

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

In the Matter of)
)
AIRCELL, INC.)
)
Petition, Pursuant to Section 7 of the Act,)
For a Waiver of the Airborne Cellular Rule,)
Or, in the Alternative, for a Declaratory Ruling)

MEMORANDUM OPINION AND ORDER

Adopted: May 24, 2000

Released: June 9, 2000

By the Commission:

I. INTRODUCTION

1. AirCell, Inc. (AirCell) has developed and tested a system of modified cellular telephones and specially equipped ground stations designed to provide airborne cellular service to airborne mobile terminals installed on board general aviation aircraft. The AirCell system design is intended to coexist with and not cause harmful interference to terrestrial cellular systems. With this Memorandum Opinion and Order, we resolve the outstanding issues that have been presented to the Commission regarding the AirCell system and its implementation.

2. By this Order, we affirm two orders of the Wireless Telecommunications Bureau (“Bureau”) that granted AirCell and certain cellular partners a waiver of section 22.925 of the Commission’s rules, which prohibits airborne operation of cellular telephones, and then modified and clarified the procedures set up to implement that waiver. We also affirm three Bureau orders granting section 22.925 waivers to additional AirCell partners. We therefore deny four Applications for Review and four Stay Requests filed against the Bureau Orders by a number of cellular carriers. We also reset the two-year term of the waiver to begin on the effective date of this Order. We also clarify the Bureau’s Orders as they pertain to interference protection given to E-911 location technology.

3. By this Order, we also resolve outstanding issues related to AirCell’s operation under experimental authorization of the Office of Engineering and Technology (“OET”) by affirming two OET Letter Rulings.

II. BACKGROUND

4. *The AirCell System.* AirCell has developed a system of specially engineered mobile cellular terminals for use aboard general aviation aircraft.¹ The AirCell system operates on secondary

¹ See *In re AirCell, Inc., Petition, Pursuant to Section 7 of the Act, for a Waiver of the Airborne Cellular Rule, or, in the Alternative, for a Declaratory Ruling*, 14 FCC Rcd 806 (Wireless Tel. Bur. 1998) (*AirCell Order*) at 806, ¶ 1.

status in order to ensure that other carriers will be free of harmful interference from AirCell operations. The AirCell equipment, which includes a modified cellular mobile telephone and specially designed aircraft antenna, is designed to avoid causing harmful interference to terrestrial cellular systems. AirCell ground stations are collocated at cellsites of cellular licensees that have entered into partnership arrangements with AirCell.² Customer traffic from an AirCell mobile telephone is interconnected with the public switched network through an AirCell partner's cellular switch.³

5. According to AirCell, the AirCell system has a number of features designed to avoid harmful interference to terrestrial cellular systems. To begin with, the design of the AirCell system is based on the difference in the ambient radio frequency noise level between heavily populated areas and sparsely populated areas. By locating its ground stations in quieter areas, AirCell asserts, it is able to operate the airborne transmitters at a very low power level.⁴ Thus, while the forward link⁵ voice and control channels transmit from ground station sites at approximately the same power levels used by cellular base stations, AirCell represents that its airborne mobile terminals operate with lower transmitter power than ordinary cellular telephones⁶ in order to reduce the likelihood of interference from the reverse link transmissions.⁷ According to AirCell, its mobile terminals typically transmit at a power output level of 5 milliwatts or less,⁸ considerably less than the normal output power of cellular portable handsets. To further decrease the likelihood that the system will cause interference,⁹ the AirCell system was designed to use horizontal wave polarization as opposed to the vertical polarization used by most conventional cellular systems, which AirCell contends provides a degree of additional isolation between the AirCell system's signals and those of

² See *id.* at 807, ¶ 3.

³ *Id.*

⁴ See *id.* at 809, ¶ 8.

⁵ Forward links are normally the transmissions from a base station to mobile units. In AirCell's case, they are the transmissions from the ground station to airborne terminals. See *AirCell Order* at 809, ¶ 8.

⁶ AirCell Petition for Waiver filed October 9, 1997 at 48; see *AirCell Order* at 809, ¶ 8.

⁷ AirCell Petition for Waiver at 48. Reverse links in this situation constitute the transmissions from the airborne unit to a ground station. The reverse link from an airborne mobile unit can raise greater interference concerns because it is transmitted from a high aircraft antenna and is free of the obstructions encountered by terrestrial cellular systems. See *AirCell Order* at 809, ¶ 8.

⁸ AirCell Petition for Waiver at 47; see *AirCell Order* at 809, ¶ 8.

⁹ To prevent such interference from occurring, the terminal employs a unique technology, which includes the following features: (1) a standard Motorola cellular phone with software modifications; (2) antennas specially configured for different aircraft designs in order to use the aircraft's fuselage or stabilizers to direct the radio signals; (3) horizontally polarized radio waves; (4) mobile units that operate at extremely low power levels, ranging between one-eighth and one-six-thousandth of the power level typically employed by terrestrial cellular telephones, made possible because the ground stations are located in low-noise rural environments and generally maintain a line-of-sight connection; and (5) dynamic power control by the ground stations, limiting the airborne units' power to the minimum needed to complete the call. AirCell Inc.'s Opposition to Request For Stay, filed February 1, 1999.

terrestrial systems.¹⁰ Finally, AirCell states that it utilizes non-standard control channels, as well as specially shaped antenna patterns, in order to afford additional protection from interference to non-participating cellular systems.¹¹ Frequency coordination with non-participating cellular licensees, as provided for in the Bureau's Orders, further reduces the potential for interference.¹²

6. AirCell claims that its system offers unique, cost-effective public safety benefits not now available to the general aviation industry, including potentially life-saving voice and data communications, such as real-time weather and air traffic data information.¹³ Governmental entities expert in air traffic safety, such as the Federal Aviation Administration and the National Transportation Safety Board, have expressed the belief that a system permitting general aviation aircraft to have access to up-to-the-minute weather information would reduce the incidence of air safety hazards.¹⁴

7. *Bureau Proceedings.* On October 9, 1997, AirCell filed a Petition for Waiver of Section 22.925 of the Commission's rules, which prohibits airborne operation of cellular telephones.¹⁵ On July 31, 1998, AirCell and a number of cellular partners entering into resale agreements with AirCell jointly amended AirCell's petition for waiver, establishing that the cellular partners joined in the waiver request. The partners thereby agreed to modifications to their existing cellular licenses to authorize this secondary use of their licensed spectrum. AirCell and its cellular partners represented that they would work together to resolve any harmful interference caused to non-participating cellular carriers. Further, AirCell and its partners stated that, in the event of unresolved harmful interference, they would shut down the relevant AirCell mobile terminal or cease AirCell operation from the relevant ground station altogether.¹⁶

8. On December 24, 1998, the Bureau released an Order granting AirCell and certain participating cellular carriers a waiver of the Commission's prohibition on the airborne operation of cellular telephones.¹⁷ Specifically, the Bureau granted AirCell and its participating partners a waiver of section 22.925 of the Commission's rules,¹⁸ subject to certain conditions.¹⁹ The Bureau reviewed the extensive record of the AirCell proceeding and was persuaded that AirCell had shown that a limited waiver

¹⁰ AirCell Petition for Waiver at 44; *see AirCell Order* at 809, ¶ 8.

¹¹ *See AirCell Order* at 809, ¶ 8.

¹² *Id.*

¹³ *Id.* at 809, ¶ 9.

¹⁴ *Id.*

¹⁵ AirCell Petition for Waiver. *See* 47 C.F.R. § 22.925.

¹⁶ *See* AirCell, Inc. Amendment to Petition (July 31, 1998).

¹⁷ *AirCell Order.*

¹⁸ 47 C.F.R. § 22.925 (prohibition on airborne operation of cellular telephones).

¹⁹ *AirCell Order*, Appendix A.

of section 22.925 was justified.²⁰ The Bureau was convinced that the AirCell system warranted an opportunity to operate for a limited two-year term and believed that the *AirCell Order* articulated an operating scheme that would enable AirCell to offer its air-ground voice and data link system to the public while also protecting non-participating carriers from harmful interference.²¹ The waiver authorized certain specified cellular providers to furnish system capacity for the provision of cellular service on a secondary basis to airborne mobile units utilizing AirCell technology, and established a number of mandatory conditions and recommended guidelines regarding operation of the AirCell equipment.²² The Bureau stated that AirCell's acceptance of secondary status with respect to the primary terrestrial operations of cellular licensees was a significant factor in its evaluation.²³

9. In response to the Bureau's action in this matter, we received a Stay Request²⁴ and Consolidated Application for Review²⁵ of the *AirCell Order* on January 25, 1999, contending that the Bureau's action was arbitrary and capricious and unsupported by the record.²⁶ The pleadings were filed by AirTouch Communications, Inc., Ameritech, AT&T Wireless Services, Inc., Bell Atlantic Mobile, Inc., BellSouth Cellular Corporation, GTE Wireless Incorporated, and SBC Wireless, Inc. (collectively, "opposing carriers"). On the same date, AirCell filed a Petition for Reconsideration and Clarification of the *AirCell Order*,²⁷ expressing its concern that the notification distance of 168 miles required in Special Condition 6 of the *AirCell Order* was overly burdensome and requesting that the Bureau extend the term of its waiver.²⁸

10. The Bureau subsequently reconsidered a portion of its *AirCell Order* to address certain implementation issues.²⁹ On July 30, 1999, the Bureau granted, in part, the AirCell Petition by modifying

²⁰ *Id.* at 819, ¶ 28.

²¹ *Id.*

²² *Id.* at 806, 817-18, 821-23, ¶¶ 2, 23-24, Appendices A and B.

²³ *Id.* at 811, ¶ 13.

²⁴ Request for Stay of *AirCell Order*, filed by opposing carriers on January 25, 1999 (January 1999 Stay Request).

²⁵ Consolidated Application for Review of *AirCell Order*, filed by opposing carriers on January 25, 1999 (January 1999 AFR).

²⁶ January 1999 AFR at 1, 18.

²⁷ Petition for Reconsideration of the *AirCell Order*, filed by AirCell on January 25, 1999 (AirCell Petition).

²⁸ AirCell Petition at 4.

²⁹ *In re AirCell, Inc., Petition, Pursuant to Section 7 of the Act, for a Waiver of the Airborne Cellular Rule, or, in the Alternative, for a Declaratory Ruling, Order on Reconsideration, DA-99-1522 (Wireless Tel. Bur. July 30, 1999) (Reconsideration Order)*, at ¶¶ 1-2.

Special Condition 6 of the *AirCell Order*,³⁰ which had provided that "[a]ppropriate licensees to be notified [of an impending service offering] are those having one or more co-block transmitter sites located within 270 kilometers (168 miles) of the proposed ground station."³¹ Persuaded by the technical record before it, the Bureau reduced the notification distance from 270 kilometers (168 miles) to 151 kilometers (94 miles).³² In that *Reconsideration Order*, the Bureau also clarified that AirCell was not precluded from placing its narrowband control channels in code division multiple access (CDMA) guardband spectrum.³³ In a companion *Additional Waivers Order*, the Bureau granted section 22.295 waivers to seven additional AirCell partners.³⁴ On August 30, 1999, the opposing carriers filed a second Consolidated Application for Review³⁵ and Request for Stay,³⁶ this time pertaining to the *Reconsideration Order* and *Additional Waivers Order*. The Bureau subsequently granted section 22.295 waivers to seven more AirCell partners, in two orders.³⁷ On December 20, 1999 and January 19, 2000, the opposing carriers filed a third and fourth Application for Review and Request for Stay,³⁸ this time pertaining to the *Second Additional*

³⁰ *AirCell Order*, Appendix A, Special Condition 6.

³¹ *Reconsideration Order* at ¶ 13.

³² *Id.* at ¶ 16.

³³ *Id.* at ¶ 12.

³⁴ In re AirCell, Inc., Pine Belt Cellular, Inc., Tennessee RSA No. 3 Limited Partnership, WESTEX Telecommunications, Inc., XIT Cellular, ETEX Cellular Co., Inc., Cellular Network Partnership, and North Alabama Cellular, LLC, Petitions for Waiver of the Airborne Cellular Rule, *Order*, DA 99-1523 (Wireless Tel. Bur. July 30, 1999) (*Additional Waivers Order*).

³⁵ Consolidated Application for Review of *Reconsideration Order* and *Additional Waivers Order*, filed by opposing carriers on August 30, 1999 (August 1999 AFR).

³⁶ Request for Stay of *AirCell Order*, filed by opposing carriers on August 30, 1999 (August 1999 Stay Request).

³⁷ In re AirCell, Inc., ALLTEL Communications, Inc., American Rural Cellular, Inc., Centennial Cellular Corporation, CenturyTel Wireless, Inc., Kentucky RSA 4 Cellular General Partnership, and Smith Bagley, Inc. d/b/a Cellular One of Northeast Arizona, Petitions for Waiver of the Airborne Cellular Rule, *Order*, DA 99-2640 (Wireless Tel. Bur. November 24, 1999) (*Second Additional Waivers Order*); In re AirCell, Inc. and Western Wireless Corporation, Petitions for Waiver of the Airborne Cellular Rule, *Order*, DA 99-2950 (Commercial Wireless Div. December 21, 1999) (*Third Additional Waiver Order*).

³⁸ Application for Review and Request for Stay of the *Second Additional Waivers Order*, filed by opposing carriers on December 20, 1999 (December 1999 AFR); Application for Review of the *Third Additional Waiver Order*, filed by opposing carriers on January 19, 2000 (January 2000 AFR). The December 1999 AFR incorporates by reference "[t]he issues presented for review and the grounds for the relief requested" set forth in the August 1999 AFR. December 1999 AFR at 2. Similarly, the January 2000 AFR incorporates by reference the December 1999 AFR and the opposing carriers' Reply to Opposition to the December 1999 AFR, filed January 18, 2000. Therefore, in this Order we primarily refer to the issues and grounds as presented in the January 1999 AFR and August 1999 AFR.

*Waivers Order*³⁹ and *Third Additional Waiver Order*, respectively. In addition, we have before us a Petition for Clarification of the *AirCell Order*, filed by TruePosition, Inc. (TruePosition) on January 25, 1999, in which TruePosition asks that the Commission expressly prohibit AirCell from interfering with carriers' deployment of Automatic Location Identification (ALI) technology (E-911 technology).⁴⁰

11. *OET Proceedings*. Also before us are an Application for Review of a May 30, 1997 Letter Ruling⁴¹ released from OET, filed by AirCell on June 30, 1997;⁴² and a Motion for Stay⁴³ and an Application for Review⁴⁴ of a February 11, 1998 OET Letter Ruling,⁴⁵ filed by certain opposing carriers on March 12, 1998. We will discuss the OET proceedings in a separate section below.

III. DISCUSSION - BUREAU PROCEEDING

12. Upon review, we largely affirm the Bureau Orders. We agree with the Bureau's technical assessment of the AirCell system, including its judgment that there is little risk the system will cause harmful interference to non-participating carriers, as well as its evaluation of the system's potential benefit for general aviation. We also agree with the terms of the waivers granted by the Bureau and the procedures set out in the Orders for implementing the AirCell system, though we add some technical operating conditions to the waiver to ensure that the AirCell system will in fact operate within the technical parameters on which the Bureau's decision was based.⁴⁶ We therefore deny the opposing carriers'

³⁹ In the December 1999 AFR, the opposing carriers ask for "vacation of [the *Second Additional Waivers Order*] in its entirety, dismissal or denial of all airborne cellular service waiver requests filed by AirCell and/or its cellular partners, a stay of the [*Second Additional Waivers Order*] and the prior Bureau orders, and a freeze on all further Bureau action." December 1999 AFR at 2.

⁴⁰ Petition for Clarification of *AirCell Order*, filed by TruePosition on January 25, 1999 (TruePosition Petition).

⁴¹ Letter from Richard M. Smith, Chief, Office of Engineering and Technology, Federal Communications Commission, to David Sieradzki, Esq., and Joel S. Winnick, Esq., Hogan and Hartson, Counsel for AirCell, Inc., dated May 30, 1997 (May 1997 OET Letter).

⁴² Application for Review of the May 30, 1997 Letter Ruling released from the Office of Engineering and Technology, filed by AirCell on June 30, 1997 (June 1997 AirCell AFR).

⁴³ Motion for Stay of the February 1998 OET Letter, filed on March 12, 1998 by BellSouth Cellular Corp., GTE Wireless Products and Services, Southwestern Bell Mobile Systems, Inc., Bell Atlantic Mobile, Inc., and AirTouch Communications, Inc. (March 1998 Stay Request).

⁴⁴ Application for Review of the February 1998 OET Letter, filed on March 12, 1998 by BellSouth Cellular Corp., GTE Wireless Products and Services, Southwestern Bell Mobile Systems, Inc., and AirTouch Communications, Inc. (March 1998 AFR).

⁴⁵ Letter from Richard M. Smith, Chief, Office of Engineering and Technology, Federal Communications Commission, to David Sieradzki, Esq., and Joel S. Winnick, Esq., Hogan and Hartson, Counsel for AirCell, Inc., dated February 11, 1998 (February 1998 OET Letter).

⁴⁶ See Appendix.

Applications for Review and Stay Requests of the *AirCell Order*, *Reconsideration Order*, *Additional Waivers Order*, *Second Additional Waivers Order*, and *Third Additional Waiver Order*. Although we agree with an initial two-year waiver term, we partially grant the AirCell Petition in that we will reset the term to begin on the effective date of this Order. Further, we clarify the *AirCell Order* as it pertains to interference protection given to E-911 location technology.

13. As we will explore further below, we find that the Bureau, in the *AirCell Order*, *Reconsideration Order*, and various *Additional Waivers Orders*, carefully considered the evidence presented by all parties in this proceeding and correctly concluded that the airborne cellular service provided by AirCell is in the public interest. The record indicates that the AirCell service operates at a power level and in a manner that poses little or no threat of harmful interference to primary cellular service. Indeed, the evidence indicates that the AirCell signal is undetectable in most circumstances. In this decision we rely on the voluminous record provided by AirCell, its partners, its opponents, and other interested commenters, including extensive testing under the aegis of a Part 5 Experimental Service license. Our review of the record convinces us that the Bureau acted properly in finding that the AirCell system of airborne mobile units can operate with their corresponding ground stations without causing harmful interference to primary cellular services.

14. In this Order, we also rely heavily on the Bureau's limitation of the AirCell system to secondary status in the cellular band. Stations with secondary status, such as those of which the AirCell system is comprised: (1) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date; and (2) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date.⁴⁷ We find that restricting AirCell and its partners to secondary status throughout their system helps ensure that all primary cellular service is and will be protected from harmful interference throughout the waiver term.

1. Waiver Standard

15. In 1984, Commission staff issued a Public Notice banning the use of all cellular telephones on airborne aircraft because of the possibility of interference to cellular systems.⁴⁸ In 1991, the Commission codified the policy.⁴⁹ Until the release of the *AirCell Order*, no waivers of that rule had been granted.⁵⁰

⁴⁷ See 47 C.F.R. §§ 2.104(d)(4). Stations of a secondary service can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.

⁴⁸ Public Notice, Cellular Units Not Authorized for Airborne Use, Report No. CL-142, Mimeo 0200 (CCB Oct. 11, 1984).

⁴⁹ Airborne Use of Cellular Telephones and the Use of Cell Enhancers in the Domestic Public Cellular Radio Service, 7 FCC Rcd 23 (1991) (adopting 47 C.F.R. § 22.925).

⁵⁰ Airborne Use of Cellular Telephones and the Use of Cell Enhancers in the Domestic Public Cellular Radio Service, CC Docket 88-411, Report and Order, 7 FCC Rcd 23, ¶ 4.

16. “[T]he essence of waiver is a narrow, particularized exception to a rule based on a showing by a particular party that such an exception will not subvert the rule under that party's unique circumstances.”⁵¹ The opposing carriers argue that AirCell’s proposal does not meet the standard for waiver consideration because AirCell does not demonstrate that its system presents the Commission with unique circumstances.⁵² In response, AirCell contends that the Bureau's *AirCell Order* was expressly based on use of specially designed, low-power airborne mobile terminals.⁵³ Further, AirCell contends that the *AirCell Order* bars any "harmful interference" as well as any sustained, continuous non-harmful interference, placing the burden on AirCell and participating licensees to continue to find solutions to any interference issues that may arise as cellular technologies develop.⁵⁴

17. We find that unique circumstances do exist that justify the grant of a waiver of Section 22.295. To begin with, the Bureau based the waiver on careful examination of the technical design of the AirCell system and analysis of its potential effects on cellular services offered by other carriers. Based on the record before us, we agree with the Bureau’s conclusion that the AirCell system is not likely to cause harmful interference to terrestrial systems, which is the basis of Section 22.925 of the Commission’s rules. Furthermore, as described below, the evidence indicates that the AirCell system offers public interest benefits such as enhanced safety to general aviation. Finally, the Bureau properly crafted its waiver in such a manner as to offer non-participating licensees adequate, indeed redundant, interference protection. First, the AirCell system’s secondary status helps ensure non-participants a regulatory remedy for any incidents of harmful interference. Second, the underlying Orders establish a notification procedure that affords non-participating carriers the opportunity to steer AirCell away from the use of particular channels if they so choose.

18. The Bureau reached its technical conclusion regarding the AirCell system as the result of a proceeding in which AirCell was required to make an affirmative showing that its system is not likely to cause harmful interference to terrestrial cellular operations. Because AirCell carried this burden, on the basis of the design characteristics of its system and field tests in Texas in July 1997, we reject the opposing carriers’ contention that the Bureau unfairly shifted the burden of proof regarding harmful interference.⁵⁵ Special Condition 4 to the waiver provides that, if a non-participating cellular licensee brings forth factual evidence of harmful interference, the relevant AirCell cellular partner must resolve any such problem in a timely fashion or face termination or modification of its authority under the waiver.⁵⁶ Special Condition 4 further invites non-participating cellular licensees to bring forth factual evidence that the operation of the AirCell system is resulting in certain interference to their operations, even if such interference does *not* rise

⁵¹ *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969), *cert. denied*, 409 U.S. 1027 (1972).

⁵² August 1999 AFR at 7.

⁵³ Opposition to Application for Review, filed by AirCell on September 14, 1999, at 13 (AirCell September 1999 Opposition).

⁵⁴ AirCell September 1999 Opposition at 13, *citing*, *AirCell Order*, Appendix A, Special Conditions 1 & 4.

⁵⁵ *See, e.g.*, December 1999 AFR at 5.

⁵⁶ *AirCell Order* at 817, ¶ 23.

to the level of harmful interference – and, again, the relevant AirCell partner is subject to termination or modification of its authority.⁵⁷ These procedures do not shift the burden of proof to an opposing carrier but merely place upon that carrier the burden to come forward with *prima facie* evidence that it has suffered interference that is likely to have been caused by AirCell’s operations. We find this arrangement to be reasonable, because AirCell has carried its initial burden to demonstrate that its system is not likely to cause harmful interference.

19. We do not agree with the opposing carriers’ assertions regarding the likelihood that AirCell operations will cause interference to terrestrial cellular operations⁵⁸ because we do not find persuasive the evidence they have presented in support of these assertions. First, the opposing carriers contend that the possibility of harmful interference is demonstrated by the results of the July 1997 Texas field test of AirCell’s system,⁵⁹ upon which the Bureau relied in making its technical findings in support of the waiver. The Texas field test consisted of two days of testing. On the first day, AirCell configured its system to operate “normally,” *i.e.*, with all the various design features that AirCell had engineered to reduce the threat of interference. AirCell also flew “normal” flight paths, *i.e.*, more or less point-to-point.⁶⁰ On the second day, at the opposing carriers’ request, AirCell disabled the dynamic power control element⁶¹ of the AirCell equipment, which eliminated, for the duration of these tests, the benefits of one of the main elements of the AirCell design. The opposing carriers also flew abnormal flight patterns, specifically, circular flight paths around the “victim” cell site. For these reasons, the Bureau used data gathered on the first day of the Texas test to characterize the normal operation of the AirCell system, and used data gathered on the second day to study the extent of harmful effects that might result from a major malfunction of the AirCell system. We find that this use of the Texas field test data by the Bureau was reasonable. The test data from the second day provided no evidence that the AirCell system would cause harmful interference when operating as designed, but only that a major malfunction could lead to interference. In such an event, however, the terms of the waiver granted by the Bureau clearly would require AirCell to cease the operations causing interference until the malfunction is corrected.

⁵⁷ *Id.*

⁵⁸ *See, generally*, January 1999 AFR at 20-23.

⁵⁹ *See id.* at 20, 22.

⁶⁰ In addition, we note that on the first day, AirCell chose a “worst case” scenario for site location, *i.e.*, the tests were conducted in a rural area where there was no urban noise to mask the AirCell signal, and in a manner such that the AirCell airborne mobile unit was close to the “victim” site and far from the AirCell partner site. With this configuration, the AirCell mobile has to emit its highest power level in order to reach its partner site. Even under this configuration, the data from the first day of testing show that there is little likelihood of harmful interference.

⁶¹ All cellular systems use dynamic power control, which enables the cellular system to control the transmitting power of mobile units in order continually to use the least power necessary to sustain the call at the desired quality. Thus, the closer an AirCell airborne mobile unit is to the serving AirCell partner ground station, the less transmitting power it uses. Conducting a test with the power control element turned off may be useful for calibrating equipment or testing antenna patterns, but it does not give useful data regarding how that system functions *as designed*.

20. Opposing carriers also cite the results of a test they conducted in Florida on September 22, 1998, as supplying evidence of actual interference by the AirCell system.⁶² We find that the Florida test was based on unrealistic test conditions and is not reliable. In the Florida test, the opposing carriers again flew abnormal, circular flight patterns around the “victim” cell site at close range and at low altitude. This put the main lobe of the aircraft antenna pattern into the cell site antenna. In addition, AirCell showed that the opposing carriers installed the wrong type of antenna for the type of airplane involved;⁶³ did not record the AirCell airborne mobile transmitter power output;⁶⁴ and deliberately matched the supervisory audio tone, thus preventing the AirCell telephone from hanging up once it had lost a usable signal from the AirCell ground station.⁶⁵ For all these reasons, the data drawn from the Florida test, and the conclusions based upon these data, cannot be credited as reflecting the nature or interference potential of the AirCell system as it was designed to operate.

21. Similarly, other assertions made by the opposing carriers regarding the interference potential of the AirCell system lack foundation in credible evidence. The conclusion of Dr. William C.Y. Lee that “AirCell’s operations will create ‘a significant level of harmful interference’ over 30 percent of the time that an AirCell-equipped plane placing a call overflies a terrestrial system”⁶⁶ was based on unrealistic assumptions, including his use of an unrealistically low interference threshold.⁶⁷ The opposing carriers’ assertion that “as many as 400 terrestrial cellular conversations could be disrupted by a single airborne call”⁶⁸ is an assertion not supported by evidence in the record.⁶⁹ The opinions of the Chief Technical

⁶² See January 1999 AFR at 20-21, 22.

⁶³ The aircraft the opposing carriers used had a raised stabilizer; the antenna was installed underneath this stabilizer, which caused a downward antenna reflection instead of the usual null directly beneath the airplane. AirCell specifies a different type of antenna for this type of aircraft, to avoid this problem.

⁶⁴ These data might have shown the power level at which the airborne unit was transmitting when the AirCell partner ground station lost control of it; automatic power control is one of the interference avoidance techniques fundamental to the AirCell design.

⁶⁵ This made it possible to capture the AirCell airborne terminal with the base station. However, under normal circumstances, the AirCell caller would have terminated the call because of interference to the AirCell call before any interference occurred to the “victim” cell site.

⁶⁶ January 1999 AFR at 21-22.

⁶⁷ Dr. Lee used test data from both days of the Texas tests, but based his conclusions on use of an interference threshold of minus 124 dBm. We believe that this is too conservative and that an interference threshold of minus 117 dBm is more realistic for typical analog systems. Based on our review of the evidence, it appears to us that use of the latter threshold would have led to a finding that AirCell would cause a significant level of harmful interference 0% of the time.

⁶⁸ January 1999 AFR at 22.

⁶⁹ This assertion appears to refer to an argument made by Bell Atlantic in comments filed against the AirCell Petition on December 15, 1997. Comments of Bell Atlantic Mobile, Inc., in Opposition to Petition for Waiver, filed December 15, 1997, at 12. However, the discussion in the 1997 pleading concerned CDMA (digital) operations, whereas a condition in the AirCell waiver does not allow AirCell partners to use channels used for digital operations within the notification distance. Moreover, the 1997 pleading appears to assume that an AirCell

Officers of six major cellular carriers stating that they “are convinced that the proposed AirCell operations would significantly interfere with our operations”⁷⁰ are not persuasive because the record does not contain credible evidence supporting those opinions. The assertion that “AirCell high power base stations with uptilted antennas will cause interference to terrestrial mobile units”⁷¹ is adequately addressed by the ordinary coordinating process that every cellular licensee, including AirCell partners, must already go through under the Commission’s rules.⁷² Finally, AirCell’s probability study was not a factor in the Bureau’s decision, which therefore did not need to settle any “[d]isputes over AirCell’s probability study.”⁷³

22. *Technical Conditions / Guidelines.* The opposing carriers contend that, although the Bureau based the *AirCell Order*, *Reconsideration Order*, and *Additional Waivers Orders* on specific assumptions about how AirCell's system was unlikely to interfere with non-participating cellular systems, the Bureau refused to impose conditions that would require AirCell and its cellular partners actually to operate in the prescribed manner.⁷⁴ Specifically, opposing carriers claim that the Bureau expressly relied on particular AirCell technical and operating parameters to justify granting the waiver⁷⁵ -- *i.e.*, the specific parameters in Appendix B to the *AirCell Order*, which the Bureau found constituted the "unique and special circumstances required to justify a waiver of Section 22.925"⁷⁶ -- but did not condition the waiver on compliance with those parameters.⁷⁷ Instead, opposing carriers state, the Bureau called them "recommended guidelines,"⁷⁸ and said that they were "not intended to be mandatory."⁷⁹ Opposing carriers contend that "[o]nce the Bureau found that a waiver was justified specifically because of the protections

airborne mobile unit could affect all three faces at a given cell site simultaneously, which we consider very unlikely because of geometrical considerations. *See infra* para. 37.

⁷⁰ January 1999 AFR at 22.

⁷¹ *Id.*

⁷² *See* 47 C.F.R. § 22.907.

⁷³ January 1999 AFR at 22. In this pleading, the opposing carriers also assert, at pages 22-23, that the Bureau ignored other disputes in the record and evidence that AirCell will cause interference. These assertions are not accompanied by record citations or other detail that would enable us to address them.

⁷⁴ January 1999 AFR at 7-10.

⁷⁵ August 1999 AFR at 7, *citing*, *AirCell Order* at ¶¶ 3, 4, 8, 14, 15, 22, 23.

⁷⁶ *Id.*, *citing*, *AirCell Order* at 817, ¶ 22.

⁷⁷ *Id.*

⁷⁸ *Id.*

⁷⁹ *Id.*, *citing*, *AirCell Order* at 818, ¶ 24.

afforded by specific technical and operating parameters, it was obliged to limit the waiver to situations where those parameters would govern."⁸⁰

23. AirCell contends that the *AirCell Order* dispenses with the need for technical conditions by using a more onerous, results-oriented solution to ensure that non-participating carriers cannot be harmed, and contends that a similar policy approach underpins the entire concept of the Part 5 experimental licensing regime. AirCell further claims that the Commission has never adopted specific technical requirements governing the operations of experimental licensees, relying instead on the general mandate that experimental licensees not cause harmful interference to primary licensees.⁸¹ AirCell argues that it is not the specific technical attributes of the AirCell technology but the non-interfering result of those attributes that constitute the unique and special circumstances justifying the waiver. Finally, AirCell contends that incorporating the technological features summarized in Appendix B of the *AirCell Order* as mandatory conditions would only require further proceedings if AirCell is able to make changes improving its technology while having the same non-interfering result.⁸²

24. We agree with AirCell that the results-oriented conditions imposed on the AirCell system in the *AirCell Order* are more stringent than any specific technical conditions we might impose. The Bureau was clear in its insistence that the AirCell system produce no harmful interference. We also share the Bureau's expectation that AirCell continue to improve its technology, including its interference protection functions, and we do not wish to restrict AirCell's ability to make technical improvements to its service as long as primary cellular service is protected from harmful interference. However, we will add to the mandatory conditions set forth in the *AirCell Order* a limited number of technical conditions that are based on the Bureau's analysis of the features of the AirCell system that justified granting the waiver. While we believe that AirCell's secondary status is sufficient to ensure non-interference to terrestrial cellular operations, we adopt this conservative approach to regulating the relationship between AirCell operations and those of the terrestrial cellular carriers in order to give added assurance that AirCell's operations under the waiver will not compromise the non-interference policy behind the rule that has been waived. Attached to this order, therefore, is an Appendix containing both the original conditions to the waiver (from Appendix A to the *AirCell Order*, as modified by the *Reconsideration Order*) and new technical conditions regarding transmitting power, antenna pattern and installation, and wave polarization. This Appendix of conditions supersedes and replaces both appendices attached to the original *AirCell Order*.⁸³

2. Cellular Carriers' Rights to Provide Service Within Cellular Geographic Service Areas

⁸⁰ August 1999 AFR at 10.

⁸¹ AirCell September 1999 Opposition at 13 n. 24, *citing, e.g.*, Amendment of Part 5 of the Commission's Rules to Diminish Restrictions on the Licensing and Use of Stations in the Experimental Radio Services (other than Broadcast), Gen. Docket No. 82-469, FCC 83-471 (released Nov. 16, 1983).

⁸² AirCell September 1999 Opposition at 14.

⁸³ Special Conditions 6 and 7 continue to be subject to the clarifications made in the Bureau's *Reconsideration Order*. See *Reconsideration Order* at ¶¶ 10-16.

25. We reject the opposing carriers' arguments that the AirCell system violates these carriers' exclusive channel block assignments.⁸⁴ The opposing carriers state that in 1981 the Commission adopted a licensing structure for the then-new cellular service that limits a licensee to providing cellular service on a dedicated channel block in a discrete geographic area unique to each carrier, known as its Cellular Geographic Service Area ("CGSA").⁸⁵ The carriers contend that each licensee is entitled to be free from any other carrier's provision of cellular service on the same channel block within its CGSA, and they argue that under the rules, no cellular licensee can provide service in another licensee's exclusive CGSA without the other licensee's express permission.⁸⁶ The opposing carriers assert that the *AirCell Order* and *Reconsideration Order* violate their rights by allowing AirCell to provide cellular service within their CGSAs.

26. We take issue with the opposing carriers' analysis of the rights and protections provided to them as licensees by our cellular rules. The CGSA of a cellular system is the geographic area considered by the FCC to be served by the cellular system.⁸⁷ Within its CGSA, a cellular system is entitled to protection from co-channel and first-adjacent channel interference and from capture of subscriber traffic by adjacent systems on the same channel block.⁸⁸ Licensees must cooperate in resolving co-channel and first-adjacent channel interference by changing channels used at specific cells or by other technical means.⁸⁹ Subscriber traffic is captured if a service area boundary (SAB)⁹⁰ of one cellular system overlaps the CGSA of another operating cellular system. Cellular licensees are entitled to have a CGSA free of SABs from other cellular systems on the same channel block.⁹¹ Therefore, cellular licensees must not operate any facility that would cause an SAB to overlap the existing CGSA of another cellular system on the same channel block, without first obtaining the written consent of the licensee of that system.⁹² None of these

⁸⁴ January 1999 AFR at 11-12.

⁸⁵ January 1999 AFR at 2, *citing*, 47 C.F.R. § 22.905, 22.909, 22.911, 22.912.

⁸⁶ See, *e.g.*, Amendment of Part 22 of the Commission's Rules to Provide for Filing and Processing of Applications for Unserved Areas in the Cellular Service and to Modify Other Rules, *Further Memorandum Opinion and Order on Reconsideration*, 12 FCC Rcd 2109 at 2116, 2118 (1997) ("any non-consensual extension into a licensee's CGSA on the same channel block would constitute interference from which the licensee and its customers have a right to be protected, pursuant to Section 22.911...").

⁸⁷ 47 C.F.R. § 22.911.

⁸⁸ 47 C.F.R. § 22.911(d).

⁸⁹ 47 C.F.R. § 22.911(d)(1). However, because of AirCell's secondary status, licensees here may "steer" AirCell toward or away from any particular channel(s) on AirCell's proposed channel list.

⁹⁰ The service area of a cell is the area within its service area boundary (SAB), which is a line of points described by the mathematical formula in section 22.911(a)(1) and (3)-(6) of our rules. 47 C.F.R. § 22.911(a)(1), (3)-(6). The CGSA is the composite of the service areas of all the cells in the system. 47 C.F.R. § 22.911(a).

⁹¹ 47 C.F.R. § 22.911(d)(2)(ii).

⁹² 47 C.F.R. § 22.911(d)(2)(i).

rules places any limitations on where a cellular licensee may provide non-interfering service from its own facilities.

27. We conclude that the waiver conditions imposed by the Bureau's Orders and those we have added here fully protect the opposing carriers' service. Most importantly, the opposing carriers are protected by AirCell's secondary status, which requires it to refrain from harmful interference to primary cellular licensees, both co-channel and first-adjacent channel. Furthermore, based on our review of the extensive record before us and "real world" experience gained with the AirCell system under its experimental license, we find that the AirCell system is not likely to be detected in normal operation and is not likely to cause harmful interference even in unusual circumstances. In addition, under the *AirCell Order*, opposing carriers have an even greater opportunity to coordinate channel selection to avoid interference than is afforded under the rules.

28. The opposing carriers also err in their analysis regarding their protection from subscriber traffic capture. The AirCell system cannot capture other carriers' traffic. The AirCell system only serves AirCell mobile units and cannot interact with ordinary cellular telephones. Thus, the AirCell partners only capture their own airborne mobile subscribers, an action provided for in the Bureau's waiver grant. Further, the fact that an airborne subscriber flying over an opposing carrier's CGSA may receive service from the adjacent-market AirCell partner does not equate to SAB overlap.⁹³

29. *License Modification.* We also reject the opposing carriers' related contention that the *AirCell Order* improperly modified nonparticipating cellular carriers' licenses by diminishing their protection from interference, without notice or an opportunity to be heard, in violation of Section 316. They further argue that the Bureau modified existing carriers' licenses by authorizing AirCell's partners to serve airborne units without any geographical limitation. Opposing carriers claim such action by the Bureau is in direct conflict with the Commission's rules, specifically 47 CFR §§ 22.905(a) and 22.911, under which a cellular licensee is granted an exclusive license to use a specific channel block in a defined geographic area.⁹⁴ Opposing carriers claim that if the Commission authorizes a second carrier to use a block of cellular spectrum in a given carrier's defined service area, it thereby modifies the authorized carrier's license and must comply with the procedures for license modification set forth in 47 USC § 316.

30. We do not agree that the Bureau's actions have improperly modified non-participating carriers' licenses, either directly or indirectly. First, as we discuss above, the waiver does not diminish non-participating carriers' protection from interference; through the *AirCell Order* and the *Reconsideration Order*, the Bureau took steps to ensure that the AirCell system would not cause harmful interference to the operations of any non-participating licensee. Second, in the conditions it imposed on the AirCell system,

⁹³ The SAB of a cell site is determined only by use of a mathematical formula in § 22.911(a) of the Commission's rules and the height and the power of that site. The SAB is not determined by considering the physical locations where subscriber units can receive service, as the opposing carriers imply.

⁹⁴ 47 CFR § 22.905(a) provides: "Each channel block is assigned exclusively to one licensee for use in that licensee's cellular geographic service area (*see* § 22.911)." 47 CFR § 22.911, in turn, provides in relevant part that "[t]he cellular Geographic service area (CGSA) of a cellular system is the geographic area considered by the FCC to be served by the cellular system. The CGSA is the area within which cellular systems are entitled to protection...."

the Bureau established notification and coordination procedures that encouraged, but did not obligate, non-participants to cooperate with AirCell and its partners in the initial configuration of the AirCell system. Non-participating parties are not subject to any new obligations or changes in their rights or responsibilities.⁹⁵ Those parties need do no more in operating their systems today than they did before the limited waiver was granted allowing operation of the AirCell system. Third, as we discuss above, nothing in the Bureau's orders allows AirCell or its cellular partners to violate any aspect of the assignment of channel blocks to other licensees.⁹⁶ We therefore conclude, as the Bureau did, that because "non-participating cellular licensees are not required to accept harmful interference, nor are they required to alter their operations to accommodate AirCell operations in any way... there can be no indirect modifications triggering a section 316 or section 1.87 notice and hearing requirement"⁹⁷

3. Notification Distance

31. We reject the opposing carriers' challenge to the Bureau's reconsideration of the notification distance AirCell must observe. In the *AirCell Order*, the Bureau initially required AirCell and its cellular partners to notify all carriers with sites located within 168 miles of an AirCell partners' site of the frequencies on which AirCell signals would be carried. In its *Reconsideration Order*, the Bureau reduced this notification distance to 94 miles. We find that the Bureau acted properly in reducing the notification distance from 168 miles to 94 miles. The Bureau's reasoning for reducing the distance was that "the normal signal from the AirCell airborne terminal is not detectable by typical OET-53 compatible analog cellular base stations when the airborne terminal is more than 10 miles away...."⁹⁸ This is because of "the airborne antenna pattern and polarization, combined with the low airborne transmitter power," and the fact that the "design of each AirCell ground station's link budget limits its effective range to aircraft at 5000 feet altitude to 135 kilometers (84 miles)."⁹⁹ By adding these two distances, the Bureau concluded that a notification distance of 94 miles provided conservative protection. The opposing carriers disagree with the decision's rationale because, they argue, it is premised on what the Bureau considers to be "normal" AirCell operation but AirCell is not obligated to operate in any particular manner. Specifically, the carriers argue that AirCell is not obligated to use any particular antenna pattern or polarization, is not limited to using "low" power, and is not bound by any "link budget" it may have employed in any proposal or test.¹⁰⁰ Further, opposing carriers argue that AirCell's interference range is increased by its use of an omnidirectional antenna pattern.¹⁰¹ Finally, opposing carriers contend that their urban base stations are

⁹⁵ *AirCell Order* at 811, ¶ 13; *Reconsideration Order* at ¶ 10.

⁹⁶ In this context, we make clear that the only limitation our cellular service rules place on where mobile units (*i.e.*, cellular telephones, or in this case the AirCell airborne transmitters) may operate is the airborne cellular prohibition itself, section 22.925, the waiver of which is at issue in this proceeding.

⁹⁷ *AirCell Order* at 816-817, ¶ 21.

⁹⁸ *Reconsideration Order* at ¶¶ 15-16.

⁹⁹ *Id.*

¹⁰⁰ *Id.*

¹⁰¹ *Id.*

more sensitive to AirCell's interference than predicted by AirCell's analysis¹⁰² and that AirCell's airborne units may operate at higher powers 84 miles from their ground stations than AirCell admits.¹⁰³

32. The Bureau based its decision to reduce the notification distance on a comprehensive analysis of the empirical data gathered from the July 1997 Texas tests, in which the opposing carriers participated and which we believe indicate that the original 168-mile notification distance was overly conservative.¹⁰⁴ With regard to urban cellular base station receivers, opposing carriers overlook, and the Bureau took into account, the fact that the higher noise floor¹⁰⁵ in urban areas will ensure that the AirCell units' signal remains substantially below a detectable level.¹⁰⁶ Based on the record, therefore, it is reasonable to expect the AirCell system actually to operate as designed. Moreover, the opponents' argument that AirCell is not obligated to operate in any particular manner is addressed by the additional technical conditions we adopt in this Order. However, we will review the determination regarding the notification distance at the conclusion of the waiver term. In the meantime, as discussed above, AirCell is relegated to secondary status and is forbidden to cause harmful interference.

4. CDMA Guardbands

33. We agree with the Bureau's analysis of the propriety of AirCell's use of CDMA guardband channels and reject the opposing carriers' contention that the Bureau erred when it allowed AirCell to operate on CDMA guardbands.¹⁰⁷ The opposing carriers take issue with the Bureau's

¹⁰² August 1999 AFR at 20, *citing*, Final Report, AirCell Flight test, July 10-11, 1997, at 53-56 (Exhibit C to the AirCell Waiver Application) (*Final Report*).

¹⁰³ August 1999 AFR at 20.

¹⁰⁴ *AirCell Order* at 813, ¶ 16.

¹⁰⁵ Defined as the received power when there is no desired signal present, the "noise floor" is comprised of thermal noise, receiver noise, and environmental noise (including that caused by interfering signals). See C.J. Hall, "Evaluating Noise," on the Internet at <http://www.wirelessreview.com/issues/1998/81115/tm.htm>.

¹⁰⁶ It appears from our analysis of the record that AirCell's contribution to the overall radio noise level is comparable to that of the existing sources of noise that cellular system planners must routinely overcome. Although very marginal quality calls in quiet rural areas may be affected, we believe such occurrences will be rare and are totally avoidable with careful channel selection. See *AirCell Order* at 812, ¶ 14.

¹⁰⁷ We also reject opposing carriers' complaint regarding the Bureau's clarification that, for the purposes of Special Condition 7, "unused" channels include channels that other carriers may plan to use for digital service in the future but that are not currently carrying digital transmissions. See *Reconsideration Order* at ¶ 11; August 1999 AFR at 15. We believe this is an appropriate clarification. We also believe that it was appropriate for the Bureau to require carriers to give AirCell and its partners sixty days' notice of a carrier's intention to put a channel currently being used for AirCell transmissions into digital service. Without notification, AirCell and its partners would be unaware that AirCell transmissions would no longer be permitted on that channel under the terms of the waiver. The notice period also gives AirCell and the partner time to re-engineer their operations and undertake a new 30-day notification period, as required by Special Condition 6, without unnecessary disruption of service to AirCell's customers.

characterization of the guardband channels as "not used" and "essentially wasted."¹⁰⁸ The opposing carriers claim that part of the CDMA signal is actually contained within the guardbands and that if AirCell is allowed to put its analog FM control channel signals in the opponents' CDMA guardbands, AirCell's analog signals will destroy the CDMA bits residing in the guard channels.¹⁰⁹ Second, opposing carriers contend that the Bureau misconstrues the purpose of the guardbands, which they argue is not merely to prevent sideband noise¹¹⁰ generated by nearby analog mobiles from adding to the noise floor but also to prevent an increase in the noise floor caused by the existence of a mobile unit carrier in the guardband.¹¹¹ The opponents, for example, contend that an AirCell unit operating at a power of +27 dBm on the first guardband channel, while located 9 miles from the CDMA cell, would raise the noise floor by 9 dB, which they say would be devastating to the CDMA cell site.¹¹² Finally, the opposing carriers argue that the Bureau's belief that AirCell airborne units will not come within the "immediate proximity" of a CDMA cell site has no basis.¹¹³ With AirCell's 84-mile range and plans to provide coverage to the entire United States, the opposing carriers contend, every CDMA cell site in the country will be at risk of having its service degraded when AirCell-equipped planes fly in the "immediate proximity" of CDMA sites.¹¹⁴

34. The arguments submitted by the opposing carriers do not persuade us that the Bureau erred in its conclusion that AirCell can use the analog cellular channels contained within a CDMA guardband¹¹⁵ without adversely affecting the adjacent CDMA signals. First, we find that the persuasiveness of the opponents' arguments is limited because the technical statements, hypothetical example, and conclusions concerning the CDMA guardbands in the opposing carriers' pleading are unsupported by any technical data or analyses. Additionally, as noted by AirCell in its response, the transmitting power attributed to the AirCell mobile terminal in the opposing carriers' example (27 dBm) is 8 dB higher than that which AirCell is actually designed to use (19 dBm).¹¹⁶ One of the additional

¹⁰⁸ August 1999 AFR at 20, citing, *Reconsideration Order* at ¶ 12.

¹⁰⁹ *Id.*

¹¹⁰ Defined as that portion of a radio emission outside of its occupied bandwidth, "sideband noise" generally consists of ½% of the emission's power above and below the occupied bandwidth, for a total of 1%.

¹¹¹ August 1999 AFR at 21.

¹¹² *Id.*

¹¹³ *Id.*

¹¹⁴ *Id.*

¹¹⁵ A cellular CDMA guardband typically comprises 6 to 9 contiguous unused analog cellular channels (180 to 270 kHz).

¹¹⁶ Additionally, the opposing carriers do not explain why AirCell would be using the closest channel to the CDMA channel rather than one several analog channels away. The coordination process set up in the *AirCell Order* and *Reconsideration Order* allows non-participating carriers to "steer" AirCell away from particular channels in favor of others if they so choose.

conditions we adopt today limits airborne terminal power to 19 dBm, which we hope will end discussion of the effect of higher-power operation.¹¹⁷

35. Second, while we agree with opposing carriers that the purpose of the CDMA guardband is to prevent an increase in the noise floor experienced by the CDMA cell site receiver as a result of the operation of ordinary analog cellular telephones in the immediate vicinity (by this we mean within a half mile) of that CDMA cell site,¹¹⁸ we note that the guardband is considered necessary only for cellular systems that are transitioning from analog to CDMA and wish to provide both types of service in the same area, and in particular from the same or proximate cell sites. Thus, if a cellular system were to convert entirely to CDMA, the guardbands would no longer be needed. In fact, the principal purpose of the CDMA guardbands is to protect a cellular system's CDMA operations from its own remaining analog subscribers.¹¹⁹ We also disagree with the opposing carriers that the guardbands are provided or intended to serve in any way as conduits for portions of the adjacent CDMA signal. In fact, any energy from the CDMA signal that may be emitted in the guardband would be outside of what is normally considered to be the occupied bandwidth of a CDMA transmission. Consequently, we disagree with the opposing carriers' contention that the guardbands are used for digital transmissions. We instead agree with the Bureau that these guardbands are unused.¹²⁰

36. Turning now to how analog transmissions in the guardbands might affect a CDMA operation, we first consider the opposing carriers' contentions that certain bits of information from a CDMA transmission are normally transmitted in the guardbands, that an analog signal transmitted there could destroy these bits, and that this would adversely affect telephone calls on a CDMA system. This description does not agree with our understanding of CDMA systems as they are commonly explained in the technical literature.¹²¹ To begin with, the CDMA modulation function is dominated by a pseudo-random spreading code that alone accounts for most of the overall bandwidth of a CDMA emission.¹²² Typically, 128 bits of the pseudo-random code ("code bits") are transmitted to carry each bit of the

¹¹⁷ See Appendix, Special Condition 10.

¹¹⁸ The guardband may also help to reduce the noise floor increase experienced by a CDMA mobile telephone receiver as it passes in the immediate vicinity of an analog cell site (base station), but that situation is irrelevant to our analysis here because the AirCell ground stations would not be located within an opposing carrier's CGSA, and on the opposing carrier's channel block.

¹¹⁹ However, at the geographic juncture between a CDMA cellular system and an adjacent-market analog cellular system, some careful channel coordination is generally required to protect the CDMA operations from the adjacent-market system's analog subscribers, as well.

¹²⁰ We do disagree with the Bureau's characterization of the guardbands as "essentially wasted." *Reconsideration Order* at ¶ 12. The basic rationale for CDMA guardbands is that using 42 analog channels for a single CDMA channel and refraining from using an additional 9 channels on each side (the guardbands) results in much greater capacity than if all 60 channels were used for analog service.

¹²¹ See, e.g., "CDMA Technology & Benefits," Motorola Cellular Infrastructure Group; on the Internet at <http://rf.rfglobalnet.com/library/ApplicationNotes/files/7/motcig.htm>.

¹²² The bandwidth of an IS-95A CDMA emission is typically given as 1.25 MHz.

digitized telecommunications signal (“information bits”). This means that the energy corresponding to each information bit does not appear in only one specific spot within the occupied emission bandwidth (much less an adjacent guardband) but rather is spread across the entire emission bandwidth. Thus, assuming for the sake of argument that there is a code bit in the guardband, the loss of this code bit would be unlikely to cause the loss of an information bit. But even if it did, CDMA employs an advanced forward error correction code that compensates for such losses in most cases.¹²³ It is this characteristic, namely the ability to recover from loss of part of the signal, that makes CDMA robust in the face of selective fading and multipath, when compared to narrower emission types. Consequently, it is not the possibility of the loss of a code bit or even an information bit that necessitates the CDMA guardbands, and we therefore reject the opposing carriers’ argument concerning loss of bits transmitted in the guardband.

37. Rather, the function of the guardband is to protect against an unduly increased noise floor in the CDMA receiver. This occurs because any uncorrelated energy appearing in the passband¹²⁴ of a CDMA receiver will be spread across the entire receiver bandwidth by the demodulation function and appear as broadband noise. When an increase in the noise floor occurs, either because of additional telephone calls being carried, or because of some interfering signal in the passband of the CDMA receiver,¹²⁵ the system responds by requiring all CDMA cellular telephones with ongoing calls to increase power by the same amount to maintain an acceptable signal to noise ratio.¹²⁶ In the event one of these telephones is already operating at its maximum power and cannot increase, it could possibly be dropped, although in most cases control of it will be picked up by cell faces at other cell sites.¹²⁷ This is called “soft hand-off” and is possible because CDMA cellular telephones normally communicate with multiple cell faces simultaneously.

38. With this background, we now consider how AirCell airborne mobile transmissions differ from those of ordinary analog cellular telephones, and why we believe the difference makes it possible for AirCell mobile terminals to transmit in the CDMA guardband without causing harmful interference. First, as stated clearly in the record, the received power of an AirCell transmission in a typical cellular base receiver is generally several orders of magnitude lower than that of an ordinary analog cellular telephone.

¹²³ While the loss of numerous information bits may cause loss (erasure) of an entire frame of data (a frame is a basic interval of time, typically 20 milliseconds), a call can survive loss of some frames. Thus, CODECs (COder/DECoder units used in CDMA systems to convert analog signals into digital signals and vice versa) are generally tested for their performance under condition of a 3% frame erasure rate.

¹²⁴ “Passband” is defined as the frequency range within which the receiver is designed to receive signals. Cellular receivers are designed to receive signals over a certain range and block signals not within that range.

¹²⁵ The CDMA receiver front end should provide some attenuation to signals appearing in the guardband, which is actually outside of the receiver passband. For the purpose of analysis, however, we will assume the CDMA receiver would have some sensitivity to energy transmitted in the guardband in addition to spurious energy transmitted into its passband, such as sideband noise from transmitters operating in the guardband.

¹²⁶ CDMA cellular systems automatically control the power of CDMA cellular telephones very precisely – as often as 800 times per second in 1 dB steps over an 84 dB range.

¹²⁷ CDMA cell sites are normally tri-sectored. Each sector or “face” independently uses the same CDMA channel.

As noted by the Bureau in its *Reconsideration Order*, the sideband power from an AirCell airborne mobile, which could fall into the CDMA receiver passband if the nearest analog channels in the guardband were employed, is likewise attenuated far below that of an ordinary analog cellular telephone. Second, while an ordinary analog cellular telephone could get within a few hundred feet of a CDMA cell site, an airborne AirCell mobile terminal, even if directly overhead, will be nearly a mile away. Moreover, directly overhead AirCell transmissions would typically not be detected by cellular base stations because of the null cast by the AirCell airborne antennas.¹²⁸ Thus, we agree with the Bureau that a transmitting AirCell airborne terminal cannot physically enter the immediate vicinity of a CDMA cell site, *i.e.*, close enough to cause the effects against which the CDMA guardband is designed to guard. Third, while an ordinary analog cellular telephone may be located alongside a CDMA telephone, and thus transmit energy into all of the cell site faces with which the CDMA telephone is in communication, an AirCell airborne terminal, by contrast, will be far enough away that the physical geometry would only permit its signal to illuminate one common cell site face. Thus, even assuming the AirCell signal were strong enough to raise the noise floor a significant amount (which our analysis does not lead us to expect), the CDMA call would merely be "soft handed off" to the other faces with which it is in communication. For all of the foregoing reasons, we agree with the Bureau that the CDMA guardbands should be considered to be unused for our purposes here and thus need not be off limits to AirCell when it is considering possible channel usage.

5. Authority to Grant Waivers

39. We reject the opposing carriers' contention that the Bureau has unlawfully delegated authority to AirCell to exempt cellular carriers from the airborne cellular rule via a discriminatory, non-particularized waiver process.¹²⁹ It is well established that the grant of waivers must be based on a "general standard" and "nondiscriminatory."¹³⁰ In this case, however, the opposing carriers contend that, simply by signing on with AirCell, cellular licensees can receive a waiver of the airborne cellular rule without undertaking any technical measures to prevent interference or even making any technical showings.¹³¹ In other words, the opposing carriers argue, AirCell has effectively been given the power to grant a waiver to any cellular licensee without any showing that the licensee has met the basic requirements for a waiver.¹³² AirCell contends that it would be arbitrary and capricious (as well as "unprincipled and discriminatory") for the Bureau not to grant a waiver to one party showing the same special circumstances and the same public interest factors previously found sufficient to justify a waiver to another party.¹³³ In

¹²⁸ AirCell Petition for Waiver, Appendix C at p. 20; Letter from David L. Sieradzki, Hogan and Hartson, Counsel for AirCell, Inc. to Magalie Roman Salas, Secretary, Federal Communications Commission, dated November 19, 1998, Attachment at p. 6 ("AirCell's Mobile Antenna Pattern has a Null Directly Downward to Minimize Radiated Power Downward"); Letter from Joel S. Winnik, Hogan and Hartson, Counsel for AirCell, Inc. to Magalie Roman Salas, Secretary, Federal Communications Commission, dated October 21, 1998, Attachment at p. 17; *see also AirCell Order* at ¶ 8.

¹²⁹ August 1999 AFR at 11.

¹³⁰ *Id.*

¹³¹ *Id.*

¹³² *Id.*

¹³³ AirCell September 1999 Opposition at 23-24.

any event, AirCell claims that the opposing carriers are in no position to complain about this "additional waiver" procedure because they have been the frequent beneficiaries of this routine and appropriate Commission procedure.¹³⁴

40. Only the Commission or the Bureau acting within its delegated authority can issue a waiver of the airborne cellular rule. We take issue with the opposing carriers' contention that prospective AirCell partner licensees can "become exempt from the rule without making any showing of unique circumstances and without undertaking any technical means to prevent interference."¹³⁵ AirCell has adequately demonstrated the interference-reducing design of its AirCell system. In conjunction with the Bureau-imposed secondary status of AirCell's operations, we conclude that the harm that section 22.925 was designed to prevent is not likely to occur from the operation of the AirCell system. Consequently, we believe that special circumstances exist here which justify a waiver of section 22.925. The additional waiver recipients all must commit that they will abide by the same conditions that apply to AirCell and the licensees already covered by the *AirCell Order* and the *Reconsideration Order*,¹³⁶ and they therefore demonstrate the same circumstances as the original waiver recipients.

6. Responsibilities of AirCell Partners

41. We reject the opposing carriers' argument, in their opposition to the *AirCell Order* and in subsequent filings, that AirCell and its authorized partners have not complied with the terms imposed on them by the *AirCell Order*.¹³⁷ The opponents contend that AirCell's cellular partners have delegated to

¹³⁴ *Id.*, citing, e.g., Petitions for Waiver of Part 69 of the Commission's Rules to Establish Switched Access Rate Elements for SONET-based Service, 11 FCC Rcd 21010 (CCB 1996) (granting waivers to Bell Atlantic and six other "me-too" LECs -- Pacific Bell, BellSouth, US West, Ameritech, GTE, and SNET -- to permit establishment of new rate elements to recover costs of switched transport services using Synchronous Optical Network ("SONET") technology); Bell Atlantic Telephone Companies, Southwestern Bell Telephone Company, Petitions for Waiver of Section 69.4(b) of the Commission's Rules, 9 FCC Rcd 7868 (CCB 1994) (granting waivers to Bell Atlantic and "me-too" petitioner SWBT to permit establishment of additional rate elements for automated calling card handling, automated collect and billed-to-third-number handling, live operator handling of IXC [interexchange carrier] traffic); The Ameritech Operating Companies, Bell Atlantic Telephone Companies, BellSouth Telecommunications, Inc., Cincinnati Bell Telephone Company, GTE Services Corporation, The NYNEX Telephone Companies, Pacific Bell, Rochester Telephone Corp., Southern New England Telephone Company, Southwestern Bell Telephone Company, The United Telephone and Central Telephone Companies, and U S West Communications, Petitions for Waiver of Sections 69.4(b) and 69.106 of Part 69 of the Commission's Rules, 9 FCC Rcd 7873 (CCB 1994) (granting waivers to permit establishment of separate rate elements for provision of 500 access service).

¹³⁵ See AirCell September 1999 Opposition at 22-23.

¹³⁶ *Id.*

¹³⁷ AirCell system implementation issues have been sharply contested by the opposing parties; see, e.g., Letter from Kathryn A. Zachem, Wilkinson, Barker, Knauer, LLP, Counsel for BellSouth Cellular Corporation, *et al.*, to Magalie Roman Salas, Secretary, Federal Communications Commission, dated May 28, 1999; Letter from David L. Sieradzki, Hogan and Hartson, Counsel for AirCell, Inc. to Magalie Roman Salas, Secretary, Federal Communications Commission, dated June 8, 1999; Letter from David L. Sieradzki, Hogan and Hartson, Counsel for AirCell, Inc. to Magalie Roman Salas, Secretary, Federal Communications Commission, dated June 15, 1999; Letter from C. Clairborne Barksdale, BellSouth Cellular Corp., *et al.*, to Magalie Roman Salas, Secretary, Federal

AirCell complete responsibility for complying with the notification, coordination, contact, and system shutdown responsibilities that the *AirCell Order* specifically imposed on them as licensees.¹³⁸ The opposing carriers conclude that this effects an unauthorized transfer of control of the licensees' operations to AirCell.¹³⁹ The opponents contend that the *Additional Waivers Order* did not fully consider these documented violations, did not even mention the "unauthorized transfer of control" issue, and simply endorsed what AirCell had done.¹⁴⁰

42. In our view, the Bureau has examined the allegations of the opposing carriers in this regard and addressed each of them fairly and adequately. The Bureau considered allegations regarding the AirCell partners' delegation to AirCell of authority to perform certain notification, coordination and system management functions, and found that "[t]his delegation of authority is consistent with the *AirCell Order* and is not inconsistent with each of the AirCell partners being ultimately responsible for the operations conducted under their respective cellular licenses and at all times fully retaining their rights and obligations as Commission licensees."¹⁴¹ The Bureau correctly reiterated in the various *Additional Waivers Orders* that the AirCell licensee partners are ultimately responsible for all aspects of the operations of their individual stations.¹⁴² In the case of a nationwide network such as AirCell is attempting to build, we agree that the AirCell partners, while remaining responsible for complying with Commission requirements in their participation in the AirCell system, may reasonably and prudently assign a single entity the task of being a central contact point for system management and system/site termination purposes. We therefore agree that this does not effect an unauthorized transfer of control of the licensees' operations to AirCell.

7. Public Interest Claims

43. We agree with the Bureau's finding that the waiver makes available to general aviation aircraft air-ground communications capabilities that would otherwise be unavailable, enhancing public safety by giving pilots access to safety-related communications.¹⁴³ The opposing carriers argue that this

Communications Commission, dated June 22, 1999; Letter from Timothy E. Welch, Hill and Welch, Counsel for New-Call Inc, dba Cellcom, *et al.*, to Magalie Roman Salas, Secretary, Federal Communications Commission, dated June 23, 1999; Letter from C. Clairborne Barksdale, BellSouth Cellular Corp., *et al.*, to Magalie Roman Salas, Secretary, Federal Communications Commission, dated June 30, 1999; Motion to Dismiss "Me-Too" Waiver Requests filed by C. Clairborne Barksdale, BellSouth Cellular Corp., *et al.*, on June 30, 1999; Letter from David L. Sieradzki, Hogan and Hartson, Counsel for AirCell, Inc. to Magalie Roman Salas, Secretary, Federal Communications Commission, dated July 7, 1999; Letter from Kathryn A. Zachem, Wilkinson, Barker, Knauer, LLP, Counsel for BellSouth Cellular Corporation, *et al.*, to Magalie Roman Salas, Secretary, Federal Communications Commission, dated July 20, 1999.

¹³⁸ August 1999 AFR at 23.

¹³⁹ *Id.*

¹⁴⁰ *Id.*

¹⁴¹ *Additional Waivers Order* at ¶ 8; *see also Second Additional Waivers Order* at ¶ 8.

¹⁴² *Id.*

¹⁴³ *AirCell Order* at 812- 814, ¶¶ 15-17.

rationale does not withstand scrutiny,¹⁴⁴ claiming that the AirCell system was "certified [by the FAA] only for use in other than safety critical applications."¹⁴⁵ The opposing carriers further assert that the provision of air-ground service to general aviation is not a valid reason for waiving the rule even if such service might have some public safety benefits.¹⁴⁶ For support, the opposing carriers cite the Bureau's *JET-TEL Order*, in which the Bureau denied a build-out waiver requested by an 800 MHz air-ground licensee on "similar" grounds, stating that there were alternative sources of communications available to general aviation aircraft for safety-related communications.¹⁴⁷ In this instance, however, we find few viable alternatives that may provide "safety-related voice communications between pilots and emergency personnel, and can be used to uplink in-cockpit, up-to-the-minute weather and air traffic information as well as potentially provide in-flight monitoring of airframe and engine operations, serving to better inform ground personnel of aircraft operations."¹⁴⁸ It is clear that although the FAA did not certify the AirCell system as dedicated public safety equipment, the FAA did note that several public benefits could be derived from the system.¹⁴⁹ On balance, as long as primary cellular service is protected as described above, consideration of these benefits supports grant of the waiver with the safeguards the Bureau has imposed.

8. Stay Requests

44. Because of our resolution of the issues raised by the opposing carriers, we deny their requests to stay the *AirCell Order*, *Reconsideration Order*, *Additional Waivers Order*, *Second Additional Waivers Order*, and *Third Additional Waiver Order*. In requesting a stay, a petitioner must demonstrate

¹⁴⁴ August 1999 AFR at 21.

¹⁴⁵ *Id.* In its June 21, 1999 letter to the Commission, Aeronautical Radio, Inc. (ARINC) contends that although it took no position on "whether, or under what conditions, AirCell should be permitted to operate in conjunction with terrestrial cellular systems," it noted that the "AirCell system is certified only for use in *other than safety critical* applications." Letter from John L. Bartlett, Wiley, Rein and Fielding, Counsel for Aeronautical Radio, Inc. to Magalie Roman Salas, Secretary, Federal Communications Commission, dated June 21, 1999. We note that ARINC bases its conclusions on a Letter from Barry L. Valentine, Acting Deputy Administrator, Federal Aviation Administration (FAA) to William Caton, Secretary, Federal Communications Commission, dated December 19, 1997. In that letter, the FAA noted that "[a]t the present time, the AirCell system is certified only for use in other than safety critical applications . . . [b]ecause it does not operate within the spectrum dedicated to aviation." However, the FAA also stated that "reliable, real-time flight information provided to the cockpit can be very important," and that the FAA supports "the development of technologies that may assist the pilot." Despite this limitation in the system's certification, therefore, we believe that AirCell's airborne cellular service offers significant public safety benefits, in particular the enhancement of navigational safety of general aviation aircraft. See *AirCell Order* at 806-807, ¶ 2.

¹⁴⁶ *Id.*

¹⁴⁷ August 1999 AFR at 22, n. 63, *citing*, *JET-TEL Group Limited Partnership*, 11 FCC Rcd 21,215, ¶ 15 (WTB 1996).

¹⁴⁸ *AirCell Order* at 812-813, ¶ 15, *citing*, GE Research Comments at 2-3; Harris Corporation at 1.

¹⁴⁹ See *AirCell* September 1999 Opposition at 11, *citing*, Letter from Barry L. Valentine, Acting Deputy Administrator, FAA, to William Canton, Secretary FCC (December 19, 1997) (Attachment A-2 to *AirCell* Reply Comments filed January 12, 1998).

that: 1) it is likely to prevail on the merits; 2) it will suffer irreparable harm if a stay is not granted; 3) other interested parties will not be harmed if the stay is granted; and 4) the public interest favors granting a stay.¹⁵⁰ The decision we make here resolves the merits of this matter and consequently renders petitioners' requests for stay moot.

9. Waiver Term

45. Special Condition 9 of the *AirCell Order*¹⁵¹ allows cellular licensees that provide cellular service to airborne terminals in accordance with the *AirCell Order* to "submit a comprehensive report to assist the Commission in evaluating whether continuation of the waiver is in the public interest."¹⁵² The *AirCell Order* then provides that "[u]nless the Commission shall determine otherwise as a result of evaluation of these reports, the waiver will terminate two years after the date of grant."¹⁵³ AirCell asks that the two-year waiver term be extended to five years or made permanent,¹⁵⁴ contending that by narrowly limiting the duration of this waiver, the Bureau may have unnecessarily jeopardized AirCell's commercial deployment before AirCell and its cellular partners can obtain sufficient operating experience.¹⁵⁵ AirCell argues that due to the contentious nature of these proceedings, only the first year of operation will form the basis for the Commission's decision whether or not to continue the waiver, whereas the second year will be consumed by efforts to persuade the Commission of the need to extend the waiver.¹⁵⁶ Therefore, AirCell requests that it be granted a permanent waiver of the airborne cellular rule, with the Commission reserving the opportunity to reconsider the waiver based on a full two years of operation.¹⁵⁷ Under AirCell's proposal, the Bureau could still accept reports filed by cellular licensees at the end of the first and second

¹⁵⁰ *Virginia Petroleum Jobbers Assoc. v. FPC*, 259 F. 2d 921, 925 (D.C.Cir. 1958); *Washington Metropolitan Area Transit Comm. v. Holiday Tours, Inc. et al.*, 559 F.2d 841, 843 (D.C. Cir. 1977); In re CBS Communications Services, Inc., Licensee of Private Operational Fixed Microwave Station WEH913, Miramar, Puerto Rico and Centennial Wireless PCS License Corporation, Licensee of B Block PCS Station KNLF 250, Puerto Rico-U.S. Virgin Islands MTA, *Order*, 13 FCC Rcd. 4471, 4473 (Wireless Tel. Bur. 1997).

¹⁵¹ *AirCell Order*, Special Condition 9.

¹⁵² *Id.*

¹⁵³ *Id.*

¹⁵⁴ AirCell Petition at 1. The Petition also asks for Bureau reconsideration of the 168-mile notification distance requirement. The notification distance issue was resolved in the *Reconsideration Order*, in which the notification distance requirement was reduced from 168 miles to 94 miles. AirCell has not requested further review of that order.

¹⁵⁵ *Id.* at 7-8.

¹⁵⁶ *Id.*

¹⁵⁷ AirCell Petition at 9.

years of operation to ensure that the technology operates as expected.¹⁵⁸ At a minimum, AirCell requests that the waiver be given a five-year term.¹⁵⁹

46. We agree with the Bureau's setting of an initial two-year term for the waiver, but we believe it is appropriate to re-start that term. We are sympathetic to AirCell's contention that any decision on its future operation should be based on a reasonable period of actual operation. Because of the substantial uncertainties attendant on this proceeding, we believe that the two-year term of this waiver should be reset to begin on the effective date of this Order. Only in that way can we ensure that there will be enough operational experience to judge the technical characteristics of this system. Therefore, we will affirm the Bureau's grant of a two-year waiver, but reset the term to begin on the effective date of this Order.¹⁶⁰

10. TruePosition Petition for Clarification

47. In its Petition for Clarification, TruePosition requests that the Commission expressly prohibit AirCell from interfering with carriers' deployment of Automatic Location Identification (ALI) technology (E-911 technology) developed by TruePosition. TruePosition requests that the Commission establish that 1) if AirCell's operation interferes with TruePosition's ALI technology, AirCell is required to cooperate with TruePosition to resolve the problem; and 2) if harmful interference with a carrier's ALI technology cannot be eliminated, AirCell must cease operation. As stated above, AirCell and its partners are authorized to operate only as a secondary service and AirCell is prohibited from interfering with any primary Commission licensee. AirCell is therefore required to cooperate with all primary carriers in resolving interference conflicts and is required to cease operation if it causes harmful interference into any primary carrier's system, whether the primary carrier uses E-911 technology or not. We do not believe we need to impose any further restrictions on the AirCell system to protect E-911 technology.

IV. DISCUSSION – OET PROCEEDING

48. AirCell has operated under various OET experimental authorizations and special temporary authorizations since 1992.¹⁶¹ On December 24, 1994, OET granted AirCell a Part 5 authorization, call sign KI2XCS, authorizing operation as an experimental radio station. On May 30, 1997, in response to oppositions filed by a number of cellular licensees operating on the same channel block as AirCell's partners, OET requested information from AirCell about its compliance with the terms of its experimental license and Part 5 rules, and imposed limitations on AirCell's experimental operations

¹⁵⁸ *Id.*

¹⁵⁹ *Id.*

¹⁶⁰ By this action, we are not extending the waiver pursuant to Special Condition 9 of the Bureau's *AirCell Order*; instead, we are re-starting the two-year clock on the term of the waiver as of the effective date of this Order, for the reasons stated above. Special Condition 9 to the waiver shall apply, going forward and as modified in the Appendix to this Order to take account of the new start date, to any extension of the waiver by the Bureau. The reports contemplated in Special Condition 9 may be submitted on the basis of a year's experience under the waiver, as reset by this Order, *i.e.*, based on experience through one year from the effective date of this Order.

¹⁶¹ AirCell first operated under Special Temporary Authority, call sign KS2XAT.

pending the results of field testing with the opposing cellular operators. Specifically, OET suspended AirCell's licensed authority to conduct a limited marketing study of its experimental AirCell system and further limited the AirCell system to the equipment (*i.e.*, base stations, mobile units and infrastructure) AirCell then had in place -- namely, 25 base stations and 33 mobile units. Also, the *May 1997 OET Letter* reduced the maximum number of authorized mobile units from 6,000 to 250.¹⁶² OET stated that it "froze" the AirCell system in place pending the completion of interference tests, a detailed report on those tests, and OET's review of that report.¹⁶³

49. On June 30, 1997, AirCell filed an Application for Review of the *May 1997 OET Letter*, in which AirCell opposed the "freeze" and the reduction in the maximum number of authorized mobile units. Subsequently, AirCell jointly conducted field tests with AT&T Wireless, GTE Wireless Corp., and BellSouth Cellular Corp. on July 10-11, 1997, using four cell sites in Texas and Oklahoma. AirCell filed a test report prepared by a consulting firm under contract to AirCell that it believed supported the conclusion that normal operation of the AirCell system produces very low signal strengths with little possibility of interfering with cellular base station receivers.¹⁶⁴ On October 9, 1997, AirCell filed a Request to lift the "freeze," in which it also requested that the maximum number of authorized mobile units be increased from 250 to 4500. Opponents of the AirCell experimental license contested the AirCell request, arguing that their evaluation of the test results showed that the AirCell system could cause interference.¹⁶⁵

50. In its February 11, 1998 Letter, OET lifted the AirCell system freeze, increased the maximum number of authorized mobile units from 250 to 1800, and stated that, although there is a possibility that AirCell's airborne mobile terminals could cause co-channel interference to cellular systems, it believed that this interference potential is limited to rural areas, the probability of such interference occurring is low and, if it occurred, would be transitory due to the mobility of the airborne terminals. In response to this OET action, certain opposing carriers filed the March 1998 Motion for Stay and the March 1998 Application for Review of the *February 1998 OET Letter*. In both pleadings, these carriers oppose the lifting of the "freeze" and the increase in the maximum number of authorized mobile units, citing their interpretation of the May 1997 Texas/Oklahoma tests that the AirCell system could cause harmful interference to primary ground-based cellular systems.

51. Because the freeze has been lifted, the only remaining issue before us from the June 1997 AirCell AFR is whether the Commission should increase the maximum number of authorized mobile units in the AirCell system beyond the level subsequently authorized in the *February 1998 OET Letter*. We deny this request because it is not justified on this record. We have nothing presently before us to indicate that the 1800 mobile units currently authorized under the OET experimental license are insufficient for

¹⁶² May 1997 OET Letter.

¹⁶³ *Id.*

¹⁶⁴ See Final Report, *supra*, note 68.

¹⁶⁵ See, e.g., Letter from C. Claiborne Barksdale, BellSouth Cellular Corp., and Andre J. Lachance, GTE Wireless Products and Services, to Richard M. Smith, Chief, Office of Engineering and Technology, dated Oct. 20, 1997.

AirCell's testing purposes.¹⁶⁶ We emphasize that there is no legal relation between the number of mobiles authorized under the OET experimental license and AirCell's operations under the Bureau waiver, and that there is no limit on the number of mobile units AirCell may deploy as part of its commercial operations pursuant to that waiver.

52. The opposing carriers that filed the March 1998 Stay Request and the March 1998 AFR cite four major concerns regarding the *February 1998 OET Letter*. First, the opponents assert that the Letter reaches conclusions regarding the interference potential of the AirCell system that are unsupported by and contrary to the weight of the evidence. Second, the opponents allege that the Letter, despite claiming otherwise, prejudices the interference issue that was being considered by the Commission at that time in the context of AirCell's then pending petition for waiver. Third, the opponents claim that the Letter improperly and incorrectly assumes that meaningful interference data will be derived from continuing and expanding the AirCell experiment. Finally, the opponents contend that the Letter will allow AirCell to interfere with terrestrial cellular systems.¹⁶⁷ The carrier opponents request that the Commission review the *February 1998 OET Letter* and reinstate the freeze on AirCell's operations until the Commission has decided the issues pending in the waiver proceeding.

53. First, as described in greater detail above, we believe the weight of the evidence gathered in both the OET and Bureau proceedings does, in fact, justify the conclusion that the AirCell system is unlikely to cause harmful interference to terrestrial cellular systems. Second, because of our decision in this order upholding the Bureau's waiver, the claim regarding the prejudging of the interference issue is rendered moot. Third, in light of our decision here supporting OET and the Bureau in their interpretation of the 1997 Texas/Oklahoma test data, we find that meaningful data were and can be derived from continuing and expanding the AirCell "experiment." Therefore, we deny both the March 1998 Stay Request and the March 1998 AFR for the reasons stated above.

V. ORDERING CLAUSES

54. ACCORDINGLY, IT IS ORDERED that Appendix A and Appendix B to In re AirCell, Inc., Petition, Pursuant to Section 7 of the Act, for a Waiver of the Airborne Cellular Rule, or, in the Alternative, for a Declaratory Ruling, 14 FCC Rcd 806 (Wireless Tel. Bur. 1998), are hereby deleted and that the waiver granted to AirCell, Inc. in that order is hereby subject to the conditions set forth in the Appendix to this Order.

55. IT IS FURTHER ORDERED that the Application for Review filed by Ameritech, AirTouch Communications, Inc., BellSouth Cellular Corporation, AT&T Wireless Services, Inc., GTE Wireless Incorporated, Bell Atlantic Mobile Inc., and SBC Wireless Inc. on January 25, 1999 is hereby DENIED.

¹⁶⁶ Because AirCell may properly wish to continue improving its technology through testing under the aegis of the OET license as it simultaneously continues commercial implementation of its system consistent with the restrictions set forth in the Bureau waiver, AirCell's OET experimental license is not superseded by our decision in this Order upholding the Bureau's waiver of Section 22.925 of our rules.

¹⁶⁷ March 1998 Application for Review at 2.

56. IT IS FURTHER ORDERED that the Motion for Stay Pending Action on Petitioners' Application for Review filed by Ameritech, AirTouch Communications, Inc., BellSouth Cellular Corporation, AT&T Wireless Services, Inc., GTE Wireless Incorporated, Bell Atlantic Mobile Inc., and SBC Wireless Inc. on January 25, 1999 is hereby DENIED in part and is otherwise DISMISSED as moot.

57. IT IS FURTHER ORDERED that the Application for Review filed by Ameritech, AirTouch Communications, Inc., BellSouth Cellular Corporation, AT&T Wireless Services, Inc., GTE Wireless Incorporated, Bell Atlantic Mobile Inc., and SBC Wireless Inc. on August 30, 1999 is hereby DENIED.

58. IT IS FURTHER ORDERED that the Motion for Stay Pending Action on Petitioners' Application for Review filed by Ameritech, AirTouch Communications, Inc., BellSouth Cellular Corporation, AT&T Wireless Services, Inc., GTE Wireless Incorporated, Bell Atlantic Mobile Inc., and SBC Wireless Inc. on August 30, 1999 is hereby DENIED in part and is otherwise DISMISSED as moot.

59. IT IS FURTHER ORDERED that the Application for Review filed by AirTouch Communications, Inc., AT&T Wireless Services, Inc., Bell Atlantic Mobile Inc., BellSouth Cellular Corporation, GTE Wireless Incorporated, and SBC Wireless Inc. on December 20, 1999 is hereby DENIED.

60. IT IS FURTHER ORDERED that the Request for Stay filed by AirTouch Communications, Inc., AT&T Wireless Services, Inc., Bell Atlantic Mobile Inc., BellSouth Cellular Corporation, GTE Wireless Incorporated, and SBC Wireless Inc. on December 20, 1999 is hereby DENIED in part and is otherwise DISMISSED as moot.

61. IT IS FURTHER ORDERED that the Application for Review filed by AirTouch Communications, Inc., AT&T Wireless Services, Inc., Bell Atlantic Mobile Inc., BellSouth Cellular Corporation, GTE Wireless Incorporated, and SBC Wireless Inc. on January 19, 2000 is hereby DENIED.

62. IT IS FURTHER ORDERED that the Request for Stay filed by AirTouch Communications, Inc., AT&T Wireless Services, Inc., Bell Atlantic Mobile Inc., BellSouth Cellular Corporation, GTE Wireless Incorporated, and SBC Wireless Inc. on January 19, 2000 is hereby DENIED in part and is otherwise DISMISSED as moot.

63. IT IS FURTHER ORDERED that the Petition for Reconsideration filed by AirCell, Inc. on January 25, 1999 is hereby DENIED in part and GRANTED in part, as described herein.

64. IT IS FURTHER ORDERED that the Petition for Clarification filed by TruePosition, Inc. on January 25, 1999 is hereby DENIED in part and GRANTED in part, as described herein.

65. IT IS FURTHER ORDERED that the Application for Review filed by AirCell, Inc. on June 30, 1997 is hereby DENIED in part and is otherwise DISMISSED as moot, as described herein.

66. IT IS FURTHER ORDERED that the Application for Review filed by BellSouth Cellular Corp., GTE Wireless Products and Services, Southwestern Bell Mobile Systems, Inc., and Airtouch Communications, Inc. on March 12, 1998 is hereby DENIED.

67. IT IS FURTHER ORDERED that the Motion for Stay Pending Action on the March 12, 1998 Application for Review filed by BellSouth Cellular Corp., GTE Wireless Products and Services, Southwestern Bell Mobile Systems, Inc., Bell Atlantic Mobile, Inc. and Airtouch Communications, Inc. on March 12, 1998 is hereby DENIED in part and is otherwise DISMISSED as moot.

68. IT IS FURTHER ORDERED, pursuant to section 1.4(b)(2) of the Commission's rules, 47 C.F.R. § 1.4(b)(2), that the effective date of this Order shall be the date of release of this Order.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas

APPENDIX**Special Conditions**

Authority to provide cellular service to airborne terminals pursuant to this Order is subject to the following conditions derived from the record of this proceeding:

1. Secondary service. Cellular service provided to airborne terminals is deemed a secondary service and as such will be held subject to the provisions of section 2.104(d)(4) of the Commission's rules (47 C.F.R. § 2.104(d)(4)).
2. Contact. A contact point capable of shutting down, either individually or collectively, the ground stations that provide cellular service to airborne terminals, must be available at all times. The telephone number of this contact point must be provided to notified licensees (see Special Condition 6).
3. Duty to provide information. Cellular licensees providing cellular service to airborne terminals must promptly provide upon request by the Commission any information relating to any complaint of interference. Such information could include, but is not be limited to, call records for specific ground stations including abnormal terminations and information regarding channel usage. Records of such information must be retained for at least 30 days.
4. Harmful interference. Harmful interference, for the purpose of this condition, is defined as the serious degradation, obstruction, or repeated interruption of cellular service. *See* definition of "harmful interference" in section 2.1 of the Commission's rules (47 C.F.R. § 2.1). Any cellular licensee providing cellular service to airborne terminals must immediately take action to resolve any instance of harmful interference, where factual evidence (*e.g.*, time of incident and channel coincide) shows that the instance is likely to have occurred as a result of the operation of ground stations or airborne terminals under its control. In addition and notwithstanding the foregoing, any cellular licensee providing cellular service to airborne terminals must promptly take action to resolve any complaint concerning the effect of unwanted energy on reception in a cellular radiotelephone system, manifested by a measured degradation in actual performance relative to that normally attained in the absence of such unwanted energy, where factual evidence shows that such effect is likely to be occurring as a result of the operation of ground stations or airborne terminals under its control. *See* definition of "interference" in section 2.1 of the Commission's rules. Factual evidence means actual operational data (such as abnormal terminations or other relevant performance measures), collected over a substantial continuous period, which shows degradation of performance on channels used for airborne service as compared to other channels in service using the same antenna. The Commission may terminate or modify authority for any cellular licensee to provide cellular service to airborne terminals from any or all ground stations under the control of that licensee, without opportunity for a hearing, if any valid complaint under this condition is not satisfactorily resolved in a timely fashion.
5. Operational requirements. Airborne terminals may transmit only when in communication with a ground station. Airborne terminals must be designed such that unintended interoperation with co-block terrestrial cellular systems is prevented.

6. Ground station channel selection. Each ground station may use no more than six paired channels taken from those specified as communication channels in Section 22.905 of the Commission's rules (47 C.F.R. § 22.905). Licensees providing cellular service to airborne terminals must notify appropriate co-block licensees at least 30 days prior to commencement of testing or initiation of service of each ground station. The purpose of such notification is to provide the notified licensees an opportunity to participate in determining which channels are to be used at the ground station. Appropriate licensees to be notified are those having one or more co-block transmitter sites located within 151 kilometers (94 miles) of the proposed ground station. Notification must contain relevant technical details including the geographical coordinates of the ground station antenna site, the channels proposed to be used, and the designed communication range of the ground station to airborne mobile terminals. If a notified licensee fails to respond within 30 days, the notifying cellular licensee may consider this to be concurrence with the channel selection set forth in the notification. This latter 30-day period begins on the date of receipt of the notification by the licensee being notified.
7. Co-channel technology limitation. Channels that may be used at each ground station are limited to those that either are (1) unused by the parties with whom coordination is required, or (2) are used by the parties with whom coordination is required to provide compatible analog cellular service as defined in Section 22.933 of the Commission's rules (47 C.F.R. § 22.933), unless all of the parties with whom coordination is required agree to allow the use at a particular ground station of channels that they are using to provide service using an alternative technology.
8. International limitation. Until such time as appropriate arrangements between the U.S. Government and the governments of Canada and Mexico, respectively, are agreed to concerning cellular service to airborne mobile terminals, the following restriction applies: No ground station may be established at that will enable cellular service to airborne mobile terminals on aircraft while such aircraft are in flight over Canada or Mexico.
9. Duration of waiver. One year after the effective date of this Order, which affirms the grant of the waiver allowing cellular licensees to provide cellular service to airborne terminals in accordance with these conditions, cellular licensees may each submit a comprehensive report to assist the Commission in evaluating whether continuation of the waiver is in the public interest. Reports from participating licensees should include a description of their experiences with the provision of cellular service to airborne terminals, including feasibility, quality of service, customer satisfaction, incidents of interference, if any, and how any such incidents were successfully resolved. Unless the Commission shall determine otherwise as a result of evaluation of these reports, the waiver will terminate two years after the release of this Order.
10. Transmitting power. The transmitter output power of each airborne terminal must not exceed 19 dBm. The transmitter output power of each airborne terminal must be dynamically controlled by a ground station to the lowest power consistent with maintaining quality air-ground signals.¹⁶⁸
11. Antenna pattern and installation. Each ground station must employ an uptilted antenna pattern. Each airborne mobile terminal antenna pattern must exhibit an electromagnetic null directly below the aircraft. Each airborne mobile terminal must employ only external, permanently installed antennas.

¹⁶⁸ In addition, our rules require that the effective radiated power of each ground station transmitter must not exceed 500 Watts. 47 C.F.R. § 22.913(a).

12. Wave polarization. Electromagnetic waves emitted by each ground station must be horizontally polarized. Electromagnetic waves emitted by each airborne terminal must be predominantly horizontally polarized during normal flight.