful completion of significantly more wireless calls to 911 than occurs today. In this way, we are responding to an important public safety concern: the need for confidence that wireless calls to 911 will in fact go through.

2. The rule we adopt requires that analog cellular phones include a separate capability for processing 911 calls that permits those calls to be handled, where necessary, by either cellular carrier in the area. The purpose of this separate capability is to improve 911 reliability, increase the probability that 911 calls will be efficiently and successfully transmitted to public safety agencies, and help ensure that wireless service will be maintained for the duration of the 911 calls. The rule applies to new handsets manufactured more than nine months after the adoption date of this order. We also set out guidelines for 911 call completion methods that satisfy our rule, approving three methods that have been proposed in the record, Automatic A/B Roaming-Intelligent Retry (IR), Adequate/Strongest Signal, and Selective Retry.

3. These improvements in 911 call completion should significantly increase the reliability of using wireless phones to reach emergency help. Calls that cannot be handled by one of the cellular carriers will, under this rule, be routed to the other carrier for transmission to emergency dispatchers. While this should represent an important improvement in completing 911 calls, especially in areas where cellular coverage is less complete, it is also important to recognize the problems and limits that remain in completing 911 calls. We address the comparative advantages and disadvantages of the three methods we are approving more specifically in a later section of this Order,[1] and note that the present limits of technology deprive us of the opportunity to craft perfect solutions. Wireless callers should be aware, for example, that 911 calls may still not be completed in some cases, as when neither cellular carrier provides a usable signal. The 911 call completion modes we approve here, while important improvements over current methods, also are not infallible. Each of the methods we are approving, while improving the current situation regarding 911 call completion, is subject to some disadvantages in certain situations. In some cases, callers may still encounter circumstances where the handset fails to deliver a 911 call adequately. Moreover, this new rule only applies to new analog cellular handsets, not to existing handsets or to digital services such as Personal Communications Service (PCS) or Enhanced Specialized Mobile Radio (ESMR).

[1] *See* paras. 78-84, *infra*.

4. Even with these qualifications, however, we believe the steps we take in this Order will significantly improve the reliability of the most vital use of wireless phones, reaching needed help in an emergency. We expect to continue to explore ways to improve wireless 911 service because the improvement of wireless 911 is an essential element in applying wireless communication to improving public safety and hastening the day when wireless and wireline can truly be viewed as substitute services by American consumers.

II. BACKGROUND

5. As part of our efforts to promote public safety, this Commission in 1996 adopted the *E911 First Report and Order*, establishing rules requiring wireless carriers to implement 911 and Enhanced 911 (E911) services.[2] At the same time, the Commission also issued the *E911 Second NPRM* to develop additional means of improving E911 system performance to serve public safety needs.[3]

6. One issue in the *E911 Second NPRM* concerned proposals to help improve the transmission of 911 calls, particularly from locations where the wireless caller's preferred carrier has a "blank spot" — an area where the system's radio signal is relatively weak or non-existent.[4] To improve 911 call completion in these locations, the Ad Hoc Alliance for Public Access to 911 proposed that the Commission require that analog cellular 911 calls be sent to the cellular system with the strongest control channel signal.[5] The Commission sought

[2] 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 (1996) (*E911 First Report and Order* and *E911 Second NPRM*). On December 1, 1997, the Commission adopted the *E911 Reconsideration Order,* which addressed petitions seeking reconsideration of the *E911 First Report and Order*. 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 22665 (1997) (*E911 Reconsideration Order*), *further recon. pending.*

[3] In response to the *E911 Second NPRM*, the Commission received 31 comments and 18 reply comments. A list of pleadings is included in Appendix A. Abbreviations used in this Order in citing to pleadings also are included in Appendix A.

[4] We note that parties use the term "blank spots" as interchangeable with "dead spots," as that term is defined in the Commission's Rules. "Dead spots" are defined as "small areas within a service area where the field strength is lower than the minimum level for reliable service." The definition is intended to apply only to "dead spots" or "blank spots" that occur within existing cellular geographic service areas, not in unserved areas. *See* Section 22.99 of the Commission's Rules, 47 C.F.R. § 22.99.

[5] Alliance Petition for Rulemaking, filed Oct. 27, 1995. Call completion issues relating to 911 are discussed in greater detail in Section IV, *infra.* We note that, since the time of the referenced pleading, the Ad Hoc Alliance for Public Access to 911 has reorganized. The "Wireless Consumers Alliance" has organized to support

comment on this proposal and, more broadly, on ways to enable mobile users to complete 911 calls without regard to the geographic availability of the system or technology used by their wireless service.[6]

7. In subsequent rounds of comments and *ex parte* filings, the Wireless E911 Implementation Ad Hoc Committee (WEIAD), a group consisting of representatives from the wireless industry, the public safety community, and Alliance, recommended that manufacturers set analog cellular handsets to default to a call completion method called "A/B, B/A," which would also permit routing via the non-preferred carrier. Alliance also submitted a revised proposal, "Adequate/Strongest Signal," which would route 911 calls to the preferred carrier if it had an adequate signal, and, if not, to the cellular carrier with the strongest forward control channel signal.[7] In response, the Cellular Telecommunications Industry Association and the Telecommunications Industry Association proposed a method called "Automatic A/B Roaming," under which handsets would overrule their programming for other calls when a 911 call is placed, and would seek to route a 911 call to the preferred carrier, if possible, but, if not, deliver the call to the other cellular carrier.[8] In subsequent filings, Motorola and CTIA presented a specific version of Automatic A/B Roaming called "Intelligent Retry."[9] In addition, Bell Atlantic proposed the use of a 911 button that could be pushed to redirect a 911 call to the other cellular carrier, an approach called "Selective Retry."[10]

III. OVERVIEW OF WIRELESS E911

A. Importance of Wireless 911 Enhancements

8. Mobile telephones have evolved over the last ten years from a business tool or personal luxury installed primarily in automobiles to a familiar pocket-sized way to send and

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and continue the efforts of the Alliance.

[6] *See E911 Second NPRM*, 11 FCC Rcd at 18746-48 (paras. 144-148).

[7] Public Notice, Additional Comments Sought: Wireless 911 "Strongest Signal" Proposal Filed by Ad Hoc Alliance for Public Access to 911, DA 98-1936 (released Sept. 22, 1998) (September 22 Public Notice). The list of Comments and Reply Comments filed in response to the September 22 Public Notice is listed in Appendix A. (Additional Comments and Additional Reply Comments)

[8] *See, e.g.*, CTIA Additional Comments at 11; Public Safety Additional Comments at 2-3; *see also* CTIA *Ex parte* Filing, Dec. 4, 1998.

[9] *See,* paras. 31-42, *infra.*

[10] BAM Additional Comments at 5. *See* paras. 69 -77, *infra.*

receive calls seemingly almost anywhere.[11] One of the most compelling reasons why people purchase mobile phones is safety, especially in emergencies.

9. The number most Americans dial in emergencies is 911. Since the 911 emergency number was introduced in 1968 for wireline services, it has become almost ubiquitous.[12] Moreover, most wireline 911 systems and Public Safety Answering Points (PSAPs) have been upgraded to E911, which adds features that permit more efficient and rapid response by emergency personnel. According to the National Emergency Number Association, 93 percent of the U.S. population is covered by some form of 911 service, 95 percent of which is E911. This includes 50 percent of the country's land area.[13]

10. Unfortunately, the advantages of E911 have not been available for wireless calls. Even in locations where wireline E911 capability is in place, the attendant at a PSAP generally does not automatically receive information regarding the telephone number of a wireless phone or, most importantly, its user's location. In response to these shortcomings, the public safety community has long sought to bring the benefits of E911 to wireless phone users.

B. Commission Actions

11. In the *E911 First Report and Order* and the *E911 Reconsideration Order*, the Commission adopted rules setting a schedule for implementation of wireless E911, and also resolved many basic issues. These rules were based in large part on a wireless E911 framework established by industry and public safety community representatives in their Joint

[11] More than 74 million cellular, broadband PCS, and ESMR phones are now in use in the United States, and their number continues to grow rapidly. *See* CTIA website (visited May 13, 1999) <http://www.wow-com.com>.

[12] Although the Commission recognized the designation of 911 by AT&T as a national emergency number in the N11 rulemaking proceeding, decisions to implement 911 service continue to be made locally. Some States and local jurisdictions still use different emergency numbers particularly for wireless emergency calls from highways. *See* The Use of N11 Codes and Other Abbreviated Dialing Arrangements, CC Docket No. 92-105, First Report and Order and Further Notice of Proposed Rulemaking, 12 FCC Rcd 5572, 5586 (para. 23) (1997) (*N11 First Report and Order*).

[13] *See* National Emergency Number Association, Resources, History, The Development of 911 (visited May 13, 1999) <http://www.nena9-1-1.org>.

Expert Meetings (JEM), and on a Consensus Agreement[14] among the wireless industry and public safety organizations.[15]

12. Cellular, broadband PCS, and certain SMR carriers are now required to forward all 911 calls they receive to PSAPs, without delays for validation or the blocking of calls from non-subscribers.[16] Effective April 1, 1998, these carriers were also required to implement service in accordance with Phase I of the wireless E911 rules, provided that the administrator of the designated PSAP has requested the service and is capable of receiving and utilizing the data elements associated with the service, and a mechanism for recovering the costs of the service is in place. Under Phase I, the PSAP receives data that both permits the handset to be called back if necessary and identifies the location of the cell site or base station that received the call, a rough indication of the location of the call.[17] In Phase II, effective October 1, 2001, carriers are required to provide PSAPs with automatic location identification (ALI), within 125 meters Root Mean Square (RMS), provided again that PSAPs meet the conditions described.[18]

IV. IMPROVING 911 CALL COMPLETION

13. In the *E911 Second NPRM*, we sought ways to enable mobile users to complete 911 calls without regard to the availability of the system or technology used by their wireless service in the area in which they seek to place the call.[19] The original proposal on this issue was from Alliance and, in the *E911 Second NPRM*, we sought comment on Alliance's strongest signal proposal. More broadly, we also sought comment on any other ways to enable wireless telephone users to complete 911 calls wherever a mobile system providing 911 service is present.[20]

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[14] "Public Safety-Wireless Industry Consensus: Wireless Compatibility Issues, CC Docket 94-102," filed by CTIA, APCO, NENA, and NASNA, Feb. 12, 1996 (Consensus Agreement).

[15] *E911 First Report and Order*, 11 FCC Rcd at 18687-88 (paras. 21-23).

[16] Section 20.18(b) of the Commission's Rules, 47 C.F.R. § 20.18(b).

[17] Section 20.18(d) of the Commission's Rules, 47 C.F.R. § 20.18(d).

[18] Sections 20.18(e) and 20.18(f) of the Commission's Rules, 47 C.F.R. §§ 20.18(e), 20.18(f).

[19] *E911 Second NPRM*, 11 FCC Rcd at 18747 (para. 147).

[20] *Id.* at 18748 (para. 148).

14. One reason access to emergency 911 systems is not always available for wireless handsets is that there are gaps in the signal coverage provided by wireless carriers. A wireless telephone user who happens to be located in a coverage gap or "blank spot" where his or her carrier's signal is inadequate may find that it is not possible to establish and maintain adequate communications over the wireless system accessed by the handset. One industry study indicates that a typical cellular service or PCS cell provides 90 percent coverage, leaving gaps in coverage as a result of factors such as local terrain.[21] A recent study in the Los Angeles area found similar gaps, with weekday, daytime call connection rates among wireless carriers ranging from 84.6 to 95.5 percent.[22]

15. Coverage gaps may be even larger in rural and suburban areas and for portable, handheld phones. Analog cellular mobile phones, typically installed in vehicles, transmit signals at a maximum power level of 3.0 watts. Portable, handheld phones transmit a less powerful signal, a maximum of 0.6 watts. At this lower transmission power, a portable phone may not be able to complete a call at a location where a mobile phone can. In effect, the coverage gap is larger for portable phones. Alliance estimates that, while urban core cells provide 90 percent coverage for both mobile and portable phones, suburban cells provide only 75 percent coverage for portable phones and rural cells fall to 66 percent coverage.[23] We recognize these figures are estimates and actual coverage gaps will differ in different locations. In addition, the situation is likely to be improving as carriers further develop their network infrastructures. Nevertheless, there is no serious dispute that coverage gaps do occur within cellular service areas.

16. Moreover, in a call attempt, analog cellular phones first establish communication with a cell site over a data or control channel. Once a link is established over the control channel, the cell site assigns a voice channel, if available. According to technical studies submitted on behalf of Alliance, if the preferred carrier provides a weak or inadequate signal, the handset may nonetheless lock onto that carrier even if sustained voice communications between the handset and the preferred carrier's system is not possible. Under those circumstances the handset would be unable to complete the 911 call to the preferred carrier,

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[21] CTIA *Ex parte* Filing, May 20, 1998, "A Study of 911 Call Origination Policies in Cellular and PCS System and Strongest Signal Impact on Call Setup Time," at 2-3 (CTIA Study).

[22] Jennifer Oldham, *L.A. Cellular Beats Rivals in Wireless Derby*, L. A. Times, Aug. 10, 1998, at D5. It was submitted as part of Alliance *Ex parte* Filing, Feb. 18, 1999, at 22-24. The study evaluated calls from six wireless networks, including analog and digital cellular and PCS. Rates for overall good call performance, reflecting call connection, call retention, and voice quality ranged from 74.2 to 82.2 percent. Data from this study on Sprint PCS are excluded from these figures, because Sprint did not provide service at the time in much of the area surveyed.

[23] Alliance *Ex parte* Filing, June 3, 1998, at 3.

yet also prevented from switching to the other system even if the handset has the capability to contact that carrier. This "lock-in" problem is not challenged by other technical studies,[24] and the wireless industry agrees that handsets can lock in to one carrier, even if the handset cannot communicate with that carrier, for several reasons.[25]

17. These 911 call completion difficulties represent a significant public safety problem. According to National Highway Traffic Safety Administration data, for example, rural areas are where emergency communications are most valuable and improvements are most needed. In 1996, motor vehicle crashes in rural areas accounted for 59 percent of total motor vehicle fatalities, 25,000 deaths a year. 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.[26] Overall, a person is as much as three times as likely to suffer a fatality in a rural crash.[27]

18. Further, when an accident happens, it generally takes much longer before help arrives in rural areas. Many rural accidents are single-vehicle and run-off-the-road crashes in remote areas, where it can take hours for someone to discover and report the accident. Such delays can play a major role in increasing crash fatalities and serious injuries. 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.[28]

19. The failure to deliver 911 calls because of coverage gaps can contribute to tragic outcomes in these emergency situations.[29] The record strongly indicates that one specific step

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[24] *See* para. 48-49, *infra*.

[25] CTIA *Ex parte* Filing, Feb. 19, 1999, "Wireless Industry Response to FCC's Follow-up Questions," at 2-3.

[26] NHTSA, Traffic Safety Facts 1996, Rural Areas.

[27] NHTSA, Research Note, Rural and Urban Crashes - A Comparative Analysis, Aug. 1996, at 2.

[28] Ricardo Martinez, M.D., Administrator of NHTSA, An Address to the American College of Emergency Physician's Scientific Meeting, on the Subject of the Cellular Phone and the Nation's Enhanced 911 System (Oct. 16, 1997) <http://www.erwatch.com/cell.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).

[29] *See, e.g.*, Michael A. Hiltzik, *Cell Phones, 'Crime Fighters of the '90s,' Are Striking Out*, Los Angeles Times, Nov. 16, 1997, at A1 (describing how Marcia Spielholz was severely injured when her cellular phone failed to connect 911 calls while she was being pursued by carjackers); Alliance *Ex parte* Filing, Mar. 18, 1998,

the Commission can take in the interest of public safety is to improve wireless 911 call completion, especially in rural areas, and thus to facilitate more efficient and rapid emergency response.

A. Access to 911 Service via Multiple Wireless Systems

20. One approach to reducing the blank spot problem is to route calls to another wireless carrier in cases where a wireless phone user is located in a blank spot for his or her preferred carrier, but where another wireless carrier has coverage. Two cellular carriers usually provide service in each market, referred to as the A carrier and the B carrier. Each A carrier uses one set of assigned frequencies and each B carrier another, but both use compatible technology and air interface standards for analog service.[30] Cellular handsets are manufactured to be used for both A and B carrier systems, and software programs in these handsets permit them to operate in several modes. One common operating mode permits calls only to the carrier with whom the customer has a subscription agreement. This mode is referred to as "A-only" or "B-only," depending on the preferred carrier.

21. The A-only or B-only modes can pose a significant disadvantage for emergency 911 calls. If the caller happens to be trying to place a 911 call from within a coverage gap in his or her own carrier's service area and the handset is programmed only to route calls to that carrier, the call will not be completed even if the other carrier has an adequate radio signal and an available channel to complete the call. The A-only or B-only handset mode would act to block the 911 call in the same way that it would block an ordinary call.[31]

22. In the *E911 Second NPRM*, we expressed the view that, "ideally, a 911 call should be handled by whatever wireless system is available in the area of need and, if there are multiple systems available, by the one that will provide the quickest and most reliable and accurate response."[32] We sought comment on the broad issue of whether to establish arrangements and procedures under which all wireless 911 calls could be handled by the

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"Report Concerning the Failure to Connect Emergency Calls Made from Mrs. Lechuga's AirTouch Cellular Phone on November 29, 1997" (Lechuga Report) (describing how a California couple and their two children, the Lechuga family, died after their cellular phone failed to connect a 911 call in the wake of a highway accident).

[30] *See* Section 22.933 of the Commission's Rules, 47 C.F.R. § 22.933.

[31] While the customer might theoretically be able to override this default and manually select a different calling mode, many users might not realize this or be unable to accomplish it, especially in an emergency. Having to reprogram the handset to override a default setting would in any event cause delay in placing the call.

[32] *E911 Second NPRM*, 11 FCC Rcd at 18746 (para. 145).

service available in an area, as well as on the specific proposal of Alliance to route 911 calls to the carrier with the strongest forward control channel signal.

B. "A/B, B/A" Default

23. One option for improving 911 call completion is to initially program handsets to a calling mode termed A over B, B over A (A/B, B/A). Under this approach, all analog cellular calls — including 911 calls — would be routed to the customer's preferred carrier if a usable channel is available. If a channel is not available, the handset would automatically switch to a usable channel on the other cellular carrier's system. WEIAD has recommended that the wireless industry undertake efforts to educate users of analog phones with regard to capabilities of the A/B, B/A logic for 911 calls.[33] In addition, it proposes that all analog phones manufactured or provisioned after a specified future date must be programmed, where capable, to use A/B, B/A for 911 calls, at a minimum, with the proviso that users can elect to defeat this default capability.[34]

24. As an initial measure to improve accessibility to 911 services for wireless users, we support this part of the WEIAD recommendations as a voluntary industry practice. All of WEIAD's members, including public safety organizations and Alliance, agree that this proposal would improve 911 call completion without any additional implementation cost or delay.[35] None of the parties in this proceeding suggests that setting A/B, B/A as the default for new analog handsets will increase costs or present other problems. Setting the default in this way does permit the handset to place calls with non-preferred carriers, and in the case of ordinary calls this could produce unexpected and unwanted roaming charges. However, handsets ordinarily inform callers if a call would incur roaming charges. The industry program to educate users should also inform customers of this possibility so that they can decide whether to make such calls. This program might include information in the handset manuals and in materials provided to the customer at the time of activation that will help users understand the operation of the handset and the charges that will apply, including possible roaming charges. Customers also, of course, will have the option of setting a different default if they prefer. Moreover, adoption of the A/B, B/A mode as a default may be helpful to wireless users, particularly those whose primary interest in acquiring a wireless phone is security in emergency situations. The A/B, B/A default will provide those customers

[33] *See* Report of CTIA, PCIA, APCO, NENA, NASNA, and Alliance, filed Jan. 30, 1998 (1997 Joint Annual Status Report). "WEIAD Summary Discussion on Strongest Signal" is attached to the 1997 Joint Annual Status Report, Appendix A (WEIAD Proposal).

[34] WEIAD Proposal at 12.

[35] *Id.* at 11-12.

with a handset programmed by default to a more reliable way to reach help in an emergency, and the industry effort to inform customers should further assist them in understanding how to use the handset.

C. Need for a 911-Only Operating Procedure

25. The WEIAD Proposal points the way to additional steps that will further improve 911 call completion. While useful, the A/B, B/A default approach, standing alone, is of limited value. Cellular phone users will still be faced with the problem that the A/B, B/A default setting will apply to both 911 and regular calls. Because non-emergency calls make up the vast majority of calls, consumers will face substantial incentives to reprogram their handsets back to A only, B only, or some other mode that best meets their needs for non-emergency calls. To the extent that they do so, the benefits of the A/B, B/A default for 911 calls will vanish. This operational mode is also subject to the lock-in problem and may not switch the call to the non-preferred carrier in some cases where the handset does not connect to a usable voice channel.[36] In addition, WEIAD only proposes to use A/B, B/A where the handset is capable of being programmed in this way. These limitations could reduce the availability of the A/B, B/A mode substantially. Manufacturers could simply choose not to include this setting in their handsets and thus be under no obligation to select it as a default.

26. To address some of these problems, we conclude that 911 call completion for cellular phones operating in the analog mode should be further enhanced by requiring that handsets include separate programming for 911 calls. By providing cellular phone users with a program for 911 calls separate from that used for their other calls, we will equip each user with an operational mode, or possibly a choice of modes, that will best enhance 911 call completion without intruding on the user's preference for routing other calls. Users thus will not be faced with the problem of whether to compromise 911 call completion, for example to avoid roaming charges for ordinary calls from within their preferred carrier's blank spots. Users will, rather, be able to select both the calling mode that is likely to be most reliable and effective for them in emergencies and a different mode, if they prefer, for ordinary calls.

D. 911-Only Call Processing Modes

27. Three 911-only call processing modes have been proposed in this proceeding. Two of these, Automatic A/B Roaming-IR and Adequate/Strongest Signal, are based on earlier proposals, but have been modified significantly to address concerns raised in the record. Selective Retry was proposed as another method to address such concerns. Although we recognize that each approach has certain limitations that are pertinent to our objective of

[36] *See* para. 16, *supra*.

maximizing 911 call completions, we also believe that each of the three proposals represents a substantial improvement toward meeting this objective. We have also concluded, moreover, that each approach offers benefits under certain circumstances, as compared to the *status quo*, and may also suit different user preferences. Finally, we believe that each of the three call processing modes may also provide a foundation for future improvements in 911 call completion, reflecting actual operating experience, innovation, or adaptation to technologies other than analog cellular.

28. Based on our experience with this issue and our analysis of the record, we believe that any reasonable analog cellular 911 call processing mode should satisfy certain basic principles. *First*, the most basic goal is to improve the 911 call completion rate so far as practicable, including in circumstances where the caller's preferred carrier is unable to complete a call that can be completed by another carrier. *Second*, as the advocates of the various proposals recognize, it is often desirable to complete 911 calls, where possible, via the preferred cellular carrier. This routing minimizes delay in setting up the call and encourages competition among carriers in the most effective provision of 911 service, including E911 features.

29. *Third*, a 911 call processing mode should not disrupt the overall operation of 911 service, including the networks of both wireless carriers and public safety organizations. *Fourth*, the 911 call processing mode should address the lock-in problem in a reasonable and effective way that substantially reduces or eliminates the likelihood that a 911 call might be locked in on the system of a cellular carrier that is unable to provide a usable voice communication channel. And, *fifth*, the benefits of the calling mode to public safety should outweigh any additional costs. These principles represent general criteria for evaluating 911 call processing modes. We believe these principles will ensure that any approved 911 call processing mode will serve the public interest. Further, these principles will help further our policy of technological and competitive neutrality in wireless 911 service. In this Order, we apply them to evaluate the three 911-only modes that have been presented in the record. In doing so, we note that it is not our intent to limit the development and improvement of 911 call completion modes, so long as they meet the criteria we have established. We wish to encourage the development of new and improved methods of making wireless technology enhance public safety.

30. Before turning to our review and discussion of alternative 911-only call processing modes, we note that some commenters have claimed that Alliance, in proposing and supporting a strongest signal approach, has not met its burden of demonstrating that a problem exists that is sufficiently extensive to warrant Commission intervention.[37] We believe that the

[37] *See, e.g.,* True Position Additional Comments at 5-7 and Attachment A; CTIA Additional Comments at 12-16.

evidence before us in the record of this proceeding dispels such claims. As we discussed above, Alliance has submitted technical studies that support its conclusion that as a result of cellular coverage "blank spots" and other problems, many wireless 911 calls, especially from rural and suburban areas, cannot be delivered to PSAPs. The wireless industry itself has submitted two technical studies that confirm that coverage gaps exist and, specifically, that strongest signal would improve call completion rates in light traffic locations such as rural and suburban areas.[38] Moreover, the wireless industry clearly recognizes the problem that some 911 calls now are not completed, though it has proposed solutions other than strongest signal, as we discuss below. Especially in light of the serious problems of reporting, locating, and responding to emergencies in rural and suburban areas, we believe a clear case has been made in favor of effective steps to improve 911 call completion.

1. Automatic A/B Roaming – Intelligent Retry

31. In comments responding to the September 22 Public Notice, several commenters proposed a new alternative operational mode, called Automatic A/B Roaming.[39] CTIA had previously referred 911 call completion issues to a standards body, TIA Wireless Communications Division, in June 1998. In a letter to CTIA and in comments, TIA states that it found that Automatic A/B Roaming is superior to the original Alliance strongest signal proposal.[40] Automatic A/B Roaming is described in this manner:[41]

> [T]he handset overrides any "local" programming of the handset (*i.e.*, subscriber programmed, preferred carrier only) and seeks a non-preferred carrier in the event the preferred carrier is unable to process the 9-1-1 call attempt. Such "*Automatic A/B Roaming*" can be implemented within *existing standards* and is compatible with present network registration and control procedures and functions. Relative to digital technology, the attachments indicate that the standards support similar capabilities for an integrated network approach in meeting the requirements for improved 9-1-1 call completion rates.

32. According to AT&T, this approach would allow callers to place a 911 call even if their preferred carrier's network is not available, while leaving to each carrier the ability to

[38] *See*, paras. 47-48 , *infra*.

[39] *See, e.g.*, CTIA Additional Comments at 11; AT&T Additional Comments at 3-4; Public Safety Additional Reply Comments at 6-7.

[40] TIA Additional Reply Comments at 1; *see also* CTIA Additional Comments, Attachment 1.

[41] Letter from John A. Marinho, Chair, Engineering Committee TR45, TIA to Mr. Art Prest, CTIA, Sept. 24, 1998, at 2, submitted as Attachment 1, CTIA Additional Comments (emphasis in original) (TIA Letter).

make determinations about signal strength based on the characteristics of its individual infrastructure.[42] Commission staff solicited additional information to clarify how Automatic A/B Roaming would operate to improve 911 call completion.[43] In response, TIA and CTIA submitted information concerning what they describe as an enhancement or variation of Automatic A/B Roaming using an "Intelligent Retry" (IR) method proposed by Motorola.[44]

33. Under IR, as described in materials submitted by Motorola to WEIAD in December 1998 and to TIA in January 1999, a 911 call would be placed using alternate channels and systems until the call is successfully completed, if at all possible. Specifically, the handset would override any features which prevent scanning of either the A side or the B side and default to A/B, B/A, depending on the handset's preferred carrier setting. Initially, the handset would seek to complete the call with the preferred carrier. If the handset detected no decodable forward control channel signal from the preferred carrier, the handset would retry the call with the non-preferred carrier, as in the A/B, B/A mode. If the handset detected a forward control channel from the preferred carrier, it would then attempt to complete the call with the preferred carrier. The number of attempted retries with the preferred carrier would be limited to no more than three, and the length of time for each attempt would be limited to three seconds. If this initial call attempt via the preferred carrier should fail, the handset would attempt to complete the call via the non-preferred carrier. If both call attempts should fail, the handset would continue to rescan and reattempt placing the call with both the preferred and the non-preferred carrier, using the same algorithms, until the call is completed, the user terminates the call, or the handset loses power. If a voice channel is established but the 911 call terminates for some reason other than the user ending the call or the base station releasing the call — for example, if the handset moves into a coverage gap or encounters some other transmission problem — the handset would automatically reattempt the call using the same algorithm. According to the proposal, the user should also receive feedback from the handset to indicate that this call set-up process is underway.[45]

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[42] AT&T Additional Comments at 3-4.

[43] On November 18, 1998, the Commission staff sent a list of questions regarding Automatic A/B Roaming to CTIA. (Staff Questions)

[44] CTIA and TIA Response to Staff Questions, submitted as CTIA *Ex parte* Filing, Dec. 4, 1998. *See also* CTIA *Ex parte* Filing, Jan. 29, 1999.

[45] "9-1-1 Call Completion, An Enhancement/Variation to Automatic A/B Roaming using "Intelligent Retry" as proposed by Motorola, Inc." and Contribution to TIA TR-45.1 Sub-Committee: "Proposal to Consider for Enhanced Completion of 911 Calls Initiated on Wireless Networks," submitted as attachments to CTIA *Ex parte* Filing, Jan. 29, 1999.

34. We have reviewed the IR version of Automatic A/B Roaming and believe that, in most respects, it should improve 911 call completion and satisfy the criteria we discussed above.[46] IR is a separate mode for 911 calls that operates independently of the handset's program for ordinary calls. While it seeks first to route calls to the preferred carrier if possible, IR should significantly improve 911 call completion by delivering calls to the other cellular carrier when the preferred carrier is unable to handle the call. In most cases the call will be completed without additional call set-up delay via the preferred carrier. Moreover, if the preferred carrier provides no detectable forward control channel signal, the handset will quickly, within a few seconds, seek to complete the call with the other cellular carrier. In most cases, then, 911 calls will be completed promptly with minimal delay. In cases where call completion is more problematic, as where forward control channels are weak or other problems occur, the handset will continue to search for a way to complete the call by one carrier or the other.

35. We conclude that the sequential procedure in IR by which the handset initiates a new call attempt when the 911 call fails for any of several reasons, including the lack of a control channel or a voice channel at the time of call set-up and the loss of signal during a call, is a reasonable and effective approach to ensuring that 911 calls are switched to the other cellular carrier when necessary. This algorithm thus should effectively address the lock-in problem, because, if the handset does not establish or maintain a "handshake" with the base station, the handset will reattempt the call and, if this cannot be accomplished with the preferred carrier, seek to complete the call with the other cellular carrier. IR should also offer another important improvement because the algorithm monitors the voice channel during the call. Thus, the handset would automatically and immediately seek to reinitiate the 911 call if it failed after initial setup. IR also does not appear to present any problems for the overall operation of 911 service and requires only relatively modest changes in handset software that should not be unduly expensive and should not take long to incorporate into mobile units. In addition, we believe that a potential advantage of this approach is the fact that it may be adaptable to digital and multi-mode operations.[47]

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[46] *See* paras. 28-29, *supra*.

[47] A TIA working paper states in its evaluation that "Such 'Automatic A/B Roaming' can be implemented within *existing standards* and is compatible with present network registration and control procedures and functions. Relative to digital technology... [existing] standards support similar capabilities for an integrated network approach in meeting the requirements for improved 9-1-1 call completion rates." TIA Letter at 2 (emphasis in original). This appears to indicate that Automatic A/B Roaming can be applied to digital technologies. We note that CTIA states: "There are significant difficulties in applying Automatic A/B Roaming to incompatible digital air interfaces. Even within compatible digital air interfaces, Automatic A/B Roaming can not be applied to GSM, CDMA, or TDMA digital air interfaces because of the way these digital technologies function." CTIA *Ex parte* Filing, Dec. 4, 1998, at 2. However, it appears possible that the concept of Automatic A/B Roaming-IR — that the handset seek to complete 911 calls using each technology already

36. We do note, however, that, as proposed, Automatic A/B-IR does present some concerns. As Alliance points out, one significant disadvantage of the proposal involves the length of set-up times.[48] For most 911 calls, which would be completed via the preferred carrier, the call set-up time should be no longer than for any other call. However, as described, the IR approach could lengthen set-up for calls not completed via the preferred carrier, in some cases by many seconds. The initial scan of the preferred carrier's system could require 6 to 12 seconds. Each additional scan could require an equal length of time. The algorithm as proposed would permit as many as three scans of the preferred carrier's control channels before seeking to complete the call with the non-preferred carrier. The total time for those four scans (three with the preferred carrier and one with the non-preferred carrier) could be up to 48 seconds, and additional time might be needed for other call set-up functions. Further, the algorithm treats a call as completed when the handset is in what is termed "Conversation State." However, at this stage the handset has not necessarily been connected with the wireless carrier or the 911 PSAP.

37. Several parties have argued in this proceeding that time delays in 911 call completions could confuse and frustrate callers and seriously hamper emergency assistance efforts.[49] Alliance contends that the usual time to connect a wireless call is from 4 to 6 seconds, and that studies have indicated that 10 to 15 seconds is the maximum length of time most callers will wait for a connection without attempting to redial.[50] Although Automatic A/B Roaming-IR would incorporate a method for providing feedback to users on the status of 911 call processing, and in most cases calls will be completed in the same manner as ordinary calls without additional delay, we remain concerned that this approach could result in excessively long call set-up times. Long delays in call set-up may induce callers in an emergency situation to sign off before the process has adequate time to run, even if the call could have been completed with the non-preferred carrier. Because the same call completion algorithm would be implemented for each new call attempt, callers might be repeatedly frustrated if they mistakenly interpreted the long set-up time as an indication that the call had failed. In effect, this would be an additional form of the "lock-in" problem. Such reductions in 911 call completion rates could undercut our first principle, improving 911 call completion rates so far as practicable, as well as the principle that the 911 call processing mode should address the lock-in problem in a reasonably effective way. Even if the caller persevered, any lengthy delay in completing emergency calls would also delay the dispatch of help.

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incorporated into the handset and each carrier available to it, and continue monitoring the voice channel to reinitiate the process if necessary — can be adapted to other technologies, as TIA suggests.

[48] *See, e.g.*, Alliance *Ex parte* Filing, Apr. 1 2, 1999, at 5.

[49] *See, e.g.*, Rural Cellular Association *Ex parte* Filing, Jan. 21, 1999.

[50] Alliance *Ex parte* Filing, Feb. 26, 1999, at 3.

38. Information from proponents of Automatic A/B Roaming-IR, indicate, however, that the duration of call set-up times, and in particular the length of time before the handset seeks to transmit the call via the non-preferred carrier, can be adjusted and reduced in several ways. Most obviously, the number of times the handset scans the preferred carrier's control channels can be limited to one or two attempts before the handset attempts to place the call with the non-preferred carrier. It may also be possible to reduce the length of time for each scan and for other aspects of the call set-up process.

39. Based on this record, we find it appropriate to require that Automatic A/B Roaming-IR meet two conditions to address this problem. First, as proposed, the handset must provide effective feedback to inform the user when 911 call processing is underway and has not finished. This could take the form of an audible tone or message in addition to a visual status report on the handset's screen. We recognize that this need for some form of feedback to the caller represents a disadvantage of the Automatic A/B Roaming-IR method because the feedback might encourage callers to continue with a call attempt that in the end will not be completed. Such a situation might delay callers from seeking help in another way. However, we expect that the feedback will generally be beneficial to callers in providing information that the handset is continuing to attempt to complete the 911 call. The time limits we discuss below will also reduce delays in testing all means of completing 911 calls. In addition, we anticipate that the nature of the feedback information can be improved over time by manufacturers and carriers based on actual operational experience.

40. Second, the IR algorithm should be such that, in any case, the handset would not spend more than a reasonable amount of time seeking to complete the call with the preferred carrier before reattempting the call with the other cellular carrier. In general, we expect that for the vast majority of calls, call set-up under IR will be no longer than usual, as the call is completed with the preferred carrier using the normal call set-up process. Further, where the preferred carrier provides no signal, calls should be quickly routed to the non-preferred carrier. But it is possible that in a small percentage of cases, call set-up could take much longer under IR as proposed, because the algorithm permits up to three attempts to complete the call with the preferred carrier before switching to the non-preferred carrier. This could lead callers to terminate 911 calls that eventually would have been completed. To minimize this possibility, while also allowing a reasonable period for initial call set-up to the non-preferred carrier, we conclude that a time limit should be placed on the initial attempt to set-up the call with the preferred carrier.

41. Taking into account the fact that the user will be receiving feedback information from the handset, we find that 17 seconds from the time the call is sent would be a reasonable and achievable maximum time period. In general terms, the handset should seek to complete the call with the non-preferred cellular carrier if the preferred cellular carrier has not successfully delivered the call to the landline carrier within 17 seconds after the call is placed.

The feedback information should reassure callers that they should continue waiting for this amount of time, so that abandonment of 911 calls that could have been completed should be very infrequent or nonexistent. The 17-second period is also generally consistent with the combined time periods for two basic call processing tasks that must be performed and completed if a call attempt is to be successful after the call is sent: in the first task, a handset waits up to 12 seconds to receive a voice channel assignment from a base station; in the second task, the base station waits up to 5 seconds[51] to receive a voice channel transmission from the handset.[52] Handset manufacturers may elect to set an even briefer period to further minimize 911 call set-up delays. Overall, under the modified IR algorithm, we expect that the great majority of 911 calls will be handled by the preferred carrier within normal call set-up periods and many of the remaining calls will be quickly transferred to the non-preferred carrier (when the preferred carrier has no signal). Calls to 911 should in almost all cases be completed in less than 15 seconds. For the relatively small fraction of calls not completed in this time, the handset will in any event seek to complete the call with the non-preferred carrier in no more than 17 seconds and continue this process until the call is completed, whenever that is possible. This time limit will also provide additional protection against any lock-in of calls, beyond 17 seconds, with the preferred carrier.

42. We also note that Automatic A/B Roaming-IR is currently under review by an industry standards body, TIA. As part of this review, we specifically request that TIA consider whether and to what extent the 17 second time limit might be further reduced in order to further minimize call set-up delays and lock-in. We encourage wireless carriers and mobile phone manufacturers to be active in addressing this request so that future revisions to industry cellular standards and generations of mobile phones provide for further reductions in call set-up delays for 911 calls where feasible. We look forward to receiving the results of TIA's review and will continue monitoring TIA's progress with respect to these issues. In the meantime, however, we stress that we are sufficiently satisfied that Automatic A/B Roaming-IR, as conditioned in this Order, meets our basic objectives and will serve to improve the

[51] *See* WILLIAM C. Y. LEE, MOBILE CELLULAR TELECOMMUNICATIONS 91 (1995).

[52] After a handset receives a voice channel assignment and begins transmission to a base station on that channel, Conversation State is reached. As noted, however, at this stage, the handset's voice channel transmission has not necessarily been received at the base station, and thus the handset may not necessarily be able to use the voice channel to communicate with the base station (and thence to the landline network). In establishing a time limit for delivering the call to the landline carrier, we are seeking to ensure that communication between the handset and base station on the voice channel goes beyond Conversation State and reaches the point where the handset's voice channel transmission is indeed received at the base station. It should also be noted that an earlier task, Initialization (3 seconds) will ordinarily be completed before the call is sent. *See* Office of Engineering and Technology Bulletin No. 53, "Cellular System Mobile Station - Land Station Compatibility Specification" (April 1981 ed.).

status quo regarding 911 call completion. For those reasons, we approve this method as one means of complying with our 911 call completion rules.

2. Adequate/Strongest Signal

a. Initial and Revised Alliance Proposals

43. The initial proposal submitted by Alliance was to route 911 calls using the "strongest signal." Under strongest signal, handsets would scan the forward control channels of both cellular carriers and select the carrier with the strongest control channel signal. The 911 call would then be routed using an assigned voice channel from this carrier for delivery to the PSAP. Under Alliance's proposal, strongest signal capability would be required for all new analog cellular phones and would be enabled as the default setting, but could easily be disabled by consumers choosing to do so.[53] Alliance supported its proposal with a series of technical reports prepared by the Trott Communications Group, Inc. These reports claim that the strongest signal would be especially beneficial in improving 911 call completion rates in rural and suburban areas.[54] By routing calls to the carrier with the strongest forward control channel signal, the reports contend, callers are much less likely to experience the "lock-in" problem, because the carrier providing the strongest forward control channel to the location will be more likely to be able to receive the handset's voice channel, especially from lower power portable handsets.[55]

44. In response, the public safety community and the wireless industry raised concerns that strongest signal would have unintended and adverse consequences. One concern is that strongest signal would increase blocking of 911 calls in areas where call traffic is heavy, for example in urban areas or at the site of an emergency incident.[56] Public safety groups reasoned that strongest signal would eliminate the carrier that has the weaker signal in a given area from processing any calls and force all 911 calls onto the network of the carrier with the stronger forward control channel, even where the signal of the other carrier is only slightly weaker (but still fully adequate) to complete calls.[57]

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[53] Alliance *Ex parte* Filing, Mar. 20, 1998, at 5.

[54] *See, e.g., Id.* at 3-4; Alliance *Ex parte* Filing, Sept. 17, 1998, "Trott Reports of Aug. 19, 1998," at 4.

[55] Alliance *Ex parte* Filing, Mar. 20, 1998, at 3: Alliance *Ex parte* Filing, Feb. 9, 1999, at 2-5.

[56] Call blocking issues are discussed in greater detail at paras. 51-53, *infra*.

[57] Public Safety *Ex parte* Filing, Feb. 23, 1998, at 1-2; *see* Wilkie, Farr & Gallagher *Ex parte* Filing, May 11, 1998, at 6-7.

45. In addition to concerns about blockage in urban areas, commenters also suggested that strongest signal would serve as a disincentive to carriers considering early deployment of Phase II ALI, because a carrier providing ALI service could not guarantee to its customers that it would be the carrier transmitting their 911 calls.[58] They also pointed out that a carrier providing early ALI capability might not offer the strongest signal at a particular location, so that the PSAP would not receive location information with the call even if the carrier could have provided an adequate voice signal and location information.[59] They also expressed concern that strongest signal will lengthen 911 call set-up times (by 4 to 18 seconds, delaying delivery of the call and possibly inducing callers to terminate the call and redial)[60] and, more generally, that reliance on strongest signal inflexibly and arbitrarily relies only on the single parameter of forward control channel strength to route calls.[61]

46. While Alliance claimed that these concerns were unfounded or outweighed by the benefits of strongest signal, it responded by submitting a significantly revised proposal, which we will term "Adequate/Strongest Signal."[62] Under this proposal, analog cellular 911 calls would be routed to the customer's preferred carrier if that carrier provides an "adequate" channel of communication as measured in the handset by its forward control channel signal strength. If the preferred carrier does not provide an adequate signal, the call would be routed to whichever analog carrier had the stronger forward control channel signal. Based on a technical study by Trott Communications, Alliance initially proposed that an adequate control channel signal be defined as one with a strength of at least -80 dBm.[63]

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[58] *See, e.g.*, TruePosition Additional Comments at 7-9; TruePosition *Ex parte* Filing, June 1, 1998, Attachments B, at 8-9; Corsair Additional Reply Comments at 3-4.

[59] Public Safety *Ex parte* Filing, Feb. 23, 1998, at 2-3.

[60] CTIA *Ex parte* Filing, May 20, 1998, Attachment 2. *See also* CTIA *Ex parte* Filing, Dec. 4, 1998, at 2.

[61] These issues are discussed at paras. 54 -56, *infra*.

[62] Alliance *Ex parte* Filing, Sept. 17, 1998.

[63] *Id.* at 1. The proposed measurement, dBm, is a variation of the decibel, a measure of signal strength, that uses a milliwatt as a reference. Specifically, dBm = 10 log P1/1mW, where P1 is the output power. If P1 is greater than 1 mW, dBm is a positive value. When P1 is below 1 mW, the dBm value is negative, and the weaker the signal, the more negative the dBm value becomes. For example, a signal of -80 dBm is stronger than one of -100 dBm. *See The Decibel and Some of Its Disguises*, Appendix I, Singer, Land Mobile Radio Systems, 2d ed., 1994 at 260.

47. The Commission sought comment on this revised proposal.[64] With the exception of Alliance and ICSA (a group of small cellular companies seeking Commission approval of cellular extension telephones),[65] all of the commenters continue to oppose strongest signal, even as modified. For example, public safety organizations continue to express concerns over the use of the strongest control channel signal as the sole criterion for determining the wireless carrier to handle 911 calls.[66] CTIA continues to assert that increased call blockage may occur.[67] In response to comments regarding the threshold signal strength,[68] Alliance later revised its proposed -80 dBm threshold to a weaker signal level of -85 dBm, which it suggested could be an interim standard pending further study.[69] In later comments, Alliance also proposes to give a range of choices, by requiring that handset manufacturers permit the consumer to select or change handset settings in increments of not more than 4Db to a minimum level of -100 dBm, in order to permit more calls to be routed to the preferred carrier if the consumer wishes.[70]

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[64] September 22 Public Notice.

[65] *See* Alliance Additional Reply Comments; ICSA Additional Reply Comments; *see also* ICSA *Ex parte* Filing, Oct. 6, 1998.

[66] Public Safety Additional Reply Comments at 1-6.

[67] CTIA *Ex parte* Filing, Dec. 4, 1998, at 3-4 (emphasis in original):

> [Based on Dallas and Atlanta field data submitted by the Alliance] strongest signal and adequate signal approaches result in 9-1-1 calls being processed by the non-preferred carrier approximately *50 % of the time*. . . . Because the strongest signal and adequate signal approaches will divert 9-1-1 calls that could otherwise be completed successfully by the preferred system, they *will cause congestion and blockage, both at the air interface and on the trunks linking the wireless carrier to the PSAP.*

According to CTIA, this result, based on a threshold gate of -80dBm, occurs because forward control signal strength is randomly distributed, so that when the preferred carrier is below the threshold in most instances so is the non-preferred carrier.

The Alliance claims that CTIA misconstrues its study, which concern "holes" in coverage and does not apply to the entire coverage areas. Using data from Los Angeles, the Alliance assumes that on average 78 percent of calls will be handled by the preferred carrier with a good channel of communication and 22 percent of the time there will be a problem in reaching 911 over the preferred system. Alliance *Ex parte* Filing, Feb. 26, 1999, at 4.

[68] *See, e.g.*, AirTouch Additional Comments at 4; RTG Additional Comments at 3-4.

[69] Alliance Additional Reply Comments at 9. *See* para. 65, *infra*.

[70] Alliance *Ex parte* Filing, Mar. 23, 1999. Alliance calls this approach "911 System Selection Process."

48. In the initial comment round of this proceeding, none of the comments opposing strongest signal contained the supporting engineering analyses we requested in the *E911 Second NPRM* to assess the technical feasibility of the strongest signal proposal. More recently, opponents of strongest signal have filed two technical studies as *ex parte* comments, a study by CTIA[71] and an analysis prepared for CTIA by eXpert Wireless Solutions, Inc.[72] These reports do not question several aspects of Alliance's proposal or of the reports prepared by Trott Communications supporting strongest signal. For example, the reports do not dispute and, in some cases, support the propositions that cellular systems contain coverage gaps, that these gaps are more likely in rural areas,[73] that portable handsets operating at lower power can lock onto a control channel but lack power to "talk back" to the cell,[74] and that implementation of strongest signal would have a minimal impact on equipment manufacturers.[75]

49. In addition, both reports conclude that strongest signal would have some benefits. The CTIA Study concludes that strongest signal is superior in light call traffic conditions, although only slightly.[76] The EWS Analysis similarly concludes that strongest signal clearly has the potential to provide emergency services to callers under some circumstances, which it describes as "very special."[77] The two technical studies do raise objections to strongest signal,

[71] CTIA *Ex parte* Filing, May 20, 1998 (CTIA Study).

[72] CTIA *Ex parte* Filing, June 3, 1998, Attachment, "Analysis of the "Strongest Signal Proposal" for Handling Cellular 911 Calls," by eXpert Wireless Solutions, Inc. (EWS Analysis).

[73] EWS Analysis at 5.

[74] Three public safety organizations did argue that the presence of a weak and inadequate preferred signal would not prevent a handset from switching to the non-preferred system under A/B, B/A, but presented no technical analysis in support of this claim or respond to Trott's response and explanation of the problem for low power, portable handsets. *Compare* Public Safety *Ex parte* Filing, Feb. 23, 1998, at 3 *with* Alliance *Ex parte* Filing, Mar. 20, 1998 at 3-5. Neither of the two later technical studies questions the accuracy of the Trott reports on the operation of portable handsets.

[75] EWS Analysis at 5.

[76] CTIA Study at 2.

[77] EWS Analysis at 6.

largely similar to those presented by the wireless industry and public safety organizations.[78] Our review of these concerns is presented in the following sections.

50. We stress here, however, that, although we agree with the commenters that the Adequate/Strongest Signal method has some disadvantages and may not increase the likelihood of 911 call completions in all cases, we conclude that there is sufficient evidence in the record to support the conclusion that Adequate/Strongest Signal will result in an overall improvement over the *status quo* with regard to the transmission of wireless 911 calls and otherwise satisfies our basic criteria for 911 call completion performance.[79]

b. Call Blocking

51. The CTIA Study seeks to compute call blocking probabilities, from a model based on various assumptions, and concludes that strongest signal would increase chances of call blocking when the system is busy.[80] This study addresses the earlier Alliance proposal, not Adequate/Strongest Signal, but even for the earlier proposal its results do not provide substantial grounds for concluding that increased call blocking is likely to be substantial. As Alliance points out, the premise that one carrier will handle all calls in these situations may be erroneous.[81] Alliance's studies conclude that in high density areas the signal strengths of the two cellular carriers tend to be nearly equal and the stronger signal changes from one carrier to the other over very short distances.[82] The EWS Analysis supports this view, claiming that in most metropolitan markets it is rare to see large regions where only one carrier has dominant coverage, and that, given the nature of signal fading in cellular environments, by moving the receiving antenna a few inches, the stronger signal will likely change.[83] This effect would tend to even out 911 call distribution and reduce blocking.

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[78] The CTIA Study, at 1, concludes that when call traffic is heavy or when many 911 calls need to be made due to the large scale of an emergency incident, a strongest signal policy may lead to catastrophe with an unacceptably high level of blocking. The EWS Analysis, at 6, argues that further analysis need to be done by subject matter experts such as those within TIA.

[79] *See* paras. 28-29, *supra*.

[80] CTIA Study at 1-5.

[81] *See* Alliance *Ex parte* Filing, June 3, 1998, at 1-2 (Alliance Response to CTIA Study).

[82] Alliance *Ex parte* Filing, Mar. 20, 1998, at 3.

[83] EWS Analysis at 3, 5.

52. Moreover, the extent to which any actual increased blocking in metropolitan areas would reduce the provision of public safety assistance is questionable. Many 911 calls from busy locations are duplicative reports about a single incident, such as an auto accident. If the first call gets through and additional calls are blocked there may be no loss of information. Indeed, Alliance asserts that 911 systems are designed to "choke" such redundant calls to prevent loss of access to 911 for other emergencies.[84]

53. Finally, concerns about increased blockage of 911 calls in high volume, urban areas should be further ameliorated under the revised Adequate/Strongest Signal approach. In contrast to the original proposal, the handset would first attempt to route all calls to a customer's preferred carrier. The only circumstance under which calls would be routed to the other cellular carrier is when the preferred carrier is providing only a relatively low power signal at the location of the call, such that it is less likely that the call could be completed at all. This is unlikely to happen frequently in the high volume, urban situations in which blockage is a likely problem.[85] Some increase in call blockage could occur in some cases, when the preferred carrier provides a forward control channel below the threshold gate and both carriers provide relatively similar or randomly distributed forward control channels. We believe this will be an uncommon situation and that any problems caused in this situation will be outweighed by the benefits of improved 911 call completion in many other cases, particularly in rural and suburban areas. Thus, assuming that the threshold gate level is set at an appropriate level, and we believe -85 dBm is appropriate, the record demonstrates that Adequate/Strongest Signal will produce higher 911 call completion rates overall and with little, if any, increase in call blockage when systems are busy.

c. Reliance on Forward Control Channel Signal

54. Concerns are also raised that selecting the strongest control channel signal may not always deliver the strongest voice channel or, in some circumstances, any voice channel at all. For example, while the EWS Analysis concurs with the Trott studies that the signal strength of a control channel is designed to be less than or equal to that of the associated voice channel coverage from the same cell site, it asserts that the strongest signal on the forward control channel "does not always ensure increased probability of access to the system and assignment of a voice channel."[86] Public safety groups suggest that the strongest control

[84] Alliance Response to CTIA Study at 3.

[85] For example, the EWS Analysis submitted by CTIA states that "[i]n most metropolitan markets where competitive market forces dictate substantial coverage in the entire area, it is very rare to see large regions where only one carrier has dominant coverage." EWS Analysis at 5.

[86] EWS Analysis at 4.

channel will not always deliver the strongest voice channel because, if a voice channel is not available, the cellular phone will be redirected to another sector or cell site which may produce a weaker voice channel than the one assigned by a weaker forward control channel from the other carrier.[87]

55. We conclude that the fact that the control channel signal strength is engineered to be less than or equal to that of the associated voice channel signal strength from the cell site provides a reasonable degree of confidence that the strongest signal approach will generally improve 911 call completion. If the phone locates the strongest forward control channel, it will also have identified the highest minimum power level for an available voice channel. The identification of this channel should increase the chance that the 911 call will be completed. While it is possible that the cell site with the strongest control channel signal will not have a voice channel available, any such redirected calls should normally be handed back to the closer cell as channels become available. As in our evaluation of the Automatic A/B Roaming-IR proposal, in evaluating this and other technical issues, the relevant question is not whether Adequate/Strongest Signal provides a final and perfect solution but whether it improves 911 call completion and the public safety. We believe the record indicates that use of the forward control channel pursuant to the Adequate/Strongest Signal method does represent an improvement in 911 call completion modes in some important cases where calls might otherwise fail.

56. Commenters also assert that basing carrier selection only on the forward control channel strongest signal, even as a backup call completion method under the Adequate/Strongest Signal approach favored by Alliance, ignores other important parameters in call completion and is not reliable as a single predictor of adequate communications.[88] Although we recognize that there may be certain circumstances where the use of the forward control channel signal under the Adequate/Strongest Signal method would not complete a call that might be completed using a different methodology,[89] we also recognize that the nature of radio transmission through the use of current technology means that no solution will guarantee 911 call completion in every theoretical situation. Our goal is to introduce technologies that will meaningfully increase 911 call completion. As we read the current record, Adequate/Strongest Signal, even though it is subject to some disadvantages in certain

[87] Public Safety *Ex parte* Filing, Feb. 23, 1998, at 2. *See also* Wilkie Farr & Gallagher *Ex parte* Filing, May 8, 1998, at 7.

[88] Public Safety Additional Reply Comments at 4; EWS Analysis at 3-5.

[89] Routing calls by the signal strength of the forward control channel is a component of the current industry standard and has been used for many years. The comments do not identify any concrete, actual problem or drawback to extending its application to 911 call selection.

situations, should improve 911 call completion in keeping with the five criteria for improvements in 911 call completion performance that we have established.[90]

d. Cost Effectiveness of Alliance Proposal; Deployment of E911 Features

57. Some comments claim that a strongest signal mandate has not been shown to be cost effective.[91] We do not agree. Alliance has consistently explained that implementation of strongest signal would require only changes in handset software that could be quickly and inexpensively implemented.[92] This explanation is logical and persuasive. Software changes in handsets should not require substantial increases in prices or costs and, to the extent they provide greater safety and security to consumers, will increase value. In addition, throughout the several rounds of pleadings on these issues and extensive *ex parte* filings in which wireless handset manufacturers and their trade associations have participated, none has disputed that any cost increases would be minor. For example, Motorola filed reply comments in response to the September 1998 Public Notice and did not suggest that the Adequate/Strongest Signal proposal would impose significant increased costs.[93] In a recent *ex parte* submission, the cost of handset modification is estimated at about six cents per handset.[94]

58. Some comments also raise concerns that Adequate/Strongest Signal will diminish the benefits or disrupt the deployment of E911 features.[95] For example, some suggest that it would increase the number of calls the switch cannot validate and for which the switch cannot provide Phase I call back information.[96] We do not believe this is a problem, however, because our rules instruct carriers to forward all 911 calls without respect to their validation processes, which might block or delay them.[97] In addition, WEIAD is studying the cost of an

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[90] *See* paras. 28-29, *supra*.

[91] *See, e.g.*, True Position Additional Comments at 6.

[92] *See* Trott Communications Group Report, Aug. 19, 1998 at 6.

[93] *See* Motorola Additional Reply Comments at 2-3.

[94] Wireless Consumers Alliance *Ex parte* Filing, Apr. 27, 1999, attaching "Opinion on Implementation of 911 Call in Analog Cellular Systems," prepared by Giordano Automation Corp. on Apr. 26, 1999.

[95] *See, e.g.*, TruePosition Additional Comments at 7-9; Corsair Additional Reply Comments at 3-4.

[96] *See, e.g.*, EWS Analysis at 6; Public Safety *Ex parte* Filing, Feb. 23, 1998, at 3.

[97] Section 20.18(b) of the Commission's Rules, 47 C.F.R. § 20.18(b).

apparently effective method of producing call back information for all calls, even those from handsets that lack valid numbers or are registered with other carriers.[98]

59. Other comments argue that Adequate/Strongest Signal, like the original strongest signal proposal, will discourage early deployment of Phase II ALI and in some cases route calls away from carriers who provide it.[99] With respect to the possible discouragement of Phase II ALI deployment, the claim is that, if customers cannot be assured that their emergency calls will be routed to their preferred carrier, then the carrier will have less incentive to introduce ALI and promote it to those customers.[100]

60. Under the Adequate/Strongest Signal approach, however, all calls would in fact be routed to the caller's preferred carrier whenever that carrier provides the specified signal level. Thus, the handset would, in the first instance, attempt to place the call over the preferred carrier, which would be providing whatever E911 features were marketed to the customer. The strongest signal backup mode would be employed *only* when signal strength is relatively low. In those circumstances, use of the strongest signal approach, in our view, would help increase the chances that the call would be completed, even if ALI might not be provided. The crucial first step in receiving emergency help is completing at least one 911 call that alerts the PSAP to the fact and nature of the emergency. Location capability is not valuable to the caller or the PSAP if the call does not go through. Thus, improving the rate at which emergency incidents are reported to PSAPs is a primary public safety goal. The real benefits of the Adequate/Strongest Signal as a backup method in improving 911 call completion over the long term thus outweigh the temporary effects it might have on ALI competition.

e. Call Routing Problems; Call Set-Up Times; Additional Technical and Other Issues

61. One comment suggests that when the caller is near system borders the system with the stronger control channel may transmit calls to a more distant PSAP, rather than the PSAP serving the caller's location.[101] Initially we note that any such routing problem should be resolved when ALI is introduced to provide more precise locations that can be used for selective routing to PSAPs. Even before then, however, it appears that the Adequate/Strongest Signal approach may, in certain circumstances, improve, rather than

[98] WEIAD Report to the Commission, Jan. 30, 1998.

[99] *See, e.g.*, TruePosition Additional Comments at 7-9; Corsair Additional Reply Comments at 3-4.

[100] *See, e.g.*, TruePosition Additional Comments at 7.

[101] USCC Additional Comments at 2.

degrade, routing. Routing calls to the carrier with the strongest signal rather than to the preferred carrier, in cases where the preferred carrier's signal falls below the threshold, would appear more likely to route the call to a nearby cell site that would then transmit the call to the PSAP serving the cell site location. It is not clear that it would result in worsening the routing problems that currently exist because of the vagaries of radio transmission and local geographies. Moreover, as we have stressed, the first priority is to maximize 911 call completion, so that the emergency can be reported. Unless more calls are completed, the increase in calls located will be limited.

62. The comments also raise several technical issues regarding Adequate/Strongest Signal. One comment suggests that its use would increase call set-up times by 4 to 18 seconds, causing users to abort the call attempt and redial.[102] However, this claim appears to be based on the mistaken premise that carriers will apply their validation procedures to the call as they would to calls from roamers. In fact, carriers should not apply validation procedures to 911 calls[103] and the actual delay should be more in the range of a few seconds.

63. BAM suggests that it is not possible to measure forward control channel signal strengths without taking averages of each of the 42 such channels for a duration of 1 to 5 seconds per channel. Thus, it contends that meaningful, accurate measurements could take minutes and these measurements could change in that time.[104] The Adequate/Strongest Signal proposal, however, uses the normal call set-up process of searching for the strongest control channel of the preferred carrier, and accepts that channel if it is above the threshold gate level. If not, it searches for the strongest control channel for both carriers. Alliance claims that scanning of 21 control channels takes 50 milliseconds, not 1 to 5 seconds per channel, and thus requires only brief extension of the call set-up time.[105] While it might be theoretically desirable to take average readings over longer periods, this has not been found necessary for other calls and Adequate/Strongest Signal represents only a relatively minor variation in the normal, established method of routing cellular calls. Whatever its theoretical limitations, this call completion mode is a practical, effective method that should work equally well under Adequate/Strongest Signal to improve 911 call completion.

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[102] AWS Additional Comments at 2. *See also* SBC Additional Comments at 2; CTIA Additional Comments at 4.

[103] *See* note 97, *supra*, and accompanying text.

[104] BAM Additional Comments at 2-3.

[105] Alliance *Ex parte* Filing, Jan. 13, 1999, at 2.

64. One commenter also suggests that if the signal of the preferred carrier is below the threshold gate, there is no guarantee that the other cellular carrier would be able to handle the call.[106] This comment appears based on a misconception about how Adequate/Strongest Signal would operate. If the preferred carrier's signal is below the threshold, the call would not automatically be switched to the second carrier but would be switched to whichever carrier provides the strongest signal, whether that is the preferred carrier or the other cellular carrier.

65. Some comments also question the use of -80 dBm initially proposed by Alliance as the threshold gate. RTG states that customers tolerate much lower signal levels and suggests that a threshold of -92 dBm would be more appropriate.[107] Others argue that even signals stronger than -80 dBm may not always produce a usable signal on the assigned voice channel. AT&T suggests that any "bright line" signal strength definition would necessarily be both under-inclusive and over-inclusive because of differences among systems, geographies, and equipment.[108] AirTouch states that, according to its expert, the 9 dB margin for attenuation that was used to calculate the -80 dBm threshold is not justified because any signal attenuation is already included in the received signal level.[109] Alliance replies that all commenters on this issue agree that the appropriate threshold is somewhere between -80 and -92 dBm. In response, it proposes an interim standard of -85 dBm, subject to further review by a standards body.[110] We believe that there is a range of signal levels that would be appropriate for use as a threshold signal gate. We also conclude that Alliance's revised proposal of a -85 dBm threshold is a reasonable one, as is its proposal that this be considered an interim figure subject to further study and, if necessary, modification.[111]

66. CTIA also claims that use of Adequate/Strongest Signal "would most likely require all CMRS handset manufacturers to utilize a patented technology" and would violate an alleged Commission policy against selecting standards based on a single patent.[112] It is important to keep in mind that we are *not* concluding that the Adequate/Strongest Signal

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[106] BAM Additional Comments at 4.

[107] RTG Additional Comments at 3.

[108] AT&T Additional Comments at 4.

[109] AirTouch Additional Comments at 4-5.

[110] Alliance Additional Reply Comments at 9.

[111] *See* para. 47, *supra*.

[112] CTIA *Ex parte* Letter, Nov. 12, 1998.

method is the *exclusive* means by which our basic principles can be satisfied.[113] We are endorsing in this Order two other methods for satisfying these basic principles, and we also anticipate that other methods could be developed in the future. Thus, no manufacturer or carrier is required to employ any specific patented technology. [114]

67. Overall, we are approving Adequate/Strongest Signal as one of the means by which carriers can comply with our rules to improve 911 call completion because we believe this record demonstrates that, although Adequate/Strongest Signal is not free from disadvantages in some situations, it generally satisfies the criteria for a reasonable 911-only call completion method. It switches 911 calls to the non-preferred carrier when the preferred carrier is less likely to be able to complete them, but seeks first and primarily to complete calls via the preferred carrier. In particular, we conclude that Adequate/Strongest Signal is likely to improve 911 call completion in rural and suburban areas for portable phones.[115] It appears to provide a reasonable and effective method of substantially reducing the lock-in problem, though it remains possible that 911 calls will not be completed, in cases where the selected carrier has no channels available. In those cases, the customer should be notified by a system busy signal to terminate the call and try again.

68. This is not to say, of course, that Adequate/Strongest Signal is a perfect or ultimate solution to 911 call completion problems. Because this method relies solely on the forward control channel to route and complete calls, it is possible that it will in some cases deliver calls to a carrier that is unable to complete the call, because other aspects of call setup prevent call completion. In such cases, the same problem could then reoccur if the caller terminates the first call and dials 911 again, because the same routing procedure would be followed. It is also possible that Adequate/Strongest Signal might increase call blockage in some situations, specifically in urban areas where both carriers provide relatively low forward control channel signal levels, below the -85 dBm threshold gate, and the strength of those

[113] *See* paras. 28-29, *supra.*

[114] We also note that the claimant to the strongest signal patent, as identified by CTIA, has given representations that the patent would be made available on reasonable terms and conditions without unfair discrimination, should any manufacturer choose to use technology within the scope of the patent. Alliance *Ex parte* Letter, Mar. 8, 1999, at 3; Zicker Letter to CTIA, Nov. 10, 1998, filed as an *ex parte* submission, Nov. 20, 1998. These representations are consistent with the arrangements the Commission has endorsed in cases involving patented technology. Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service, 6 FCC Rcd 7024 (1991); Revised Patent Procedures of the Federal Communications Commission, Public Notice (Dec. 1961), *reprinted*, 3 FCC 2d 26 (1966).

[115] Alliance calculates from the CTIA Study that the strongest signal approach would improve 911 access by as much as 13.5 percent in suburban areas and 18.3 percent in rural areas. Alliance *Ex parte* Filing, June 3, 1998, at 4.

signals is relatively evenly distributed. The -85dBm threshold gate, though reasonable, is to some extent arbitrary and may not be optimal in all cases. It may, for example, route calls to the non-preferred carrier in cases where the preferred carrier could provide a usable and acceptable voice channel. Adequate/Strongest Signal also operates only during call set-up and does not help maintain calls or reattempt them if the call is disrupted. These limitations, however, do not in our view, and on this record, override the general improvement in 911 call completion that Adequate/Strongest Signal should provide in comparison with current methods. Overall, however, we find that it will substantially improve 911 call completion and otherwise satisfies our criteria for an acceptable 911 call completion mode. Accordingly, we approve its use by handset manufacturers as a method of complying with our rules.

3. Selective Retry

69. In its additional comments to the September 22, 1998, Public Notice, BAM proposed an additional 911 call completion mode, called Selective Retry, which it says would encourage one-button access to 911 service without the problems created by Alliance's Adequate/Strongest Signal proposal. BAM describes its proposal this way:[116]

> In this approach, wireless 911 calls will be handled by the subscriber's carrier, except where the mobile handset cannot access that carrier or where the quality of the voice communications is unsatisfactory to the subscriber. Where the handset cannot set-up the call at all, the phone would be programmed to search for an alternative carrier. If call set-up is accomplished on the subscriber's carrier, but the voice quality is inferior, the subscriber would be able to press the 911 button and the mobile handset will automatically complete the call on the non-preferred system. At least one manufacturer has developed handsets which have similar capabilities.

BAM claims that this solution will provide increased assurance of access to emergency help, but only when an alternative is truly needed, and that it has the advantage of working on both analog and digital cellular systems.[117]

70. This proposal did not receive much attention from other commenters. Ameritech opposed the BAM proposal as well as a variation of Automatic A/B Roaming proposed by AT&T. Ameritech objected that the proposal (1) placed new regulations only on analog cellular equipment, allegedly a violation of Commission goals of regulatory parity; (2) by requiring the addition of a button to handsets, likely would make the handsets more

[116] BAM Additional Comments at 5.

[117] *Id.* at 6.

cumbersome for persons with disabilities, contrary to Section 255 of the Communications Act;[118] and (3) the carrier might face litigation risks without liability limitation if the caller attempts to hold the subscriber's carrier liable, even though the 911 button may have been pressed and the call transferred to a different system, but the carrier may not be able to prove that the button had been pressed.[119]

71. None of these objections has merit, in our view. The rule we are adopting today for improving 911 call completion applies only to analog cellular because it is only for that technology that workable approaches have been presented. We sought comment on improving 911 call completion for other technologies and services but neither Ameritech nor other parties have presented workable methods for cases other than analog cellular. This does not, in our view, justify postponing action where emergency 911 service can in fact be improved, because that improvement cannot be applied universally. The improvements we are adopting will improve public safety to the extent that such improvement is currently feasible.

72. The claim that adding a 911 button to handsets will make them more cumbersome for persons with disabilities is also unpersuasive, and in fact the reverse seems more likely to be the case. A single button for emergency calls would make it easier and quicker to call 911, which should be a particular benefit for any person with disabilities for whom dialing a handset is difficult. Moreover, if a person with disabilities does prefer a handset without a 911 button for some reason, the rule we are adopting fully accommodates that choice. This rule permits the use of any of three current 911 call completion methods. We also anticipate that other future methods would qualify for approval.

73. Finally, the theory advanced by Ameritech regarding how a 911 button might create litigation risks is also unpersuasive. Improving 911 call completion methods will reduce the likelihood that 911 calls will fail, and thus should also reduce the potential for litigation concerning such failed calls. Ameritech also provides no explanation for why the carrier would not have call records that would permit the identification of 911 calls initially placed with a preferred carrier but switched by the caller to the other cellular carrier. Wireless carriers generally compile detailed data for each call attempt and it is not clear why they would be unable to identify 911 calls that had been switched to the other carrier, or why the other cellular carrier's records would not identify its role in handling the call. PSAPs also can identify the carrier delivering the call from the trunk groups over which the call is transmitted to them. Overall, we find no substantial basis for concluding that misidentification of the carrier handling a call rerouted because of use of a 911 button, or

[118] 47 U.S.C. § 255.

[119] Ameritech Additional Reply Comments at 1-3.

indeed of any other method to reroute calls to a non-preferred carrier, will cause unfair litigation risks for carriers.

74. Our own review and analysis of Selective Retry leads us to conclude that it is a viable method of improving 911 call completion. Selective Retry should be simple and inexpensive to add to handsets because it uses program modes that are currently available and a separate button already available on some handsets; it should also not disrupt or otherwise interfere with network or emergency response operations. It also appears that use of this method should be readily available to all handset manufacturers. And no commenters suggest that Selective Retry would be costly or otherwise problematic to implement.

75. Selective Retry initially uses the A/B, B/A program, which, as we discussed above,[120] routes calls to the preferred carrier unless that carrier provides no signal. In the latter event, the call would be routed to the other cellular carrier. What Selective Retry adds is the ability for a caller to route a call to the other carrier if and when the caller judges this to be necessary. Use of Selective Retry could occur both during call set-up and after a caller is in conversation. At a minimum, we believe that it should be made available as a third 911 call set-up procedure manufacturers can incorporate in handsets (the others being Strongest /Adequate Signal and Intelligent Retry). If Selective Retry is available in handsets, it will enable callers to route a 911 call to the other carrier if and when a call is taking too long to be completed; and this will effectively eliminate the lock-in problem that can occur in such instances. We also believe that Selective Retry has merit as an option that should be available to a caller once he or she is in conversation (this might occur if, for example, the voice quality of either the calling party or the called party is considered to be unsatisfactory). We therefore suggest that manufacturers employ Selective Retry as an procedure that can also be invoked by a caller after call set-up has taken place and conversation is underway.

76. Selective Retry may have drawbacks in the eyes of some customers. It is a manual, rather than an automated system, and may depend more than other modes on the caller's knowledge and awareness of the right way to use it in an emergency. On the other hand, the only activity required by the calling party, if they are having difficulty completing a 911 call or receiving a usable voice channel, is to push the 911 button, which customers may typically do in an attempt to complete or reattempt a call. If the caller is using a handset with a 911 button, a redial would shift them to the other carrier's network, thus avoiding the "lock-in" problem.

77. Handsets with 911 buttons may also seem vulnerable to accidental, false alarm calls. We are aware, for example, that a recent E911 Phase II trial in Los Angeles found, unexpectedly, that many wireless 911 calls were made inadvertently, when a handset on a belt

[120] *See* para. 23, *supra*.

or in a pocket was bumped.[121] In fact, though, a dedicated 911 button could, if properly designed, help address this problem. Accidental dialing of 911 now probably occurs when the user has programmed the handset to dial 911 with a single speed-dial button, so that only a single button must be pushed to dial the call. We believe that, once alerted to this problem, handset manufacturers will be able to design 911 buttons that are much less vulnerable to accidental dialing.[122] To the extent that effective designs are put in service, users will no longer need to program a speed dial button to dial 911 quickly, which should help reduce accidental dialing of 911. While we are not adopting specific requirements for 911 buttons, we encourage manufacturers to consider and address this issue in their designs. If necessary, we are prepared to adopt specific rules to reduce accidental 911 calls, in order to assist the public safety organizations which must process such calls. It is our hope, however, that regulatory action will prove unnecessary, once manufacturers are alerted to this problem.

4. Comparison and Application of the Approved 911 Calling Modes

78. Our approval of these three different procedures for improving 911 call completions and the quality of 911 transmissions recognizes that each should be successful in realizing these improvements, that each approach also has advantages and limitations that may affect its desirability for particular customers, and that each may display unanticipated advantages and disadvantages in actual practice.

79. Automatic A/B Roaming-IR may more frequently route calls to the preferred carrier. It also continues to seek to complete a call if a busy signal is encountered and monitors the voice channel to automatically reinstate the call if it is interrupted. These features should more reliably promote eventual completion of 911 calls than current modes or other alternatives. Automatic A/B Roaming-IR should in most cases complete 911 calls with little or no added delay and quickly route calls to the non-preferred carrier if the preferred carrier provides no signal. The 17 second time limit for the initial call attempt with the preferred carrier will further limit such delays when the call cannot be handled by the preferred carrier for other reasons as well as limiting possible lock-in problems. Nonetheless, Automatic A/B Roaming-IR may generate longer set-up times in some cases and permit calls with lower voice quality than might be provided by the non-preferred carrier. By quickly seeking to complete calls to either cellular carrier when the preferred carrier provides a relatively weak signal, the Adequate/Strongest Signal mode may more quickly route calls to

[121] Los Angeles County E9-1-1 Wireless Trial, Preliminary Draft Project Report, at 69-70.

[122] For example, the button could be concave rather than convex, and recessed into the body of the handset. This would both reduce the chance that it would be bumped and better identify this unique function. No doubt other design solutions can be devised.

the non-preferred carrier in rural areas where dead spots or weak signals are more common. But this mode may also route some calls to that carrier that might have been completed adequately via the preferred carrier and fail to complete calls routed to a carrier that has no available channels. In the latter case, the caller might even experience another type of "lock-in," because once the strongest signal algorithm selects a carrier, the caller is stuck with that carrier and may not even be able to access the other carrier by redialing. Adequate/Strongest Signal also does not monitor the call after setup. Selective Retry may appeal to callers who prefer to control the call routing process themselves and to have a quick, reliable way to reroute 911 calls, but may not appeal to users who prefer more automatic call routing. These are matters of handset and system operation, as well as of customer preference, that do not have a single clear answer. Moreover, new or revised approaches may present different choices and trade-offs.

80. Acceptance of these three reasonable and effective approaches will, we believe, achieve our goal of improving public safety by increasing 911 call completion rates, while also giving customers, manufacturers, and carriers opportunities to select 911 call completion modes that best suit their needs and preferences. It should also further our policy of technological and competitive neutrality in a way that encourages development of improvements in these platforms, and of new methods, which may be submitted for approval by the Wireless Telecommunications Bureau on delegated authority. Deployment of different approaches should also provide instructive real-world experience that may guide future research and development.

81. In *ex parte* comments, the Alliance suggests that, if we approve both Adequate/Strongest Signal and Automatic A/B Roaming-IR, we also require that handset manufacturers offer both choices in each handset.[123] Alliance claims that wireless carriers, which purchase over half of all handsets for their customers, would create barriers to keep consumers from using the Adequate/Strongest Signal approach unless both alternatives are built into the handset, accompanied by a notice inside the handset case and on the display screen to inform consumers, and possibly additional forms of notice.[124]

82. We do not believe that requiring handset manufacturers to provide more than one acceptable 911 call completion mode is warranted. Such a requirement would likely add cost and complexity to handsets in order to offer multiple 911 calling modes even where the user would generally be expected to choose and use only one. As additional acceptable 911 calling methods are developed, such costs and complexity could increase unpredictably.

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[123] Alliance *Ex parte* Presentation to J. Knapp, Chief, Policy and Rules Division, FCC Office of Engineering and Technology, Mar. 23, 1999.

[124] *Id.* at 2, 3.

While our rules do not bar manufacturers from electing to incorporate more than one calling mode, or some combination of modes, if that is a cost-effective design and marketing solution, we do not believe there is a clear public interest reason for the Commission to mandate that result. Implementation of any one of the 911 calling modes that we approve in this Order would improve 911 call completion, and it is not apparent that requiring multiple 911 calling modes would improve public safety over simply allowing customers to purchase handsets with the mode they prefer.

83. We are also unconvinced by Alliance's claims that customers will not in fact have a real choice, because carriers dominate the handset market and have an economic incentive to select an alternative that limits the number of 911 calls, particularly from non-subscribers, who present a higher risk of liability.[125] First, while carriers are major distributors of handsets, there are other sales channels available to customers (*e.g.*, consumer electronics stores) and many customers make use of these alternatives. According to one study, direct sales from carriers account for about 24 percent of cellular sales and sales by agents about 25 percent. Other sources, such as specialized communications stores and a wide range of other retailers provide about 44 percent of handsets, while resellers represent about 5 percent.[126] Second, we do not find convincing Alliance's assertion that carriers routinely attempt to minimize the number of 911 calls they handle and therefore will seek to implement the least effective of the alternative 911 calling modes. Wireless carriers in 1998 delivered approximately 98,000 911 calls a day to public safety agencies, which represents a ten-fold increase over the last decade. While carriers and this Commission sometimes differ on specific issues concerning the best means of implementing 911 service, we see no evidence that wireless carriers have been systematically attempting to reduce the availability of their networks for 911 calling. Indeed, the data cited above suggests the opposite. In addition, given the importance of security and safety to their customers, such a carrier strategy would be surprising and likely ineffective in the marketplace. Finally, Alliance's arguments seem to assume that Adequate/Strongest Signal is clearly the best alternative for improving 911 call completion in all cases. For the reasons indicated above, the record does not support this conclusion. We anticipate that each of the acceptable 911 calling modes will provide improved 911 call completion rates, though the levels may vary in different circumstances.[127]

84. Finally, Alliance's option of allowing consumers to select the threshold signal strength levels, at steps no greater than 4dBm to a minimum of -100 dBm could require

[125] *See id.* at 2; Alliance *Ex parte* Filing, Feb. 9, 1999, at 7.

[126] The Strategis Group, US Cellular 97 Marketplace, at 175-77, filed as part of CTIA *Ex parte* Filing, Apr. 20, 1999.

[127] *See,* para. 78 , *supra.*

elaborate consumer information efforts without any clear benefit in improving 911 call completion. We have no information, for example, that this choice of forward control channel levels would be useful to customers in improving the likelihood that their 911 calls would be completed or that it would provide other advantages. It could, however, pose daunting technical issues for any purchaser or user of an analog handset and the notices associated with it would seem as likely to alarm as inform. The proposed option also does not represent, in our view, a full alternative to the other 911 call completion methods. It would not provide the continuing call monitoring of Automatic A/B Roaming-IR or the user control of Selective Retry. We decline to require this option or to adopt it as the only acceptable 911 call completion mode.

E. Analog Operation of Dual and Multi-Mode Handsets

85. Public safety organizations cite market studies to project that about 37 million new dual-mode, digital-preferred handsets will be sold within the next three years, and only 10 million purely analog handsets.[128] They reason that it is thus important that an improved 911 calling mode, such as Automatic A/B-IR, be included in dual-mode or multi-mode handsets with analog cellular capabilities.[129] CTIA indicates that the feasibility of including Automatic A/B Roaming to the analog portion of dual-mode and multi-mode handsets has only recently been raised and handset manufacturers are still investigating whether it can be applied and whether it would add complexity and require redesign of such handsets.[130]

86. We see no reason why dual-mode and multi-mode handsets when operating in the analog mode cannot and should not be subject to the same 911 call completion principles and rules as analog-only handsets. The analog functions of these handsets are otherwise subject to the same standards and rules and we believe that should continue to be the case in this critical area. Certainly, these more technologically advanced handsets should not be subject to an obsolete rule that will permit them to operate in ways that reduce public safety, both for their users and others on whose behalf "Good Samaritan" calls may be placed. We also are not aware of any clear reason why such upgrades cannot be implemented for these handsets as well as for analog-only handsets. Accordingly, we will adopt the same rule and schedule for all handsets that operate in the analog cellular modes, including dual-mode and multi-mode handsets when they are operating in the analog cellular mode. Dual and multi-mode handsets may operate in a digital mode in routing 911 calls, but when the handset operates in analog mode, it should do so in compliance with the rules we are adopting today.

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[128] Public Safety Additional Reply Comments at 7-8.

[129] *Id.* at 2-3.

[130] CTIA *Ex parte* Filing, Dec. 4, 1998, at 3.

F. Implementation Schedule; Further Improvements in 911 Call Completion

87. To allow a reasonable time for cellular handset manufacturers to comply with these requirements to implement a separate 911 call menu that includes an approved 911 call completion mode, we will establish a deadline nine months from the adoption date of this Order. The Alliance proposed a six month deadline. We are concerned, however, that this deadline might not allow adequate time for product and standards development or for thorough testing, a period that we understand is typically about 3 months. The wireless industry has stated that Automatic A/B Roaming-IR would require a "relatively minor change to the phone's programming" that it believed would be "relatively easy to begin to manufacture — and therefore could be accomplished expeditiously."[131] Although the wireless industry in fact requested a 12 to 18 month period to incorporate the proposed features into new handsets, apparently to conform with manufacturer product cycles, we believe this would be unnecessarily long in view of the important public safety needs involved here and the relatively minor changes in handsets which the industry concedes would be required. A nine month deadline should allow manufacturers to make the programming changes in handsets, test the updated handsets, and revise the handset manuals. While it may require them to accelerate planned product cycles in some cases, we believe this can be accomplished and is justified by the public safety benefits to consumers. We also believe the nine month period will allow carriers and PSAPs sufficient time to plan for changes in 911 calling patterns and make any other needed adjustments.

88. We will implement this rule through an equipment manufacturing requirement and our equipment authorization process. As of the date nine months from the adoption date of this Order, any mobile unit manufactured with analog cellular capability will be expected to incorporate at least one approved 911 call processing mode, as we have described them herein. Any application for equipment authorization of an analog cellular telephone submitted six months after the adoption date of this Order must include a statement and a description of the approved 911 call processing method used by the device. We will consider the incorporation of modifications to existing authorized equipment to be Class I permissive changes that do not require a filing with the Commission.[132] This means, for example, that if the unit includes the Automatic A/B Roaming-IR mode, it will satisfy conditions such as the 17 second maximum time allowed before attempting to complete the call with the non-preferred carrier and the requirement that the unit provide feedback to the user. Similarly, units incorporating Adequate/Strongest Signal shall employ the -85 dBm threshold gate, at

[131] CTIA *Ex parte* Filing, Feb. 19, 1999, at 3.

[132] *See* Section 2.1043(b) of the Commission's Rules, 47 C.F.R. § 2.1043(b).

least as an interim level, as proposed by the Alliance. Manufacturers or carriers wishing to incorporate new or modified 911 call processing modes may submit such requests to the Wireless Telecommunications Bureau, and we delegate authority to the Bureau to act on such requests.

89. In setting this requirement and adopting this schedule, we are in no way seeking to conclude consideration of 911 call completion improvements. We recognize that the steps we are taking today, though important, are in some ways, small ones. They only apply, for example, to analog cellular service, not to the rapidly growing digital cellular, PCS, and SMR services. Even for analog cellular, our decision only addresses situations where at least one of the two cellular providers provides an adequate signal and is only likely to improve 911 call completion by about 13 to 18 percent in suburban and rural areas, according to Alliance's data. This might not seem a major improvement, but it should mean that each year lives will be saved that would otherwise have been lost, because help arrives more quickly. Some parties consider that tower siting issues are a more important root cause of 911 coverage gaps and argue that we should address those first.[133] Without minimizing the importance of tower siting issues, we believe that we should pursue whatever approach efficiently and effectively helps improve the ability of wireless phones to contribute to public safety. These are not mutually exclusive solutions to improving 911 call completion.

90. We continue to encourage other efforts to improve wireless 911 call completion. For example, we encourage groups such as standards bodies to consider improved 911 call completion approaches for other technologies and services. We do not believe, however, that we should delay taking action to await further review of these or other issues by standards bodies or other groups. If new information or improved methods of completing 911 calls are developed, we stand ready to take the necessary steps to implement them. We encourage carriers and manufacturers to act voluntarily, based upon the objectives we have stated in this Order, to extend 911 performance improvements. One important step would be to expand the application of these improved 911 calling methods to digital services, such as digital cellular and PCS. We encourage manufacturers, standards bodies, and others to explore and develop methods of improving 911 call completion for these services, for example by expanding the Automatic A/B Roaming approach to permit routing 911 calls via other technologies and carriers when necessary. Actual deployment of handsets with improved 911 call completion capabilities should provide valuable information to consider such further improvements.

[133] *See, e.g.*, Wilkie Farr & Gallagher *Ex parte* Filing, May 11, 1998, at 3.

V. PROCEDURAL MATTERS

A. Regulatory Flexibility Act

91. As required by Section 603 of the Regulatory Flexibility Act, the Commission has prepared a Final Regulatory Flexibility Analysis of the expected impact on small entities of the changes in our rules adopted herein. The Final Regulatory Flexibility Analysis is set forth in Appendix C.

B. Paperwork Reduction Act of 1995 Analysis

92. This Order contains proposed or modified information collections. As part of its continuing effort to reduce paperwork burdens, we invite the general public 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. 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.

The Commission is seeking emergency approval of these burdens from the Office of Management and Budget (OMB). Written comments by the public on the proposed or modified information collections are due on or before 60 days after date of publication of this Order in the Federal Register. In addition to filing comments with the Secretary, a copy of any comments on the information collections contained in this Order should be submitted to Lex Smith, Federal Communications Commission, Room 1A-804, 445 12th Street, S.W., Washington, DC 20554, or via the Internet to lesmith@fcc.gov, and to Timothy Fain, OMB Desk Officer, 10236 NEOB, 725 - 17th Street, N.W., Washington, DC 20503, or via the Internet to fain_t@al.eop.gov.

C. Authority

93. This action is taken pursuant to Sections 1, 4(i), 201, 303, 309, and 332 of the Communications Act of 1934, as amended by the Telecommunications Act of 1996, 47 U.S.C. §§ 151, 154(i), 201, 303, 309, 332.

D. Further Information

94. For further information, contact Dan Grosh or Won Kim of the Policy Division, Wireless Telecommunications Bureau, at 202-418-1310 (voice) or 202-418-1169 (TTY).

VI. ORDERING CLAUSES

95. Accordingly, IT IS ORDERED that Part 22 of the Commission's Rules is amended as set forth in Appendix B.

96. IT IS FURTHER ORDERED that the rule amendments made by this Order and specified in Appendix B SHALL BECOME EFFECTIVE 30 days after the date of the publication of the rule amendments in the Federal Register.

97. IT IS FURTHER ORDERED that authority is delegated to the Wireless Telecommunications Bureau to consider and approve, deny, or approve with modifications new or revised 911 call processing modes.

98. IT IS FURTHER ORDERED that, the Commission's Office of Public Affairs, Reference Operations Division, shall send a copy of this Second Report and Order, including the Final Regulatory Flexibility Act Analysis, to the Chief Counsel for Advocacy of the Small Business Administration in accordance with Section 603(a) of the Regulatory Flexibility Act of 1980, Pub. L. No. 96-354, 94 Stat., 5 U.S.C. 601-612 (1980).

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas

Magalie Roman Salas
Secretary