Before the
FEDERAL COMMUNICATIONS COMMISSION FCC 94-144
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Commission's Rules to	)	GEN Docket No. 90-314
Establish New Personal Communications	)	RM-7140, RM-7175, RM-7618
Services	)	

MEMORANDUM OPINION AND ORDER

Adopted: June 9, 1994; Released: June 13, 1994

By the Commission: Commissioners Quello, Barrett, Ness, and Chong issuing separate statements.

TABLE OF CONTENTS

	Paragraphs
I. INTRODUCTION AND EXECUTIVE SUMMARY	1- 16
II. BACKGROUND	17- 23
III. SPECTRUM ISSUES AND SERVICE AREAS	24- 97
A. Allocation, Block Plan and Service Areas	24- 87
1. Block Positioning	28- 40
2. Block Size	41- 62
3. Aggregation and Disaggregation	63- 71
4. Service Areas	72- 79
5. Geographic Partitioning	80- 83
6. Unlicensed Devices	84- 87
B. Private Use	88- 90
C. Mobile Satellite Service Issues	91- 97
IV. OWNERSHIP RULES AND CELLULAR ELIGIBILITY	98- 146
A. Eligibility of Cellular Licensees for PCS Licenses	102-104
B. Attribution Rules	105-122
C. Attribution Rules for Certain Designated Entities	123-132
D. Population Standard	133-140
E. Post-Auction Divestiture	141-146

V. CONSTRUCTION REQUIREMENTS 147-158

VI. TECHNICAL STANDARDS 159-202
A. Roaming and Interoperability Standards 159-165
B. PCS Power Limits 166-174
C. Protection of Fixed Microwave Operations 175-193
D. PCS-to-PCS Interference Standards 194-201
E. Enhanced 911 Standards 202

VII. UNLICENSED PCS 203-244
A. Spectrum Allocation 203-208
B. Coordination 209-223
C. Spectrum Etiquette 224-244

VIII. RADIO FREQUENCY EXPOSURE LIMITS 245-249

IX. CONCLUSION 250

X. PROCEDURAL INFORMATION 251-252

Appendix A ..... Final Rules

Appendix B ..... List of Parties

Appendix C ..... Final Flexibility Statement

Appendix D ..... Broadband PCS Band Plan

Appendix E ..... Calculating PCS Signals at Microwave Receivers

Appendix F ..... Permissible Ownership of PCS Licenses by the Owners of Same-Area Cellular Systems

I. INTRODUCTION AND EXECUTIVE SUMMARY

1. By this action, we amend certain aspects of our rules governing broadband personal communications services (PCS). We take this action in response to 67 petitions for reconsideration or clarification of the rules and policies adopted in the Second Report and Order in this proceeding.[1]

2. PCS encompasses a broad range of new radio communications services that will free individuals from the limitations of the wireline public switched telephone network and will enable individuals to communicate when they are away from their home or office telephones. Broadband PCS devices are likely to be portable and have their own unique telephone numbers. A basic feature of PCS is expected to be the ability to communicate person-to-person, rather than station-to-station.

3. We take this action to foster rapid creation of a competitive market to deliver these new mobile digital voice and data services to the American public. Personal communications needs are changing rapidly as our society becomes more mobile and people demand rapid communications no matter where they are or what time it is. A competitive market is the best way to introduce broadband PCS to help meet these demands. We expect that PCS will provide a variety of mobile services competitive with existing cellular, paging and other land mobile services as well as new services offering communications capabilities not currently available. These services will be provided on an entire family of new communications devices that will include small, lightweight multi-function portable phones, portable facsimile and other imaging devices, new types of multi-channel cordless phones, and advanced paging devices with two-way data capabilities. We expect that these new services and devices will affect the future development and configuration of all telecommunications networks by significantly improving their flexibility and increasing the number of functions they can perform.

4. We are amending the broadband PCS spectrum allocation and regulatory structure to better achieve what have been and continue to be our four primary goals in this proceeding: competitive delivery, a diverse array of services, rapid deployment, and wide-area coverage.[2] Furthermore, our PCS rules as modified will partner with our competitive bidding procedures to meet Congressional objectives that include promoting economic growth and competition, enhancing widespread access to telecommunications service offerings, and ensuring that PCS licenses are disseminated to a wide variety of applicants.[3]

---

[1] See Second Report and Order, GEN Docket No. 90-314, 8 FCC Rcd 7700 (1993) (Second Report and Order). This includes a petition filed by Apple on September 13, 1993, which was separately put on notice and comment separately received. Id. at & 92.

[2] See Second Report and Order at & 5.

[3] See 47 U.S.C. 309(j), as amended by Section 6002(a) of the Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, 107 Stat. 312 (1993).

5. The actions we take are designed to enable PCS providers to compete effectively with each other and with other wireless providers so that the American public can enjoy the greatest benefit from the delivery of these new services. To promote competitive delivery, we have modified the band plan to ensure there is an opportunity for a sufficient number of competitors to offer PCS services. Further, providers will have the flexibility to determine the amount of spectrum needed for their particular service or services. However, we have also set limits on the total amount of spectrum that can be acquired by new entrants and by incumbent cellular providers. This ensures that there will be a significant number of competitors in each area.

6. We have purposely adopted a broad definition of PCS to encourage a variety of firms with their own visions of PCS to bid for various combinations of licenses and to provide a diverse array of new services. Firms will compete not only on price, but also on quality and the types of new products and services they offer. We have allocated spectrum both in different sized blocks and in different sized service areas because we want to encourage businesses to be able to acquire the spectrum and service areas that best suit their business plans. This additional flexibility will result in a greater diversity of products and services for consumers.

7. Rapid deployment is important so that consumers do not have to wait for the benefits of the new services. To ensure rapid deployment, we have allocated two different sized spectrum blocks, which can be aggregated to form other block sizes. We have also altered the allocation of some of the PCS spectrum to reduce the cost of moving microwave incumbents that must be relocated. Both of these decisions will allow more rapid introduction of service because of the reduced costs of microwave relocation.

8. The revised band plan also will reduce the cost of service and equipment to consumers. In addition, we have increased the power level available for PCS service. Together with our decisions to license some BTAs and 10 MHz blocks, these changes will make PCS service more viable in rural areas, help ensure wide-area coverage and increase access for all Americans.

9. Many of the actions we take today are directed toward ensuring that a wide variety of applicants have an opportunity to acquire PCS licenses. In addition to providing for different spectrum blocks and geographic areas, we are modifying our ownership rules to encourage participation in PCS by rural telephone companies, small businesses and businesses owned by minorities and women.

10. The most significant of the changes that we adopt today involves modification of the band plan that was adopted in the Second Report and Order. In that Order, we allocated 120 MHz of spectrum to PCS, some of which was in the lower portion of the 2 GHz band allocated for emerging technologies and some of which was in the upper portion of that band. Under our revised plan, all of the 120 MHz of spectrum allocated to PCS is located in the lower band. The previous band plan would have required those who wished to operate in both the upper and lower bands to utilize more expensive dual mode handsets capable of operating on both bands.

Providing PCS licenses in only the 1850-1990 MHz band will lower costs to consumers by permitting use of a single-band handset. Reducing the costs of equipment to consumers should also increase consumer demand and strengthen the economic viability of the PCS providers. Placing all the licensed and unlicensed spectrum in a single contiguous band also will decrease the cost of handsets that can operate in both licensed and unlicensed blocks. In addition, these changes will preserve spectrum in the upper band that is allocated internationally for the emerging Mobile Satellite Services (MSS) industry to provide worldwide service. Taken together, these changes will increase the competitiveness of PCS service providers in urban, suburban, and rural areas which should lower prices and stimulate demand, thereby increasing investment and economic growth. Lower prices will also enhance consumer access to PCS services.

11. Having all blocks in a single contiguous band also will increase the value of the 10 MHz blocks. These blocks would have been less desirable in the upper band because upper band equipment is expected to be available from manufacturers twelve or more months after lower band equipment. In addition, the upper band contains a higher concentration of microwave facilities that would have had to share spectrum with broadband PCS licensees or be relocated from the broadband PCS spectrum to avoid interference. Our action avoids the expense and potential delay associated with relocating the numerous microwave links currently operating in the upper band. The change we have made to the band plan also makes it more feasible to aggregate a 10 MHz block with a 30 MHz block for a total of 40 MHz. Taken together, these factors will reduce the time and the cost of PCS providers offering their services to the American public. The overall allocation of 120 MHz for broadband PCS remains unchanged.

12. In the Second Report and Order, we divided 120 MHz of spectrum into seven blocks: two 30 MHz blocks, one 20 MHz block, and four 10 MHz blocks. In this Order, we are amending our band plan to provide six blocks: three 30 MHz blocks and three 10 MHz blocks. We changed the 20 MHz block to a 30 MHz block and eliminated one 10 MHz block primarily because we were persuaded that a single 20 MHz block would not provide enough spectrum to support a viable competitor to the 30 MHz PCS MTA licensees, or to the two existing cellular licensees currently serving most areas. As a primary goal of our proceeding was to promote competitive delivery of PCS services, we believe that it is essential to make available an additional 30 MHz block. We anticipate that the three 10 MHz blocks will be used in a variety of ways that may include "niche services" and other functions, or as an enhancement for PCS or cellular providers that choose to purchase a 10 MHz block to complement a 30 MHz or 25 MHz block, respectively. Thus, our revised band plan provides for an additional competitor to cellular service and to the other PCS providers, while also providing three 10 MHz blocks for multiple uses.

13. In addition to modifying our band plan, we also make significant amendments to the rules relating to participation in PCS by holders of cellular interests. In the Second Report and Order, we recognized that unfettered participation in PCS by cellular operators could lessen the potential competition that could develop between PCS and cellular systems. At the same time,

we recognized that cellular licensees could foster rapid development of PCS for a variety of reasons, including their expertise with commercial mobile radio services. Promoting competition and providing for rapid deployment of PCS are both among the objectives that Congress instructed us to promote in Section 309(j) of the Communications Act, as amended by the Reconciliation Act. We have balanced those competing interests by allowing entities with a 20 or more percent investment interest in a cellular license to acquire a 10 MHz PCS license in the same area. We adhere to that decision. However, we have decided that as of January 1, 2000, we will afford cellular operators the same overall 40 MHz spectrum cap as other PCS operators, and allow them to acquire an additional 5 MHz for a total of 15 MHz of PCS spectrum in the same service areas as their cellular interests.

14. In Section 309(j), Congress also directed us to promote economic opportunity by disseminating licenses to a wide variety of applicants, including small businesses, rural telephone companies, and businesses owned by members of minority groups and women ("designated entities"). We are modifying our PCS cellular eligibility rules to promote that goal as well. Specifically, we are relaxing our cellular ownership attribution rules to allow designated entities with up to a 40 percent non-controlling interest in a cellular license to obtain a PCS license in the same area. One effect of this change will be to allow some rural telephone companies with non-controlling cellular interests, to provide PCS service in areas that might otherwise not be served in a timely manner.

15. We also are relaxing our cellular attribution rules to allow any entity with up to a 40 percent non-controlling ownership interest in a cellular license covering 10 percent or more of the population in a PCS service area to also attain a non-controlling, investment interest in a PCS license held by a business owned by minorities or women. While there is some risk that relaxing the cellular eligibility rule will limit the vigor of competition in some markets, we think that risk is sufficiently limited where the party holding interests in two licenses holds a minority interest in the cellular license and the PCS license is controlled by another entity. We have concluded that we should take that risk in order to advance the goal of promoting economic opportunity for these groups.

16. Our cellular eligibility rules balance the goals that Congress has established -- promoting competition, ensuring rapid deployment of PCS, and providing economic opportunity for designated entities. We have decided that limited participation by cellular providers will serve the public interest by promoting rapid deployment of PCS, participation by designated entities, and overall competition.

17. We have made a number of minor modifications to our rules. With these changes, we intend to proceed expeditiously toward licensing providers of broadband personal communications services. The following is a summary of all of the specific actions we take today to promote the goals outlined above:

a. Adopting a band plan that provides for three 30 MHz licenses (Blocks A, B, and C) and three 10 MHz licenses (Blocks D, E, and F), all of which are within the 1850-1990 MHz band;

b. Providing that the A and B Blocks be licensed within 51 service areas based on the Major Trading Areas (MTAs) and that the C, D, E, and F Blocks be licensed within 493 smaller service areas based on the Basic Trading Areas (BTAs) set forth in the Rand McNally Commercial Atlas & Marketing Guide (123rd ed. 1992);[4]

c. Maintaining the allocation of spectrum at 1910-1930 MHz for unlicensed PCS devices, and committing to initiate a proceeding in the near future to examine allocation of additional spectrum for unlicensed PCS operations. Within this band, we have adopted a 1.25 MHz channelization scheme for isochronous (voice) devices and eliminated channelization requirements for asynchronous (data) devices;

d. Continuing to permit all eligible entities to acquire spectrum up to a cap of 40 MHz;

e. Retaining our five percent equity attribution threshold for PCS licenses so that the same entity may not own more than five percent of PCS licenses constituting more than 40 MHz within the same area;

f. Retaining our cellular attribution threshold of 20 percent equity ownership of a cellular licensee and our service area overlap test of 10 percent of the population of the relevant PCS market, so that the same entity generally may not own more than 20 percent of the cellular license and more than 5 percent of PCS license(s) that would place the entity above the spectrum limit in an overlapping service area;

g. Relaxing the eligibility rules to permit entities with attributable interests in cellular companies whose combined cellular geographic service areas overlap between 10 and 20 percent of the PCS service area population to submit bids for more than 10 MHz of PCS spectrum provided that, prior to the auction, they commit to divest themselves of sufficient cellular interests to come into compliance with our eligibility rules within 90 days of license grant;

h. Providing that voting stock, general partnership interests, interlocking directorates and certain other controlling interests and relationships will be considered in determining attributable interests under our spectrum caps;

[4] Our current rules provide 492 service areas based upon BTAs. In response to a request we are dividing the Puerto Rico service area into two areas, infra.

i. Raising from a 20 percent to a 40 percent non-controlling interest the threshold for determining attributable cellular equity ownership for rural telephone companies, small businesses and businesses owned by minorities and women which are collectively termed "designated entities" under 47 U.S.C. 309(j);

j. Increasing from a 20 percent to a 40 percent non-controlling interest the threshold for determining attributable cellular equity ownership to allow non-designated entities to make non-controlling investments in PCS licenses owned and controlled by minority- and women- owned businesses;

k. Permitting entities with attributable cellular interests covering 10 or more percent of the population in a PCS service area to acquire 10 MHz of PCS spectrum within the PCS service area and, after January 1, 2000, to acquire an additional 5 MHz for a total of 15 MHz of PCS spectrum in their cellular service areas;

l. Relaxing construction requirements to provide that (a) 30 MHz broadband PCS licensees must provide coverage to one-third of their service area population within five years of initial licensing and two-thirds within ten years and (b) 10 MHz licensees must provide coverage to twenty five percent of their service area population within five years of initial licensing or, submit a showing of equivalent or substantial service;

m. Increasing the maximum power level permitted for broadband PCS base stations to 1640 watts equivalent isotropically radiated power (e.i.r.p.), which is equivalent to 1000 watts effective radiated power (e.r.p.);

n. Retaining with minor amendment rules ensuring compliance with minimum standards for exposure to radio frequency (RF) energy emitted by PCS devices;

o. Committing to initiate a proceeding in the near future to allocate additional spectrum for mobile satellite services (MSS) and to work toward having additional spectrum allocated to MSS at the World Radio Conference to be held in 1995 (WRC-95); and

p. Pledging to examine management contracts and spectrum leases in the CMRS docket for the purpose of determining whether other interests in PCS licenses should be limited in order to foster vigorous competition.

II. BACKGROUND

18. The Commission began its investigation of broadband PCS in 1989.[5] Since then the Commission has addressed broadband PCS in this docket by issuing a Notice of Inquiry, holding an En Banc meeting, and adopting a Policy Statement and Order, a Notice of Proposed Rule Making and Tentative Decision, and a Second Report and Order;[6] and held a Public Forum on broadband PCS.[7] We have also allocated 220 MHz of spectrum between 1850 and 2200 MHz for emerging technologies that include PCS;[8] provided for band sharing or negotiated relocation of microwave facilities occupying 2 GHz PCS spectrum;[9] provided spectrum to accommodate the existing 2 GHz facilities that relocated;[10] and adopted technical, licensing and auction rules for narrowband PCS.[11] We also considered 50 pioneer's preference requests related to broadband PCS.[12] Finally, the Commission made recommendations and participated in an international

---

[5] Petitions for Rule Making requesting establishment of PCS were filed by Cellular 21, Inc., in September 1989, RM-7140; and PCN America, Inc. (PCN America), in November 1989, RM-7175. Subsequently, in February 1991, Apple, RM-7618, proposed that 40 MHz from the 1850-1990 MHz band be allocated for unlicensed high-speed local-area data communications services connecting personal computers.

[6] See Notice of Inquiry, GEN Docket No. 90-314, 5 FCC Rcd 3995 (1990); Policy Statement and Order, 6 FCC Rcd 6601 (1991); Notice of Proposed Rule Making and Tentative Decision, 7 FCC Rcd 5676 (1992); Erratum, 7 FCC Rcd 5779 (1992); and Second Report and Order.

[7] See FCC, Transcripts of PCS Public Forum, April 11-12, 1994 (Transcripts of the PCS Public Forum). The transcripts are available for public viewing at both the FCC Reference Center and the Library, 1919 M Street, N.W., Washington, DC. The transcripts also may be purchased from the Commission's duplication contractor.

[8] See First Report and Order and Third Notice of Proposed Rule Making, ET Docket No. 92-9, 7 FCC Rcd 6886 (1992).

[9] See First Report and Order and Third Notice of Proposed Rule Making, ET Docket No. 92-9, 7 FCC Rcd 6886 (1992); Second Report and Order, 8 FCC Rcd 6495 (1993); Third Report and Order and Memorandum Opinion and Order, 8 FCC Rcd 6589 (1993); Memorandum Opinion and Order, 9 FCC Rcd 1943 (1994), petition for further recon. pending.

[10] See Second Report and Order, ET Docket No. 92-9, 8 FCC Rcd 6495 (1993).

[11] See First Report and Order, GEN Docket No. 90-314 and ET Docket No. 92-100, 8 FCC Rcd 7162 (1993) (initial narrowband rules); Memorandum Opinion and Order, 9 FCC Rcd 1309 (1994) (adopting certain narrowband PCS rule amendments on reconsideration); Third Report and Order, PP Docket No. 93-253, FCC 93-98, released May 10, 1994 (design of narrowband auctions).

[12] See Third Report and Order, 9 FCC Rcd 1337 (1994), recon. pending, appeal pending sub

allocation conference at which decisions were made that recognize and permit use of 2 GHz spectrum for PCS.[13] Numerous telecommunications companies and associations have actively participated in our PCS proceedings, and over 100 companies have applied for and received more than 220 experimental licenses to develop and test PCS services and technologies.

19. On August 10, 1993, the President signed the Omnibus Budget Reconciliation Act of 1993 (Reconciliation Act),[14] which amended Sections 3(n), 309(j) and 332 of the Communications Act of 1934, as amended (Communications Act).[15] Section 309(j) for the first time authorized the Commission to select licensees by competitive bidding and establishes objectives for the bidding process, including rapid deployment of new technologies, promotion of economic opportunity, competition and public access, wide dissemination of licenses, and efficient use of the spectrum. The Reconciliation Act also amended Sections 3(n) and 332 to provide that PCS is a mobile service and to establish a new framework for regulatory treatment of mobile services.

20. On September 23, 1993, shortly after the Reconciliation Act was enacted, the Commission adopted the Second Report and Order establishing regulations and policies for broadband PCS that are under review here. In the Second Report and Order, the Commission enumerated goals of competitive delivery, diversity of services, speed of deployment, and wide-area service. The Commission took a number of actions to help meet these goals.

Specifically, the Commission:

---

nom. Pacific Bell v. FCC, No. 94-1148 (D.C. Cir., filed March 1, 1994). We intend to address shortly the petitions for reconsideration of our pioneer's preference decisions.

[13] A worldwide allocation for PCS was discussed at the 1992 International Telecommunication Union (ITU) World Administrative Radio Conference (WARC-92) in Torremolinos, Spain. The conference decided to maintain primary fixed and mobile allocations at 2 GHz in Region II (which includes the United States), and to make additional primary mobile-satellite service allocations in the 1930-2010 and 2120-2200 MHz bands. It added a footnote stating that future public land mobile telecommunications systems, similar in concept to PCS, are expected to use the 1885-2025 MHz and 2110-2200 MHz bands on a worldwide basis. See Report, GEN Docket No. 89-554, 6 FCC Rcd 3900 (1991); ITU, Final Acts of the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (Malaga-Torremolinos, 1992).

[14] Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, Title VI, '' 6002(b)(2)(A), (B), 107 Stat. 312, 392 (1993).

[15] 47 U.S.C. '' 3(n), 309, 332.

a. Defined PCS as "radio communications that encompass mobile and ancillary fixed communication that provide services to individuals and businesses and can be integrated with a variety of competing networks";[16]

b. Allocated spectrum at 2 GHz for PCS, including 120 MHz of spectrum for licensed broadband PCS and 40 MHz for unlicensed PCS devices;

c. Provided for two 30 MHz licenses and one 20 MHz license in the "lower" band of the emerging technologies spectrum, and four 10 MHz licenses in the "upper" band, in each geographic area;

d. Provided that the two 30 MHz licenses would be authorized within 51 service areas based on the Rand McNally Major Trading Areas (MTAs) and that the 20 MHz and 10 MHz licenses would be authorized within 492 service areas based on the Rand McNally Basic Trading Areas (BTAs);[17]

e. Established eligibility requirements that limit entities with certain cellular interests to 10 MHz of PCS spectrum where there is significant overlap between a PCS service area and the cellular service area (i.e., 10 percent or more of the PCS service area population);

f. Limited broadband PCS licensees to 40 MHz of spectrum, and established certain licensing and renewal mechanisms;

g. Established a maximum power level of 100 watts e.i.r.p. for PCS base stations, and adopted technical specifications to avoid harmful interference to other operations while leaving maximum technical flexibility to permit development of new technologies;

h. Adopted rules to minimize radio frequency (RF) exposure risk; and

i. Noted an intent to continue participating in international efforts to provide standards and consistent spectrum allocations for international deployment of worldwide terrestrial mobile and global satellite services.

---

[16] Second Report and Order, ET Docket No. 92-9, 7 FCC Rcd 6886 (1992) at App. A, ' 99.5.

[17] See Rand McNally, Inc., 1992 Commercial Atlas & Marketing Guide 38-39 (1992).

21. In related proceedings, the Commission provided a transition plan to govern PCS licensees sharing their authorized spectrum with existing 2 GHz fixed microwave facilities or relocating those facilities to other spectrum;[18] determined that broadband PCS presumptively will be classified as a commercial mobile radio service under Section 332 of the Communications Act as amended by the Reconciliation Act;[19] and found that broadband PCS is within the Commission's competitive bidding authority, when it adopted generic competitive bidding rules and procedures.[20] With regard to competitive bidding for broadband PCS licenses, the Commission proposed to set aside two blocks of spectrum -- the 20 MHz block (Block C) and a 10 MHz block (Block D) -- that would be reserved for bidding purposes to "designated entities", (small businesses, rural telephone companies and businesses owned by members of minority groups and women), and proposed other measures to ensure economic opportunity for designated entities.[21] These proposals remain pending. The proposed set-aside and other outstanding issues concerning broadband PCS auctions will be decided in a forthcoming Order (in PP Docket No. 93-253) addressing competitive bidding rules.

22. In response to the Second Report and Order, 67 parties filed petitions requesting reconsideration or clarification. Of the 67 petitions, 58 primarily address issues relating to licensed PCS services and 9 primarily address issues relating to unlicensed PCS operations. The petitioners collectively request reconsideration of the spectrum allocation and frequency block plan, eligibility and attribution matters, construction requirements, technical standards,

---

[18] See First Report and Order and Third Notice of Proposed Rule Making, ET Docket No. 92-9, 7 FCC Rcd 7997 (1992).

[19] Second Report and Order, GN Docket No. 93-252, 9 FCC Rcd 1411, 1423 (1994) (CMRS Second Report and Order), recon. pending.

[20] See Second Report and Order, PP Docket No. 93-253, FCC 94-61, released April 20, 1994. (competitive bidding rules).

[21] See Notice of Proposed Rule Making, PP Docket No. 93-253, 8 FCC Rcd 7635, 7655 (1993); Second Report and Order at n.61.

microwave interference criteria, power limits, radio frequency (RF) hazard requirements, and matters related to unlicensed PCS devices. The Commission received comments addressing the petitions for reconsideration from 44 parties and replies from 54 parties.

23. On March 17, 1994, the Commission established an intra-agency task force to coordinate the reconsideration of PCS policies and rules. On April 11 and 12, 1994, the task force conducted a series of public panel discussions on PCS issues. The panelists included potential PCS service providers, technical experts, members of the financial community, economists and representatives of designated entities. The presentations of the panelists and transcripts of the panel discussions were placed in the record of this proceeding, and 30 interested parties filed statements in the record responding to the panel discussions.

III. SPECTRUM ISSUES AND SERVICE AREAS

A. Allocation, Block Plan and Service Areas.

24. In the Second Report and Order, the Commission allocated 120 MHz for licensed PCS and 40 MHz for unlicensed PCS from the 220 MHz of emerging technologies spectrum.[22] Specifically, (lower band) 1850-1890 MHz and 1930-1970 MHz, and the (upper band) 2130-2150 MHz and 2180-2200 MHz, were allocated for licensed PCS; and the 1890-1930 MHz band was allocated for unlicensed PCS devices. In addition, 60 MHz remained in reserve for future allocations to emerging technologies such as MSS or other applications. The frequency plan for licensed PCS included two 30 MHz frequency blocks, one 20 MHz block, and four 10 MHz blocks. Service areas were defined based on Rand McNally's "Major Trading Areas" (MTAs) and "Basic Trading Areas" (BTAs).[23] The two 30 MHz blocks were in the lower band and licensed on an MTA basis; the 20 MHz block also was in the lower band, but licensed on a BTA basis; and the four 10 MHz blocks were in the upper band and licensed on a BTA basis.[24]

---

[22] See "PCS Band Plan" chart attached as Appendix D.

[23] See Rand McNally, Inc., 1992 Commercial Atlas & Marketing Guide 38-39 (1992) ("BTA/MTA Map"). Rand McNally organizes the 50 states and the District of Columbia into 47 MTAs and 487 BTAs. The BTA/MTA Map is available for public inspection at the Office of Engineering and Technology's Technical Information Center, Room 7317, 2025 M Street, N.W., Washington, D.C. 20554. For PCS licensing purposes, the Commission adopted service areas that separated Alaska from the Seattle MTA and added five insular areas: Puerto Rico, U.S. Virgin Islands, Guam, Northern Mariana Islands, and American Samoa. In our rules, the insular areas are treated as five BTA service areas and three MTA service areas. See Section 24.102 of the Commission's Rules. Additionally, a listing of counties, parishes, and census divisions that constitute each BTA and MTA is available for inspection at the Technical Information Center. This is a listing of Rand McNally's 47 MTAs and 487 BTAs, and therefore, the census divisions of Alaska are listed within the Seattle MTA and the insular areas are not listed.

[24] Some parties opposed the use of the Rand McNally MTAs and BTAs for PCS service areas. AIDE Comments at 10-15; FCBA Replies at 1-6; GTE Comments at 13-14; Hill & Welch

Comments at 4-8; Killen Petition at 1-3; NTCA Petition at 2-3; PacBell Comments at 6-8; Point Petition at 3; UTC Petition at 3, 6; and PCIA Petition at 16-18. The principal objection was the use of proprietary and copyrighted material to define service areas for PCS. On February 15, 1994, a blanket licensing agreement was reached between PCIA, on behalf of PCS entities, and Rand McNally. This agreement permits all interested persons to use Rand McNally's copyrighted material for purposes of PCS licensing, building, marketing and operating. As a result of this agreement, PCIA asked to delete from its Petition for Reconsideration all issues related to the use of Rand McNally's MTA/BTA service areas and the objections of the other parties appear to have been resolved by this agreement. We therefore consider the copyright issues related to using MTA/BTA service areas to be resolved.

25. Twenty-eight parties argue for reconsideration of various aspects of the allocation and frequency block plan adopted in the Second Report and Order.[25] In general, the petitioners address: 1) alternatives for the PCS frequency block plan, including the number of PCS providers, PCS service areas, and issues relating to the aggregation or subdivision of PCS spectrum; 2) whether spectrum should be designated for private PCS use; and 3) the impact of the PCS allocation on the international allocations for mobile satellite service (MSS).

26. We are revising the band plan to move the 10 MHz blocks from the upper band to the lower band, increase the size of the 20 MHz block to 30 MHz, and reduce the number of 10 MHz blocks from four to three. The revised band plan is depicted in Appendix D, "Broadband PCS Band Plan," and detailed in the following table.

Frequency Block	Amount of Spectrum	Geographic Scope	Frequency Range
A	30 MHz	MTA	1850-1865/1930-1945 MHz
B	30 MHz	MTA	1870-1885/1950-1965 MHz
C	30 MHz	BTA	1895-1910/1975-1990 MHz
D	10 MHz	BTA	1865-1870/1945-1950 MHz
E	10 MHz	BTA	1885-1890/1965-1970 MHz
F	10 MHz	BTA	1890-1895/1970-1975 MHz

[25] See Alliance Reply at 2-4; APCO Petition at 6; Bell Atlantic Petition at 3; BellSouth Petition at iii; Columbia Petition at 1-3; Comcast Petition at 15-16; Comsat Petition at 15-22; CTIA Petition at iii; DWMP Petition at 3; Florida Cellular Petition at 4; Killen Petition at 1-3; Murray Petition at 4-8; INS Petition at 6; McCaw Petition at 7; NTCA Petition at 2-3; Nextel Petition at 5; NYNEX Petition at 3, 6-11; PacBell Petition at 2; PCS Action Petition at 3, 9-10; Pegasus Petition at 1-2; PNSC Petition at 5; Point Petition at 1-2; RCA Petition at 2, 7-8; TDS Petition at 2; Time Warner Petition at 2-7; TRW Petition at 2; Intelco Petition at 3-6; and UTC Petition at 2-6.

Unlicensed	20 MHz	Nationwide	1910-1930 MHz

27. This plan provides for three large blocks and three small ones. This will allow potential licensees to aggregate varying amounts of spectrum in different geographic areas depending on their individual business plans. The three large 30 MHz blocks ensure that these licensees have sufficient spectrum to begin service rapidly. The three small 10 MHz licenses will allow the provision of services that might not require a full 30 MHz, or for aggregation with a 30 MHz PCS license or an existing cellular license. As noted above, moving the 10 MHz blocks from the upper band to the lower band provides a number of important procompetitive benefits: consumer equipment costs will be significantly lower, costs of relocating incumbent fixed microwave links will be significantly reduced for new PCS entrants, the ability to aggregate spectrum will be increased, and valuable spectrum will be preserved that can be used to provide mobile satellite service on a worldwide basis. This revised plan reduces the amount of spectrum for unlicensed devices, but will increase the ability of new consumer equipment to work on both a licensed and unlicensed basis, increasing the utility of the devices for consumers. The improvement in this band plan will increase competition, lower equipment costs and provide other benefits. As a result, consumers will receive lower-cost and higher-quality service.[26]

1. Block Positioning

28. NYNEX proposes that the number of licenses and size of the frequency blocks be maintained, but that the 20 MHz block be switched to the upper band and that two of the 10 MHz blocks be switched to the lower band and located between the two 30 MHz blocks.[27] NYNEX states that this would facilitate aggregation of up to 40 MHz in the lower band because both 30

[26] In the Second Report and Order, the Commission declined to allocate additional support spectrum to connect PCS cell sites. We found that fixed service spectrum already allocated in other bands is adequate to support such PCS backhaul operations. The Commission also noted that some of these support operations can be provided through facilities that do not require use of radio spectrum, such as fiber optic cable. APC, in its comments to the petitions for reconsideration, requests that we allocate at least a portion of the 38 GHz band specifically for PCS backhaul operation. See APC Comment at 23-24. We continue to believe that the spectrum already allocated for fixed microwave services is adequate to support PCS operations and will not allocate additional spectrum at this time. We do recognize, however, that it is important that PCS operations have access to adequate support spectrum. Accordingly, we will henceforth examine more closely requests for use of the 38 GHz band to ensure that such requests are justified and that the spectrum is used efficiently.

[27] Appendix B lists parties that filed petitions for reconsideration, oppositions or comments, and replies. Abbreviations for parties used throughout this Memorandum Opinion and Order are indicated in this appendix.

MHz MTA blocks would be adjacent to a 10 MHz BTA block. It states that this arrangement of the frequency blocks would be especially helpful to cellular licensees who are limited to 10 MHz in-market, but can aggregate up to 40 MHz out-of-market. NYNEX states that this approach would allow a cellular carrier to purchase licenses only in the lower PCS band so that its customers would not need handsets that operate in both the upper and lower bands. NYNEX states that, while it is possible to design equipment that can work in both the lower and upper PCS bands and the cellular bands, such "interoperable" handsets would result in increased equipment cost, size, weight, and power consumption.[28]

29. INS proposes two 30 MHz and two 10 MHz blocks in the lower band and one 30 MHz and one 10 MHz block in the upper band. It states that this plan would increase the opportunity for designated entities to aggregate 40 MHz because the current frequency plan encourages designated entities to bid on three different blocks (one 20 MHz and two 10 MHz blocks). INS agrees with NYNEX that use of spectrum in both bands would result in higher per unit capital costs and indicates that this is of particular importance to small businesses.

30. Bell Atlantic states that six 20 MHz blocks would eliminate the need for costly and inefficient aggregation of licenses between the lower and upper frequency bands. CTIA states that the plan adopted in the Second Report and Order will force licensees in the lower band to aggregate with the 10 MHz frequency blocks in the upper band if their systems require more than 20 or 30 MHz and contends that this approach requires complex and expensive equipment capable of operating in both bands.[29]

[28] See NYNEX Petition at 3.

[29] See CTIA Petition at iii, 3-5.

31. MSS providers argue that the location of the PCS allocations located in the upper band spectrum nullifies the International Agreement on Global MSS allocations. They propose combining all 120 MHz of licensed PCS in a single block below 2 GHz.[30]

32. Motorola discussed a plan to move all of the PCS spectrum to the lower band in ex parte presentations. They note that their plan gives the Commission the flexibility to allocate three 30 MHz and three 10 MHz licenses in the lower band. Motorola argues that bidders would be able to aggregate licenses without the need for dual band equipment.

33. A number of parties filed comments and ex parte presentations which also discuss the benefits of placing all of the licensed PCS spectrum in a contiguous band. These benefits include lower equipment costs and lower microwave relocation costs. In addition, some stress the increased ability of a provider to have spectrum in the same band in different service areas to provide competitive service.[31] Other parties discuss the desirability of having 10 and 30 MHz blocks in the same band as the 30 MHz blocks to facilitate aggregation.[32]

34. Decision. We initially authorized 10 MHz blocks in the upper PCS band. Many parties, however, argue that the upper band blocks would be of little value in the near term because equipment would not be developed for this spectrum for a year or more.[33] In addition, handsets that can bridge the upper and lower bands are predicted to cost about 25 percent more and to be bulkier than handsets operating only on the lower frequencies.[34] In addition, dual mode handsets would be heavier and have shorter battery life. Several parties argued that dual band handsets were essential to the success of upper band service because PCS operators would be likely to aggregate upper and lower band spectrum and consumers would want to be able to receive service on both bands, both to permit roaming across geographic areas and to facilitate changing service providers.[35] These parties contended that the higher costs, delay, and other limitations associated with the upper band presented serious impediments to achieving our goals of fostering a competitive market, rapid deployment, opportunities for designated entities, and fostering a wide diversity of services. Upon reconsideration, we conclude that MSS and PCS

---

[30] See MSS Industry Spectrum Coalition Briefing for PCS Task Force at 1-5 (April 14, 1994).

[31] See e.g., MCI Comments at 5.

[32] See NYNEX Comments at 2.

[33] See e.g., NYNEX Petition at 3.

[34] See Transcripts of the PCS Public Forum at 247-249 (April 12, 1994); Letter from Motorola to the FCC at 2 (May 25, 1994); Letter from Concord to the FCC at 1 (May 31, 1994); Letter from Northern Telecom to the FCC at 1 (June 1, 1994).

[35] See Murray Petition at 7-8; PCS Action Petition at 2.

services can both be accommodated by using only lower band spectrum for licensed and unlicensed PCS services.

35. Moving licensed PCS from the upper band to the lower band provides a number of procompetitive benefits. First, the cost of interoperability between licensed and unlicensed PCS will be reduced. As noted above, equipment costs to consumers are predicted to be reduced by 25 percent. Moreover, under the revised plan, manufacturers will concentrate on a single band with uniform frequency spacing, which should result in greater economies of scale in manufacturing that reduce consumer equipment prices. This additional cost for interoperability between bands was not evident to us when we made our earlier decision. Increased interoperability has the additional benefit of reducing lock-in costs for consumers, giving them greater ability to switch providers, and thereby resulting in a more competitive market. Because of the less expensive handsets and the ability to combine adjacent blocks, aggregation is much more desirable. This will benefit all new providers, including designated entities, because they will be able to reduce costs and compete more effectively. Furthermore, there appear to be a number of different potential uses for the 10 MHz blocks: innovative niche services that are unlikely to be provided initially on the 30 MHz blocks, aggregation with the 30 MHz blocks, aggregation with other 10 MHz blocks, service extensions for incumbent cellular providers, and opportunities for designated entities to provide service with lower capital cost. Moving the 10 MHz blocks from the upper band to the lower band will enhance the value of some, if not all, of these uses and allow licensees to decide the most valuable use for the spectrum.

36. Second, the cost and time required to relocate incumbent fixed microwave links should be significantly less in the lower band because the number of microwave links in the upper band is higher than the number in the lower band.[36] While the bandwidth used by the upper band microwave incumbents is much less, making it easier to find some clear spectrum immediately, the ultimate requirement to clear the spectrum would result in significantly higher costs for PCS licensees.

37. Third, equipment should be available for the lower band at an earlier date. Manufacturers have spent significant time and resources developing lower band equipment but the record indicates that they have not done much work on developing equipment for the upper band. As a result, some parties assert that the availability of upper band equipment trails the availability of lower band equipment by about one year.[37] Time to market is a critical factor in the rollout of PCS services that will compete against existing cellular and enhanced specialized mobile radio (ESMR) entities. Thus, earlier equipment availability is a significant factor in developing a competitive PCS service.

---

[36] See Transcripts of the PCS Public Forum at 145 (April 12, 1994).

[37] See Letter from PCS Action to the FCC (March 23, 1994).

38. Fourth, many cellular companies have expressed a desire to operate PCS systems both outside and inside their current cellular service areas.[38] By moving the PCS spectrum to the lower band, PCS and cellular providers will have the ability to provide service over a large geographic area even though they desire (or are required) to have different amounts of PCS spectrum in different areas. This capability could lower costs to the benefit of consumers because cellular companies will be able to compete using PCS spectrum inside and outside of their service areas.

39. Finally, as we discuss infra, moving all the PCS spectrum to the lower band will better meet the needs of the emerging MSS industry. We also believe that this action will increase the value of the unlicensed spectrum because interoperability with licensed PCS will increase.

40. Accordingly, we find that moving all of the PCS spectrum to the lower band will increase competition, reduce both consumer equipment and system costs, and increase equipment functionality. This new band plan has significant industry support, as evidenced by numerous recent filings submitted in the record by a variety of interests supporting Motorola's proposal to move all of the PCS spectrum to the lower band.[39]

2. Block Size

41. In developing our original plan, we concluded that 10 MHz blocks could support viable and competitive PCS services through the use of advanced digital techniques, such as Code Division Multiple Access (CDMA) and Time Division Multiple Access (TDMA), and microcellular technology. We also stated that some types of PCS operations would require more than 10 MHz of spectrum. In addition, we recognized that initially PCS is required to share spectrum with fixed microwave operations and therefore the full amount of spectrum will not be

---

[38] See e.g., NYNEX Petition at 3.

[39] See Letter from Motorola to the FCC (May 25, 1994); Letter from MCI to the FCC (May 26, 1994); Letter from Northern Telecom to the FCC (June 1, 1994); Letter from MSS Spectrum Coalition to the FCC (May 27, 1994); Letter from U.S. West to the FCC (June 1, 1994); Letter from OPATSCO to the FCC (June 2, 1994); Letter from CTIA to the FCC (May 27, 1994); Letter from Concord to the FCC (May 31, 1994); Letter from Pacific Telesis to the FCC (May 27, 1994); Letter from APC to the FCC (June 2, 1994).

available initially in many locations. We concluded that 20 and 30 MHz frequency blocks were needed to support the rapid development and implementation of the fullest range of PCS services. We also permitted most licensees to aggregate up to 40 MHz of broadband PCS spectrum in each service area, except that cellular licensees were limited to 10 MHz where their cellular geographic service area (CGSA) overlapped with the PCS service area. For these reasons, we concluded that the combination of 10, 20, and 30 MHz licenses would allow users to acquire the amount of spectrum appropriate for their applications.

42. In its petition, Time Warner requests that we allocate 40 MHz per PCS license. Time Warner argues that 40 MHz blocks are needed to share the PCS frequencies with fixed users and that allowing aggregation does not adequately remedy the problems caused by licensing blocks smaller than 40 MHz. Time Warner states that under current PCS rules, the only way for a licensee to aggregate 40 MHz is to aggregate across the lower and upper bands, which would necessitate the use of subscriber equipment that is larger and more expensive.[40] Alternatively, INS proposes that we divide the PCS spectrum into three 30 MHz and three 10 MHz blocks, arguing that this facilitates aggregation of spectrum without crossing between the bands and will enable designated entities to obtain a 30 MHz block in the lower band.[41]

[40] See Time Warner Petition at 2.

[41] See INS Petition at 6.

43. Several parties express support for alternative plans based on blocks of equal size.[42] Bell Atlantic, BellSouth, Florida Cellular, Point, and TDS urge that we allocate six 20 MHz blocks (four 20 MHz blocks in the lower band and two 20 MHz blocks in the upper band).[43] Bell Atlantic states that the net efficiency and capacity gain in moving from four 10 MHz to four 20 MHz blocks greatly outweighs the slight efficiency loss from reducing the two 30 MHz allocations to 20 MHz. Florida Cellular states that equal-sized blocks would provide a "more equitable playing field" for small businesses. Other commenters, especially smaller companies and associations representing the interests of smaller groups, support the principle that competition will be increased if we allocate blocks of equal size.[44]

44. Point submits that a 20 MHz block is more than enough spectrum to create a viable PCS service, arguing that digital technology permits a provider with 20 MHz to serve the entire population in all but the very largest markets. It argues that in a marketplace comprised of two cellular carriers, one wide-area specialized mobile radio (SMR) carrier, and from two to six viable PCS carriers, no single carrier could expect to achieve more than a 30 percent market share. Point concludes that a 20 MHz block is more than sufficient to serve 30 percent of the total population even in the largest markets.[45]

45. CTIA and Nextel propose four 20 MHz blocks in the lower band and four 10 MHz blocks in the upper band. CTIA and Nextel argue that digital technology offers unprecedented customer capacity and that the record does not identify any PCS service requiring as much as a 30 MHz block. Nextel states that 10 and 20 MHz blocks are sufficient to permit engineering around unrelocated microwave systems while encouraging the use of spectrally-efficient technologies.[46] Additionally, CTIA states that 30 MHz blocks make coordination with microwave incumbents more difficult than the 20 MHz blocks because incumbent microwave users generally have 20 MHz channels.

---

[42] In his petition, Murray requested allocation of all broadband PCS spectrum in 10 MHz blocks and licensed in BTA license areas. In his comments, however, Murray indicates that although he still favors 10 MHz licenses, a move toward uniformity (in channel blocks of 20 MHz) would be a improvement over the plan adopted.

[43] See Bell Atlantic Petition at 3; BellSouth Petition at 17; Florida Cellular Petition at 4; Point Petition at 2; TDS Petition at 2.

[44] See Murray Petition at 4-8.

[45] See Point Petition at 2.

[46] See Nextel Petition at 5-8.

46. PacBell urges that we reduce the number of blocks (and PCS licensees). In particular, PacBell argues that, given two established cellular providers and one SMR competitor, a maximum of three new PCS providers would be viable even in the largest metropolitan areas.[47]

47. AMT/DSST, in joint comments, submit that the adopted frequency plan should not be altered. AMT/DSST argue that the petitioners reflect no consensus on the appropriate direction to be taken by the Commission on reconsideration. They state that the 10 MHz licenses will facilitate the provision of specialized or "niche" applications and that such specialized applications and services will not be offered by PCS providers operating on the larger blocks and expecting to compete with incumbent cellular providers. AMT/DSST also state that the two 30 MHz blocks will foster the rapid introduction of PCS services with system capacities comparable to cellular system capacities. In the view of AMT/DSST, the current plan represents a "reasoned balancing of the regulatory, policy and technical considerations that have received a full airing in this Docket."[48]

48. GCI states that, while it would have preferred fewer blocks, each with a greater amount of spectrum, the current frequency plan should not be revised. It states that the diversity of arguments for different block sizes demonstrates that a diversity of services may result from the allocation of spectrum blocks of varying size. Further, GCI believes that cellular providers will combine 10 MHz of PCS spectrum with their existing allocation of 25 MHz. GCI therefore believes it important to provide PCS licensees with 30 MHz so that new entrants can compete with cellular providers.[49]

---

[47] See PacBell Petition at 2.

[48] See AMT/DSST Comments at 2-8.

[49] See GCI Comments at 3-5.

49. A number of responding parties argue strongly that the current plan should not be amended to eliminate 30 MHz blocks in favor of smaller blocks. For example, APC states that the 30 MHz blocks are necessary to permit licensees to share spectrum with microwave users, to enable PCS to compete with the wired local loop, and to facilitate the provision of high-speed data broadband and information services. APC believes that entities favoring smaller spectrum blocks hope to place PCS providers at a competitive disadvantage to cellular and wide-area SMR operations.[50] PCS Action similarly argues that large spectrum blocks and geographic areas will enable independent PCS operators to be competitive sooner with the existing mobile communications providers.[51] US West believes that 30 MHz is necessary to support new entrants.[52] MCI submits that smaller blocks would increase the costs and delays associated with the development of a broadband wide area PCS system. MCI believes that smaller blocks would be inefficient and would require new entrants to resort to the secondary market to obtain the spectrum necessary to compete with other mobile communications providers.[53]

[50] See APC Comments at 13.

[51] See PCS Action Comments at 3-9.

[52] See US West Petition at 9-12.

[53] See MCI Comments at 2-3, 5.

50. Bell Atlantic, CTIA, Nextel, and Sprint oppose Time Warner's proposal for 40 MHz blocks, arguing that such a large amount of spectrum would permit too much concentration of control and discourage participation by designated entities, who will tend to be smaller than other PCS providers.[54]

51. At the PCS Public Forum held on April 11 and 12, 1994, and in comments filed in response to those discussions, many of the parties supported 30 MHz blocks. For example, Mark Roberts of Alex Brown & Co. stated that PCS entrants will need large blocks of spectrum to be able to compete efficiently and to operate with a cost structure similar to that of cellular providers that already have 25 MHz. He further argued that license sizes of less than 30 MHz would be likely to lock in premium returns for the cellular industry.[55] Paul Rissman of Alliance Capital stated that the financial community would be interested in PCS only if large spectrum blocks are created.[56] Daniel Kelley of Hatfield & Associates stated that, given the spectrum clearing problems, 30 MHz would be about the minimum amount of spectrum needed for a PCS provider to compete with incumbent cellular providers.[57] Other participants at the public meeting, including George Murray, Dr. Charles Jackson, and Dr. Jerry Hausman, expressed the view that 20 MHz blocks would be sufficient for the provision of PCS service and that by allocating 20 MHz blocks the Commission could facilitate aggregation to 40 MHz if some providers felt that was necessary.[58]

---

[54] See Bell Atlantic Comments at 4-5; CTIA Comments at 12; Nextel Comments at 10-12; Sprint Comments at 4.

[55] See Transcripts of the PCS Public Forum at 439 (April 11, 1994).

[56] See Transcripts of the PCS Public Forum at 441-449 (April 11, 1994).

[57] See Transcripts of the PCS Public Forum at 251-252 (April 11, 1994).

[58] See PCS Public Forum transcript at 111 (April 12, 1994) (Murray), 28 (April 12, 1994) (Jackson), and 353 (April 11, 1994) (Hausman).

52. Decision. In the Second Report and Order, we allocated two 30 MHz blocks, one 20 MHz block and four 10 MHz blocks. Our intent was to encourage participation of as many viable new PCS entrants as possible while maintaining sufficient spectrum to ensure the viability of both MSS and unlicensed devices. Based on the reasoning presented below, and on information provided by the petitioners and other responding parties, including presentations made by industry experts at our panel discussions, we find that our goals will be better served by two modifications to the band plan: (a) an increase in the size of the 20 MHz block to 30 MHz; and (b) a reduction in the number of 10 MHz blocks from four to three. Overall, the total amount of spectrum allocated for licensed PCS remains unchanged.[59]

53. One of our goals in this proceeding is to stimulate competition in the wireless and wireline industries, thus reducing costs and improving quality for consumers. In so doing, we must balance two objectives. First, we want to maximize the number of opportunities for new viable competitors to emerge. We also want to allow market forces to guide how many competitors survive. We have endeavored to provide as many opportunities as possible to aggregate blocks into viable service offerings to ensure that several strong competitors emerge to provide service. Our desire to maximize competition must be tempered, however, because 1) spectrum is limited and 2) for new entrants to be viable we must provide sufficient spectrum to begin service quickly with reasonable upfront capital costs. We believe that the combination of microwave incumbents occupying part of this spectrum and economies of scale lead to the conclusion that the a set of three 30 MHz blocks will support the rapid introduction of competitive PCS services whereas 20 MHz blocks could lead to PCS service start-up delays or a reduction in the number of viable competitors.

[59] See "PCS Band Plan" attached as Appendix D.

54. We believe that our new band plan is superior to uniform 20 MHz blocks, as advocated by Bell Atlantic, BellSouth, Florida Cellular, Point and TDS.[60] The combination of three 30 MHz blocks and three 10 MHz blocks allows the aggregation of a variety of license sizes that could not occur with uniform 20 MHz blocks.[61] As a result, we find that the allocation of six 20 MHz blocks would not provide as many benefits as either the allocation adopted in the Second Report and Order on the modified plan we adopt in this order and it might lead to fewer new service providers with sufficient spectrum to provide service quickly. We also reject the plan of twelve 10 MHz blocks proposed by Murray, because such an arrangement might seriously delay the implementation of PCS, since the process of aggregating so many spectrum blocks could be time consuming and costly.[62] It also could dramatically increase complexity and transaction costs at and after the auction. Finally, we believe that dividing the spectrum into 40 MHz blocks as requested by Time Warner would be inefficient for many applications and would foreclose innovative niche services.

55. The record indicates significant concern that a 20 MHz block may not provide sufficient spectrum to enable a PCS provider to compete effectively with other PCS licensees operating on 30 MHz spectrum blocks or with other commercial mobile radio service providers. Some parties argue that 20 MHz will provide sufficient capacity in the long run.[63] However, APC argues that with only 20 MHz, there could be a significantly larger portion of each service

---

[60] See Bell Atlantic Petition at 3; BellSouth Petition at 17; Florida Cellular Petition at 4; Point Petition at 2; TDS Petition at 2.

[61] We also believe that fewer new viable PCS competitors might emerge under the six blocks of 20 MHz plan, given a spectrum aggregation limit of 40 MHz and the head start of cellular incumbents.

[62] See Murray Petition at 4-8.

[63] See Point Petition at 2; Nextel Petition at 5-8.

area where the licensee has no usable spectrum due to the presence of microwave incumbents.[64] The presence of fixed microwave links requires that, on the average, a licensee with 20 MHz initially will have to relocate more microwave links than a 30 MHz license before PCS service can begin, which could significantly delay the commencement of service and increase the upfront cost of initiating service. In addition, APC states that the ability of a microwave incumbent to delay or extract a premium for relocating its link because its microwave path fully blocks service diminishes significantly with a 30 MHz spectrum block.[65] While incumbent microwave links are 20 MHz wide, we feel that the advantages of being able to work around specific links with a 30 MHz block outweigh the additional transaction costs which result from not matching the incumbent fixed microwave assignments identically.

[64] See APC Comments at 11.

[65] See APC Comments at 10.

56. Other parties support the notion that a 30 MHz block will help new PCS entrants compete more effectively with existing wireless and wireline providers.[66] We also believe that limiting one licensee to 20 MHz could be a disadvantage for future competition. The ability to provide a complete package of mobile voice and data services could become a significant competitive advantage in the future. Such a package of wireless services, however, may require more than 20 MHz of spectrum.[67] Other services may require less spectrum and are better suited to the 10 MHz blocks.

57. Due in large part to these concerns, the investment community has stated that financing would be much more difficult to obtain for the licensees on the 20 MHz block than on the other blocks.[68] These handicaps are of particular concern to us because the 20 MHz block was proposed to be reserved for designated entities.[69] The competitive handicaps of a 20 MHz block relative to 30 MHz blocks would not have served our goal of providing a viable competitive opportunity for designated entities.

58. Increasing the third license from a 20 MHz block to a 30 MHz block appears to eliminate any competitive disadvantages stemming from the band plan. The A, B and C blocks each will have a roughly equivalent portion of its service area completely blocked by incumbent microwave users in any geographic area. As a result, the costs and delay due to incumbent relocation should be similar on each of the blocks. This change should also reduce the difficulty faced by the C block licensee in obtaining financing. We conclude, therefore, that three equal sized 30 MHz blocks will facilitate competition and the rapid development and implementation of the fullest range of PCS services and ensure that PCS is more fully competitive with other mobile radio services. Accordingly, we are changing the single 20 MHz license to a 30 MHz license.

59. Time Warner petitioned us to allocate 40 MHz blocks in order to promote rapid introduction of service and to enhance the ability a wide range of services in competition with

---

[66] See PCS Action Comments at 4; INS Petition at 6; Letter from PacBell to the FCC (April 28, 1994).

[67] See PCS Action Comments at 4.

[68] See Transcripts of the PCS Public Forum at 439-449 (April 11, 1994).

[69] In the Notice of Proposed Rule Making in the competitive bidding proceeding, PP Docket No. 93-253, 8 FCC Rcd 7635 (1993) (competitive bidding), the Commission indicated that it would consider setting aside Blocks C and D for small businesses, rural telephone companies, and businesses owned by minorities or women. Reconciliation Act ' 6002(a), 107 Stat. at 389. See H.R. Rep. No. 103-213, 103d Cong., 1st Sess. at 482-484 (1993) (Conference Report); H.R. Rep. No. 103-111, 103d Cong., 1st Sess. at 255 (1993).

existing wireless and wireline providers.[70] While we believe that some new entrants may need to acquire 40 MHz to fully realize their business plans, requiring all applicants to purchase 40 MHz in all areas would not serve our goal of giving potential licensees the ability to determine the amount of spectrum they need for particular services, nor would it maximize competition. Companies that desire to provide service using 40 MHz can do so through aggregation at the auction or afterwards. Providing a combination of 30 MHz and 10 licenses MHz provides the benefits of 40 MHz licenses, without restricting the options of firms nor affecting competition.

[70] See Time Warner Petition at 2.

60. Consistent with our decision to formulate a flexible definition of PCS, we allocated four 10 MHz blocks in the Second Report and Order that could serve a variety of needs.[71] We continue to believe that 10 MHz blocks, both on their own and in combination with the 30 MHz blocks or with each other, are useful to support a variety of PCS services. Throughout this proceeding, several parties have indicated that 10 MHz blocks would be suitable for providing services ranging from specialized or "niche" applications to services comparable to those now provided by cellular systems.[72] In addition, the 10 MHz blocks will be beneficial both for cellular licensees, who have limited eligibility for PCS participation in region, and possibly also for augmenting SMR. Finally, commenters discussed the desire to aggregate the 10 MHz blocks with the larger blocks in order to increase capacity for PCS services in heavy demand areas.[73]

61. For these reasons, we believe the public interest is best served by continuing the allocation of licenses on 10 MHz channel blocks in addition to the 30 MHz licenses. We must limit the number of 10 MHz blocks to three for any given area, however. We are constrained because we also want to reserve spectrum for other uses such as MSS and unlicensed PCS. Allowing the flexibility to aggregate spectrum blocks of different size will help ensure that efficient providers succeed. We believe that 120 MHz will provide sufficient spectrum to promote competition rapidly and that flexibility in the provision of service will provide incentives for efficient use of the spectrum.

62. In sum, we believe that a band plan that provides for three 30 MHz licenses and three 10 MHz licenses, all in the lower band, compared to our earlier plan, will better ensure that PCS services are available promptly and competitively to the American public.

3. Aggregation and Disaggregation

63. A number of petitioners request clarification of, or changes to, our policies regarding the aggregation or subdivision of PCS spectrum and PCS service areas. In the Second Report and Order, we limited any party's ability to aggregate PCs spectrum to an attributable interest in 40 MHz.[74] Companies that were deemed to hold attributable interests in cellular license(s) covering 10 percent or more of the population in a PCS service area were limited to holding a

---

[71] See Second Report and Order at & 24.

[72] AMT/DSST states that specialized services can meet unserved demand for PCS and that 10 MHz will be sufficient for some applications. See AMT/DSST Comments at 4. See also CTIA Comments at 10; Murray Comments at 3-4; and Nextel Reply at 4; Transcripts of the PCS Public Forum at 43 (April 11, 1994).

[73] See PCS Action Reply at 2; Time Warner Reply at 2-4.

[74] See Second Report and Order at & 61.

single 10 MHz PCS license in that area.[75] We did not address the issue of whether we would allow disaggregation of spectrum.

[75] Id. at & 106.

64. Comcast requests clarification that the 40 MHz aggregation limit applies only to PCS spectrum.[76] PNSC submits that certain PCS licensees should be permitted to aggregate more spectrum than that allowed under the current plan. It recommends that BTA licensees in areas with populations between 200,000 and 999,999 be permitted to aggregate up to 60 MHz and that cellular carriers serving markets with populations of one million or less be permitted to aggregate up to 20 MHz. PNSC further urges that no limit be set on aggregation of spectrum in areas with populations less than 200,000. PNSC questions the viability of seven PCS licensees and states that rural BTA licensees should be permitted to aggregate more spectrum because they are at a competitive disadvantage vis-a-vis MTA licensees.[77] It contends that if we do not raise the aggregation limit, we should adopt a channeling plan that provides for three 30 MHz MTA licenses, with one set-aside for designated entities, and three 10 MHz BTA licenses, with one set-aside for designated entities.

65. PCS Action and Time Warner request that PCS licensees be permitted to aggregate up to 40 MHz of spectrum in the lower band through leasing, joint ventures, consortia, or other means.[78] They contend that this would eliminate the need for licensees to use more expensive equipment capable of operating in both the upper and lower bands. CTIA does not object to the overall 40 MHz limit on PCS ownership. However, it requests that cellular licensees be subject to the 40 MHz limit and that they be allowed to acquire up to 15 MHz of PCS spectrum. Thus, CTIA argues that, in addition to the right to bid on a 10 MHz channel, cellular operators should be permitted to acquire an additional 5 MHz either through bidding and subsequent divestiture or after the auction.[79] BellSouth and Point suggest a uniform 45 MHz aggregation limit that would apply to the total spectrum used by an entity for all the mobile communications services it provides in a given area, including, cellular, SMR, wide-area SMR and PCS.[80] BellSouth argues that the current approach limits cellular providers to an additional 10 MHz of PCS or a total of 35 MHz of spectrum while enhanced SMRs can acquire up to 40 MHz of PCS spectrum or a total of 59 MHz of spectrum.[81]

66. Decision. We believe that the 40 MHz limit for PCS spectrum is appropriate. No new information has been presented to indicate that each licensee in a market would require more than 40 MHz to provide broadband PCS service. Although at least one party argued that this

---

[76] See Comcast Petition at 15.

[77] See PNSC Petition at 5-8.

[78] See PCS Action Petition at 39; Time Warner Petition at 8.

[79] See CTIA Petition at iii.

[80] See BellSouth Petition at 15-17; Point Petition at 3.

[81] See BellSouth Petition at 15-17.

limit should be amended to allow greater aggregation in rural areas, we do not believe that greater aggregation is needed.[82] In particular, the demand in rural areas is expected to be sufficiently low that there should be no need for more than 40 MHz by any one provider. If demand in rural areas is not sufficient to meet than 40 MHz of spectrum to one entity, it would be preferable to have additional competitors serve these customers rather than to license more than 40 MHz of spectrum to one entity.

[82] See PNSC Petition at 8.

67. One of our goals in this proceeding is to promote competitive delivery of wireless services. As a result, we feel that not only is an overall cap on PCS spectrum important to prohibit excessive spectrum aggregation, but that a comparable separate limit should be placed on cellular providers since they already hold 25 MHz of clear spectrum and already have a large number of existing wireless customers. To ensure competitive parity, cellular carriers will be subject to an overall spectrum cap of 35 MHz for their combined PCS and cellular spectrum. We are persuaded by the argument, raised by a number of parties, that because of cellular's "headstart" in the wireless telephone market, existing infrastructure and large base of customers, cellular carriers might be able to dominate the wireless market if they receive more than 10 MHz of PCS spectrum.[83] We also recognize that new entrants face a possibly lengthy process to relocate existing microwave users so they can use all of their spectrum. Cellular carriers already have 25 MHz of clear spectrum in operation whereas new entrants may have to relocate microwave users to gain access to that much spectrum, even if they acquire 40 MHz at the auction. In addition, we are concerned that additional spectrum acquired by cellular entities may reduce the amount of spectrum available to new entrants and increase the costs to new entrants. To promote the ability of new entrants to acquire spectrum and rapidly begin service as strong competitors to in-region cellular carriers, we have decided to continue to permit cellular carriers to acquire and hold only a single 10 MHz license in any PCS service area where they are considered in-region. (See Cellular Eligibility section infra). However, because we realize that as competitive PCS offerings are implemented, the market advantages enjoyed by cellular carriers should decrease, we will allow cellular carriers to acquire an additional 5 MHz after January 1, 2000. This will allow cellular carriers to acquire the same total amount of spectrum (40 MHz) as other entities. Limiting in-region cellular carriers to 10 MHz of PCS spectrum for five years will not disadvantage them relative to the new entrants who must contend with microwave relocation over their entire spectrum block(s) and do not necessarily have an established customer base or comparable infrastructure advantages.[84]

68. We reject the contention BellSouth and Point that the aggregation limit be raised to 45 MHz to permit cellular entities to acquire an additional 20 MHz. If we were to allow such aggregation to 45 MHz through the disaggregation of 30 MHz blocks, the number of full service competitors could be reduced to the detriment of realizing the goals we have set forth for PCS. If we were to allow aggregation to 45 MHz through the aggregation of 10 MHz blocks, there would not be enough blocks to assure both full cellular participation and the participation of other parties who desire 10 MHz licenses. We conclude that 40 MHz remains an appropriate limit on

---

[83] See Letter from PCS Action to the FCC (May 27, 1994). Many other parties, including one company with existing cellular holdings, expressed concern that allowing in-region cellular carriers to acquire additional spectrum would lead to a market dominated by cellular carriers. See Letter from US West to the FCC (June 1, 1994); Letter from MCI to the FCC (May 26, 1994); Letter from Time Warner to the FCC (May 27, 1994).

[84] Because we are prohibiting spectrum disaggregation until the year 2000, cellular entities will have an opportunity to acquire 5 MHz of additional spectrum at that time.

PCS spectrum because it protects the competitive structure, provides sufficient spectrum for efficient provision of wireless services, and encourages a wide diversity of firms to participate in the industry. Furthermore, we are seeking comment in another proceeding as to whether and how our aggregation limit may be applied uniformly to all mobile communications providers. We find that extending the PCS spectrum aggregation limit to include other mobile services, such as SMR and wide-area SMR services, is beyond the scope of this proceeding. We therefore intend to address issues relating to spectrum aggregation across other commercial mobile radio services in a separate proceeding.[85]

69. Although, as stated above, we believe spectrum disaggregation should be permitted, we are concerned that initially, there may be anticompetitive incentives to disaggregate spectrum. Two or three entities might purchase a viable 30 MHz license and disaggregate it to reduce the number of new entrants. Thus, we will permit disaggregation of spectrum by any licensee only after it meets the five year construction requirement. The five year point will allow the PCS market to take shape. Entities desiring to use small amounts of spectrum before the prohibition on disaggregation ends can either purchase the 10 MHz blocks of spectrum if they wish to provide service using less than 30 MHz or enter into joint ventures or resale arrangements to facilitate their access to spectrum. We expect to conduct a further proceeding to specify the rules for spectrum disaggregation, which will also explore the possibility of permitting disaggregation for other commercial mobile radio services.

70. We agree with the suggestions of the petitioners and responding parties that PCS entities should eventually be permitted to disaggregate spectrum. We feel that, in the future, disaggregation will complement the three 30 MHz and three 10 MHz channel plan by allowing subdivision of spectrum blocks where service providers find that economic or other conditions warrant it. Allowing spectrum disaggregation, even if it is prohibited until the first construction benchmark, will provide appropriate incentives for service providers to conserve their use of spectrum and to invest in spectrum conserving technologies. Because PCS licensees have paid for the use of the spectrum and have the ability to sell it in the future, they should be especially sensitive to the value of the resource they are using and will be motivated to ensure that it is used in the most valuable way.

71. In determining the appropriate placement of the 10 MHz blocks within the lower band, we seek to promote the development of an efficient market structure and to ensure that no subset of license has any inherent competitive disadvantage due to placement of licenses in the band plan. In particular, we must consider the benefits of aggregating the 30 MHz blocks with the 10 MHz blocks compared to the benefits of aggregating the 10 MHz blocks themselves. Interspersing the 10 MHz blocks between each 30 MHz block facilitates aggregation to 40 MHz by allowing combination of each contiguous 30 MHz and 10 MHz license pair. This also

[85] See Further Notice of Proposed Rule Making, GN Docket No. 93-252, FCC 94-100, released May 20, 1994.

facilitates relocations of the existing fixed microwave operations by matching fixed microwave channels with PCS channels. This will keep to a minimum the number of parties responsible for each relocation which will reduce relocation negotiation, timing and costs. On the other hand, keeping all 10 MHz licenses contiguous would allow more efficient aggregation of these licenses as a substitute strategy for obtaining one of the three 30 MHz block. We conclude that interspersing the 10 MHz licenses between the 30 MHz licenses to permit efficient aggregation up to 40 MHz should the market favor that outcome is the best approach. Recognizing that aggregation of the 10 MHz licenses may be attractive to some parties, however, we are also making two of the 10 MHz licenses contiguous so as to permit this aggregation to 20 MHz, should some parties favor 20 MHz over 30 MHz. (See Cellular Eligibility infra.)

4. Service Areas

72. In the Second Report and Order, we specified that the two 30 MHz blocks would be licensed on an MTA basis. We also specified that the 20 MHz block and four 10 MHz blocks would be licensed on a BTA basis.[86] We adopted this plan to promote the rapid deployment and ubiquitous coverage of PCS and felt that these areas would follow the natural flow of commerce.[87]

[86] See Second Report and Order at & 76.

[87] Id. at & 73.

73. A number of petitioners request changes in the service areas designated for PCS blocks. Pegasus, for example, requests that the Commission adopt a Mayaguez/Aguadilla-Ponce BTA separate from the San Juan BTA. Pegasus argues that Puerto Rico should comprise two BTAs because the two areas are split geographically by mountains.[88] In addition, DWMP points out that some rural BTAs are larger than a small MTA and that it would be unreasonable to ask a rural PCS provider to meet the construction requirements in these sparsely-populated areas. DWMP requests that we specify smaller service areas.[89] Other parties, such as Killen and NTCA, favor use of the MSA/RSA service areas that are used for cellular licenses.[90] Point Communications states that either BTAs or the cellular MSA/RSA service areas should be used for PCS, arguing that all PCS should be licensed on the same service area basis.[91] CTIA and Nextel suggest that all licensing be based on BTA service areas.[92] Nextel believes that MTA service areas will result in poor build-out and lack of service in rural locations.[93] BellSouth submits that the six 20 MHz blocks it suggested should be licensed on a BTA basis.[94] BellSouth argues that MTAs are inappropriate because they would result in a lack of parity among competitors, and uniform initial spectrum blocks and service areas would encourage competition and give effect to market forces.

74. At the PCS Public Forum held on April 11 and 12, 1994, Dr. C. J. Waylon of GTE submitted that MTA coverage offers large geographic service areas that would enhance competition with existing cellular service providers.[95] Mark Roberts of Alex Brown and Co. also voiced support for the larger MTA service areas.[96] However, some parties, such as George Murray, felt that all blocks should be licensed on a BTA basis to provide an opportunity for small entrants to compete on an equal footing with other PCS providers.[97]

---

[88] See Pegasus Petition at 1-2.

[89] See DWMP Petition at 3.

[90] See Killen Petition at 1-3, NCTA Petition at 1-8. There are 306 Metropolitan Statistical Areas (MSAs) and 428 Rural Service Areas (RSAs). See 47 C.F.R. ' 22.2.

[91] See Point Petition at 2-4.

[92] See CTIA Petition at 9-10, Nextel Petition at 11-13.

[93] See Nextel Petition at 12.

[94] See BellSouth Petition at 17.

[95] See Transcripts of the PCS Public Forum at 82-83 (April 11, 1994).

[96] See Transcripts of the PCS Public Forum at 439 (April 11, 1994).

[97] See Murray Petition at 4-8.

75. Decision. We have decided to retain the geographic license areas definitions for PCS licenses, adopted in our Second Report and Order. We reject the arguments that all licenses should have the same geographic scope, as in NTIA's proposal to use the Department of Commerce Economic Areas.[98] We also reject a re-drawing of the boundaries along cellular MSA/RSA lines as proposed by Killen, NTCA, and Point.[99]

[98] See Letter from NTIA to the FCC at 2 (May 31, 1994).

[99] See Killen Petition at 1-3; NTCA Petition at 1-8; Point Petition at 2-4.

76. We reject the use of cellular MSA/RSA boundaries for a number of reasons. The ten year history of the cellular industry provides evidence generally that these service areas have been too small for the efficient provision of regional or nationwide mobile service. The large transaction costs to aggregate MSAs and RSAs that have been incurred over the past ten years in the cellular industry have frequently been directed towards geographic aggregation to provide wider service areas for consumers and to lower costs of providing service. Rather than forcing replication of this costly and time-consuming process, we are beginning with larger service areas, which we expect to minimize the need for costly post-auction transactions. We also hope to spur market competition from new PCS providers by starting with larger initial geographic service areas to alleviate the cellular headstart advantage.[100] We realize that the MTA and BTA license boundaries do not coincide with existing cellular license boundaries, but feel that the costs imposed by these different license boundaries will be outweighed by the benefits of larger initial service areas. We are cognizant of problems created by overlaps between the PCS and cellular service areas, and provide some relief from these problems. (See Cellular Eligibility, infra.)

77. We also are rejecting the suggestion that all licenses should have the same geographic scope whether MTAs (as proposed by PCS Action), BTAs (as proposed by BellSouth, CTIA, and Nextel) or Department of Commerce Economic Areas (proposed by NTIA). While identical geographic areas may impose more initial competitive parity, we do not believe that this will maximize competitiveness and participation in the provision of PCS services. Licensing all blocks on an MTA basis might increase competitiveness with cellular, but it would limit the ability of cellular companies and designated entities to participate in the provision of PCS. Cellular companies could be restricted because of overlaps with MTAs that might not occur with BTAs. Designated entities are likely to be better able to finance the construction of PCS across a BTA than an MTA. Thus, by licensing some blocks on a BTA basis, we comply with Congress' directive that we prescribe area designations that promote economic opportunity for a wide variety of applicants, including small businesses, rural telephone companies, and business owned by members of minority groups and women.[101]

78. We therefore continue to feel that a combination of MTA and BTA licenses will give licensees the opportunity to select and combine service areas and promote broad participation in the provision of PCS services by firms of various sizes. Licensing two of the 30 MHz blocks on an MTA basis will permit these licensees to operate in large service areas which will facilitate interoperability and roaming across wide geographic areas. Licensing the third 30 MHz block on a BTA basis will not preclude such efficiencies because of the ability to aggregate licenses geographically. In addition, in much the same way as the variety of spectrum block sizes allows various strategies, the variety of geographic sizes will allow firms to determine the optimal

---

[100] CTIA states that as of year-end 1993, cellular companies served more than 16 million subscribers and had invested nearly $14 billion in building their systems. Letter from CTIA to the FCC (April 29, 1994).

[101] See 47 U.S.C. ' 309 (j)(4)(C).

geographic strategy they wish to pursue. This will also help us to meet the statutory objectives of disseminating licenses to a wide variety of licensees.[102] In addition, allocating four of the six licenses on a BTA basis addresses the concern that rural buildout would not occur with MTA licenses.

79. Finally, we concur with Pegasus' suggestion with regard to the Puerto Rico service area and will provide two separate BTA service areas in Puerto Rico, one for Mayaguez/Aguadilla-Ponce and the other for San Juan. This action recognizes the difficulties created by the mountain range separating these two areas. No parties opposed this request and we find this adjustment to be in the public interest.[103]

5. Geographic Partitioning

[102] See 47 U.S.C. ' 309(j)(3)(B). See also Alliance Petition at 2-3; Columbia Petition at 2-3; NTCA Petition at 3; RCA Petition at 2, 7; Intelco Petition at 7.

[103] See Pegasus Petition at 10.

80. In its petition, McCaw asks us to permit applicants to subdivide PCS blocks and service areas.[104] McCaw states that this would allow parties to bid jointly for PCS BTA and MTA licenses, and then subdivide the PCS operating authority on either a geographic or spectrum basis. It states that this approach would diminish the disadvantages created by using MTAs and BTAs rather than the significantly smaller cellular MSA and RSA service areas. This would allow cellular entities to offer PCS services in areas where they do not provide cellular service and yet would not qualify for licensing in the entire PCS service area.

81. Several parties responding to the petitions favor allowing partitioning of PCS service areas. For example, AIDE, CTIA and McCaw state that geographic and spectrum partitioning will promote efficient use of the spectrum and will encourage service in rural areas.[105] AMT submits that partitioning will offer flexibility to PCS providers.[106] GTE states that partitioning will expedite the introduction of new services, promote participation in PCS, and allow PCS to serve niche markets.[107] Finally, CUC recommends that the Commission allow partitioning only within a specified time after licensing to ensure universal deployment of PCS and prevent licensees from warehousing spectrum that they do not intend to utilize.[108]

82. Other responding parties oppose allowing geographic partitioning. For example, GCI and MCI argue that interested parties should form consortia to provide uniform service across

---

[104] See McCaw Comments at 2-24.

[105] See AIDE Comments at 5; CTIA Comments at 16; McCaw Comments at 2-24.

[106] See AMT Comments at 2-3.

[107] See GTE Comments at 9-10.

[108] See CUC Comments at 12.

areas instead of dividing the allotments.[109] GCI, MCI and Nextel argue that allowing geographic partitioning would inject additional variables into the initial auction process and complicate the development of an orderly post-auction market.[110] MCI contends that to avoid manipulation and evasion of the construction requirements, voluntary partitioning should be limited to geographic sizes no smaller than a BTA with no less than 10 MHz of spectrum, pending examination of the feasibility of smaller partitions in a separate rule making.[111]

[109] See GCI Comments at 15-16; MCI comments at 3-5.

[110] See GCI Comments at 15-16; MCI comments at 3-5; Nextel Comments at 13-14.

[111] See MCI Comments at 3-5.

83. Decision. We agree with the parties that oppose permitting geographic partitioning at this time. We find that there is a significant risk that partitioning can be used to circumvent construction requirements. While there may be efficiency enhancing geographic partitions, much of the benefit can be obtained through other arrangements that do not raise the same concerns about circumvention of our construction rules.[112] On balance, we conclude that we should not adopt a policy allowing general geographic partitioning, but recognize that the balance may be different for particular groups of service providers, such as rural telephone companies or to create PCS ownership opportunities for companies owned by minorities or women. Therefore, we will consider the issue of geographic partitioning for rural telephone companies and other designated entities in our forthcoming Order, to adopt specific competitive bidding rules for broadband PCS in PP Docket No. 93-253.[113] There we will address other designated entity preferences and will rely on the record in both proceedings in making our final determinations on this matter. Also, we will address whether we should recover the unserved PCS areas at the end of the ten-year construction period, in a later proceeding after we have had an opportunity to assess the scope of system build-outs.

6. Unlicensed Devices

84. In developing a band plan for PCS, we have had to weigh the spectrum requirements of licensed PCS with the amount of spectrum allocated for unlicensed PCS. For reasons described above, the new band plan moves all of licensed PCS to the lower band. As a result of this change, we have had to reduce the amount of spectrum available for the operation of unlicensed PCS devices from 40 to 20 MHz. This is the amount of spectrum we originally proposed for unlicensed devices. Despite having less spectrum available for unlicensed PCS devices in the near term, we believe the new band plan will have an overall positive effect for consumers in terms of the diversity and utility of unlicensed devices available on the market, as well as the rapid deployment of competitive licensed PCS Services.

85. One reason we reach this conclusion is that even without this change it is unlikely that the 20 MHz reallocated to licensed from unlicensed would have been used in the near term for unlicensed. The spectrum at 1890 to 1910 MHz was regarded as less desirable than the 20 MHz retained for unlicensed PCS at 1910-1930 MHz because it contains significantly more microwave incumbents.[114] Our expectation was that unlicensed devices first would operate on the 1910-1930 MHz spectrum because the cost of clearing this spectrum is significantly less.

---

[112] See GCI Comments at 15-16; MCI Comments at 3-5; Nextel Comments at 13-14.

[113] We recognize that we stated in an earlier order that the issue of geographic partitioning by rural telephone companies would be addressed in this order, but we now believe that this issue should be addressed with other issues regarding designated entities. See Second Report and Order in PP Docket No. 93-253 at & 243.

[114] See Transcripts of the PCS Public Forum at 11-12 (April 12, 1994):

Licensed PCS providers, by contrast, provide ample evidence in the record that they are ready to begin the relocation of microwave incumbents in the lower band and provide service in the near term and can use the spectrum from 1890-1910 MHz rapidly. Thus, consumers are more likely to obtain immediate benefits if we allocate this spectrum to licensed PCS rather than for unlicensed PCS devices.

86. Another benefit of the new band plan is that the licensed and unlicensed PCS spectrum will be located in close proximity on the lower band. Consumers will have more choices for equipment that operates on both unlicensed and licensed PCS bands, and will not have to buy higher-priced equipment that operates on both the lower and upper PCS bands to have available the full array of service options with a single piece of equipment. Finally, we intend that the initial 20 MHz allocation for unlicensed PCS devices meet the near term spectrum requirements for unlicensed devices.[115] To consider the long-term spectrum requirements of unlicensed PCS devices, we intend to issue a Notice of Proposed Rule Making in the near future to identify additional spectrum for unlicensed PCS devices.

87. For the reasons set forth above, therefore, we conclude that consumers and manufacturers of equipment intended for use on the unlicensed band will benefit from the new band plan. This does not diminish our concern that there be sufficient spectrum allocated for unlicensed PCS devices to accommodate expected demand, and therefore as noted above, we are committed to instituting a further rule making for this purpose to meet the long term requirements for unlicensed PCS devices, including those potential unlicensed uses that may not be accommodated readily in the initial 20 MHz allocation.

B. Private Use

[115] We agree that both unlicensed asynchronous and isochronous devices may need additional spectrum in the near future. See Transcripts of the PCS Public Forum at 10 (April 12, 1994).

88. In their petitions, UTC and APCO request that we set aside a portion of the licensed PCS spectrum for private PCS operations such as public safety or internal company use.[116] UTC argues that essential public services and private industries require advanced mobile/portable communications capabilities that cannot be provided by commercial PCS. Further, UTC states that the current rules preclude the development of such private systems. UTC also states that for private users: 1) 10 MHz channels are too large for a single licensee's requirements; 2) the construction requirements are impractical and inappropriate;
3) the service areas do not correspond to the service territories of private entities; and
4) competitive bidding is inappropriate for public safety and private systems.[117] APCO agrees, and argues that public safety agencies need spectrum for new life-saving communications technologies that will not, and cannot, be provided by carrier-based services such as PCS. APCO states that Congress repeatedly has mandated that radio services that are necessary for the safety of life and property deserve special consideration in the allocation of spectrum.[118]

89. Several parties, including APC, MCI, Sprint, PCIA and TDS, oppose allocation of PCS spectrum for the private use of utilities and public-safety organizations.[119] These parties argue that private organizations will have full access to unlicensed PCS and that PCS licensees will have incentives to structure systems for the internal use of private organizations. Sprint states that reducing the amount of spectrum available for commercial PCS licenses would compromise the competitiveness and viability of PCS. Sprint also notes that providing emerging technology spectrum for private use would not provide auction revenue for the government. On the other hand, API and ITA support a separate spectrum allocation for "private PCS" systems, arguing that many private communications operations cannot be transferred to public systems due to service reliability concerns.[120]

---

[116] See UTC Petition at 2-4; APCO Petition at 4-6.

[117] See UTC Petition at 2-4.

[118] See APCO Petition at 4-6.

[119] See APC Comments at 3; MCI Comments at 6; Sprint Comments at 5-6; PCIA Reply at 2; TDS Comments at 13.

[120] See API Comments at 8-9; ITA Comments at 4-5.

90. Decision. We agree with the parties who argue that both commercial PCS service and unlicensed PCS devices will be able to meet many of the communications requirements of private entities. The PCS licensees will be permitted to tailor specific service applications to the particular needs of individual organizational customers. Any such service applications, of course, must be consistent with policies we have established for the regulation of commercial mobile radio services under Title II of the Communications Act.[121] Such applications could include the use of dedicated capacity. Where such arrangements might not be satisfactory, entities desiring spectrum solely for internal private use could, of course, bid for licensed PCS spectrum individually or as a group intending to share the licensed facilities.[122] Companies that value private use of the spectrum highly could win a license at auction; otherwise they could contract with a licensee to provide the services they need, or procure such services from resellers. Moreover, as many commenters argue, we believe that setting aside spectrum for private interests would not help us achieve the goals set forth for PCS, and at the same time, could detrimentally affect competitive service provision and the efficient allocation of scarce spectrum resources. Also, the extent to which additional spectrum is required for private and public safety use is being considered in a separate proceeding that addresses allocation of spectrum below 5 GHz transferred from Federal government use.[123] Accordingly, we will deny UTC's and APCO's requests that we set aside a portion of the spectrum allocated to PCS exclusively for private PCS operations.

---

[121] See CMRS Second Report and Order, 9 FCC Rcd at 1439 n.130:

> The terms and conditions for different classes of customers may, of course, vary. Whether such differences are lawful would be a question of whether there is unreasonable discrimination under Section 202(a) of the [Communications] Act. In the case of individualized or customized service offerings made by CMRS providers to individual customers, it is our intent to classify and regulate such offerings as CMRS, regardless of whether such offerings would be treated as common carriage under existing case law, if the service falls within the definition of CMRS.

[122] We also note that, while broadband PCS is presumptively classified as a Commercial Mobile Radio Service (CMRS), parties acquiring licenses may request Private Mobile Radio Service (PMRS) classification if they meet our requirements. See CMRS Second Report and Order at & 39.

[123] See Notice of Inquiry, ET Docket No. 94-32, 9 FCC Rcd 2175 (1994). This proceeding addresses, inter alia, a Petition for Rule Making filed by the Coalition of Private Users of Emerging Multimedia Technologies (COPE) for the development of an "Advanced Private Communications Service," using 75 of the 200 MHz to be transferred to our jurisdiction from Federal government spectrum in compliance with the terms of the Omnibus Budget Reconciliation Act of 1993.

C. Mobile Satellite Services (MSS) Issues

91. AMSC, Comsat, and TRW argue for preservation of the 2180-2200 MHz band for future allocation to MSS.[124] The petitioners oppose allocation of spectrum to PCS that has been allocated internationally to MSS, contending that such allocation is inconsistent with the United States' support for these allocations at WARC-92 and impedes the introduction of global MSS. In their comments, AMSC claims that since sharing between MSS and the Broadcast Auxiliary Service in the 1990-2010 MHz band may be possible, the MSS paired frequencies at 2180-2200 MHz should not be allocated to PCS.[125] Comsat and TRW argue that the Notice did not propose to consider allocation to PCS of the 2180-2200 MHz band and that parties were therefore denied the opportunity to comment fully on this issue.[126] TRW argues that we should reallocate the entire 1970-2010 MHz and 2160-2200 MHz bands to MSS to match the international allocations. To preserve at least the worldwide MSS allocations, TRW suggests that the four 10 MHz PCS blocks in the 2130-2150 MHz and 2180-2200 MHz bands be relocated to the 2110-2150 MHz band.[127] Motorola also filed a petition stating that, while it supports allocation of sufficient spectrum for terrestrial PCS, the Commission should initiate a separate proceeding to identify and allocate additional spectrum outside the PCS bands for MSS.[128]

---

[124] The 1992 World Administrative Radio Conference of the International Telecommunications Union (WARC-92) allocated 80 MHz of spectrum to MSS in the bands 1970-2010 MHz and 2160-2200 MHz while retaining the existing fixed and mobile allocations in those bands. Petitions from MSS interests seek removal of the PCS allocation from the 2180-2200 MHz band to preserve the option of allocating that band domestically to MSS. In 20 MHz (the 1970-1980 MHz and 2160-2170 MHz bands) of this spectrum, MSS is limited to Region II (generally countries in the Western Hemisphere); in the remaining 60 MHz (1980-2010 MHz and 2170-2200 MHz), the MSS allocation is worldwide. In the Second Report and Order, the Commission allocated 20 MHz (2180-2200 MHz) of this spectrum to PCS and retained the existing U.S. allocations in the remaining 60 MHz (the bands 1970-1990 MHz and 2160-2180 MHz were held in reserve for future emerging technologies, and the existing broadcast auxiliary allocation was maintained in the 1990-2010 MHz band). The WARC-92 allocation pairs 2180-2200 MHz for transmission from the satellite (downlink) with 1990-2010 MHz for transmission from subscribers (uplink).

[125] See AMSC Petition at 2-3, 6.

[126] See Comsat Petition at 2-3, 15-22; TRW Petition at 1-2.

[127] See TRW Petition at 2-6.

[128] See Motorola Petition at 3.

92. Most responding parties oppose the petitioners' requests that additional spectrum be reserved for MSS. MCI, Sprint, UTC, API and Bell Atlantic oppose reallocating any of the PCS spectrum to MSS. API and UTC state that while MSS can offer a wide range of valuable services, an adequate spectrum reserve for the development of MSS has been established and no more should be allocated.[129] MCI states that, to the extent the Commission believes there may be a future need for additional MSS spectrum, the Commission should initiate a separate proceeding to identify and allocate other bands for MSS.[130] UTC argues that the over 100 MHz allocated for MSS is more than sufficient.[131] It contends that the petitioners' real concern appears to be that there should be sufficient spectrum to accommodate all potential MSS applicants rather than that the overall allocation to MSS is insufficient to meet expected demand. Sprint and Bell Atlantic support the allocation of 120 MHz for broadband PCS and oppose reallocating any of that spectrum to MSS. Sprint states that to do so would compromise the competitiveness and ultimate viability of PCS.[132]

---

[129] See API Comments at 8-9; UTC Comments at 6-7.

[130] See MCI Comments at 6.

[131] UTC observes that 63 MHz of spectrum is allocated domestically for MSS at 1544-1559/1645.5-1660.5 MHz and 1610-1626.5/2483.5-2500 MHz and that 40 MHz can be used for MSS at 1970-1990/2160-2180 MHz. See UTC Comments at 6-7.

[132] See Sprint Comments at 5-6; Bell Atlantic Comments at 8-10.

93. In reply comments, TRW, AMSC, Comsat, and LQSS support reallocation of the 2180-2200 MHz band from PCS to MSS. Comsat and LQSS agree with TRW that we could substitute other spectrum for PCS to replace the 1980-2200 MHz band.[133] AMSC opposes expansion of the PCS proceeding to include the possible allocation of the 1990-2010 MHz band to MSS. It argues that the current allocation of this band to broadcast auxiliary operations is necessary, that these frequencies are already congested and that there currently is no evidence that sharing between broadcast auxiliary operations and MSS would be feasible.[134]

94. Decision. We recognize the potential value of MSS as a service provider to rural areas that may not be economically served by PCS. We have thus given the petitions of MSS interests, including the various alternatives they suggest, careful consideration. Having been instrumental in obtaining the international MSS allocations at WARC-92, we would not wish unnecessarily to reduce our flexibility to implement those allocations in the U.S. On the other hand, we must also recognize the large potential value of PCS which is a matter of record in this proceeding.[135] It should be noted that these MSS bands are also allocated internationally to fixed and mobile services. PCS, as we have broadly defined it, fits within the international definition of fixed and mobile services and is thus consistent with international agreements on the use of this spectrum. Because spectrum is a limited resource, we find that to satisfy our goal of allocating sufficient spectrum for a competitive PCS service, we must allocate to PCS a portion of the spectrum internationally designated for MSS. We believe the new plan we are adopting today strikes an appropriate balance between these two services and will provide maximum benefits to U.S. consumers.

95. We disagree with the assertion of Comsat and TRW that we provided insufficient notice and opportunity for comment on the possibility that we might allocate a portion of the internationally designated MSS spectrum to PCS. The PCS Notice sought comment on a wide range of allocation options for licensed PCS ranging from three to five spectrum blocks of from 20 to 40 MHz each.[136] Several of the possible combinations of block size and number of blocks would require the use of spectrum in the bands designated internationally for MSS, and at least

---

[133] See Comsat Reply at 4-6; LQSS Reply at 1-4; TRW Reply at 2-5.

[134] See AMSTV Reply at 1-5.

[135] PCIA, The Yankee Group, EMCI, and BIS Strategic Decisions all presented demand studies at the PCS Public Forum on April 11, 1994 that showed significant demand for PCS services. In addition, also at the PCS Public Forum, Dr. Jerry Hausman pointed to stock market valuations for SMR companies to support his assertion that there will be significant demand for wireless services in the future.

[136] See Notice of Proposed Rule Making and Tentative Decision, GEN Docket No. 90-314, ET Docket No. 92-100, 7 FCC Rcd 5676, 5692 (1992).

one option (i.e., five blocks of 40 MHz each) would require virtually all of that spectrum.[137] We specifically called attention to the fact that some of these options would necessarily require the use of spectrum in other emerging technologies bands, and we did not exclude emerging technologies bands that had been designated internationally for worldwide or Region II MSS.[138] Thus, contrary to petitioners' contentions, we believe that parties were given adequate notice of the possibility that our final PCS allocation could include some or even all of the internationally allocated MSS spectrum in these bands.

[137] See Second Report and Order at && 34, 36.

[138] Id. at & 40.

96. Under the new band plan, the entire allocation to broadband PCS is located in the 1850-1990 MHz band. The 2180-2200 MHz band, which was allocated to PCS in the Second Report and Order has been returned to reserve status for future allocation potentially to MSS, as requested by the MSS interests. Our new band plan, however, removes an equal amount of spectrum from potential consideration for MSS in the band 1970-1990 MHz band, 10 MHz of which can be used for Region II MSS service. We believe that our new band plan accommodates the future potential of MSS more fully than our original plan and therefore addresses the concerns of a majority of the MSS industry.[139]

97. By shifting the PCS allocation out of the 2180-2200 MHz band we have preserved the option of allocating some or all of that spectrum to MSS in the future. This preserves 50 MHz of the 60 MHz allocated worldwide and thus fits more closely with our international agreements. Twenty MHz of this worldwide MSS spectrum is paired with spectrum inside the current broadcast auxiliary band. In the future, this spectrum could potentially be reallocated for MSS use on a shared basis, if feasible, or exclusively, if suitable replacement spectrum could be found for broadcast auxiliary service. It is our intent to initiate a proceeding to investigate these additional allocation possibilities in the near future, with the purpose of accommodating MSS operations within the remaining internationally designated bands, while at the same time maintaining sufficient spectrum for broadcast auxiliary use. We also intend to pursue additional international allocations for MSS at WRC-95.[140]

IV. OWNERSHIP RULES AND CELLULAR ELIGIBILITY

98. In the Second Report and Order, the Commission recognized that permitting cellular licensees to participate in PCS could foster rapid development of PCS by taking advantage of cellular providers' expertise, economies of scope between PCS and cellular service, and existing

---

[139] See Letter from Motorola to the FCC (May 25, 1994); Letter from MSS Spectrum Coalition to the FCC (May 27, 1994).

[140] See Preparation for International Telecommunication Union World Radio Communication Conferences, IC Docket No. 94-31, FCC 94-96, released May 5, 1994.

infrastructures.[141] The Commission also recognized that new entrants would foster competition and expressed concern about potential anticompetitive conduct by parties with cellular and PCS interests in the same geographic area.[142] To balance these competing interests, we permitted cellular licensees to obtain PCS licenses outside of their cellular service areas, but restricted them each to one 10 MHz PCS license within their respective cellular service areas.

[141] See Second Report and Order at & 106.

[142] Id. at && 101, 105.

99. For the purposes of its PCS rules, the Commission defined an attributable cellular interest as ownership of 20 or more percent of a cellular license.[143] If an entity has attributable cellular interests in a license or licenses individually or jointly covering 10 or more percent of the population in a PCS service area, then that entity would be restricted to one 10 MHz PCS license in that area. If an entity holds interests of less than 20 percent in a cellular license, these interests are not considered attributable and the population covered by that cellular license area is not counted towards the 10 percent population threshold. If an entity holds attributable cellular interests, i.e., interests of 20 percent or more, in licenses that individually or jointly cover less than 10 percent of the population in a PCS service area, that entity may hold licenses for up to 40 MHz of PCS spectrum in that PCS service area. Entities that have attributable interests that put them over the 10 percent population overlap threshold in a PCS service area are deemed "in market" cellular entities and as such may only hold 10 MHz of PCS spectrum in that PCS service area.[144]

100. The 20 percent attribution rule applies on a cumulative basis to all parties with ownership interests in cellular operations. Thus, for example, if four participants in a PCS venture each have an ownership interest of 5 percent in the same cellular licensee serving more than 10 percent of the population of a BTA, the PCS venture in which they all have an interest is deemed to have a 20 percent cellular ownership interest and is restricted to one 10 MHz frequency block in that BTA.[145] However, if the four parties to a PCS application each own 5 percent interests in four different cellular licensees, each of which serves 10 or more percent of the BTA, together they are not restricted to one 10 MHz block because they do not exceed the 20 percent attribution threshold as to any single cellular license. Therefore, in the latter instance, the parties are permitted to purchase a full 40 MHz PCS spectrum block.

101. Twenty-four parties petitioned for reconsideration of various aspects of the cellular eligibility rules and the general attribution standard used for invoking our PCS ownership limits.[146] The petitioners address: 1) eligibility of cellular licensees; 2) the 20 percent attribution standard; 3) the 10 percent population standard; 4) post-auction compliance by cellular licensees with the ownership restrictions; 5) exemptions from the eligibility restrictions for certain cellular providers; and 6) the interests that should be deemed attributable for purposes of calculating ownership and control of a PCS or cellular license.

---

[143] See Second Report and Order at && 107-108.

[144] Id. at && 104-110.

[145] Id.at & 107 and n.93.

[146] Petitioners addressing eligibility and attribution issues include: Alliance, APC, Bell Atlantic, CCIMR, Columbia, Comcast, Concord, CTIA, Florida Cellular, GCI, GTE, INS, MCI, McCaw, NYNEX, OPASTCO, Pacific Telecom, PMN, PNSC, Radiofone, Sprint, Time Warner, TDS, Intelco and US West.

A. Eligibility of Cellular Licensees for PCS Licenses

102. Six parties advocate eliminating all eligibility restrictions on cellular providers.[147] Fourteen parties agree with the concept that there should be some restrictions on cellular participation in PCS.[148] These latter parties' positions range from agreeing with the standards of the Second Report and Order to arguing for different measures of both coverage and ownership to favoring different standards entirely, but these parties all accept the idea that there should be limitations on cellular entities holding PCS licenses.[149]

[147] See Bell Atlantic Petition at 4; McCaw Petition at 3; NYNEX Comments at 5-6; Radiofone Petition at 12-15; TDS Petition at 3; USTA Comments at 5.

[148] See AIDE Comments at 18; Cablevision Comments at 6-8; CIS Comments at 1; Concord Petition at 2; CTIA Petition at 14; Florida Cellular Petition at 5; GCI Petition at 5-8; GTE Petition at 2-5; MCI Petition at 1; PCS Action Comments at 13-15; PNSC Petition at 9-10; Sprint Petition at 9-10; Time Warner Reply at 6-8; U.S. West Petition at 16, 26.

[149] Id.

103. We have decided to retain restrictions on cellular participation in PCS. In making this decision, we are aware of the benefits that the cellular industry has to offer PCS, as TDS and McCaw note,[150] including capital, economies of scope, and experience and expertise in the provision of mobile communications services. For this reason, we will continue to allow cellular participation in PCS. In addition, we will make some changes in the specific standards of the Second Report and Order, but we remain convinced that restrictions on in-market cellular providers are necessary to achieve our goal of maximizing the number of new viable and vigorous competitors. In reaching this conclusion we do not assume that in-market cellular providers will engage in illegal anticompetitive behavior. We agree with the assertion of Dan Kelley of Hatfield Associates that our goal in crafting these rules should not be to prevent anticompetitive behavior which may or may not materialize, but rather, to promote competition.[151] Bell Atlantic's assertion that we should not restrict cellular participants because we have no basis for assuming that cellular providers will behave anticompetitively in the PCS market, does not address our goal of promoting vigorous new competition.[152] Similarly, McCaw's arguments that existing cellular providers have minimal market penetration do not respond to our desire to provide consumers with as many competitive choices as possible.[153] We conclude that the public interest would be best served by maximizing the number of viable new entrants in a given market.

104. Finally, while some petitioners, such as Radiofone, point out that SMR and MSS providers are not subject to the same eligibility restrictions as cellular providers,[154] only U.S. West affirmatively requests that the eligibility restrictions of the Second Report and Order be extended to wide-area SMR services.[155] US West claims that wide-area SMR is competitive with PCS and cellular services and asserts that the competitive concerns that apply to cellular systems also apply to wide-area SMR operations. AIDE and Time Warner agree with U.S. West that cellular eligibility limitations should also apply to wide-area SMR providers, because wide-area SMRs are expected to compete with cellular and PCS.[156] Nextel, however, opposes the application of cellular eligibility restrictions to wide-area SMR systems.[157] It states that

---

[150] See TDS Petition at 3; McCaw Petition at 3.

[151] See Transcripts of the PCS Public Forum at 389, (April 11, 1994).

[152] See Bell Atlantic Petition at 4; see also Second Report and Order at && 5, 108.

[153] See McCaw Petition at 3.

[154] See Radiofone Petition at 12-15.

[155] See U.S. West Petition at 16.

[156] See AIDE Comments at 18; Time Warner Reply at 6-8.

[157] See Nextel Reply at 8-9.

extending the eligibility restrictions to wide-area SMR systems is beyond the scope of this proceeding and that wide-area SMR operation is too new and too small to have the capability of behaving anticompetitively. We agree with Nextel that imposing eligibility restrictions is beyond the scope of this proceeding. We are, therefore, addressing in another proceeding[158] the eligibility of wide-area SMRs and other commercial radio services to participate in PCS.

B. Attribution Rules

[158] See Further Notice of Proposed Rule Making, GN Docket No. 93-252, FCC 94-100, released May 20, 1994.

105. In the Notice of Proposed Rule Making in this proceeding, we noted our expectation that PCS and cellular licensees serving the same area will compete on price and quality of service. We therefore stated that competitive benefits might be reduced if cellular licensees are permitted to acquire PCS licenses within their service areas and proposed an outright prohibition on cross-ownership of PCS licenses by entities with cellular interests, except that ownership interests of less than one percent (or less than five percent for publicly traded companies) would not be considered.[159] In the Second Report and Order, we found this approach too restrictive. Although we still sought to avoid the potential for undue market power by entities with significant existing market share, we balanced that goal against recognition of the expertise that cellular licensees would bring to PCS markets.[160] We also noted that many entities possess non-controlling interests in cellular licensees exceeding 5 percent but, due to the non-controlling nature of their equity interests, create little potential for anti-competitive behavior.[161]

106. We therefore adopted a simple, bright-line 20 percent cross-ownership attribution standard, pursuant to which entities with 20 percent or greater ownership of a cellular operator were limited to one 10 MHz BTA license for broadband PCS in the same region as their attributable cellular interests.[162] We did not distinguish between different types of ownership such as voting and non-voting stock and general and limited partnership interests. We noted, however, that while a clear 20 percent ownership threshold may be more administratively efficient, a concern remained that some parties with cellular ownership interests will use our rules as an opportunity to control local cellular licensees while retaining less than 20 percent ownership. Since such occurrences would undermine our intent to limit cellular ownership in PCS, we said that we would review carefully this decision, and we explicitly put parties on notice

---

[159] See Notice of Proposed Rule Making, GEN Docket No. 90-314, 7 FCC Rcd. 5676, 5703 n.46 (citing 47 C.F.R. ' 22.921(b)).

[160] See Second Report and Order at & 108.

[161] Id. at & 107.

[162] Id. at && 107, 108; Section 24.204 of the Commission's Rules.

that we would reconsider this limit if our intent to ensure competition between cellular and PCS would be undermined under the ownership rules adopted in the Second Report and Order.[163]

[163] Id. at && 109-110.

107. With respect to ownership interests in multiple PCS licensees in a single market, we adopted a 5 percent attribution threshold for purposes of the 40 MHz PCS spectrum limit and for purposes of determining cellular ownership in a PCS licensee. We stated that PCS ownership interests of 5 percent or more will be attributed to the holder of the interest.[164] In adopting this standard, we cited similar market-based concerns, noting our desire to "ensure that [no entity] is able to exert undue market power through partial ownership in multiple PCS licensees in a single service area."[165] The 5 percent threshold is consistent with the ownership thresholds we apply to cellular and broadcast licensees.[166] We did not find any potential advantages possessed by any existing PCS licensees inasmuch as there are no such licensees. Similarly, we did not discuss the need to accommodate settlements among PCS licensees resulting in non-controlling interests of between 5 and 20 percent because there are no such settlements in the PCS context. We therefore adopted this 5 percent limit for application to PCS multiple ownership, whereas it appeared too restrictive in the cellular-PCS cross-ownership context given the realities of existing historical cellular settlements.[167]

108. Twelve parties petitioned for reconsideration of the cellular ownership attribution standard.[168] The petitioners recommend the following alternatives: 1) raising the 20 percent level of permissible ownership in cellular licensees; 2) attribution based on control rather than ownership; 3) applying an affiliation standard like that in our telco-cable cross-ownership rules; 4) applying an attribution standard based on the rules used to enforce our alien ownership restrictions under Section 310 of the Communications Act; and 5) applying the same attribution rules to PCS as those we apply to broadcast interests.

109. Decision. We continue to believe that the PCS and cellular ownership attribution decisions we adopted in the Second Report and Order, with certain modifications, are appropriate and strike a reasonable balance between promoting vigorous competition and the advantages of allowing experienced mobile communications operators such as cellular licensees to participate as PCS licensees. We disagree with those parties, such as Bell Atlantic and GCI, that suggest the same 20 percent attribution limits should apply to cellular/PCS cross-ownership and to PCS multiple ownership.[169] Generally, we would prefer to use the 5 percent standard for all cross-

---

[164] Id. at n.62, n.92.

[165] Id. at & 61.

[166] See 47 C.F.R. ' ' 22.902(b)(5), 73.3555, note (2).

[167] See Second Report and Order at & 107.

[168] Petitioners include: Alliance, Bell Atlantic, Columbia, NYNEX, Pacific Telecom, PMN, CCIMR, Comcast, CTIA, GCI, PCS Action and Time Warner.

[169] See Bell Atlantic Petition at 4; GCI Comments at 9-11.

ownership situations, to maximize competition. We are adopting an attribution threshold of 5 percent for multiple PCS ownership purposes to prevent any party from exerting market power through substantial partial ownership in multiple PCS licensees in the same service area.[170] We see no countervailing reason to risk reducing competition by raising this 5 percent limit for PCS multiple ownership limits. Moreover, the 5 percent threshold is consistent with ownership thresholds we apply to cellular and broadcasting.

[170] See Second Report and Order at & 29.

110. Such a strict rule for PCS/cellular cross-ownership, however, would not recognize the history of cellular licensing. The 20 percent ownership attribution standard for cellular operators was adopted, in part, because settlements during the initial phase of cellular licensing resulted in partial and often non-controlling interests in those licensees.[171] In light of this history, we believe it would be unfair and unduly restrictive to place the same 5 percent limit on cellular/PCS cross-ownership. For this reason, we decided to allow a 20 percent cellular ownership interest. Further, we believe that given the nature of these settlement agreements, permitting this level of ownership will not decrease the incentives for competition. Therefore we will not require divestiture to a lower level of ownership. The 20 percent standard permits many entities with partial, non-controlling cellular interests to participate in PCS. In adopting the 20 percent standard, we recognized that participation by cellular operators in PCS would offer benefits that include promoting early development of PCS by taking advantage of cellular providers' expertise and permitting attainment of economies of scope between PCS and cellular service and existing infrastructure.[172] We therefore are making an exception to our usual treatment of cross-ownership for purposes of cellular-PCS cross-ownership.

111. We disagree with those entities such as CTIA that argue for a higher cellular ownership attribution threshold such as 35 percent.[173] PCS Action states that if our PCS attribution standard were raised to CTIA's proposed 35 percent, a consortium of NYNEX, Bell Atlantic and Bell South, each holding 33 percent of the consortium, could hold all the 30 MHz MTA licenses in the areas covered by the three parties' CGSAs. According to PCS Action, this would amount to cellular control of PCS services in the entire East Coast and South. PCS Action concludes by advocating retention of the current standard.[174] We believe that 20 percent is the proper standard. A higher attribution threshold (i.e., above 20 percent) for all incumbent cellular entities would tend to suppress competition, because the licensee would have economic incentives not to compete vigorously against competitors in which it holds a substantial equity interest. We conclude that these standards, with exceptions discussed below related to certain designated entities, remain appropriate, and accordingly we affirm them.

112. A number of parties, including Alliance, Bell Atlantic, Columbia, NYNEX, Pacific Telecom and PMN, request that we amend the attribution standard to base it on case-by-case determinations of control rather than the 20 percent attribution standard.[175] Alliance and others

---

[171] Id. at & 107.

[172] Id. at & 104.

[173] See CTIA Petition at iv.

[174] See PCS Action Comments at 16-17.

[175] See Alliance Petition at 7-8; Bell Atlantic Petition at 4-5; Columbia Petition at 6-7; NYNEX Petition at 4-5, 13-15; Pacific Telecom Petition at 5.

contend that 20 percent is too restrictive and unnecessarily limits participation in PCS by entities that have only passive interests in cellular systems.[176] Bell Atlantic and NYNEX also advocate examining only legal control.[177] Bell Atlantic argues that this standard should apply to both cellular/PCS and PCS/PCS ownership. NYNEX argues that a standard based upon control would ensure that cellular carriers and local exchange carriers are able to provide needed capital and expertise to PCS. CCIMR advocates applying broadcast ownership attribution standards, arguing that these rules distinguish between ownership and control and are as easy to administer as the 20 percent attribution standard.[178]

[176] See Alliance Petition at 7; Columbia Petition at 6-7; CTIA Petition at 20; NYNEX Petition at 13-15; Pacific Telecom Petition at 5.

[177] See Bell Atlantic Petition at 5; NYNEX Petition at 4-5, 13-15.

[178] See CCIMR Petition at 11.

113. Our goals here include ensuring that the holder of the PCS license has strong incentives to compete against the cellular licensees in the same geographic market.[179] A PCS licensee that has a large equity stake (i.e., more than 20 percent) in a cellular license in the same area has less incentive to compete vigorously against its own equity interest in a cellular provider, even though it may not exercise legal control over the cellular licensee. We believe that our attribution rules provide the right balance between maximizing competition and allowing cellular entities to bring their expertise to PCS.[180] We therefore will not adopt a rule that would require us to find that a party had a "controlling interest" in a cellular licensee before it would be prohibited from investing in a PCS licensee in the same area. Such a rule could substantially delay the licensing of PCS and would not serve our goal of promoting vigorous competition between PCS and cellular licensees in the same area. We believe the bright-line rules we are adopting will result in a faster, less burdensome licensing process.

114. We also reject the suggestion by Time Warner that we prohibit all "affiliations" between cellular and PCS licensees in the same market, along the lines of our telco-cable cross-ownership rules.[181] These rules, which are even more restrictive than our broadcast attribution rules, would not provide the flexibility to recognize the history of settlement agreements in cellular licensing and would not allow us to draw on the experience and expertise provided by cellular providers who have low equity stakes. They also might have the effect of restricting contracts between PCS licensees and companies financing their equipment and the build-out of their PCS systems, which could seriously impair rapid investment in and deployment of PCS systems.

115. Comcast recommends that we adopt the attributable ownership standard used to apply the alien ownership restrictions of Section 310(b) of the Communications Act, along with policies found in the broadcast rules.[182] Comcast notes that these alien ownership provisions recognize both voting and non-voting stock in determining percentage of ownership. Comcast also suggests that we adopt the "multiplier" policies of our broadcast ownership rules.[183] Comcast claims that the use of these standards together, because they are clear and well-defined, would help a potential PCS investor decide whether to invest in PCS.

---

[179] See Policy Statement and Order, GEN Docket 90-314, 6 FCC Rcd 6601 (1991), Notice of Proposed Rule Making and Tentative Decision, GEN Docket 90-314, 7 FCC Rcd 5676, 5690, 5704 (1992).

[180] See Second Report and Order at & 108.

[181] See 47 C.F.R. ' 63.54.

[182] See Comcast Petition at 3, 12-15.

[183] See 47 C.F.R. ' 73.3555, note (2). See also Comcast Petition at 3, 12-15.

116. We disagree that the alien ownership rules provide a clearer guide than our present attribution standards. Because the alien ownership restrictions set forth in section 310(b) of the Communications Act were created specifically to avoid an undue concentration of foreign influence in the direction of entities involved in communications, the attribution thresholds defined in that section are more complicated than the 5 percent/20 percent bright- line thresholds which we have adopted here. Further, unlike our rules in the broadcast context, we will not allow use of a "multiplier" in the case of multi-tiered entities; the interest of the subsidiary is attributed in full to the parent. We agree, however, that both voting and non-voting stock should be included in determining percentage of ownership of PCS and cellular entities.

117. In determining attributable interests for the purposes of both the 20 percent cellular/PCS cross-ownership rule and the 5 percent PCS/PCS multiple ownership rule, we agree with some of the parties that some clarifications and modifications to our attribution rules are warranted. Our attribution rules must be simple for applicants to understand because they are essential to enforcement of our PCS spectrum cap and our PCS/cellular cross-ownership rules. In the Second Report and Order, we stated that we would consider all equity ownership, including voting and non-voting stock and limited partnership interests, in calculating the percentages of attributable ownership interest in a PCS or cellular licensee. We explained that we would count these interests even if they did not confer on the holder meaningful participation, because the public interest would best be served by a "bright-line" test. We continue to believe that our ownership rules should be clear and easy to administer, and, to that end, we will provide further clarification about which of our ownership rules from the broadcast regime will be applied to PCS. We decline to adopt the full panoply of attribution rules that we apply in the broadcast and in the telco/cable contexts because we
believe that the restrictions we are adopting will be sufficient to prevent undue influence and preserve competition.

118. We clarify that, for purposes of these ownership rules, controlling interests per se are attributable. As in other contexts, "control" means not only majority equity ownership, but includes any general partnership interest, or any means of actual working control over the operation of the licensee, in whatever manner exercised. We will rely on existing case law for making control determinations where such issues arise.[184]

119. We also clarify that PCS equity investments of 5 percent or more, and cellular equity investments of 20 percent or more, also are attributable.[185] These equity interests are attributable because they support our goals of developing a competitive PCS service and

---

[184] See e.g., Intermountain Microwave, 24 RR 983 (1963); Cellular Control Notice, 1 FCC Rcd 3 (1986); News International, PLC, 97 FCC 2d 349 (1984); Loraine Journal v. FCC, 351 F.2d 824, 828 (D.C. Cir. 1965), cert. denied, 383 U.S. 967 (1966).

[185] Attribution for cellular purposes also means overlap of the CGSA with at least 10 percent of the population of the PCS market (BTA or MTA).

reducing the incentive for any entity to retard the capability of the new PCS licensee to compete with the cellular or any other PCS licensee in which the entity has an attributable interest. Specifically, the following equity investments will be counted: voting stock, non-voting stock, and limited partnership interests.[186] The percentage of ownership interest in a limited partnership will be based on the partner's economic interest in the partnership. Therefore, the Commission will assess the percentage of the partner's capital contribution as well as the percentage of profits and losses allocated to the partner. As noted above, general partnership interests are deemed attributable regardless of equity percentage because of the control conferred on general partners by the nature of their interest. The following investments are not attributable for multiple or cross-ownership purposes: debt interests, including loans secured by the equipment used in the licensed system, and equity interests below the 20 percent and 5 percent thresholds. These interests are of less consequence to or independent of the entity's performance and therefore provide little incentive to delay or dilute the participation of the new PCS license in the market. In addition, consistent with other multiple- and cross-ownership attribution standard, convertible debt instruments or options with rights of conversion to equity interests shall not be attributed unless and until conversion is effected.

120. We also clarify that the interests of a cellular or PCS licensee, or entity in control of a licensee, are attributed to the officers and directors of that entity. We remain concerned about the ability of such individuals to exert influence over companies in which they have significant managerial responsibility. Therefore, if an officer of a company wishes to invest in a PCS market, he or she may only do so if this company itself could make the same investment in compliance with our rules.

121. We also will not allow an exemption for minority investors in companies controlled by a single majority shareholder. Although these rules are used in the broadcast area to exempt from attribution entities not believed to be able to exercise control over a licensee, in the context of PCS we believe that not allowing use of a "multiplier" serves our goal of maximizing competition. These rules will help ensure against undue influence, short of control, by minority stockholders and distant stockholders in parent or intermediate corporations.

[186] Thus, in a stock company, PCS and cellular interests of 5 or 20 percent, respectively, of the total outstanding stock as well as interests of 5 or 20 percent, respectively, of the outstanding voting stock will be attributable.

122. Through an ongoing proceeding concerning multiple ownership of commercial mobile radio service (CMRS) licensees, we will address whether we should change our rules to restrict or attribute resale, management agreements or other ownership arrangements that could confer possible anticompetitive incentives on parties with multiple CMRS interests.[187] This proceeding will examine whether and to what extent such arrangements could be used to exert control over more spectrum than is permitted under our PCS spectrum cap (40 MHz) or the proposed CMRS spectrum cap.[188]

C. Attribution Rules for Certain Designated Entities

123. Several petitioners request that we exempt from the cellular eligibility restrictions certain classes of cellular owners, such as rural telephone companies or other designated entities. INS, TDS, Intelco and OPASTCO all request us to exempt rural telephone companies from the cellular eligibility restrictions. INS, for example, argues that most rural telephone companies are merely passive investors in cellular licensees, incapable of exercising market power. It argues that PCS could be introduced in rural areas more rapidly through consortia of rural telephone companies.[189] OPASTCO argues that Congress directed the Commission to ensure that opportunities exist for rural telephone companies, among others, to participate in spectrum-based services and that the current cellular eligibility rules exclude meaningful participation in PCS for many rural telephone companies.[190] Similarly, Intelco contends that rural telephone companies should not be prohibited from bringing PCS to less populated areas simply because they previously invested in cellular licenses serving such areas.[191] USTA argues that all cellular

[187] We will issue a notice requesting comment on these issues as part of our current proceeding regarding CMRS, in GN Docket No. 93-252.

[188] Id.

[189] See INS Petition at 12. See also TDS Petition at 3-6.

[190] See OPASTCO Petition at 1-8.

[191] See Intelco Petition at 4-8.

eligibility limits should be eliminated on the grounds that such limits will restrict the full participation of small and mid-sized cellular providers, who are more likely to bring full PCS service to under-served areas.[192]

[192] See USTA Comments at 5.

124. Most commenting parties generally favor exemptions for rural telephone companies and consortia led by designated entities. For example, CUC argues that rural telephone companies are most likely to deploy PCS in rural and remote areas and therefore should be encouraged to do so.[193] RCA contends that the cellular interests of rural telephone companies cannot exercise market power.[194] NRTA states that the Congress intended to ensure that new technologies are available to the residents of less populated areas, and that applying the cellular eligibility restrictions to rural telephone companies that hold significant but non-controlling interests in cellular licenses is incompatible with the intent of Congress.[195]

125. Decision. We agree with INS, OPASTCO, TDS and Intelco that relaxing the cellular eligibility restrictions is appropriate for designated entities.[196] We recognize that many designated entities are merely passive investors in cellular operators and, because of their size, are unlikely to influence pricing decisions. In addition, we seek to address Congress' goal of encouraging the participation of designated entities in the auction process and in the provision of spectrum-based services. We believe that designated entities which have some interests in cellular operations may be especially effective PCS competitors because of their cellular experience. This will help ensure that service is brought quickly to underserved areas and that designated entities become viable competitors. In particular, we believe that rural telephone companies and some small cellular companies, due to their existing infrastructure, are uniquely positioned rapidly to introduce PCS services into their service areas or adjacent areas. However, we are not exempting designated entities entirely from the cellular eligibility rules, because such an exemption could foreclose from competition from a new PCS entrant. To the extent that designated entities are involved in the control of cellular services, we remain concerned that there is potential for some of these parties to compete less vigorously in the nascent PCS industry. In balancing these interests, we conclude that increasing the cellular attribution threshold for designated entities from 20 percent to 40 percent, if non-controlling, would be appropriate and would further the Congressional mandate noted above. Accordingly, we will permit a designated entity to hold a non-controlling equity interest of up to 40 percent in a cellular licensee without being subject to the cellular PCS eligibility restrictions.

126. AIDE and Comcast support exempting from the PCS eligibility restrictions those cellular entities with minority interests in consortia controlled by designated entities. AIDE states that such an exemption would serve the Congressional intent that designated entities have

---

[193] See CUC Comments at 3.

[194] See RCA Reply at 1-2.

[195] See NRTA Reply at 1-5.

[196] The Commission will provide further guidance as to what constitutes a small business, rural telephone company and a business owned by a member of a minority group or a woman for purposes of 47 U.S.C. ' 309(j)in a forthcoming order in PP Docket No. 93-253.

opportunities to participate in PCS.[197] Murray supports the recommendation of the FCC's Small Business Advisory Committee that only parties that form alliances with designated entities be exempt from eligibility restrictions.[198] Cablevision, on the other hand, opposes an exemption for cellular parties that participate with designated entities in PCS. Cablevision argues that the potential for the cellular provider to exercise undue influence over the PCS licensee is too great to be ignored given the superior knowledge and experience of the cellular provider.[199]

[197] See AIDE Comments at 7-9; see also Comcast Petition at 18-19.

[198] See Murray Comments at 7-8.

[199] See Cablevision Comments at 5.

127. We have decided to increase the cellular attribution threshold from 20 percent to 40 percent for any entity proposing to invest in businesses controlled by members of minority groups and/or women. An entity may hold up to a 40 percent interest in cellular licensees before its cellular interests will be deemed attributable, but must limit its participation in a PCS licensee controlled by women or minority group members to a non-controlling interest. We believe that this action will encourage entities with attributable cellular interests to make non-controlling investments in businesses owned by minorities and/or women, furthering Congress' objective of ensuring the participation of these entities in the competitive bidding process by encouraging an alternative source of financing. The record indicates that the main challenge that minorities and women face when seeking to participate in telecommunications licensing is ready access to capital.[200] Investments by cellular providers in these designated entities should increase the entities chances for success in the auctions and later in service competition by providing access to capital and valuable industry experience.

128. We are not, as requested by Comcast and AIDE, granting a blanket exemption to in-region cellular parties with 40 percent or greater equity or control to participate in consortia that include designated entities. Such an exemption would allow a cellular entity to control a cellular license and create the potential for the entity to influence the PCS licensee to compete less vigorously. As Cablevision observes, the potential for a cellular entity to exercise undue influence over the PCS licensee, especially absent limits on the control exercised by the cellular carrier over the designated entity and its own cellular license, is too great, given the superior knowledge and experience of cellular providers.[201] Therefore, we have relaxed the cellular attribution standard to permit entities that hold up to 40 percent non-controlling equity in cellular licensees in the same service area to make non-controlling investments in PCS licensees controlled by woman- or minority-owned businesses. Because their investment will be non-controlling in both the PCS and cellular license, the threat to competition is diminished. We believe that this relaxed standard encourages availability of capital to PCS businesses owned by women and minorities, yet guards against the dominance of these designated entities by entities which also control a cellular license in the same service area.

129. Comcast requests that the Commission exempt non-wireline cellular carriers from the cellular eligibility rules. Comcast asserts that we have focused too narrowly on wireless competition in devising the cellular eligibility rules. Comcast argues that PCS is a competitor to the wireline "local loop" service of local exchange carriers (LECs) and that one 10 MHz block is not adequate to provide service that is competitive to the wireline local loop. Comcast argues

---

[200] See, e.g., Report of the FCC Small Business Advisory Committee to the Federal Communications Commission Regarding GEN Docket 90-314, 8 FCC Rcd 7826-28 (1993); Second Report and Order, PP Docket No. 93-253, FCC 94-61, released April 20, 1994.

[201] See Cablevision Comments at 5.

that non-wireline cellular providers have not posed competitive problems, and therefore should be allowed full participation in PCS.

130. Bell Atlantic opposes Comcast's request that we exempt non-wireline cellular providers from the PCS eligibility restrictions. Bell Atlantic argues that Comcast is merely trying to improve its competitive position by this request.[202] PMN agrees that non-wireline cellular carriers should not be entitled to special treatment.[203]

131. We deny Comcast's request that we exempt non-wireline cellular carriers from the PCS attribution rules. Comcast's arguments, which we considered in the Second Report and Order, could impair successful achievement of our goal of creating the maximum number of new competitors.

132. We believe that these important modifications will increase the efficacy of our cellular eligibility rules by guarding against the improper exercise of market power by cellular providers through controlling interests in PCS systems overlapping their cellular coverage areas. We believe that these changes will better address our concerns regarding reduced competition without unnecessarily restricting the ability of cellular providers to participate in PCS, and will provide further incentives for investment in and participation by designated entities in PCS.

D. Population Standard

[202] See Bell Atlantic Comments at 4.

[203] See PMN Comments at 7.

133. When we adopted regulations restricting the eligibility of certain cellular licensees to hold PCS licenses within their cellular service areas, we noted assertions that cellular operators might have unfair competitive advantages over PCS licensees.[204] On the other hand, we also noted the valuable contributions that the expertise of cellular providers could provide to the PCS industry. Finally, we noted that, because of different geographic licensing boundaries for cellular and PCS, there was a potential for excluding cellular providers from PCS markets even though the degree of overlap was minimal. We decided that such an exclusion was neither fair nor desirable for maximizing competition. In resolving these conflicting interests, the Commission adopted the 20 percent ownership attribution rule to define cellular ownership for purposes of the PCS rules. For entities at or exceeding 20 percent ownership, we applied a 10 percent population coverage overlap test to determine whether the cellular licensee would be restricted to a single 10 MHz PCS license.[205]

134. Florida Cellular, PNSC and CTIA request higher population coverage overlap thresholds. Florida Cellular states that the coverage threshold should be raised to 20 percent so that cellular carriers can compete with PCS carriers in providing mobile services.[206] PNSC requests a 20 to 30 percent threshold, claiming that a 10 percent threshold is unduly harsh and unjustified.[207] CTIA argues for a 40 percent overlap threshold and provides a market analysis based on the merger guidelines of the Department of Justice and the Federal Trade Commission to support its claim that this degree of coverage overlap will not result in anticompetitive conduct.[208] Radiofone also objects to the 10 percent population threshold.[209]

---

[204] See Second Report and Order at && 101, 105, 108.

[205] Id. at && 104, 108.

[206] See Florida Cellular Petition at 5.

[207] See PNSC Petition at 9-10.

[208] See CTIA Petition at 20.

[209] See Radiofone Petition at 12-15.

135. Cablevision responds that the petitioners requesting a revision of the cellular eligibility rules raise no new facts or arguments and that their petitions therefore should be denied. Cablevision states that the Commission's finding that broadband PCS and cellular will compete justifies maintaining the cellular eligibility rules adopted in the Second Report and Order.[210] AIDE agrees, arguing that cellular providers are unlikely to be aggressive in introducing PCS services in their service area.[211] Similarly, CIS argues that any relaxation of the current rules would allow Regional Bell Operating Companies (RBOCs) and large LECs with cellular holdings to dominate the PCS market to the exclusion of smaller operators.[212] PCS Action also opposes the requests for changes to the current cellular eligibility threshold, arguing that the current standards appropriately limit cellular participation in PCS.[213] Finally, Time Warner finds that our cellular eligibility rules strike an appropriate balance between preventing anti-competitive behavior and allowing cellular providers to participate in PCS.[214]

136. Decision. We have decided to retain the 10 percent population overlap threshold adopted in the Second Report and Order. Our goal is to provide for entry into the PCS market for the maximum number of viable competitors. We remain concerned about the potential for cellular operators to exercise market power and to reduce the number of viable competitors in the PCS market. We believe that the 10 percent population overlap figure is justified and should foster robust competition and prevent competitive abuse. Balancing the potential benefits of the participation in PCS of cellular providers and the potential harms of reduced competition, we are convinced that the 10 percent coverage threshold is appropriate. With this limit we have ensured the opportunity for the emergence of the maximum number of competitors that the market will support for 90 percent of the population. Increasing this limit beyond 10 percent would create greater risk that consumers would be denied the benefit of vigorously competing service

---

[210] See Cablevision Comments at 6-7.

[211] See AIDE Comments at 18-20.

[212] See CIS Comments at 4-5.

[213] See PCS Action Comments at 13-15.

[214] See Time Warner Reply at 6.

providers. We also believe that this threshold is an important means of encouraging new entrants in each area, thereby enhancing competition. On balance, we conclude that the 10 percent population coverage threshold promotes competition among licensees serving a significant percentage of the population, while providing some recognition of the overlaps that will result from the different licensing areas for PCS and cellular. In addition, as discussed below, we will allow divestiture for those entities with CGSA/PCS service area population overlaps between 10 and 20 percent. In reaffirming our 10 percent threshold, we reject proposals to adopt a national population measure or to use a multiplier formula.

137. Concord, GCI and MCI argue that coverage of the national population is a better measure of market dominance than coverage of population within a PCS service area. Concord states that the 10 percent overlap standard will preclude many small and mid-size local exchange carriers with partial interests in cellular carriers from participating in PCS. It recommends an eligibility threshold of 1 percent coverage of the national population to ensure that large cellular providers are not able to dominate the market. Concord argues that this standard would allow small and mid-size LECs to participate in PCS.[215] GCI and MCI advocate barring the largest cellular providers from bidding on at least one of the 30 MHz blocks of PCS spectrum. MCI claims that consumer welfare will be served best by barring any cellular provider with more than 10 percent coverage of the nation's population from at least one of the 30 MHz blocks.[216] GCI agrees, claiming that the bidding power of the largest cellular providers will allow cellular providers either to capture the nationwide PCS market or at least to prevent any other licensee from doing so.[217] NYNEX specifically opposes the petitions by MCI and GCI, and asserts that all limitations on cellular participation should be eliminated.[218] PacBell argues against the national population standard proposed by GTE and Sprint, and asserts that the 10 percent rule is clear on its face.[219]

138. We do not believe that a national population test would achieve our goal of providing the maximum number of new competitors in each market. PCS is being licensed on a local and regional, not national basis. A cellular entity who operates in one city but has no presence in another city would be a new competitor in the latter city. We seek to encourage that entity's PCS participation in the second city, because of the likelihood that the experience and economics it brings from its cellular business will stimulate PCS development in the market and promote vigorous competition to other PCS licensees.

---

[215] See Concord Petition at 2.

[216] See MCI Petition at 1-5.

[217] See GCI Petition at 5-8.

[218] See NYNEX Comments at 5-6.

[219] See PacBell Comments at 9-10.

139. Two petitioners, GTE and Sprint, recommend a formula for determining eligibility. They suggest multiplying the percentage overlap of the population in the PCS and cellular service areas by the percentage ownership in the cellular provider, to arrive at an "effective POP" figure. Under this formula, an entity owning 25 percent of a cellular provider that covered 20 percent of the population of the PCS service area would have a 5 percent effective POP figure. GTE suggests that a effective population overlap of 20 percent would be an appropriate eligibility threshold,[220] and Sprint advocates a 20 to 30 percent figure.[221] These petitioners argue that this approach would allow companies to bid for MTA licenses in service areas where they hold only insulated, minority interests in cellular providers in the service area. They also contend that this approach would enhance the opportunities of independent rural and suburban telephone companies to participate in PCS.

140. We do not believe that this "effective POP" attribution rule would achieve our goal of maximizing the number of new competitors. Under this rule, an entity could have a majority equity interest in cellular licenses covering 40 percent of the population in that service area and remain eligible for 40 MHz of PCS spectrum. This would result in fewer competitive choices for 40 percent of the consumers in that market. This would not achieve our goal of maximizing competitive choices for as many consumers as possible.

E. Post-Auction Divestiture

141. In the Second Report and Order we limited PCS participation by in-market cellular licensees to one 10 MHz PCS license. In its petition for reconsideration, McCaw requests that cellular carriers be permitted to bid for PCS licenses, and to bring their ownership into compliance with the restrictions if they obtain a PCS license for more than one 10 MHz block.[222]

---

[220] See GTE Petition at 2-5.

[221] See Sprint Petition at 9-10.

[222] See McCaw Petition at 5-6.

This suggestion was supported in replies by Ameritech, Bell Atlantic, Cablevision, Comcast, CTIA, GTE, Sprint, TDS and US West.[223]

142. Decision. We concur with these parties that it would be reasonable to permit incumbent cellular operators, in certain defined circumstances, to divest their cellular interests in order to become PCS licensees. These operators could become eligible for 40 MHz of PCS spectrum by either reducing population overlap or ownership levels to below the standards discussed above. Either could be accomplished before the auction, but that would involve selling the cellular interests on an assumption that the operator would be the successful bidder for a 30 MHz license.

[223] See Ameritech Reply at 1-2; Bell Atlantic Reply at 8-9; Cablevision Comments at 7-8; Comcast Petition at 16-17; CTIA Comments at 14; GTE Comments at 8-9; Sprint Reply at 4-7; TDS Comments at 10; US West Reply at 1-2.

143. We also agree with other commenters, including APC, PCS Action and Time Warner,[224] that allowing unlimited divestiture of the cellular interest after the auction raises concerns that abuses could occur during or after the bidding process.[225] If afforded an unlimited opportunity to divest, cellular operators with significant areas of overlap could have incentives to use the bidding process to forestall licensing of new competitors in the market, because the cellular operator would be in control of both a cellular system and one of the three or four possible 30 MHz broadband PCS licenses. There are instances, however, in which such abuses are unlikely to occur. A cellular operator with less than 20 percent population coverage in the PCS service areas would have little incentive to risk incurring penalties for abusing the bidding process when PCS offers greater potential to serve the entire MTA or BTA. These cellular operators have more to gain by broadening their customer base by offering competitive PCS services in place of their overlapping cellular interests in excess of 10 percent than they do by abusing the bidding process to forestall competition. Operators with population overlaps in excess of 20 percent have increasingly greater incentives not to start competitive PCS businesses.

144. We conclude that it is appropriate to allow cellular operators to divest themselves of attributable cellular interests that do not comply with the cellular/PCS cross ownership restriction after winning more than 10 MHz of PCS spectrum in the PCS auctions, provided that the divestiture occurs within the short time frame we set forth below. However, because a cellular operator with significant overlaps may have incentives to delay the rapid introduction of PCS service, we will permit cellular divestiture only for cellular operators that serve less than 20 percent of the PCS service area. If the overlap consists of several cellular licenses, the incumbent may sell some of the licenses and keep others if the result is in compliance with the attribution and population overlap thresholds. This will help achieve our goals of rapid introduction of PCS service and competitive delivery because those entities with cellular operations near a PCS service area may be able to combine the operation into a single efficient operation that would benefit consumers.

145. We have decided to allow the post-auction partial sale of attributable cellular interests so that entities may come into compliance with the cellular eligibility rules. Procedurally, we will require that a PCS applicant that meets the criteria for post-auction divestiture submit with the PCS license application (short-form) a statement that, if successful in obtaining more than 10 MHz of spectrum, it will come into complete compliance with the cellular/PCS cross-ownership restriction within 90 days of the PCS license grant.[226] If more than

---

[224] See APC Reply at 10-11; PCS Action Comments at 15-16; Time Warner Reply at 6-8.

[225] See Letter from APC to the FCC at 2 (May 31, 1994); Letter from PCS Action to the FCC at 2 (May 27, 1994).

[226] The Commission shortly will adopt competitive bidding rules applicable to broadband PCS. See Second Report and Order, PP Docket No. 93-253, FCC 94-61, released April 20, 1994.

10 MHz is obtained, the long-form application for PCS licensing must be accompanied by a signed statement from the applicant that the cellular property causing the applicant to be in excess of the 10 percent population overlap, or enough equity to bring the entity into compliance with our attribution threshold, will be divested within 90 days of the PCS license grant to bring ownership interest below the permitted attributable ownership limits. If the PCS applicant is otherwise qualified, the PCS application will be granted subject to a condition that the PCS licensee come into compliance with the PCS/cellular cross-ownership rule within 90 days of grant.

146. As a condition of its PCS license, within 90 days of PCS license grant the PCS licensee must certify to the Commission that the applicant and all parties to the application have come into compliance with our PCS-cellular cross-ownership rules. If the PCS licensee fails to submit this certification within 90 days, we will invoke the condition on the PCS license, cancelling it immediately and retaining all monies tendered. In addition, we may investigate whether the certifications on divestiture are evidence of misrepresentations that call into question the party's qualification to hold its cellular license. The PCS licensee may divest the prohibited interest to an interim independent trustee if a buyer has not been secured in the required time frame as long as the applicant has no interest in or control of the trustee, and the trustee may dispose of the license as it sees fit.

V. CONSTRUCTION REQUIREMENTS

147. In the Second Report and Order, we stated our expectations that broadband PCS would be a highly competitive industry and that licensees would have the incentive to construct facilities to meet the demand for service in their licensed areas. We concluded that specific channel loading requirements are unnecessary; however, we required licensees to meet specified construction benchmarks to ensure efficient spectrum utilization and service to the public. Specifically, we required licensees to offer service to one-third of the population in their service area within five years of licensing, two-thirds of the population in their service area within seven years, and 90 percent of the population within ten years. We stated that failure to meet these requirements would result in forfeiture of the license and the licensee would be ineligible to regain it.[227]

[227] See Second Report and Order at && 132-134.

148. Petitioners' Requests. Several petitioners request reconsideration of the construction requirements and submit a variety of alternatives. In its petition, PacBell supports the five-year and seven-year service area requirements but requests that we eliminate the ten-year, 90 percent population coverage requirement, arguing that the 90 percent coverage requirement is too stringent in view of the PCS power limits. PacBell also argues that a PCS licensee should not have to forfeit its license if it does not meet the construction requirements.[228] PCIA also opposes the 90 percent population coverage requirement and similarly argues that licensees should not have to forfeit their license if they fail to meet the construction requirements.[229] Mebtel and RCA also oppose the requirements, arguing that the requirements will adversely affect designated entities.[230] Mebtel recommends that designated entities be allowed ten years to provide service to one-third of the population of their service area and fifteen years to provide service to two-thirds of that population.[231]

149. Some parties, including Alliance and Columbia, recommend that areas unserved for five years be re-licensed to a second party in a manner similar to relicensing of cellular unserved areas.[232] RCA recommends a similar approach, but with a seven-year period before re-licensing.[233] Columbia argues that the use of the "cellular fill-in" model would allow the market to determine the development of PCS. Alliance and Columbia both argue that the fill-in approach would be more equitable to the licensee and more administratively efficient than the current population coverage requirements.[234] Columbia also contends that standards for ascertaining the service area of a PCS system are vague and therefore the Commission's license forfeiture policy will be unenforceable.[235]

150. PNSC recommends excluding all BTA blocks from the construction requirements, and Southwestern Bell recommends excluding the 10 MHz BTA blocks.[236] PNSC recommends a

---

[228] See PacBell Petition at 5. See also UTC Petition at 6.

[229] See PCIA Petition at 6.

[230] See Mebtel Petition at 3; RCA Petition at 1-2.

[231] See Mebtel Petition at 3.

[232] See Alliance Petition at 6; Columbia Petition at 5; Intelco Petition at 4-7; PCIA Petition at 6.

[233] See RCA Petition at 6-7.

[234] See Alliance Petition at 6; Columbia Petition at 5.

[235] See Columbia Petition at 5.

[236] See PNSC Petition at 10; Southwestern Bell Petition at 2-7.

construction requirement for BTA licensees of 20 percent population coverage in five years, 30 percent in seven, and 50 percent in ten years. Southwestern Bell argues that 10 MHz licensees will not be able to provide the same scope of services or realize the same economies of scale as licensees of larger spectrum blocks and recommends that non-aggregated 10 MHz licensees be required to meet only a 25 percent population coverage requirement within ten years.

151. Other parties propose other modifications to the population coverage requirements. Sprint recommends permitting cellular PCS providers to count existing cellular population coverage toward the PCS requirements.[237] BellSouth recommends eliminating the population coverage requirements entirely and simply requiring a licensee to build a system within a five-year period.[238] Motorola argues that the current construction schedule, together with the stringent penalty of forfeiture, will limit the development of pedestrian and in-building PCS because licensees will face many economic hurdles and pedestrian PCS would cost more to implement. Motorola requests that we adopt a flexible plan that permits licensees to specify a construction plan with which they must comply to accommodate different system configurations and different coverage situations. Motorola argues that, at a minimum, the license forfeiture policy should be tempered by providing an opportunity for the licensee to demonstrate that its service is satisfactory, regardless of the overall population coverage attained.[239]

152. Responses. A number of parties expressed support for the existing construction requirements. For example, GCI and NYNEX recommend that the Commission maintain its construction requirements to ensure delivery of PCS services as quickly as possible.[240] NYNEX contends that PCS applicants can adjust their bids in the auction process to reflect the difficulties of meeting construction requirements in each market. Northern Telecom also expresses support for the Commission's construction requirements, but proposes that the definition of population served include rural residents where they work or shop, and that the Commission develop guidelines for waivers of the construction requirements.[241] On the other hand, CUC opposes overall relaxation of the construction requirements, arguing that relaxation would delay PCS implementation. It does support adoption of a waiver standard and relaxing the construction requirements in rural areas. CUC further argues that the Commission should not relax its construction requirements if the licensee has the option of partitioning its service area.[242] AIDE argues that if we allow markets to be partitioned, each partitioned market should be subject to

---

[237] See Sprint Petition at 14.

[238] See BellSouth Petition at iii.

[239] See Motorola Petition at 5-6.

[240] See GCI Comments at 13; NYNEX Comments at 8-9.

[241] See Northern Telecom Reply at 6-9.

[242] See CUC Comments at 7.

independent construction requirements.[243] PacBell opposes Sprint's suggestion that cellular carriers be permitted to include their existing coverage in meeting PCS coverage requirements.[244]

[243] See AIDE Comments at 5.

[244] See PacBell Comments at 8.

153. MCI asserts that some relaxation of the construction requirements is necessary if base and mobile power limits are not substantially increased.[245] US West opposes the 90 percent construction requirement, asserting that 90 percent coverage will increase the cost of PCS fourfold compared to a 67 percent population coverage requirement. It states that a stringent construction requirement is not necessary to prevent warehousing of spectrum because the spectrum will be purchased at auction. As part of its filing, US West submits an analysis of nine large western BTAs that indicates that increasing population coverage from 67 to 75 percent results in only a moderate increase in the geographic area that must be served. On the other hand, increasing population from 75 to 90 percent results in a very large increase in the geographic area that must be covered.[246]

154. Decision. We believe that PCS will be a highly competitive service and that licensees will have incentives to construct facilities to meet the service demands in their licensed service areas. Further, we believe that our use of competitive bidding for PCS licensing and the restrictions on the amount of spectrum that a licensee may control in a geographic area will limit the likelihood that spectrum will be warehoused. Nevertheless, we continue to believe that minimum construction requirements are necessary to ensure that PCS service is made available to as many communities as possible and that the spectrum is used effectively. We note that the Reconciliation Act amendments require the Commission to impose performance requirements.[247] While we agree with GCI, NYNEX, and others that construction requirements are needed to ensure service in a timely fashion, we also agree that relaxation of the requirements is desirable to ensure an economical deployment of the service to promote opportunities for PCS "niche" services, and to facilitate a competitive market.[248]

155. Accordingly, we are amending the construction requirements as follows. All 30 MHz broadband PCS licensees will be required to construct facilities that provide coverage to one-third of the population of their service area within five years of initial license grant and to two-thirds of the population of their service area within ten years. We will require the 10 MHz licensees to meet a single construction requirement of providing coverage to one-fourth of the population of their service area within five years; or alternatively, they may submit an acceptable showing to the Commission demonstrating that they are providing substantial service. We recognize that these requirements are less than the requirement for narrowband PCS licensees, but we believe this difference is appropriate given the higher expected construction costs involved for broadband PCS.[249] Moreover, since licensees must purchase their licenses, they will

---

[245] See MCI Comments at 17.

[246] See US West Reply at 7-9.

[247] See 47 U.S.C. ' 309(i)(4)(B), as amended by the Reconciliation Act.

[248] See GCI Comments at 13; NYNEX Comments at 8-9.

[249] The construction requirements for narrowband PCS are set forth in Memorandum Opinion

have added economic incentives to construct their systems as rapidly as possible and introduce service to a significant percentage of the population. In this regard, we also believe that these relaxed construction requirements may increase the viability and value of some broadband licenses, especially those in less densely populated service areas. Finally, since most areas are already served by cellular and SMR providers, we believe it unnecessary to require PCS licensees to provide identical or similar services to areas where it is uneconomic to do so. With regard to the 10 MHz licensees, we believe that the reduced construction requirement will make these licenses more attractive to applicants intending to provide residential, cutting-edge niche services or services to business and educational campuses where the population may be small except during business or school hours.

---

and Order, GEN Docket No. 90-314 and ET Docket No. 92-100, 9 FCC Rcd 1309, 1313-1314, && 27-34 (1994), recon. pending.

156. At the five-year benchmark we will require all licensees, and again at the 10-year benchmark for 30 MHz licensees, to file a map and other supporting documentation showing compliance with the construction requirements. Licensees failing to meet the population coverage requirements described above will be subject to the license forfeiture penalties adopted in the Second Report and Order.[250] We recognize that even with these requirements, factors such as incumbent microwave operation or sparse population density in some instances could make compliance difficult. In instances where the circumstances are unique and the public interest would be served, the Commission will consider waiving the requirements on a case-by-case basis.[251] These revised construction requirements will ensure efficient spectrum utilization and promote significant nationwide coverage without imposing substantial cost penalties on licensees that serve less densely populated areas. In this regard, we believe that these changes generally address the concerns of those parties that suggested lowering the construction requirements for designated entities or for BTA service areas.[252]

157. We also recognize the desirability of encouraging more than one provider to serve a diverse geographic area, and note that resale of a licensee's geographic area to other entities, subject to the licensee's control, is not prohibited by our rules. Accordingly, we recognize that licensees may resell spectrum, and believe that this will facilitate the deployment of PCS. Whether or not the licensee enters into resale arrangements, it will be responsible for insuring that the coverage requirement and all the other requirements of our rules are met. The reseller will not be a separate licensee, but rather, will operate subject to the control of the licensee. We believe that resale will encourage service provision, particularly to rural areas, and allow smaller, predominantly rural companies to participate in PCS. We intend to examine in another proceeding whether resale arrangements confer attributable interests on the reseller. See Section IV, supra.

158. In summary, our relaxed construction requirements will foster provision of PCS services and will promote diversity in their provision. Permitting licensees to resell service subareas, subject to the licensee's control, will permit smaller, rural companies to provide PCS without participating in the competitive bidding process. Finally, we intend to monitor closely the development of PCS in rural and other under-served areas and, if necessary, will readdress these construction requirements to ensure that our goals for wide area service are met.

---

[250] See Second Report and Order at && 133-134.

[251] See WAIT Radio v. FCC, 418 F.2d 1153 (D.C. Cir. 1969).

[252] We will also allow the licensee to use, if they choose to do so, the 2000 census to determine the 10-year construction requirement, rather than the 1990 census specified in the Second Report and Order. This change ensures that licensees will not be required to meet benchmarks based on obsolete data.

VI. TECHNICAL STANDARDS

A. Roaming and Interoperability Standards

159. In the Second Report and Order, the Commission provided maximum flexibility in technical standards to allow PCS to develop in the most rapid, economically feasible and diverse manner. Specific technical standards were prescribed only to the extent necessary to avoid harmful interference. The Commission recognized that several industry technical and standards groups were addressing matters related to PCS technical standards. It encouraged those groups to consider ways of ensuring that PCS users, service providers, and equipment manufacturers could incorporate roaming, interoperability and other important features in the most efficient and least costly manner, noting that PCS will be more useful to the extent that users are not limited by geography or by their ability to use their equipment with different systems.

160. Petitioners' Requests. NCS, Motorola, and TIA request that we reconsider our decision not to adopt PCS interoperability requirements.[253] NCS requests that we adopt standards to ensure interoperability and nationwide roaming. It argues that such standards are needed for national security and emergency preparedness purposes.[254] Motorola and TIA recommend that we require all equipment used by licensed PCS operators to meet interoperability standards developed by a standards body accredited by the American National Standards Institute (ANSI).[255] Motorola argues that interoperability standards will promote international acceptance of U.S. PCS technology and encourage competition between PCS licensees, since consumers could use the same equipment regardless of the licensee to which they subscribe. TIA states that technical standards are needed to ensure that PCS services are provided at the most competitive prices.[256]

161. Responses. Most responding parties oppose the petitioners' requests that we adopt PCS technical standards. For example, APC, GTE and Northern Telecom express concern that the development of ANSI-approved technical standards would delay the implementation of

---

[253] Texas Emergency also requests that we adopt a uniform standard for enhanced emergency 911 services. These matters are addressed in Section VI.E.

[254] See NCS Petition at 2.

[255] See Motorola Petition at 3.

[256] See TIA Petition at 3.

PCS.[257] MCI and Nextel argue that mandatory standards would inhibit technical advances that would enable licensees to deliver a broad range of services to the public.[258]

162. Decision. We continue to believe that a flexible approach, applying only those standards necessary to prevent interference, is appropriate. As indicated in the Second Report and Order, this will allow PCS to develop in the most rapid, economically feasible and diverse manner.[259] We agree with NCS and others that interoperability for PCS is an important and beneficial goal. We believe, however, that acceptable interoperability is likely to emerge between PCS licenses in a timely manner without our intervention. Our decisions to provide for large regional MTA licenses, to move all PCS licenses to the lower band, and to permit further aggregation of spectrum blocks across geographic regions all foster wide-area roaming and interoperability. In addition, competitive bidding for PCS licenses will facilitate the development of regional or nationwide systems.

163. We also are aware that the industry is now working aggressively to complete several voluntary interoperability standards for PCS in a timely manner. We strongly support these efforts and continue to encourage the industry's work in this area. The availability of interoperability standards will deliver important benefits to consumers and help achieve our objectives of universality, competitive delivery of PCS, that includes the ability of consumers to switch between PCS systems at low cost, and competitive markets for PCS equipment.

164. Interoperability, not only nationwide on one block but also between PCS spectrum blocks, should be in the business interest of all PCS providers. Such broad interoperability will increase the economies of scale in manufacturing PCS equipment such as handsets, will made consumers more likely to subscribe to PCS because they can easily move from carrier to carrier without having to purchase new handsets, and will make it easier for PCS licensees to aggregate blocks of PCS spectrum up to 40 MHz and to create wide-area or national PCS systems. For these reasons, we believe that it is in the public interest for the industry eventually to achieve compatible interoperability standards for all PCS spectrum blocks. Nevertheless, we understand that the industry is not yet ready to arrive at any standard. In addition, we do not want to

---

[257] See APC Comments at 15-17; GTE Comments at 13-14; Northern Telecom Comments at 6-9.

[258] See MCI Comments at 21-22; Nextel Comments at 15-16.

[259] See Second Report and Order at && 135-138.

discourage innovation in designing PCS services. Therefore, at this time we are not mandating that the industry arrive at a single interoperability standard across all PCS spectrum blocks.

165. We intend to monitor the industry's progress in developing and implementing PCS technical standards.[260] In particular, we hope, that some of the standards proposed for PCS will be adopted or near completion at the time of the broadband PCS auction. If we find that the development of PCS technology is not proceeding in a manner that will accommodate roaming and interoperability, we may revisit this issue and consider what actions the Commission may take to facilitate the more rapid development of appropriate standards. Finally, to facilitate international acceptance of U.S. PCS technology, we will be receptive to requests seeking our endorsement of completed ANSI standards, provided that such endorsement does not limit the flexibility of PCS licensees to select standards and technologies best suited to their needs.

B. PCS Power Limits

166. In the Second Report and Order, the Commission established a maximum e.i.r.p. of 100 watts and a maximum antenna height above average terrain (HAAT) of 300 meters for PCS base stations.[261] The Commission recognized that most PCS experimental systems operated at a maximum power of 10 watts e.i.r.p., but adopted a limit of 100 watts e.i.r.p. for base stations to permit additional flexibility in the design of PCS systems. It also specified a maximum power limit of 2 watts e.i.r.p. for mobile units.

[260] We will be conducting a comprehensive review of the CMRS market on an annual basis. See CMRS Second Report and Order. In that context we may review PCS interoperability and standardization issues.

[261] See Section 24.231 of the Commission's Rules. Antenna heights up to 2000 meters are permitted with a corresponding reduction in power.

167. Petitioners' Requests. Eleven parties filed petitions for reconsideration requesting increases in the PCS power limits. APC, Ameritech, MCI, Motorola, Northern Telecom, PacBell, PacTel, PCIA, Sprint, Time Warner and US West argue that higher-powered PCS base stations should be permitted. The majority of these petitioners request that the power limit of a PCS base station be increased to 1640 watts e.i.r.p.[262] These parties state that permitting higher power will allow PCS providers to use large cells and deploy advanced technologies, take advantage of high gain antenna technology, more effectively compete with cellular, and better cover rural areas. Time Warner and PacBell recommend that no limit be placed on power and argue that the 100 watt limit will not allow economic deployment of PCS.[263]

168. In requesting an increase in the power limit, PacBell and Northern Telecom indicate that most base stations would actually operate using low power transmitters coupled with high gain, directional antenna systems that boost the radiated signal levels.[264] Ameritech, MCI, Sprint, US West and others also support the use of high-gain antenna technology. They submit that the same antennas are also used to receive signals from subscriber units, amplifying the level of the received signal. Thus, a low power transmitter using a high gain antenna at the base station permits the system to remain "balanced," allowing low power subscriber units to communicate with the base station over the larger coverage area provided by the higher radiated base station power.[265] The petitioners, for example APC, Northern Telecom, and PacBell, argue that human exposure to radio frequency energy (RF) can be controlled through the design of the base station and the requirements of the current regulation of biohazards can be met independent of the overall transmitter power limit set by the Commission.[266]

---

[262] Many of the petitioners request the power be increased to 1000 watts e.r.p., which is equivalent to 1640 watts e.i.r.p. By comparison, the cellular rules permit the power of a base station to be up to 500 watts e.r.p. See 47 C.F.R. ' 22.904. Equivalent isotropically radiated power is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna. Effective radiated power is the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction. See 47 C.F.R. ' 2.1.

[263] See Time Warner Petition at 13; PacBell Petition at 13.

[264] See PacBell Petition at 3; Northern Telecom Petition at 5.

[265] See Ameritech Petition at 2; MCI Petition at 2; Sprint Petition at 15; US West Petition at 12-13.

[266] Increasing the separation between individuals and the antenna, using high gain antennas at the base station, and other techniques can be used to meet limits on human RF exposure. See APC Petition at 6-7; Northern Telecom Petition at 5; PacBell Petition at 4.

169. In their petitions, MCI and PCIA also request that we increase the maximum power limit for certain types of mobile and portable units from 2 to 20 watts e.i.r.p.[267] They argue that this would permit the use of higher power for PCS vehicular-mounted units and special types of non-handheld equipment such as pay telephones installed at special events, emergency restoration telephone systems, and telephones installed in areas where landline facilities are not available or justifiable due to intermittent use.[268]

170. Responses. The majority of the responding parties support the petitioners' requests that the power limit be raised.[269] These parties state that operation at higher power levels would decrease the number of base stations required for coverage, especially in sparsely populated areas. They further submit that the larger coverage area provided by higher power operation will also facilitate compliance with the construction requirements, thereby lowering operating costs.

[267] A power of 20 watts e.i.r.p. is equivalent to 12 watts e.r.p.

[268] See MCI Petition at 7-8; PCIA Petition at 8.

[269] See APC Comments at 20-21; Bell Atlantic Comments at 14; CUC Comments at 12; GCI Comments at 2-3; MCI Comments at 18-19; Murray Comments at 6; Northern Telecom Comments at 3-6; Omnipoint Comments at 4, 13; and PacBell Comments at 1-3.

171. On the other hand, AT&T indicates that the European Telecommunications Standards Institute (ETSI) recently rejected a similar proposal for increased power for the "DCS 1800" standard,[270] and limited base station transmitter output power to 40 watts and mobile transmitter power to 1 watt. AT&T argues that an increase in base station power limits is unnecessary without a corresponding increase in handset power limits, which leads to more expensive handsets that are heavier, have a shorter battery life, and interfere with other electronics.[271] Apple and Rolm request that we limit the e.i.r.p. of all transmitters operating on channels adjacent to the unlicensed band to no more than 2 watts to limit interference to unlicensed devices.[272] Nextel states that higher power limits would only encourage PCS providers to duplicate cellular service rather than develop new services.[273] TDS, UTC and others argue that any increase in the power limit should not result in increased interference from PCS systems to other radio services.[274] API opposes increasing the power level of subscriber units absent strict coordination requirements.[275]

172. Decision. We believe that increasing the maximum base station power limit to 1640 watts e.i.r.p. will improve PCS licensees' ability to configure their systems to best serve the needs of their customers and to compete with other mobile services such as cellular and wide-area SMR. Higher power will allow individual PCS base stations to serve larger geographic areas more effectively. We believe that the ability to serve larger geographic areas will also promote our goal of service to less populated areas. The flexibility to use higher power will provide PCS system operators greater flexibility in determining system architecture, i.e., the number of base stations deployed to serve a given area, based on service demands rather than adequate coverage considerations. This change will also facilitate the use of new technologies, such as high-gain, directional antennas, as well as potential improvements to the design of subscriber products. We do not agree with Apple and Rolm that PCS operations on channels adjacent to the unlicensed spectrum should be limited to two watts. We see no reason to restrict licensed PCS operations to afford additional protection to unlicensed devices. Such a limit would be detrimental to licensed PCS services and unfairly disadvantage blocks A and C that are adjacent to the unlicensed spectrum. In addition, we note that unlicensed operations will be relatively short range and therefore can be designed to resist adjacent channel interference.

---

[270] DCS 1800, which operates in the 1800 MHz region of the spectrum, is an extension of the pan-European digital cellular standard, "Global System for Mobile Communications" (GSM).

[271] See AT&T Reply at 6.

[272] See Apple Comments at 4-5; Rolm Reply at 2.

[273] See Nextel Comments at 15.

[274] See e.g., TDS Supplemental Comments at 1-2; UTC Comments at 14-16.

[275] See API Comments at 4.

Accordingly, we are amending the rules to allow PCS base stations to operate with up to 1640 watts e.i.r.p. We are also amending PCS power/HAAT coordination distance requirements to reflect this increased maximum power level.

173. While we believe that the power limit for base stations should be increased to 1640 watts e.i.r.p., this increase in power should not be used in such a manner that the resulting PCS system becomes unbalanced so that mobile units are unable to communicate with the base station. To ensure balanced base-to-mobile and mobile-to-base communications, we are also limiting the transmitter output power of the base station to 100 watts. By limiting the transmitter output power as well as e.i.r.p., we intend to promote the use of the high gain, directional antennas to achieve the larger coverage areas sought by the petitioners.

174. We disagree with those parties requesting higher power for certain mobile and portable units. A lower power output limit minimizes exposure to radio frequency energy, see infra Section VIII. Further, we agree with API that increasing the power output limit for subscriber units would necessitate unreasonably stringent and unenforceable coordination requirements. Unless the location of such higher power mobile units could be strictly controlled, interference could result to fixed microwave operations and/or to other PCS systems in adjacent service areas. For these reasons, we are not increasing the maximum power limit for mobile and portable PCS transmitters as requested by MCI and PCIA.

C. Protection of Fixed Microwave Operations

175. In the Second Report and Order, the Commission stated that a principal concern in the authorization of PCS in the 2 GHz band is that existing fixed microwave operations be protected.[276] It adopted the following approach for providing such protection: 1) required PCS licensees to provide the same level of protection to microwave operations that they currently provide under Part 94 of our Rules and through the use of EIA/TIA Bulletin TSB10-E criteria and methodology;[277] 2) specified antenna height and power limits for PCS; 3) adopted requirements for PCS licensees to coordinate with fixed microwave operators; and, 4) provided methods for calculating interference from PCS to incumbent microwave operations.[278]

176. Specifically, in the Second Report and Order, we adopted carrier-to-interference criteria for protection of short and medium length microwave links of 25 km (about 15 miles) or

---

[276] See Second Report and Order at & 141.

[277] Cf. 47 C.F.R. ' 94.63. We also stated that, as under Part 94 of our rules, other acceptable industry-developed interference procedures, such as those developed by the EIA, the Institute of Electrical and Electronics Engineers (IEEE) and the ANSI, may be used in performing interference analyses. See Section 24.237(d) of the Commission's Rules.

[278] See Second Report and Order at & 141-145, 163-174.

less. For path lengths longer than 25 km, where reliability is more dependent on the relative noise threshold and faded signal level, we limited the level of an interfering signal to that which would cause a 1 decibel (dB) degradation in the signal-to-noise ratio for analog systems or which would cause an increase in bit-error-rate (BER) from 10^{-6} to 10^{-5} for digital systems. Finally, we endorsed procedures for calculating interference to microwave operations.[279]

[279] The procedure for calculating the level of PCS signals at microwave receivers requires that the PCS licensee compute the sum of the transmitters' powers from proposed PCS base stations and all portable and mobiles associated with the base stations at each microwave receiver within the coordination distance of the base stations. See Second Report and Order, Appendix D.

177. Petitioners' Requests. Ten parties request reconsideration of issues relating to protection of microwave operations.[280] Several parties request reconsideration of our decision to use Bulletin TSB10-E. These parties request that the Commission adopt newly developed industry standards for protection of fixed microwave stations from PCS. Specifically, Alcatel, APC, API, Ameritech, Motorola, TIA and PCIA recommend using EIA/TIA Bulletin TSB10-F when it is completed, instead of the procedures in Appendix D of the Second Report and Order.[281] TIA argues that Bulletin TSB10-F, when adopted, will likely be the benchmark industry standard for determining PCS-microwave interference. API supports using TSB10-F as the only method, and states that allowing a number of calculation methods is unwise and will create needless uncertainty. Alcatel, Motorola, PCIA, and TIA also request that we clarify the rules to indicate that other appropriate interference procedures developed by the industry may be used.[282] A number of the petitioners also suggest specific changes to the procedures in Appendix D of the Second Report and Order.

178. Motorola, TIA, and PCIA object to the use of the Longley-Rice propagation model that was stipulated for interference calculations at Appendix D of the Second Report and Order.[283] TIA states that there are technical problems with the use of "urban correction factors" with the Longley-Rice model, as adopted by the Commission. Instead, they recommend that an appropriate model accepted by industry be used. For example, Motorola and PCIA argue that the propagation model in TSB10-F represents the efforts of all affected groups and should be adopted.[284]

179. Bell Atlantic suggests that we adopt rules to eliminate "excess margin" in microwave systems.[285] It argues that such excess fade margin is not needed for reliable microwave communications and reduces the amount of available spectrum to PCS operators. Bell Atlantic also recommends that we require microwave licensees to upgrade their systems when the change will reduce interference and when the PCS operator is willing to pay for the upgrade.

---

[280] The parties requesting reconsideration of these matters include: Alcatel, APC, API, Ameritech, Bell Atlantic, Blooston, Motorola, TIA, PCIA and UTC.

[281] See Alcatel Petition at 4-5; APC Petition at 8; API Petition at 6; Ameritech Petition at 2-3; Motorola Petition at 6-7; TIA Petition at 6-11; PCIA Petition 7, 10-12.

[282] See Alcatel Petition at 5-6; APC Petition at 11; TIA Petition at 10-11.

[283] See Second Report and Order at Appendix D.

[284] See Motorola Petition at 7; TIA Petition at 11; PCIA Petition at 12.

[285] See Bell Atlantic Petition at 22. Microwave systems are typically designed with additional power or signal strength, called margin, to provide for attenuation of the signal due to changes in propagation or weather conditions that may occur.

180. UTC asserts that the current PCS rules are contradictory. It notes that the rules provide for blanket licensing of all transmitters in a service area and at the same time require an engineering analysis before filing an application for a new or modified facility. UTC suggests that Section 24.11 be clarified to state that despite receiving a blanket license, licensees will need separate applications and authorizations for each station to assure that the proposed facility will not cause interference to existing microwave stations. UTC also recommends that we adopt coordination procedures based on Part 21 of our Rules and that all coordination requests be in writing.[286] API recommends that we require formal coordination by a third party.[287]

[286] See UTC Petition at 16-17. These procedures are set forth at 47 C.F.R. ' 22.100.

[287] See API Petition at 7.

181. API requests that we specify sanctions for PCS licensees that cause interference to incumbent fixed microwave operations. Specifically, API recommends that we require PCS entities to cease operation upon notification of interference by a microwave licensee, establish a scale of significant fines and/or forfeitures to deter violations, and make available expedited procedures to ensure that complaints are resolved quickly.[288] Blooston argues that the PCS rules fail to protect common carrier microwave operations in the adjacent 1990-2110 MHz band and should therefore be reworked to extend this protection.[289]

182. Responses. The responding parties generally support the use of EIA/TIA Bulletin TSB10-F and recommend that we adopt this standard when it is completed.[290] TDS states that although Appendix D may initially be used, improvements involving propagation modeling and urban correction factors need to be addressed. UTC supports giving equal consideration to either the interference standard found in Appendix D or a standard developed by a recognized authority. AAR states that it supports TIA's proposal that we adopt an industry consensus with Bulletin 10-F, provided that fixed microwave licensees are provided the same level of protection as under the current standard, Bulletin 10-E. PacBell states that we should adopt the Okumura-Hata propagation model, arguing that this model provides more realistic estimates. PCIA concurs that the Longley-Rice model should not be the only propagation model permitted if the industry can agree on the use of other models.

---

[288] See API Petition at 8.

[289] See Blooston Petition at 2.

[290] See Alcatel Comments at 2-4; APC Comments at 22; API Comments at 3; AAR Comments at 3-4; TIA-NED Comments at 2-6; MCI Comments at 19-20; TDS Supplemental Comments at 3; PacBell Comments at 3-4; PCIA Comments at 9.

183. Some parties support UTC and API's recommendation that we adopt prior coordination procedures, arguing that this would insure that all potential issues of interference are resolved prior to licensing and deployment.[291] MCI opposes API's proposal for a formal third-party coordination requirement, arguing that such a requirement would create delays in implementing PCS.[292]

184. Several commenters support Bell Atlantic's proposal to require microwave licensees to upgrade their system when it is shown that an upgrade will reduce interference and the PCS operator is willing to pay for the upgrade. API disagrees with those parties that argue that interference protection margins used for microwave systems are excessive. Alcatel does not oppose elimination of "excess margins," but asserts that neither the Commission nor an industry standards group should define what constitutes an excess margin. It states that instead, these objectives should be determined by individual users through interaction with appropriate frequency coordinators and potentially affected users.[293]

185. UTC supports API's proposal for penalties to deter creation of objectionable interference to microwave users. It argues that such penalties would cause PCS proponents to use caution and would therefore help to avoid interference situations. MCI opposes API's request for sanctions on PCS licensees causing interference. It argues that API's proposal would give microwave licensees undue power to shut down PCS operations merely by notifying the licensee that it has detected objectionable interference.

186. Decision. In the Second Report and Order, we stated that with certain modifications, the level of protection provided under Part 94 of our rules and through application of TSB10-E criteria and methodology is appropriate and will provide adequate protection to microwave users from PCS operations. We also stated that we would accept the new TSB10-F procedures, when adopted by EIA/TIA, for use in demonstrating compliance with our technical standards for PCS to fixed microwave interference.[294] Although many parties request that operators be required to use TSB10-F exclusively instead of that set out at Appendix D of the Second Report and Order, we cannot adopt this standard as the only acceptable method for determining interference to microwave operations from PCS operations until we have had a

---

[291] See AAR Comments at 4; Alcatel Comments at 3; API Comments at 3-4.

[292] See API Petition at 2-4.

[293] See Alcatel Reply at 3-4.

[294] TSB10-F was adopted on May 31, 1994; TIA Telecommunications Systems Bulletin Number 10-F, Interference Criteria for Microwave Systems, May 1994, (TSB10-F). On June 1, 1994, TIA submitted a Supplement to Petition for Reconsideration to report that TSB10-F is now a standard adopted by an ANSI-accepted body.

chance to evaluate its merits and provide it to the public for comment. Therefore, we will maintain the procedures adopted in the Second Report and Order with some modifications.[295]

[295] While we continue to believe the procedures adopted in the Second Report and Order are accurate and reliable, parties may use other methods such as TSB10-F as alternative methods. As indicated in the Second Report and Order, if both the PCS entity and the incumbent microwave entity agree to an alternative criteria for interference protection, then that criterion may be used. See Second Report and Order at n.118. We continue to believe that this flexibility is desirable, in light of the varied technologies that may be used for PCS.

187. We concur that a prior coordination procedure is necessary to ensure that potential issues of interference are resolved before deployment of PCS systems.[296] We believe that the Part 21 coordination requirements are appropriate for coordination of PCS and microwave facilities. These coordination procedures are generally familiar to the parties involved and are sufficient to address potential interference problems. Accordingly, we will amend the PCS rules to include coordination procedures similar to those contained in Part 21. We note that coordination under Part 21 does not require written notification. We find no reason to require that the PCS-to-microwave coordination be treated differently.

188. We agree with Bell Atlantic that permitting PCS entities to pay for and upgrade incumbent microwave operation, such as providing better antennas or filters that would prevent interference, would facilitate the implementation of PCS. Specifically it would provide more choices and opportunity for sharing between the two services. However, we believe that mandating such upgrades of the incumbents' facilities would be difficult to regulate. Therefore, we will allow for such upgrades when all parties agree but will not mandate them.

189. We share Bell Atlantic's concern that excess fade margins in incumbent systems will inhibit the ability of PCS entities and microwave operations to share spectrum. However, we also recognize that microwave systems vary in size, complexity and degree of reliability needed. Therefore, we see no way of adopting general rules mandating an acceptable fade margin that would apply fairly in all cases. Accordingly we will not set limits on the amount of allowable fade margin in a microwave system. We suggest, however, that incumbent licensees limit the fade margin in their systems to only that necessary for reliable service so as to help facilitate the implementation of PCS.

190. Regarding Blooston's assertion that Section 24.233 does not provide protection to common carrier point-to-point microwave radio service (PPMRS) operations in the 2110-2130 MHz and 2160-2180 MHz bands, we note that our Rules contain out-of-band radiation limits that must be met by PCS entities. We also note that under our revised allocation PCS is only allocated spectrum in the 1850-1990 MHz band, so there is 120 MHz of separation between PCS and PPMRS operations.

191. With regard to Blooston's request that we require PCS licensees to protect common carrier microwave operations in the adjacent 1990-2110 MHz band, we note that the current PCS rules provide for strict out-of-band emission limits.[297] We believe that these limits are sufficient to protect microwave operations in adjacent bands and, therefore, will not adopt any additional coordination or protection requirements for PCS operations.

---

[296] We note that we recently adopted Part 21 coordination procedures in the Emerging Technologies proceeding for 2 GHz microwave facilities that will be relocated to higher bands. See Second Report and Order, ET Docket No. 92-9, at & 60.

[297] See Section 24.234 of the Commission's Rules.

192. We disagree with UTC that PCS licensees should be required to submit separate applications and obtain separate authorizations for each transmitter in their system. The information that would be submitted on these applications is unnecessary to the Commission, and its filing would be overly burdensome for PCS licensees. We believe that UTC's concerns are adequately addressed through our requirements for coordination.

193. Finally, we deny API's request for a rule automatically imposing penalties on PCS operations that interfere with fixed microwave users. We believe that such penalties are unnecessary and inappropriate. As we stated in the Second Report and Order, a principal concern in the authorization of PCS in the 2 GHz band is that existing fixed microwave operations be protected.[298] If interference were to occur, we would expect the PCS licensee to take appropriate action to resolve that interference. In cases where the PCS licensee did not take appropriate action, we believe our current remedies, either forfeitures or revocation of licenses, are sufficient.

D. PCS-to-PCS Interference Standards

194. In the Second Report and Order, the Commission established a limit for spurious emissions appearing outside of the spectrum allocated to PCS.[299] No limit was specified for spurious emissions appearing within the PCS spectrum. The Commission also adopted minimal standards for PCS transmitter frequency stability, stating only that the stability must be sufficient to ensure that the fundamental emission remains within the authorized frequency block.[300]

195. Petitioners' Requests. Motorola and PCIA request reconsideration of several aspects of the PCS-to-PCS interference standards. First, in order to reduce the potential for interference between adjacent PCS channel blocks, Motorola and PCIA request that the same limit be applied to all spurious emissions appearing outside a licensee's channel block, regardless of whether the emissions appear inside or outside of the bands allocated to PCS. Second, Motorola and PCIA ask that we specify the resolution bandwidth of the instrumentation used to measure spurious emissions.[301] Third, Motorola requests clarification as to whether the limit on

---

[298] See Second Report and Order at & 141.

[299] Spurious emission is defined as an emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions. See 47 C.F.R. ' 2.1. See also Section 24.234 of the Commission's Rules.

[300] See Section 24.235 of the Commission's Rules.

[301] PCIA recommends a bandwidth of 1.0 percent of the emission bandwidth. See PCIA

spurious emissions contained in Section 24.234(a) applies only for type acceptance of the transmitter or to the system as installed.[302] Finally, Motorola asks that we clarify how a manufacturer must show compliance with the frequency stability requirement.

196. Responses. APC, Ericsson, and Northern Telecom support the requests for extension of the spurious emission limit to frequencies within the PCS spectrum. Ericsson and Northern Telecom also support the requests to specify the measurement bandwidth for spurious emissions.[303] Apple, Ericsson, and Rolm recommend that even tighter limits be imposed on spurious emissions appearing in the unlicensed PCS bands from licensed PCS transmitters. They state that such limits are needed to reduce potential interference to unlicensed devices.[304]

197. Decision. We concur that limits on spurious emissions outside of the frequency block employed by a PCS licensee are needed to reduce the potential for harmful interference to other PCS operations as well as other radio services operating on spectrum outside of the PCS bands. Accordingly, we are amending the rules to indicate that the spurious emissions limits apply to emissions appearing on all frequencies outside of the frequency block employed by a licensee. We are also clarifying that, when testing to show compliance with the spurious emission limits, the fundamental emission from the transmitter must be located as close the edge of the adjacent band as the transmitter is designed to operate. This will ensure that the emission limits are met under all normal operating conditions.

198. We do not agree that the limits for spurious emissions should be further restricted when those emissions fall within the frequency bands allocated for unlicensed PCS devices. Apple, Ericsson and Rolm have not provided information indicating that additional attenuation, beyond that already provided under the rules, is necessary to prevent harmful interference.

Petition at 3-4; Motorola Petition at 10.

[302] PCIA also points out that Section 24.234(a) should be corrected to indicate that the symbol "P" refers to "watts." See PCIA Petition at 4.

[303] See APC Comments at 23; Ericsson Reply at 2-4; Northern Telecom Comments at 10-11.

[304] See Apple Comments at 4-5; Ericsson Reply at 3.

199. We agree that the standards for measuring spurious emissions need to be clarified. The measured levels of spurious emissions are dependent, to an extent, on the bandwidth of the measuring instrument. Specifying a minimum resolution bandwidth will eliminate confusion within the rules and provide repeatable measurement results. However, we disagree with PCIA's proposed bandwidth of 1.0 percent of the emission bandwidth. Limits are placed on spurious emissions in order to reduce the potential for causing harmful interference. Ideally, the resolution bandwidth of the measuring instrument should be adjusted as close as possible to the bandwidth of the receiver for which interference protection is being provided.[305] Near the frequency bands employed for PCS, typical receiver bandwidths can range from tens of kilohertz to several megahertz. Since the resolution bandwidth on most measuring instruments does not go above 1 MHz, this is typically the bandwidth employed by the Commission when measuring spurious emissions above 1000 MHz.[306] We believe that the use of a resolution bandwidth of 1 MHz is also appropriate for PCS equipment and are amending the rules to add this specification.

200. In response to Motorola's question regarding on the applicability of the spurious emissions regulations, these limits apply to both the transmitter, as tested during type acceptance, and the operating system, as installed by the licensee. We recognize that the level of the spurious emissions can be affected by the type of antenna employed by a licensee. It is for this reason, among others, that the Commission also may require a licensee to provide additional attenuation to spurious emissions, even beyond those limits stated in the regulations, when these emissions cause harmful interference to other users of the RF spectrum. We are further clarifying the rules to note that additional attenuation can be required under such circumstances.

---

[305] Measurements with a narrower resolution bandwidth would result in lower values for the measured spurious emissions and increase the potential for harmful interference.

[306] There are a few exceptions to this criteria for some of the narrowband licensed services, such as the cellular service. See 47 C.F.R. ' 22.907(j).

201. The measurement procedures for testing frequency stability are already specified in the regulations.[307] As the frequency stability standard requires only that the fundamental emission stay within the authorized frequency block, the transmitter must be tested with the fundamental emission located as close to the edge of the authorized frequency block as the transmitter is designed to operate in order to demonstrate compliance under all normal operating conditions.

E. Enhanced 911 Standards

202. In its petition for reconsideration, Texas Emergency requests that we mandate a single enhanced 911 (E-911) standard. It requests that a uniform standard be adopted for all wireless technologies and that PCS licensees be required to provide accurate location information about 911 callers from the outset of service. The term "enhanced 911" generally refers to a 911 emergency system that, among other features, automatically provides 911 operators with a caller's exact location without the caller having to provide his or her location.[308] No responding parties opposed this request, although several did raise concerns about imposing such requirements. In the Second Report and Order, we indicated that we would address matters relating to enhanced 911 (E-911) capability in PCS, cellular, and other mobile services in a future rule making proceeding.[309] We note that the development of an E-911 standard will necessitate consideration of issues affecting matters beyond PCS and therefore is more appropriately addressed in a separate proceeding. We expect to begin this proceeding shortly and will address Texas Emergency's request at that time.

VII. UNLICENSED PCS

A. Spectrum Allocation

203. In the Second Report and Order, the Commission allocated 40 MHz of spectrum for unlicensed PCS devices. The 1900-1920 MHz band was designated for asynchronous (primarily data) devices, and the 1890-1910 MHz and 1920-1930 MHz band was designated for isochronous (primarily voice) devices. The Commission concluded that this 40 MHz of

---

[307] See 47 C.F.R. ' 2.995.

[308] In the existing 911 system, automatic location identification is easily accomplished because the location is known of each telephone in the wired telephone network. Location information is not so easily determined in a wireless network because the caller can be located anywhere in the network's service area. In such networks, however, a caller's location can be approximated by determining which of the network's radio transmitters is communicating with the caller. In the existing cellular system such approximations typically could be accurate only to within a few square miles.

[309] See Second Report and Order at & 139.

spectrum would be sufficient to meet the demands of both nomadic and non-nomadic data and voice applications. Further, it noted that this band plan provides both asynchronous and isochronous operations an equal share of the 1910-1930 MHz band, which has fewer incumbent fixed microwave facilities that must be relocated before full use of the band can be made for unlicensed PCS.

204. Petitioners' Requests. On September 13, 1993, Apple submitted an "Emergency Petition" addressing the spectrum allocated for unlicensed data PCS devices.[310] Apple argues that since data PCS operations primarily will be nomadic in nature -- that is, the devices will be mobile in nature and their location cannot be controlled or predicted. Such operations should be allocated the more lightly loaded 1910 to 1930 MHz portion of the spectrum set aside for unlicensed devices. Apple contends that, unlike nomadic data devices, unlicensed voice devices ordinarily will operate through a base station and can be coordinated with existing microwave operations. Due to the greater number of microwave operations that must be moved, Apple states that the current allocation significantly increases the time and cost of implementing nomadic data PCS.[311] Apple further argues that allocation of 1890 to 1910 MHz to isochronous voice operations would serve the interests of many voice technologies because of the desirability of contiguous spectrum. Separate petitions supporting Apple's position also were filed by Lace and SpectraLink.

205. Responses. Several responding parties oppose the petitioners' requests and support the current allocation scheme for unlicensed voice and data operations. For example, APC,

---

[310] See Apple Petition, passim. Apple's petition was filed three days before the sunshine cut-off date for the filing of ex parte presentations comments in this proceeding. To allow full comment and consideration of the issues raised by Apple, on October 22, 1993, the Commission requested public comment on Apple's petition. In its petition, Apple requested that the more lightly encumbered 1910-1930 MHz band be allocated for the exclusive use of nomadic data PCS devices and certain nomadic voice devices, including consumer cordless telephones. Apple also requested that an additional 20 MHz of spectrum be allocated adjacent to the 1910-1930 MHz band for the use of devices that can be coordinated. It further requested that two or more additional 10 MHz bands in the 1850-1990 MHz band be reserved for at least five years to accommodate retuned microwave incumbents from the licensed and unlicensed PCS bands. In subsequent comments, Apple stated that certain of its initial concerns were rendered moot by the Commission's decision in the Second Report and Order, and its only remaining concern was that the 1910 to 1930 MHz band be allocated for data or asynchronous devices.

[311] Id. Apple also suggests that due to the potential for adjacent channel interference, nomadic devices may be required to observe 4 MHz guard bands. It states that this will effectively limit the 10 MHz of easily cleared spectrum available under the Commission's plan to 2 MHz. Apple states that under its plan unlicensed data PCS devices would be given the entire lightly loaded 20 MHz, and therefore would have up to 12 MHz of usable spectrum by employing two 4 MHz guard bands.

AT&T, HP, Motorola, Northern Telecom and PacBell support the current plan and point out that providing data and voice with equal amounts of the lightly encumbered spectrum is fair and balanced. They argue that the Apple plan would unfairly penalize isochronous voice interests by allocating to them all of the heavily used microwave spectrum.[312] UTAM states that it is neutral on this issue, but points out that Apple's proposed allocation scheme will increase the cost of clearing the isochronous (voice) band and decrease the cost of clearing the asynchronous (data) band.[313]

[312] See APC Comments at 5-7; AT&T Reply at 4; HP Comments at 3; Motorola Reply at 3; Northern Telecom Comments at 3-4; PacBell Reply at 2.

[313] See UTAM Comments at 10-11.

206. BSA, Compaq, Ericsson, Metricom, Microsoft, Rolm and SpectraLink support the petitioners' proposed changes to the unlicensed allocation. BSA and Compaq argue that the Commission's band plan imposes initial costs for clearing the bands for data PCS that are significantly higher than those for Apple's plan. They point out that the manufacturers of devices that may be coordinated with existing facilities can more readily bear the higher costs of band clearing such costs can be absorbed incrementally using the cash flows generated by early deployment.[314] Ericsson, Rolm and SpectraLink argue that the long-term spectral efficiency advantages of 20 MHz of contiguous spectrum for voice operations outweigh the short-term band clearing problems.[315]

207. Decision. As noted above, we have amended the allocation and frequency plan for licensed PCS. Under this reallocation the amount of spectrum provided for unlicensed PCS devices is reduced from 40 to 20 MHz. Specifically, the 20 MHz of unlicensed PCS spectrum at 1890-1910 MHz is being reallocated to licensed PCS operations. Our decision to reallocate this spectrum preserves the 1910-1930 MHz band for unlicensed devices. We note that this band is the most lightly loaded portion of the PCS spectrum and is the spectrum where most unlicensed equipment was expected to operate initially. Further, since unlicensed operations are restricted to very low power, they should be able to share or "reuse" the available spectrum very efficiently. Accordingly, we believe that this reduction will not have a major effect in the near term on devices that will be able to operate on the unlicensed PCS bands. As noted above, in the near future we will initiate a proceeding to consider allocation of additional spectrum to meet long term spectrum requirements for unlicensed PCS devices.

[314] See BSA Comments at 5-9; Compaq Comments at 5.

[315] See Ericsson Reply at 3-4; Rolm Reply at 1; SpectraLink Comments at 3-4.

208. Taking into account this reduction in the total amount of spectrum available for unlicensed operations, we find that the interests of all concerned parties would be best served by retaining the plan to provide 10 MHz at 1910-1920 MHz for asynchronous or data devices, and 10 MHz at 1920-1930 MHz for isochronous or voice devices. We believe that this approach is balanced and treats both voice and data proponents fairly and equitably. We also believe that this approach will encourage the clearing of all existing microwave users from the entire 1910-1930 MHz band, thereby permitting the rapid introduction of nomadic voice and data devices. Accordingly, we are amending our spectrum plan for unlicensed devices, as indicated above.

B. Coordination

209. In the Second Report and Order, the Commission designated UTAM as the coordinating body to manage the transition of spectrum from fixed microwave to unlicensed PCS. The Commission conditioned this designation on UTAM's submission and our acceptance of: 1) a funding plan that is equitable to all prospective manufacturers of unlicensed devices, and 2) a plan for band clearing that will permit the implementation of nomadic devices, in particular, nomadic data PCS devices, as promptly as possible.[316] We stated that UTAM would be responsible for administering the transition, including negotiating costs of relocation, ensuring that comparable facilities are provided, and resolving disputes of interference to fixed microwave from unlicensed PCS operations. Further, we required that any unlicensed PCS device or system be coordinated through UTAM before being initially deployed or subsequently relocated. We required that all applicants for FCC equipment authorization of unlicensed PCS devices, be participants in UTAM.

210. Petitioners' Requests. In its petition, Apple maintains that UTAM does not adequately represent the interests of the unlicensed data community.[317] It contends that unless we intervene with additional guidance, UTAM is unlikely to adopt and implement a band-clearing plan that will ensure the earliest possible deployment of nomadic data devices. Apple requests that we remove the specific references to UTAM in the rules and that we state that we will designate another entity if UTAM fails to submit an acceptable funding and band-clearing plan.

---

[316] See Second Report and Order at & 88.

[317] See Apple Petition at 3.

211. Apple also requests that we provide for conditional technical approvals of unlicensed nomadic equipment (i.e., equipment that cannot be coordinated) in advance of complete clearing of the spectrum.[318] It further requests that the labeling requirements for unlicensed equipment be eliminated once the spectrum has been cleared and coordination is no longer needed.[319] UTC, in its petition, maintains that the definition of "coordinatable PCS device" is too vague.[320] UTC also requests that the equipment labels be more specific to let users know that unlicensed devices cannot be relocated without coordination, and that a toll-free number be placed on the label so that users can contact UTAM.

212. In its petition, UTAM asks that we clarify whether the burden of determining whether a device is coordinatable lies with itself or with the Commission.[321] UTAM notes that the rules currently appear to make UTAM responsible for such determinations.[322] It states that the responsibility for determining whether a device is coordinatable should be determined through the Commission's equipment authorization program. UTAM further requests that the rule requiring that it verify the location of coordinatable PCS devices be interpreted to allow such verifications to be made through any method that adequately identifies the location of a device, including the reports of licensed installers.[323] Ericsson, in its petition, requests that we clarify the types of showings that will be necessary to demonstrate compliance with the requirement to

---

[318] See Apple Petition at 3.

[319] Section 15.311 of the rules requires that unlicensed PCS devices, in addition to the general Part 15 labeling requirements, include a prominently located label with the statement that installation of the equipment is subject to notification and coordination with UTAM. See Section 15.311 of the Commission's Rules.

[320] See UTC Petition at 12. Section 15.303(b) states that a coordinatable PCS device is a PCS device whose geographical area of operation is sufficiently controlled either by necessity of operation with a fixed infrastructure or by disabling mechanisms to allow adequate coordination of its location relative to incumbent fixed microwave facilities. See Section 15.303(b) of the Commission's Rules.

[321] See UTAM Petition at 3-4.

[322] Cf. Section 15.307(c) of the Commission's Rules: "An application for certification of a PCS device that is deemed by UTAM, Inc., to be noncoordinatable will not be accepted until the Commission announces that a need for coordination no longer exists."

[323] Section 15.307(d) requires that a coordinatable PCS device include measures to assure that it cannot be activated until its installation at an authorized location is verified by UTAM. See Section 15.307(d) of the Commission's Rules.

either prevent activation of equipment or to disable its use upon relocation without prior coordination with UTAM.[324]

[324] See Ericsson Petition at 15. See Section 15.307(d),(e) of the Commission's Rules.

213. AT&T, in its petition, maintains that the current requirement that the existing Part 15 test procedures be used where applicable, and supplemented by good engineering practice, does not provide sufficient guidance for industry.[325] AT&T requests that the Commission allow the ANSI C63 Committee to develop standard criteria for testing and measuring unlicensed devices.

214. Responses. AAR, Microsoft and Rolm support Apple's position regarding UTAM's role as the coordinator for unlicensed devices.[326] For example, Rolm believes we should establish measures to provide additional assurances that the interests of all nomadic device proponents, both voice and data, will be protected. Several other parties, including Motorola and Northern Telecom, support our designation of UTAM as the coordinator for unlicensed operations.[327] These parties point out that various UTAM members have an interest in marketing data and voice products. They also note that UTAM's membership is open to all and that UTAM has actively solicited participation from the data industry.

215. UTC opposes UTAM's request that the requirements regarding verification of the location of coordinatable devices be construed broadly to permit any method of verification, including the reports of licensed installers.[328] UTC argues that only technological means included in the design of the equipment can provide adequate insurance against unauthorized deployment or relocation. Apple also opposes UTAM's request, arguing that its efforts to broaden the range of allowable disabling techniques appear to be at odds with the Commission's intent to ensure against interference to incumbents.[329] AAR supports UTC's request for more specific labeling.[330] AAR also maintains that UTAM should be held responsible for verifying the installation or relocation of coordinatable devices at the coordinated locations.

216. Ericsson argues that AT&T's claims regarding problems associated with the testing of unlicensed PCS devices are exaggerated.[331] Northern Telecom also opposes AT&T's request, stating that the current rules are adequate to allow products to be developed and deployed and

---

[325] See AT&T Petition at 2.

[326] See AAR Petition at 7; Microsoft Comments at 1; Rolm Reply at 2.

[327] See Motorola Reply at 2; Northern Telecom Comments at 17.

[328] See UTC Comments at 10.

[329] See Apple Comments at 6.

[330] See AAR Comments at 7-8.

[331] See Ericsson Comments at 13.

that awaiting the development of new test procedures would significantly delay implementation.[332]

217. Decision. We continue to believe that our basic approach for regulation of unlicensed PCS devices is appropriate. Based on the record, we continue to find that UTAM is the most suitable entity to act as the coordinator for unlicensed PCS devices. We concur with those parties that indicate that UTAM is making good faith efforts to be open and to include the participation of all interested parties, including representatives of the data community. We do not believe that additional guidance or requirements are needed for UTAM at this time. With regard to Apple's specific request that we eliminate UTAM's designation in the rules, we see no merit in such an approach at this time. We will have ample opportunity to review our decision to designate UTAM as the coordinator for unlicensed devices during our review of its funding and band-clearing plans. If UTAM is found unacceptable as a result of our review process, we can amend our rules at that time to designate another entity.

218. With regard to Apple's request that we grant conditional equipment approvals for nomadic devices, it is our intention to consider such approvals at an appropriate future time. When spectrum is available, or soon will be available, for the operation of nomadic devices, we will issue a Public Notice announcing that we will begin accepting and processing applications for certification of nomadic devices. If we accept such applications before the spectrum is fully cleared for use by nomadic devices, the applications will be processed, but the actual grants withheld until an announcement is made that coordination is no longer required. At that time, the grants, if justified, will be immediately issued. We believe that this approach addresses Apple's principal concerns that manufacturers be able to quickly introduce new nomadic equipment.

219. We agree with UTC that the labels for coordinatable unlicensed PCS equipment should also indicate that any relocation of the device must also be coordinated through, and approved by, UTAM and should include a toll-free number to assist users in contacting UTAM. This additional information will not impose additional burden on equipment manufacturers and will improve compliance with the coordination requirements for unlicensed PCS devices. We do not agree with UTC that a more rigorous definition of a "coordinatable PCS device" is needed. We continue to believe that the current definition is adequate to protect existing microwave operations from interference. The current definition also provides equipment manufacturers flexibility in designing their equipment to avoid such interference.

[332] See Northern Telecom Comments at 16.

220. We understand UTAM's position that the determination of whether and to what degree an unlicensed PCS device is coordinatable may place UTAM in a position of potential conflict of interest with its own members. Nevertheless, UTAM, as the coordinator for unlicensed device use, is responsible for ensuring that such devices do not cause interference to existing microwave operations. Accordingly, we believe it is entirely reasonable and prudent to require that UTAM make a finding with regard to the degree to which an unlicensed device can be coordinated and deployed. It is our intent that UTAM make such determinations in concert with the requirements of Section 15.307(b) of the rules.[333] In this regard, we also agree with UTAM that a broad interpretation of the rules for preventing interference by unlicensed devices, such as the requirement for verification that an unlicensed device is being used at an authorized location, is appropriate. This will afford UTAM latitude to develop its own policies and interpretations for the wide range of unlicensed devices that are expected to be developed. We therefore will allow UTAM broad flexibility in establishing the means it uses to fulfill its responsibility for ensuring that unlicensed devices to not interfere with existing microwave operations. Such means could include, where appropriate, the use of authorized installers to ensure that unlicensed devices do not cause interference.

221. Further, as part of our equipment authorization process, we will review closely the technical aspects of each unlicensed device. This review will include all technical matters related to the device's ability to be coordinated, as well as, other measures that may be imposed by UTAM on the operation of the device. This review will provide oversight to ensure that such measures developed by UTAM are sufficient to protect existing microwave from harmful interference.

222. We agree with Ericsson that some modification of the rules is appropriate to clarify the showings necessary to demonstrate compliance with the activation and disabling requirements of Section 15.307. Accordingly, we are amending the rules to indicate that each application for certification must contain an explanation of all measures for ensuring that the device cannot be activated until installation at its authorized location as verified by UTAM and for automatically disabling the device in the event that it is relocated outside the coordinated geographic area. Such showings shall include all procedural safeguards, such as the mandatory use of licensed technicians to install and relocate the equipment, and a complete description of all technical features controlling activation and disabling of the device. We believe that these showings, in addition with the findings required by UTAM, will be adequate to demonstrate that a device is coordinatable and can be used in a manner that will not cause interference.

---

[333] Section 15.307(b) requires UTAM to submit an affidavit with each equipment application, certifying that the applicant is a participating member of UTAM. See Section 15.307(b) of the Commission's Rules.

223. We agree with Ericsson and Northern Telecom that the current test and measurement procedures are adequate and will allow authorization of equipment to commence without delay. We note that the ANSI C63 Committee has already begun work, in cooperation with WINForum, to develop specific procedures for unlicensed PCS equipment. We will address specific test and measurement procedures developed by recognized national standards bodies, such as ANSI C63, at such times as they are completed.

C. Spectrum Etiquette

224. In the Second Report and Order, the Commission adopted technical operating requirements for unlicensed PCS devices. These requirements were based largely on a spectrum "etiquette" developed on a consensus basis by an association of manufacturers and other interested parties known as the WINForum. The Commission made some minor modifications to the WINForum etiquette to take into account the allocation of additional spectrum for unlicensed PCS, to improve spectrum efficiency and to address specific comments and concerns. In particular, it divided the 40 MHz of spectrum for unlicensed devices into two equal 20 MHz allocations; one for isochronous transmissions at 1890-1900 MHz and 1920-1930 MHz and one for asynchronous transmissions at 1900-1920 MHz. The Commission adopted WINForum's 1.25 MHz channelization for the 1920-1930 MHz band, but provided for up to 5 MHz channels in the 1890-1900 MHz band. The asynchronous spectrum at 1900-1920 MHz was divided into two 10 MHz channels. Separate technical requirements were specified for each transmission method.[334]

225. Petitioner's Requests. Several parties request modifications to the technical rules governing unlicensed operations. These parties request changes to the channelization plans for the isochronous and asynchronous bands and raise a variety of other technical concerns regarding the unlicensed spectrum etiquette.

[334] See Sections 15.321, 15.323 of the Commission's Rules.

226. Motorola requests that we adopt the 1.25 MHz channelization plan for all isochronous spectrum.[335] Motorola asserts that 1.25 MHz channels will help to avoid interference between systems and ensure that no one system or technology monopolizes the spectrum at a given location. Ericsson, Rockwell and Lace request that we impose no channelization on the isochronous spectrum and instead develop a spectrum occupancy limit.[336] They argue that the existing channelization plan disadvantages wideband technologies. Ericsson and Rockwell suggest that we limit the spectrum occupancy for isochronous devices to no more than 50 percent of the available spectrum in each portion of the isochronous band. Lace suggests, as an alternative, limiting channel bandwidths to 2.5 MHz in the isochronous spectrum. Apple requests that we adopt uniform, flexible rules for channelization of all the isochronous spectrum, so as to be fair to all technologies, and requests that the 10 MHz channelization of the asynchronous spectrum be eliminated.[337] It argues that this change would facilitate use of wideband signals and enable operation in the middle of the asynchronous spectrum to avoid adjacent channel interference.

227. AT&T, Northern Telecom, and WINForum state that the WINForum recommendations regarding the power limits were based on measurements of mean (average) power, rather than the peak power specified in the rules.[338] These parties argue that use of peak power measurements unfairly penalizes certain digital modulation techniques. They request that we base the power limit on mean power and impose a limit of 10 dB on the peak-to-average

---

[335] See Motorola Petition at 11.

[336] See Ericsson Petition, Appendix I at 5; Rockwell Petition at 3; Lace Petition at 3.

[337] See Apple Petition at 7.

[338] See AT&T Petition, Attachment B at 6; Northern Telecom Petition at 23; WINForum Petition at 6. The rules currently specify that the peak transmit power of unlicensed PCS devices shall not exceed 100 microwatts multiplied by the square-root of the emission bandwidth in hertz. See Section 15.319(c)of the Commission's Rules.

power ratio. PCIA and Rockwell request that the maximum 10 millisecond frame period for isochronous systems be increased from 10 to 20 milliseconds.[339]

[339] See PCIA Petition at 19, Rockwell Petition at 5. See Section 15.321(e) of the Commission's Rules.

228. Apple, Ericsson, Metricom, Rockwell, SpectraLink and WINForum request changes in the method by which devices are required to search for unused channels on which to operate.[340] This requirement specifies that searches for time/spectrum windows must begin at a particular band edge and search across the band until an unoccupied window is located.[341] Apple, Metricom and SpectraLink request that this requirement be deleted. Apple and SpectraLink argue that it increases the potential for adjacent channel interference between unlicensed devices and precludes the use of guard bands at the band edges. Ericsson and Rockwell request that the channel search rule be modified to permit spectrum searches to begin within a range of frequencies inside the band edge. They state that this revision will improve interoperability with the licensed service equipment. WINForum suggests that we remove the channel search rule for the isochronous spectrum. WINForum states that by mandating the same search algorithm for all unlicensed devices, the rule will increase the probability of two devices attempting to seize the open channel. Further, WINForum asserts that requiring all open channel searches to start at the same channel precludes the use of high efficiency multi-cell frequency reuse architectures because groups of channels can be allocated to specific cells. AT&T, Apple and Ericsson request that we modify the requirement for $\pm$3 dB accuracy and impose a $\pm$6 dB tolerance or one-sided 3 dB tolerance in measuring the power to determine whether a channel is occupied.[342] Motorola suggests we delete the requirement and simply prohibit devices from operating on a channel if the receive power of signals from other transmitters is a specific level above the noise floor.[343] They state that eliminating the accuracy requirement would provide equipment manufacturers additional freedom in system design without increasing interference.

229. AT&T, Ericsson and Motorola request changes in the etiquette with regard to acknowledgements of transmissions in an isochronous system in order to prevent monopolization of the spectrum.[344] The rules currently require that an acknowledgement from a system participant must be received by the initiating transmitter within one second or the transmission must cease.[345] AT&T suggests that we require a transmitter to repeat the channel access criteria whenever transmission temporarily ceases. Ericsson proposes requiring an acknowledgement every 10 seconds, and Motorola recommends every 30 seconds. AT&T, Northern Telecom,

---

[340] See Apple Petition at 5; Ericsson Petition at 2; Metricom Petition at 3, 5; Rockwell Petition at 7; SpectraLink Petition at 9.

[341] See Sections 15.321(b), 15.323(b) of the Commission's Rules.

[342] See AT&T Petition, Attachment B at 14 and 18; Apple Petition at 7; Ericsson Petition at 12.

[343] See Sections 15.321(c)(6),(8) of the Commission's Rules.

[344] See AT&T Petition, Attachment B at 11; Ericsson Petition at 14; Motorola Petition at 14.

[345] See Section 15.319(c)(4) of the Commission's Rules.

SpectraLink and Motorola also ask that we permit control and signaling information to be transmitted for 30 seconds without acknowledgement.[346] They argue that polling of a group of devices requires more than the one second currently allowed and that battery life considerations for portable devices warrant a longer time for these transmissions.

230. AT&T, Ericsson, Motorola, Northern Telecom and WINForum request that we amend the rules to specify use of the WINForum etiquette provisions for duplex operation.[347] The WINForum etiquette only requires one transmitter on a paired channel to search for an unused channel before initiating operation, while the current rules require both transmitters to perform a search.[348] These petitioners indicate that, because these devices will use fixed pairings, only one transmitter should be required to perform the search.

231. Northern Telecom requests that we adopt the WINForum provision for multicarrier shared antennas.[349] The rules currently require that an unlicensed device monitor the time and spectrum windows its transmission is intended to occupy.[350] Northern Telecom indicates that when multiple systems share the same antenna, transmissions on adjacent channels may be precluded under the monitoring technique specified in the rules. It states that this occurs because systems sharing the same antenna will detect spurious emissions of other systems that are transmitting and thus not use the adjacent channels. Northern states that the WINForum etiquette accommodates use of multiple systems sharing the same antenna by allowing the listen-before-talk operation to be performed in the intended receive time and spectrum window, rather than the

---

[346] See AT&T Petition, Attachment B at 12; Northern Telecom Petition at 24; Motorola Petition at 14; SpectraLink Petition at 8.

[347] See AT&T Petition, Attachment B at 14; Ericsson Petition at 1; Motorola Petition at 15; Northern Telecom Petition at 25.

[348] See Sections 15.321(c), 15.323(c) of the Commission's Rules.

[349] See Northern Telecom Petition at 24.

[350] See Sections 15.321(c), 15.323(c) of the Commission's Rules.

transmit time and spectrum window. Northern Telecom contends that the WINForum approach would be equally effective in preventing interference as that specified in the current rules.

232. Ericsson and Northern Telecom state that the frequency stability requirement for variations in temperature should be modified.[351] They argue that the requirement should be relaxed to ±10 ppm at stabilized temperature extremes from +10° C to +40° C. Northern Telecom also requests that the voltage component of the frequency stability requirement be relaxed to ±10 percent of the primary voltage supply. Ericsson and WINForum request that we relax the limit for spurious emissions on first adjacent channels by 10 dB.[352] They argue that the current 40 dB attenuation requirement for these emissions is more stringent than is needed to control interference and increases equipment costs.[353]

233. Metricom proposes in their petition that we conform the etiquette with the spread spectrum provisions currently in Part 15 for equipment operating in the ISM bands.[354] In their May 25, 1994 ex parte filing, their proposal was modified to request only a power increase to one watt, a requirement for automatic power control, and permission to use a 200 kHz bandwidth.[355] Metricom argues that this would promote a more competitive and cost effective data PCS service.

234. Responses to Petitions. In their response, WINForum and Northern Telecom support Motorola's request that we specify 1.25 MHz channelization for all the isochronous spectrum.[356] On the other hand, Omnipoint and Rolm support the elimination of all channelization of the isochronous spectrum.[357] They state that the 1.25 MHz channelization will impede certain wideband technologies. Ericsson opposes changes to the peak power measurement requirement, and claims that permitting a 10 dB peak-to-average ratio will cause

---

[351] See Ericsson Petition at 3; Northern Telecom Petition at 26. The rules require that the frequency stability of the carrier frequency of unlicensed PCS devices be maintained within ∀10 parts-per-million (ppm) over a temperature variation of -30° C to +50° C, and power supply voltage variations of ∀15 percent. See Sections 15.321(f), 15.323(f) of the Commission's Rules.

[352] See Ericsson Petition at 8; WINForum Petition at 5.

[353] The rules currently require that emissions between the channel edges and 1.25 MHz above or below the channel be attenuated 40 dB below the reference power level of 112 milliwatts. See Sections 15.321(d) and 15.323(d) of the Commission's Rules.

[354] See Metricom Petition at 3, Section 15.247 of the Commission's Rules.

[355] See Metricom Ex parte presentation (May 25, 1994).

[356] See WINForum Comments at 3; Northern Telecom Comments at 12.

[357] See Omnipoint Comments at 7; Rolm Comments at 1.

increased interference between unlicensed devices.[358] Motorola, Northern Telecom and SpectraLink oppose lengthening the frame period.[359] They contend that such a change would necessitate longer call setup time.

[358] See Ericsson Comments at 8.

[359] See Motorola Reply at 7; Northern Telecom Comments at 14; SpectraLink Comments at 2.

235. Rolm supports deletion of the channel search requirements.[360] Omnipoint supports the modification of these rules to allow spectrum searches to begin on a range of frequencies as requested by Ericsson and Rockwell.[361] Ericsson, SpectraLink, and Omnipoint oppose Northern Telecom's request to reinstate the WINForum provision that allows monitoring of receive channels for multicarrier shared antennas.[362] They claim that this provision undercuts the purpose of the listen-before-talk provisions of the etiquette, and therefore will degrade the ability of systems to share the spectrum. Motorola opposes relaxation of the requirement for attenuation of emissions on first adjacent channels.[363] It argues that because of measurement differences, the current 40 dB attenuation requirement for first adjacent channels is close to the WINForum proposal for this standard.

236. Decisions. Our initial decision provided spectrum for both wideband and narrowband isochronous applications. We are now, however, reducing the spectrum available for isochronous devices from 20 MHz to 10 MHz. With this reduction, it is important that the remaining spectrum be used as efficiently as possible. In this regard, we agree with Motorola, Northern Telecom and others that a 1.25 MHz channelization plan will foster more efficient spectrum utilization. As indicated by those parties, such a plan will more readily prevent a single user or system from monopolizing the spectrum at a given location. We find that a plan that provides wider channels or no channelization at all could result in inefficient use of the spectrum and preclude other parties from using the spectrum. Further, we do not believe a spectrum occupancy limit, as suggested by some parties, would be practical or enforceable. We believe that a 1.25 MHz channel plan will simplify equipment design and permit better management of spectrum use. Accordingly, we are adopting such a channelization plan for the 10 MHz of isochronous spectrum. If in the future we are presented with information that shows that wider channels can be accommodated without compromising spectrum efficiency or monopolizing the spectrum (i.e., through use of reduced power levels for wideband systems, or establishing a spectrum efficiency standard, etc.), we may revisit this matter.

237. With regard to the asynchronous band, we note that channelization is not as critical for such transmissions, since asynchronous transmissions will be of very short duration and not occupy the spectrum continuously. Accordingly, we are eliminating the channelization requirements for the asynchronous spectrum.

238. We do not agree with WINForum and others that the power specification should be based on mean rather than peak power. Given that a wide variety of modulation methods will be

---

[360] See Rolm Comments at 2.

[361] See Omnipoint Comments at 9.

[362] See Ericsson Comments at 12; SpectraLink Comments at 3; Omnipoint Comments at 11.

[363] See Motorola Reply at 4.

permitted, measurement of mean power could become complex and subject to differing interpretations. This could lead to equipment design uncertainties and potential delays and complications in equipment authorization. We find that measurement of peak power is straightforward and will not unduly penalize any technology. We therefore are not altering the method specified in the rules for measuring the output power of unlicensed PCS devices. With regard to PCIA, Rockwell and Omnipoint's request to increase the frame period, we believe that a longer frame period could potentially reduce spectrum efficiency. We are also unconvinced that an increase in the frame period would improve the likelihood of compatibility with future technical standards for licensed PCS equipment. Therefore, we are not modifying the rules in this regard.

239. With regard to the channel search requirements, we are amending the rules to permit a device to begin its search for an unused channel at any point within a range of frequencies from a band edge, as requested by the several petitioners. This will permit manufacturers greater flexibility to use guard bands, if needed, while retaining most of the spectrum efficiency advantages gained by orderly selection of channels. We disagree with WINForum and others that the channel search rule significantly increases the potential for two devices attempting to seize the same channel at the same instant in time. Nor do we believe this requirement impedes the use of coordinated multi-cell systems. We also agree with the petitioners that the existing requirement for accuracy in monitoring signal levels should be deleted. We find that the existing monitoring threshold requirements are sufficient to ensure that unlicensed devices do not interfere with one another.

240. We agree with the petitioners that a requirement for periodic acknowledgement of transmissions is necessary to ensure that a device does not monopolize the spectrum. Therefore, we are modifying the etiquette to require an transmitter to receive an acknowledgement of transmissions from a system participant every 30 seconds and to cease transmission if such acknowledgement is not received. We also will permit control and signaling information to be transmitted for 30 seconds without acknowledgement, as requested by several parties.

241. With regard to duplex operation, we are persuaded that some changes are appropriate. While we recognize that performing the listen-before-talk operation at only one transmitter location may increase the potential for interference, we believe that this increase is low and is outweighed by the benefits of simpler, more cost effective equipment design. Therefore, we are incorporating WINForum's provisions for paired duplex channel operation into the rules. We are also persuaded that an exception to the listen-before-talk provisions is appropriate for systems that employ multicarrier shared antennas. Northern Telecom's proposal to monitor the receive channel rather than the transmit channel should not significantly increase the risk of causing interference to other unlicensed PCS spectrum users and we are amending the rules to allow this approach.

242. We agree with Ericsson and Northern Telecom that the frequency stability requirements for unlicensed PCS devices should be relaxed. We believe that unlicensed PCS

devices will generally operate under the same the range of temperature and voltage conditions specified for other Part 15 devices.[364] Accordingly, we are requiring that the operating frequency of unlicensed PCS devices be maintained within ±10 ppm over a temperature range of -20° C to +50° C at normal supply voltage and for variation in the primary voltage of ±15 percent at 20° C. While we note that the stability requirement ±10 ppm is more strict than for other Part 15 devices, we believe this is necessary to ensure the proper function of the etiquette. We are also relaxing from 40 dB to 30 dB the limit for suppression of spurious emissions in the first adjacent channels as requested by Ericsson and WINForum. This will reduce equipment costs while still providing adequate interference protection between unlicensed PCS systems.

243. We note that Metricom's request to conform the etiquette to match the Part 15 standards for spread spectrum devices was not addressed by other commenters in the proceeding. Further, we observe that Metricom's clarification of its petition was made well after the comment periods had closed and so other parties had little opportunity to respond. We find that Metricom's proposal is inconsistent with the sharing and spectrum efficiency goals that underlie the unlicensed PCS etiquette described by WINForum. We find that WINForum considered factors such as power levels, bandwidth and dynamic power reduction and arrived at appropriate recommendations. Their proposal runs counter to precepts which form the basis of the spectrum etiquette that received broad industry support. Accordingly, we are rejecting Metricom's request.

244. Many of the petitioners and responding parties suggest edits in the etiquette language to improve clarity and understanding of the etiquette concepts. Examples of these changes include: clarifying that the period of time to be monitored is the time period immediately prior to initiating a transmission; specifying the starting time for calculating compliance with the monitoring period before reaccessing the same channel for isochronous equipment; and, clarifying that the range of the monitoring period for asynchronous devices must be doubled progressively for each unsuccessful channel access. To the extent that clarifications of various provisions of the etiquette were deemed necessary, they have been incorporated in the amended rules.

---

[364] The Part 15 rules require that the operating frequency of certain unlicensed devices be maintained within ∀0.01 percent (or 100 ppm) of the device's operating frequency over a temperature range of -20° C to +50° C at normal supply voltage, and for variation in the primary voltage of ∀15 percent at a temperature of +20° C. See e.g., Sections 15.231, 15.233 of the Commission's Rules.

VIII. RADIO FREQUENCY EXPOSURE LIMITS

245. In the Second Report and Order, the Commission required PCS licensees and equipment to comply with the standards set forth in ANSI/IEEE C95.1-1992, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz" (ANSI/IEEE guidelines).[365] The Commission stated that for purposes of determining compliance with these standards, all handheld PCS equipment will be considered to operate in an "uncontrolled" environment. It also noted that the exclusions for low power devices contained in the ANSI/IEEE guidelines only apply to transmitters operating at 1500 MHz and below. Therefore, the Commission indicated that, pending an interpretation from the IEEE, PCS equipment must demonstrate compliance with the ANSI/IEEE guidelines for maximum specific absorption rates (SAR).[366]

246. Petitioners' Requests. In its petition, PCIA requests that we clarify the rules governing RF exposure from PCS equipment. It notes that the text of the Second Report and

---

[365] The Commission stated that these standards will apply to PCS operations pending completion of its complete review of standards for RF exposure. See Notice of Proposed Rule Making, ET Docket No. 93-62, 8 FCC Rcd 2849 (1993). The Commission further indicated that any RF exposure standards adopted in the instant proceeding that do not conform with the final rules adopted later in ET Docket No. 93-62 will be modified as appropriate.

[366] The Commission also indicated that it had requested a formal interpretation from the IEEE as to whether the formula for determining the power threshold for the exclusion from the standards can be extrapolated up to 2200 MHz. See Letter from Thomas P. Stanley to Andrew G. Salem, IEEE Standards Board (June 2, 1993). This provision exempts a device from the SAR testing requirements, if the device operates with power output below a certain threshold level. Extrapolating the formula for this threshold up to 2200 MHz would allow PCS transmitters to operate with about 330 milliwatts of power.

Order indicates that handheld PCS devices must comply with the standards for uncontrolled environments, while Section 24.52 of the rules provides that all PCS equipment (which would include base stations as well as handheld units) will be considered to operate in an uncontrolled environment. PCIA submits that the rules should allow use of the less stringent "controlled" environment standards for base stations where appropriate.

247. Responses. APC agrees with PCIA that the rules should allow use of the standards for controlled environments for base stations. MCI also supports this request and states that the request to increase the base station power limit would not result in additional risk of harmful exposure to RF radiation. Northern Telecom, in reply comments, submits that, as an interim measure, manufacturers should be allowed to the extrapolate the ANSI/IEEE formula up to the 2 GHz band to determine whether their equipment meets the exclusions for low power devices. It states that due to a lack of testing facilities, a requirement for SAR testing would delay PCS implementation.

248. Decision. We agree with PCIA that the guidelines for RF exposure from PCS base stations should apply according to the type of environment in which the exposure takes place. We also concur with PCIA and others that there is no need to employ the uncontrolled exposure limits in those areas in the vicinity of a PCS base station where there is restricted access by the general public and exposure to the RF field is unlikely. Accordingly, we are amending the rules to include both the uncontrolled and controlled limits for PCS base stations. The definitions of "controlled" and "uncontrolled" environments specified in ANSI/IEEE C95.1-1992 will govern which limits will apply.[367]

249. As noted above, we requested a formal interpretation from the IEEE as to whether the formula for determining the threshold level for the exclusion from the RF exposure standards can be extrapolated to the 2 GHz range. The IEEE radiated power exclusion applies when a 2.5 cm separation distance is maintained between the body and the radiating structure. In its response to our request, IEEE stated that, while it cannot predict whether such an extension of the standard would be incorporated into the next revision of C95.1, extrapolation of the current formula to frequencies up to 2.2 GHz would be conservative.[368] We therefore are amending the rules to apply the ANSI/IEEE radiated power exclusions for low power devices to PCS devices. In implementing this change, however, we find that it is appropriate to provide an additional margin to ensure that devices approved for operation under the exclusion will comply with any changes to the RF exposure guidelines that may be adopted in the future. Accordingly, we will exclude PCS devices that operate with output power of 100 milliwatts or less from the SAR testing requirements. PCS devices operating at higher powers must be subjected to SAR testing to determine compliance with the RF exposure guidelines.[369]

---

[367] See ANSI/IEEE C95.1-1992, Section 2 (Definitions and Glossary of Terms).

[368] See Letter to Thomas P. Stanley from Eleanor R. Adair, Co-Chairman, SC-4, Standards Coordinating Committee 28, IEEE (October 11, 1993).

[369] The methodology for SAR testing is described in numerous technical publications. See

IX. CONCLUSION

250. We are amending our rules as described above to ensure that the American public benefits from new mobile digital voice and data services. We believe that our rules, as amended, will foster rapid development of a competitive market that will provide consumers with access to a diverse array of high-quality, low-cost PCS services and products on a wide-area basis. With adoption of these amendments, our rules are finalized and we now intend to proceed expeditiously to license broadband PCS services through the competitive bidding process.

---

e.g., IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, IEEE C95.3-1991, at '' 4.6, 4.7 and Appendix C. See also reference list in same publication. Copies of this document can be purchased from the IEEE, at telephone number (800) 678-IEEE. A copy may also be inspected at the FCC's Office of Engineering and Technology, Spectrum Engineering Division, (202) 653-8169.

X. PROCEDURAL INFORMATION

251. Regulatory Flexibility Analysis. The analysis required by the Regulatory Flexibility Act of 1980, 5 U.S.C. Section 608, is contained in Appendix C.

252. Ordering Clause. Accordingly, IT IS ORDERED, That Parts 2, 15, and 24 of the Commission's Rules ARE AMENDED as specified in Appendix A, effective 30 days after publication in the Federal Register; except that amendments to Sections 15.311 and 24.204(f)(1), (2), (3)(i), (3)(ii) are effective 90 days after publication in the Federal Register. This action is taken pursuant to Sections 4(i), 7(a), 302, 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 157(a), 302, 303(c), 303(f), 303(g), and 303(r). Furthermore, IT IS ORDERED, That the petitions for reconsideration ARE GRANTED, to the extent described above and DENIED in all other respects.

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton
Acting Secretary

Appendix A: Final Rules

Parts 2, 15 and 24 of Chapter I of Title 47 of the Code of Federal Regulations are amended as follows:

PART 2 -- FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

1. The authority citation for Part 2 is revised to read as follows:

AUTHORITY: Sec. 4, 302, 303, and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154, 302, 303 and 307, unless otherwise noted.

2. Section 2.106, the Table of Frequency Allocations, is amended as follows:

a. In the 1850-1990 MHz band: remove NG153 from column 5; and in column 6 replace PERSONAL COMMUNICATIONS SERVICES (99) with PERSONAL COMMUNICATIONS SERVICES (24). In the 2110-2150 and 2160-2200 MHz bands: remove US331 from column 5; and in column 6 remove PERSONAL COMMUNICATIONS SERVICES (99).

' 2.106 Table of Frequency Allocations

* * * * * * *

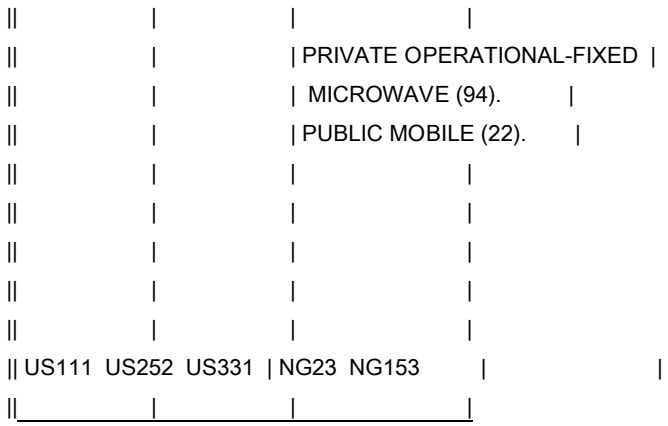
International table			United States table		FCC use designators	
Region 1-allocation	Region 2-allocation	Region 3-allocation	Government	Non-Government	Special-use	MHz	MHz	MHz
Allocation MHz	Allocation MHz	Allocation MHz	Rule part(s)	frequencies				
(1)	(2)	(3)	(4)	(5)	(6)	(7)		
* * * * *		1850-1990	1850-1990					
			FIXED.	PERSONAL COMMUNICATIONS	EMERGING			
			MOBILE.	SERVICES (24).	TECHNOLOGIES			
				PRIVATE OPERATIONAL-FIXED				
				MICROWAVE (94).				
				RADIO FREQUENCY DEVICES				

||	| US331	|	|
||	|	|	|

* * * * * * *

* * * * * * *

International table			United States table		FCC use designators		
Region 1-allocation MHz	Region 2-allocation MHz	Region 3-allocation MHz	Government	Non-Government	Special-use frequencies	MHz	MHz
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
				* * * * *		2110-2200	2110-2150
				FIXED.	DOMESTIC PUBLIC FIXED (21).	EMERGING	
				MOBILE.	PRIVATE OPERATIONAL-FIXED MICROWAVE (94).	TECHNOLOGIES	
					PUBLIC MOBILE (22).		
				US111 US252			
				NG23 NG153			
				2150-2160			
				FIXED.	MULTIPOINT DISTRIBUTION (21).		
					PRIVATE OPERATIONAL-FIXED MICROWAVE (94).		
				NG23			
				2160-2200			
				FIXED.	DOMESTIC PUBLIC FIXED (21).	EMERGING	
				MOBILE.		TECHNOLOGIES	


PRIVATE OPERATIONAL-FIXED
MICROWAVE (94).
PUBLIC MOBILE (22).
US111 US252 US331
NG23 NG153

* * * * * * *

b. The text of footnote US331 in the United States footnotes and footnote NG153 in the Non-Government footnotes is revised to read as follows:

UNITED STATES (US) FOOTNOTES

* * * * *

US331 In the frequency band 1850-1990 MHz, the only fixed PCS services permitted are ancillary services used in support of mobile personal communications services.

* * * * *

NON-GOVERNMENT (NG) FOOTNOTES

* * * * *

NG153 The 2110-2150 MHz and 2160-2200 MHz bands are reserved for future emerging technologies on a co-primary basis with the fixed and mobile services. Allocations to specific services will be made in future proceedings.

* * * * *

PART 15 -- RADIO FREQUENCY DEVICES

1. The authority citation for Part 15 continues to read as follows:

AUTHORITY: Sec. 4, 302, 303, 304, and 307 of the Communications Act of l934, as amended, 47 U.S.C. Sections 154, 302, 303, 304, and 307.

2. Section 15.301 is revised to read as follows:

' 15.301 Scope.

This subpart sets out the regulations for unlicensed personal communications services (PCS) devices operating in the 1910-1930 MHz frequency band.

3. Sections 15.303(g) and (j) are revised to read as follows:

' 15.303 Definitions.

* * * * *

(g) *Personal Communications Services (PCS) Devices [Unlicensed]*. Intentional radiators operating in the frequency band 1910-1930 MHz that provide a wide array of mobile and ancillary fixed communication services to individuals and businesses.

* * * * *

(j) *Thermal noise power.* The noise power in watts defined by the formula N=kTB where N is the noise power in watts, k is Boltzmann's constant, T is the absolute temperature in degrees Kelvin (e.g., 295^{o} K) and B is the emission bandwidth of the device in hertz.

* * * * *

4. Section 15.307 is amended by revising the introductory portion of paragraph (a), paragraph (d), and paragraph(e) as follows:

' 15.307 Coordination with fixed microwave service.

(a) UTAM, Inc., is designated to coordinate and manage the transition of the 1910-1930 MHz band from Private Operational-Fixed Microwave Service (OFS) operating under Part 94 of this Chapter to unlicensed PCS operations, conditioned upon submittal to and acceptance by the Commission of:

* * * * *

(d) A coordinatable PCS device is required to incorporate means that ensure that it cannot be activated until its location has been coordinated by UTAM, Inc. The application for certification shall contain an explanation of all measures taken to prevent unauthorized operation. This explanation shall include all procedural safeguards, such as the mandatory use of licensed technicians to install the equipment, and a complete description of all technical features controlling activation of the device.

(e) A coordinatable PCS device shall incorporate an automatic mechanism for disabling operation in the event it is moved outside the geographic area where its operation has been coordinated by UTAM, Inc. The application for certification shall contain a full description of the safeguards against unauthorized relocation and must satisfy the Commission that the safeguards cannot be easily defeated.

* * * * *

5. Section 15.311 is revised to read as follows:

' 15.311 Labelling requirements.

In addition to the labelling requirements of Section 15.19(a)(3), all devices authorized under this subpart must bear a prominently located label with the following statement:

> Installation of this equipment is subject to notification and coordination with UTAM, Inc. Any relocation of this equipment must be coordinated through, and approved by UTAM. UTAM may be contacted at [insert UTAM's toll-free number].

6. Paragraphs (a) and (i) of Section 15.319 are revised to read as follows:

' 15.319 General technical requirements.

(a) The 1910-1920 MHz sub-band is limited to use by asynchronous devices under the requirements of Section 15.323. The 1920-1930 MHz sub-band is limited to use by isochronous devices under the requirements of Section 15.321.

* * * * *

(i) The device must comply with IEEE C95.1-1991 (ANSI/IEEE C95.1-1992), "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz." Measurement methods are specified in IEEE C95.3-1991, "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave." Copies of these standards are available form the IEEE Standards Board, 445 Hoes Lane, P.O. Box 1331,

Piscataway, NJ 08855-1331, telephone 1-800-678-4333. All equipment shall be considered to operate in an "uncontrolled" environment. The application for certification must contain a statement confirming compliance with IEEE C95.1-1991. Technical information showing the basis for this statement must be submitted to the Commission upon request. PCS hand-held devices whose radiated power is 100 milliwatts or less are excluded from SAR testing requirements as long as a 2.5 cm separation is maintained between the radiating structure and the body of the user. The ANSI/IEEE standard uses the term "radiated power" as meaning the input power to the antenna.

7. Section 15.323 is redesignated as Section 15.321. In the new Section 15.321, paragraph (g) is removed, and the section heading and paragraphs (a), (b), (c)(1), (c)(4), (c)(6), (d), and (e) are revised to read as follows:

' 15.321 Specific requirements for asynchronous devices operating in the 1910-1920 MHz sub-band.

(a) Operation shall be contained within the 1910-1920 MHz sub-band. The emission bandwidth of any intentional radiator operating in this sub-band shall be no less than 500 kHz.

(b) All systems of less than 2.5 MHz emission bandwidth shall start searching for an available spectrum window within 3 MHz of the sub-band edge at either 1910 or 1920 MHz, while systems of more than 2.5 MHz emission bandwidth will first occupy the center half of the sub-band. Devices with an emission bandwidth of less than 1.0 MHz may not occupy the center half of the sub-band if other spectrum is available.

(c) * * *

(1) Immediately prior to initiating a transmission, devices must monitor the spectrum window they intend to use for at least 50 microseconds.

* * * * *

(4) After completion of a transmission, an individual device or cooperating group of devices must cease transmission and wait a deference time randomly chosen from a uniform random distribution ranging from 50 to 750 microseconds, after which time an attempt to access the band again may be initiated. For each occasion that an access attempt fails after the initial inter-burst interval, the range of the deference time chosen shall double until an upper limit of 12 milliseconds is reached. The deference time remains at the upper limit of 12 milliseconds until an access attempt is successful. The deference time is re-initialized after each successful access attempt.

* * * * *

(6) The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

* * * * *

(d) Emissions shall be attenuated below a reference power of 112 milliwatts as follows: 30 dB between the channel edges and 1.25 MHz above or below the channel; 50 dB between 1.25 and 2.5 MHz above or below the channel; and 60 dB at 2.5 MHz or greater above or below the channel. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(e) The frequency stability of the carrier frequency of intentional radiators operating in this sub-band shall be ∀10 ppm over 10 milliseconds or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of -20^{o} to $+50^{o}$ Celsius at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 degrees Celsius. For equipment that is capable of operating only from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

*****

8. Section 15.321 is redesignated as Section 15.323. In the new Section 15.323, the section heading and paragraphs (a), (b), (c)(1), (c)(4), (c)(6), (c)(8), (d), and (f) are revised and new paragraphs (c)(10), (c)(11), and (c)(12) are added to read as follows:

' 15.323 Specific requirements for isochronous devices operating in the 1920-1930 MHz sub-band.

(a) Operation shall be contained within one of eight 1.25 MHz channels starting with 1920-1921.25 MHz and ending with 1928.75-1930 MHz. Further sub-division of a 1.25 MHz channel is permitted with a reduced power level, as specified in Section 15.319(c), but in no event shall the emission bandwidth be less than 50 kHz.

(b) Intentional radiators with an intended emission bandwidth less than 625 kHz shall start searching for an available time and spectrum window within 3 MHz of the sub-band edge at 1920 MHz and search upward from that point. Devices with an intended emission bandwidth greater than 625 kHz shall start searching for an available time and spectrum window within 3 MHz of the sub-band edge at 1930 MHz and search downward from that point.

(c) * * *

(1) Immediately prior to initiating transmission, devices must monitor the combined time and spectrum windows in which they intend to transmit to determine if the access criteria are met.

* * * * *

(4) Once access to specific combined time and spectrum windows is obtained an acknowledgement from a system participant must be received by the initiating transmitter within

one second or transmission must cease. Periodic acknowledgements must be received at least every 30 seconds or transmission must cease. Channels used exclusively for control and signalling information may transmit continuously for 30 seconds without receiving an acknowledgement, at which time the access criteria must be repeated.

* * * * *

(6) If the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available.

* * * * *

(8) The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

* * * * *

(10) An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

(11) An initiating device that is prevented from monitoring during its intended transmit window due to monitoring system blocking from the transmissions of a co-located (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of at least 10 milliseconds. The monitored time and spectrum window must total at least 50 percent of the 10 millisecond frame interval and the monitored spectrum must be within the 1.25 MHz frequency channel(s) already occupied by that device or co-located co-operating devices. If the access criteria is met for the intended receive time and spectrum window under the above conditions, then transmission in the intended transmit window by the initiating device may commence.

(12) The provisions of (c)(10) or (c)(11) of this section shall not be used to extend the range of spectrum occupied over space or time for the purpose of denying fair access to spectrum to other devices.

(d) Emissions shall be attenuated below a reference power of 112 milliwatts as follows: 30 dB between the channel edges and 1.25 MHz above or below the channel; 50 dB between 1.25 and 2.5 MHz above or below the channel; and 60 dB at 2.5 MHz or greater above or below the channel. Systems that further sub-divide a 1.25 MHz channel into X sub-channels must comply with the following emission mask: In the bands between 1B and 2B measured from the center of

the emission bandwidth the total power emitted by the device shall be at least 40 dB below the transmit power permitted for that device; in the bands between B and 3B measured from the center of the emission bandwidth the total power emitted by an intentional radiator shall be at least 50 dB below the transmit power permitted for that radiator; in the bands between 3B and the 1.25 MHz channel edge the total power emitted by an intentional radiator in the measurement bandwidth shall be at least 60 dB below the transmit power permitted for that radiator. "B" is defined as the emission bandwidth of the device in hertz. Compliance with the emission limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

* * * * *

(f) The frequency stability of the carrier frequency of the intentional radiator shall be maintained within $\pm$10 ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of -20^{o} to $+50^{o}$ degrees C at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20^{o} C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

PART 24--PERSONAL COMMUNICATIONS SERVICES

1. The authority citation for Part 24 continues to read as follows:

AUTHORITY: Secs. 4, 301, 302, 303, and 332, 48 Stat. 1066, 1082, as amended; 47 U.S.C. Sections 154, 301, 302, 303, and 332, unless otherwise noted.

2. In Section 24.1, paragraph (b) is revised to read as follows:

' 24.1 Basis and purpose.

* * * * *

(b) Purpose. This part states the conditions under which portions of the radio spectrum are made available and licensed for PCS.

* * * * *

3. Section 24.3 is revised to read as follows:

' 24.3 Permissible communications.

PCS licensees may provide any mobile communications service on their assigned spectrum. Fixed services may be provided only if ancillary to mobile operations. Broadcasting as defined in the Communications Act is prohibited.

4. Section 24.10 is revised to read as follows:

' 24.10 Scope.

This subpart contains some of the procedures and requirements for filing applications for licenses in the personal communications services. One also should consult Subparts F and G of this part. Other Commission rule parts of importance that may be referred to with respect to licensing and operation of radio services governed under this part include 47 C.F.R. Parts 0, 1, 2, 5, 15, 17 and 20.

5. Section 24.11 is revised to read as follows:

' 24.11 Initial authorization.

(a) An applicant must file an application for an initial authorization in each market and frequency block desired.
(b) Blanket licenses are granted for each market and frequency block. Applications for individual sites are not required and will not be accepted.

6. Section 24.52 is revised to read as follows:

' 24.52 RF hazards.

(a) Licensees and manufacturers are required to ensure that their facilities and equipment comply with IEEE C95.1-1991 (ANSI/IEEE C95.1-1992), "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz." Measurement methods are specified in IEEE C95.3-1991, "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave." Copies of these standards are available from IEEE Standards Board, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331. Telephone: 1-800-678-4333. The limits for both "controlled" and "uncontrolled" environments, as defined by IEEE C95.1-1991, will apply to all PCS base and mobile stations, as appropriate. The application for equipment authorization must contain a statement confirming compliance with IEEE C95.1-1991. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(b) PCS hand-held devices whose maximum radiated power is 100 milliwatts or less are not required to be evaluated for compliance with ANSI/IEEE SAR (specific absorption rate) requirements, as long as a 2.5 cm separation distance is maintained between the radiating structure and the body of the user. (The ANSI/IEEE standard uses the term "radiated power," meaning input power to the antenna.)

(c) For further information on the Commission's environmental rules see Section 1.1301 through Section 1.1319.

7. Subpart E is revised in its entirety to read as follows:

Subpart E--Broadband PCS

Sec.

24.200 Scope.
24.202 Service areas.
24.203 Construction requirements.
24.204 Cellular eligibility.
24.229 Frequencies
24.232 Power and antenna height limits.
24.235 Frequency stability.
24.236 Field strength limits.
24.237 Interference protection.
24.238 Emission limits.

Subpart E--Broadband PCS

' 24.200 Scope.

This subpart sets out the regulations governing the licensing and operations of personal communications services authorized in the 1850-1910 and 1930-1990 MHz bands.

' 24.202 Service areas.

Broadband PCS service areas are Major Trading Areas (MTAs) and Basic Trading Areas (BTAs) as defined below. MTAs and BTAs are based on the Rand McNally 1992 Commercial Atlas & Marketing Guide, 123rd Edition, at pages 38-39 ("BTA/MTA Map"). Rand McNally organizes the 50 states and the District of Columbia into 47 MTAs and 487 BTAs. The BTA/MTA Map is available for public inspection as the Office of Engineering and Technology's Technical Information Center, Room 7317, 2025 M Street, N.W., Washington, D.C.

(a) The MTA service areas are based on the Rand McNally 1992 Commercial Atlas & Marketing Guide, 123rd Edition, at pages 38-39, with the following exceptions and additions:

(1) Alaska is separated from the Seattle MTA and is licensed separately.

(2) Guam and the Northern Mariana Islands are licensed as a single MTA-like area.

(3) Puerto Rico and the United States Virgin Islands are licensed as a single MTA-like area.

(4) American Samoa is licensed as a single MTA-like area.

(b) The BTA service areas are based on the Rand McNally 1992 Commercial Atlas & Marketing Guide, 123rd Edition, at pages 38-39, with the following additions licensed separately as BTA-like areas: American Samoa; Guam; Northern Mariana Islands; Mayaguez/Aguadilla-Ponce, Puerto Rico; San Juan, Puerto Rico; and the United States Virgin Islands. The Mayaguez/Aguadilla-Ponce BTA consists of the following municipalities: Adjuntas, Aguada, Aguadilla, Anasco, Arroyo, Cabo Rojo, Coamo, Guanica, Guayama, Guayanilla, Hormigueros, Isabela, Jayuya, Juana Diaz, Lajas, Las Marias, Mayaguez, Maricao, Maunabo, Moca, Patillas, Penuelas, Ponce, Quebradillas, Rincon, Sabana Grande, Salinas, San Germain, Santa Isabel, Villalba, and Yauco. The San Juan BTA consists of all other municipalities in Puerto Rico.

' 24.203 Construction requirements.

(a) Licensees of 30 MHz blocks must serve with a signal level sufficient to provide adequate service to at least one-third of the population in their licensed area within five years of being licensed and two-thirds of the population in their licensed area within 10 years of being licensed. Licensees may choose to define population using the 1990 census or the 2000 census. Failure by any licensee to meet these requirements will result in forfeiture or non-renewal of the license and the licensee will be ineligible to regain it.

(b) Licensees of 10 MHz blocks must serve with a signal level sufficient to provide adequate service to at least one-quarter of the population in their licensed area within five years of being licensed, or make a showing of substantial service in their licensed area within five years of

being licensed. Population is defined as the 1990 population census. Licensees may elect to use the 2000 population census to determine the five-year construction requirement. Failure by any licensee to meet these requirements will result in forfeiture of the license and the licensee will be ineligible to regain it.

(c) Licensees must file maps and other supporting documents showing compliance with the respective construction requirements within the appropriate five- and ten-year benchmarks of the date of their initial licenses.

' 24.204 Cellular eligibility.

(a) 10 MHz Limitation. Until January 1, 2000, no license(s) for broadband PCS in excess of 10 MHz shall be granted to any party (including all parties under common control) if the grant of such license(s) will result in significant overlap of the PCS licensed service area(s) (MTAs or BTAs) and the cellular geographic service area(s) (CGSA) of licensee(s) in the Domestic Public Cellular Radio Telecommunications Service directly or indirectly owned, operated, or controlled by the same party.

(b) 15 MHz Limitation. After January 1, 2000, no license(s) for broadband PCS in excess of 15 MHz shall be granted to any party (including all parties under common control) if the grant of such license(s) will result in significant overlap of the PCS licensed service area(s) (MTAs or BTAs) and the cellular geographic service area(s) (CGSA) of licensee(s) in the Domestic Public Cellular Radio Telecommunications Service directly or indirectly owned, operated, or controlled by the same party.

(c) Significant Overlap. For purposes of Subsections (a) and (b) of this section, significant overlap of a PCS licensed service area and CGSA(s) occurs when ten or more percent of the population of the PCS service area, as determined by the 1990 census figures for the counties contained therein, is within the CGSA(s).

(d) Ownership Attribution.

(1) For purposes of paragraphs (a) and (b) of this section, "control" means majority voting equity ownership, any general partnership interest, or any means of actual working control (including negative control) over the operation of the licensee, in whatever manner exercised.

(2) For purposes of applying paragraphs (a) and (b) of this section, and for purposes of Section 24.229(c) (40 MHz limit in same geographic area), ownership and other interests in broadband PCS licensees or applicants and cellular licensees will be attributed to their holders pursuant to the following criteria:

(i) Partnership and other ownership interests and any stock interest amounting to 5 percent or more of the equity, or outstanding stock, or outstanding voting stock of a broadband PCS licensee or applicant will be attributable.

(ii) Partnership and other ownership interests and any stock interest amounting to 20 percent or more of the equity, or outstanding stock, or outstanding voting stock of a cellular licensee will be attributable, except that ownership will not be attributed unless the partnership and other ownership interests and any stock interest amount to 40 percent or more of the equity, or outstanding stock, or outstanding voting stock of a cellular licensee if the ownership interest is held by a small business, a rural telephone company, or a business owned by minorities and/or

women, as these terms are defined in Section 1.2110 of this chapter, or if the ownership interest is held by an entity with a non-controlling equity interest in a broadband PCS licensee or applicant that is a business owned by minorities and/or women.

(iii) Stock interests held in trust shall be attributed to any person who holds or shares the power to vote such stock, to any person who has the sole power to sell such stock, and, in the case of stock held in trust, to any person who has the right to revoke the trust at will or to replace the trustee at will. If the trustee has a familial, personal or extra-trust business relationship to the grantor or the beneficiary, the grantor or beneficiary, as appropriate, will be attributed with the stock interests held in trust.

(iv) Non-voting stock shall be attributed as an interest in the issuing entity if in excess of the amounts set forth above.

(v) Debt and instruments such as warrants, convertible debentures, options or other interests (except non-voting stock) with rights of conversion to voting interests shall not be attributed unless and until conversion is effected, except that this provision does not apply in determining whether an entity is a small business, a rural telephone company, or a business owned by minorities and/or women, as these terms are defined in Section 1.2110 of this chapter or other provisions of the Commission's Rules.

(vi) Limited partnership interests shall be attributed to limited partners and shall be calculated according to both the percentage of equity paid in and the percentage of distribution of profits and losses.

(vii) Officers and directors of a broadband PCS licensee or applicant or a cellular licensee shall be considered to have an attributable interest in the entity with which they are so associated. The officers and directors of an entity that controls a PCS licensee or applicant or a cellular licensee shall be considered to have an attributable interest in the broadband PCS licensee or applicant or a cellular licensee.

(e) [Reserved]

(f) Cellular Divestiture. Parties holding controlling or attributable ownership interests in cellular licensees may be a party to a broadband PCS application (i.e., have a controlling or attributable interest in a broadband PCS applicant), and such PCS applicant will be eligible for more than one 10 MHz broadband PCS license and/or 30 MHz broadband PCS license(s) pursuant to the divestiture procedures set forth in paragraphs (1) through (3) of this section; Provided, however, that these divestiture procedures shall be available only for parties with controlling or attributable ownership interests in cellular licensees where the CGSA(s) covers 20 percent or less of the PCS service area population.

(1) The broadband PCS applicant shall certify on its short-form auction application, filed in accordance with Section 24.305, that it and all parties to the application will come into compliance with the limitations on common ownership of cellular and broadband PCS interests set forth in this section.

(2) If such an applicant is a successful bidder, it must submit with its long-form application (see Section 24.307) a signed statement describing its efforts to date and future plans to come into compliance with the limitations on common ownership of cellular and broadband PCS interests set forth in this section.

(3) If such an applicant is otherwise qualified, its application will be granted subject to a condition that the licensee shall come into compliance with the limitations on common ownership of cellular and broadband PCS interests set forth in this section within ninety (90) days of final grant.

(i) Parties holding controlling interests in cellular licensees that conflict with the attribution threshold or service overlap limitations set forth above will be considered to have come into compliance if they have submitted to the Commission an application for assignment of license or transfer of control of the cellular licensee (see Section 22.39 of this chapter) by which, if granted, such parties no longer would have an attributable interest in the cellular license. If no such assignment or transfer application is tendered to the Commission within ninety (90) days of final grant, the Commission may consider the short-form certification and the long-form divestiture statement to be material, bad faith misrepresentations and will invoke the condition on the PCS license, cancelling it automatically, retain all monies paid to the Commission, and, based on the facts presented, take any other action it may deem appropriate. Divestiture may be to an interim trustee if a buyer has not been secured in the required time frame, as long as the applicant has no interest in or control of the trustee, and the trustee may dispose of the license as it sees fit.

(ii) Where parties to broadband PCS applications hold less-than-controlling (but still attributable) interests in cellular licensee(s), they shall submit, within ninety days of final grant, a certification that the applicant and all parties to the application have come into compliance with the limitations on common ownership of cellular and broadband PCS interests set forth in this section.

NOTE 1: For purposes of the cellular ownership attribution limit, all ownership interests in cellular operations that serve 10 or more percent of the population of the PCS service area should be included in determining the extent of a PCS applicant's cellular ownership.

NOTE 2: When a party owns an attributable interest in more than one cellular system that overlaps a PCS service area, the total population in the overlap area will apply on a cumulative basis.

EXAMPLE 1: Company A holds a 15 percent non-controlling ownership interest in Cellular Licensee X and a 15 percent non-controlling ownership interest in Cellular Licensee Y. Cellular Licensee X covers 30 percent of the population of the PCS service area and Cellular Licensee Y covers 10 percent of the population of the PCS service area. A broadband PCS applicant in which Company A holds an attributable ownership interest will be eligible for a broadband PCS license or licenses for more than 10 MHz because Company A does not hold attributable ownership interests in cellular operations which together include ten or more percent of the population of the PCS service area.

EXAMPLE 2: Cellular Company A owns a 45 percent non-controlling interest in cellular license 1, and a 22 percent non-controlling interest in both cellular licenses 2 and 3. Cellular license 1 includes 15 percent of the pops in BTA 1. Cellular license 2 covers 7 percent of the

pops in BTA 2 and 5 percent of the pops in BTA 3. Cellular license 3 covers 7 percent of the pops in BTA 3. Together Cellular licenses 1, 2 and 3 cover 9 percent of the pops in MTA 1.

If Cellular Company A is not a designated entity, it can purchase 40 MHz of spectrum in BTA 2 or in MTA 1. It can acquire only 10 MHz in BTA 1 or BTA 3 because it is considered to have ownership interests in 15 percent of the pops in BTA 1 and 12 percent of the pops in BTA 3.

If Cellular Company A wants to acquire 40 MHz of spectrum in BTA 3 it can either agree to divest either cellular license 2 or 3, or it can invest as a non-controlling investor in a PCS license that is held and controlled by a business owned by minorities and/or women.

If Cellular Company A wants to acquire 40 MHz of spectrum in BTA 1 it can agree to divest its interests in cellular license 1. It cannot invest as a non-controlling investor in a business owned by minorities and/or women because its 45 percent ownership of license 1 will be attributed, since it is greater than the 40 percent threshold.

If Cellular Company A is a designated entity, it can acquire 40 MHz of PCS spectrum in every area except BTA 1, where it is considered to have an ownership interest in 25 MHz of spectrum already because it is over the 40 percent threshold.

EXAMPLE 3: Cellular Company A owns a 45 percent non-controlling interest in cellular license 1 that covers 5 percent of the pops in BTA 1. Cellular Company A also owns a 21 percent non-controlling interest in cellular license 2 that covers 9 percent of the pops in BTA 1. If Cellular Company A is not a designated entity, then it can buy only 10 MHz of spectrum, because it is considered to have an ownership interest of 14 percent of the pops in BTA 1. If it wants to buy 30 MHz it would have to certify before the auction that it will divest either cellular license 1 or 2.

If Cellular Company A is a designated entity, then it would be considered to have an ownership interest in only 5 percent of the pops in BTA 1 and would thus be eligible to buy up to 40 MHz in BTA 1.

EXAMPLE 4: Company A holds a 10 percent interest in Cellular Licensee 1. Company B holds a 10 percent interest in Cellular Licensee 1. Cellular Licensee 1 covers more than 10 percent of the population of the PCS service area. Neither Company A nor Company B is a designated entity. A PCS entity with interests held by Company A and Company B is ineligible for a 30 MHz PCS license because the attributable ownership in cellular license 1 is 20 percent.

EXAMPLE 5: Same as Example 4 except that Company A and Company B are designated entities. The PCS entity is eligible for a 30 MHz PCS license because the attributable cellular ownership is less than 40 percent.

' 24.229 Frequencies.

The frequencies available in the Broadband PCS service are listed in this section in accordance with the frequency allocations table of Section 2.106.

(a) The following frequency blocks are available for assignment on an MTA basis:

Block A: 1850-1865 MHz paired with 1930-1945 MHz; and
Block B: 1870-1885 MHz paired with 1950-1965 MHz.

(b) The following frequency blocks are available for assignment on a BTA basis:

Block C: 1895-1910 MHz paired with 1975-1990 MHz;
Block D: 1865-1870 MHz paired with 1945-1950 MHz;
Block E: 1885-1890 MHz paired with 1965-1970 MHz; and
Block F: 1890-1895 MHz paired with 1970-1975 MHz.

(c) PCS licensees shall not have an ownership interest in frequency blocks that total more than 40 MHz and serve the same geographic area. For the purpose of this section, PCS licensees are entities having an ownership interest of 5 or more percent or other attributable ownership interest, as defined in Section 24.204(d), in a PCS license.

EXAMPLE 1: Company A, which is a rural telephone company with no cellular interests, buys a 7 percent stake in a 30 MHz BTA that constitutes 8 percent of the population in MTA 1, which encompasses BTA 1. It is then offered an opportunity to buy 8 percent of the equity in a 30 MHz license in MTA 1. It cannot accept this offer because it would be over the 5 percent threshold on two overlapping PCS licenses. Its status as a rural telephone company has no impact on the 5 percent threshold for PCS licensees.

EXAMPLE 2: Company A has two investors, Company B and Company C. Company B owns 15 percent of Company A. Company C, a rural telephone company, owns 25 percent of Company A. Company B and Company C do not have any interests in each other.

Company B has 100 percent ownership of cellular license 1 that covers 20 percent of the pops in BTA 1 and 6 percent of the pops in MTA 1. Company C owns 25 percent of cellular license 2 that covers 20 percent of the pops in BTA 2 and 6 percent of the pops in MTA 1. Company A has no separate cellular interests. MTA 1 encompasses both BTA 1 and BTA 2.

Company A cannot purchase 30 MHz of spectrum in BTA 1. Such a purchase would put Company B over the aggregation limit of 40 MHz in BTA 1 because it would have over 5 percent ownership of the PCS license in addition to its cellular license.

Company A can, however, purchase 30 MHz in BTA 2 or MTA 1 because Company C is a rural telephone company, and thus Company C's interest in cellular license 2 falls below the 40 percent threshold and is not counted against the spectrum cap. If Company C were not a rural telephone company, then Company A could not acquire 30 MHz in BTA 2 or MTA 1 because its partners in those licenses would be over the spectrum cap.

Company B can also buy 30 MHz in BTA 2 or MTA 1 as long as Company A does not also buy 30 MHz in BTA 2 or MTA 1 because Company B and Company C have no joint ownership.

Company C can also buy 30 MHz in BTA 1 or 2 or MTA 1 as long as Company A does not also buy in the region where Company C buys. If Company A were to buy a 30 MHz MTA 1 license, then Company B and C would be prohibited from acquiring either of the BTAs because they would be over the 5 percent threshold for PCS spectrum in the same region.

(d) After January 1, 2000, licensees that have met the 5-year construction requirement may assign portions of licensed PCS spectrum. In no case may an assignee aggregate more than 40 MHz of PCS/cellular spectrum.

' 24.232 Power and antenna height limits.

(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT. See Section 24.53 for HAAT calculation method. Base station antenna heights may exceed 300 meters with a corresponding reduction in power; see Table 1 of this section. In no case may the peak output power of a base station transmitter exceed 100 watts. The service area boundary limit and microwave protection criteria specified in Section 24.236 and Section 24.237 apply.

Table 1. Reduced Power for Base Station Antenna Heights Over 300 Meters

HAAT in meters	Maximum e.i.r.p. (watts)
≤ 300	1,640
≤ 500	1,070
≤ 1,000	490
≤ 1,500	270
≤ 2,000	160

(b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

(c) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall

be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

' 24.235 Frequency stability.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

' 24.236 Field strength limits.

The predicted or measured median field strength at any location on the border of the PCS service area shall not exceed 47 dBuV/m unless the parties agree to a higher field strength.

' 24.237 Interference protection.

(a) All licensees are required to coordinate their frequency usage with co-channel or adjacent channel incumbent fixed microwave licensees in the 1850-1990 MHz band. Coordination must occur before initiating operations from any base station. Problems that arise during the coordination process are to be resolved by the parties to the coordination. Licensees are required to coordinate with all users possibly affected, as determined by Appendix E of the Memorandum Opinion and Order, GEN Docket No. 90-314, FCC 94-144; TIA Telecommunications Systems Bulletin 10-F, "Interference Criteria for Microwave Systems," May 1994, (TSB10-F); or an alternative method agreed to by the parties.

(b) The results of the coordination process need be reported to the Commission only if the parties fail to agree. Because broadband PCS licensees are required to protect fixed microwave licensees in the 1850-1990 MHz band, the Commission will be involved in the coordination process only upon complaint of interference from a fixed microwave licensee. In such a case, the Commission will resolve the issues.

(c) In all other respects, coordination procedures are to follow the requirements of Section 21.100(d) of this chapter to the extent that these requirements are not inconsistent with those specified in this part.

(d) The licensee must perform an engineering analysis to assure that the proposed facilities will not cause interference to existing OFS stations within the coordination distance specified in Table 2 of a magnitude greater than that specified in the criteria set forth in paragraphs (e) and (f) of this section, unless there is prior agreement with the affected OFS licensee. Interference calculations shall be based on the sum of the power received at the terminals of each microwave receiver from all of the applicant's current and proposed PCS operations.

Table 2: Coordination Distances In Kilometers

PCS Base Station Antenna HAAT in Meters

e.i.r.p. (W)	5	10	20	50	100	150	200	250	300	500	1000	1500	2000
0.1	90	93	99	110	122	131	139	146	152	173	210	239	263
0.5	96	100	105	116	128	137	145	152	158	179	216	245	269
1	99	103	108	119	131	140	148	155	161	182	219	248	272
2	120	122	126	133	142	148	154	159	164	184	222	250	274
5	154	157	161	168	177	183	189	194	198	213	241	263	282
10	180	183	187	194	203	210	215	220	225	240	268	291	310
20	206	209	213	221	229	236	242	247	251	267	296	318	337
50	241	244	248	255	264	271	277	282	287	302	331	354	374
100	267	270	274	282	291	297	303	308	313	329	358	382	401
200	293	296	300	308	317	324	330	335	340	356	386	409	
500	328	331	335	343	352	359	365	370	375	391	421		
1000	354	357	361	369	378	385	391	397	402	418			
1200	361	364	368	376	385	392	398	404	409				
1640	372	375	379	388	397	404	410	416	421				

NOTE: If actual value does not match table values, round to the closest higher value on this table. See Section 24.53 for HAAT calculation method.

(e) For microwave paths of 25 kilometers or less, interference determinations shall be based on the C/I criteria set forth in TIA Telecommunications Systems Bulletin 10-F, "Interference Criteria for Microwave Systems," May 1994, (TSB10-F).

(f) For microwave paths longer than 25 kilometers, the interference protection criterion shall be such that the interfering signal will not produce more than 1.0 dB degradation of the practical threshold of the microwave receiver for analog systems, or such that the interfering signal will not cause an increase in the bit error rate (BER) from 10E-6 to 10E-5 for digital systems.

(g) The development of the C/I ratios and interference criteria specified in paragraphs (e) and (f) of the section and the methods employed to compute the interfering power at the microwave receivers shall follow generally acceptable good engineering practices. The procedures described for computing interfering signal levels in Appendix E of the Memorandum Opinion and Order, GEN Docket No. 90-314, FCC 94-144 shall be applied. Alternatively, procedures for determining interfering signal levels and other criteria as may be developed by the Electronics Industries Association (EIA), the Institute of Electrical and Electronics Engineers, Inc. (IEEE), the American National Standards Institute (ANSI) or any other recognized authority will be acceptable to the Commission.

' 24.238 Emission limits.

(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 plus 10 $\log_{10}$ (P) decibels or 80 decibels, whichever is the lesser attenuation.

NOTE: The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

Appendix B: List of Parties

I. Petitioners

1. Advanced Cordless Technologies (ACT)
2. Alcatel Network System, Inc. (Alcatel)
3. Alliance of Rural Area Telephone and Cellular Service Providers (Alliance)
4. American Personal Communications (APC)
5. American Petroleum Institute (API)
6. American Telephone and Telegraph (AT&T)
7. Ameritech
8. AMSC Subsidiary Corporation (AMSC)
9. Anchorage Telephone Utility
10. Apple Computer, Inc. Emergency Petition of September 13, 1993
11. Apple Petition for Reconsideration and Clarification of December 22, 1993
12. Association of Public-Safety Communications Officials (APCO)
13. Bell Atlantic Personal Communications, Inc. (Bell Atlantic)
14. BellSouth Corporation
15. Blooston, Mordorfsky, Jackson & Dickens (Blooston)
16. Chickasaw Telephone Co., Cincinnati Bell Telephone Co., Illinois Consolidated Telephone Co., Milling Telephone Co., and Roseville Telephone Co. (CCIMR)
17. Columbia Cellular Corp. (Columbia)
18. Comcast Corp.
19. COMSAT Corp. (Comsat)
20. Concord Telephone Co. (Concord)
21. Cellular Telecommunications Industry Association (CTIA)
22. Duncan, Weinberg, Miller & Pembroke, P. C. (DWMP)
23. Ericsson Corporation
24. Florida Cellular RSA Limited Partnership (Florida Cellular)
25. General Communications, Inc. (GCI)
26. GTE Service Corporation (GTE)
27. Iowa Network Services, Inc. (INS)
28. Killen & Associates, Inc.
29. LACE, Inc. (Lace)
30. McCaw Cellular Communications, Inc. (McCaw)
31. MCI Telecommunications Corp. (MCI)
32. Mebtel, Inc.
33. Metricom, Inc.
34. Motorola Inc.
35. Murray, George E. (Murray)
36. National Communications System, Manager of the (NCS)
37. National Telephone Cooperative Association (NTCA)
38. Nextel Communications, Incorporated (Nextel; formerly Fleet Call)

39. Northern Telecom Inc.
40. NYNEX Corporation
41. Organization for the Protection and Advancement of Small Telephone Companies (OPASTCO)
42. Pacific Bell and Nevada Bell (PacBell)
43. Pacific Telecom Cellular, Inc. (Pacific Telecom)
44. PacTel Corp.
45. PCS Action, Incorporated
46. Pegasus Communications, Inc. (Pegasus)
47. Personal Network Services Corp. (PNSC)
48. PMN, Incorporated
49. Point Communications Company (Point)
50. Radiofone, Incorporated
51. Rockwell International, Inc. (Rockwell)
52. Rural Cellular Association (RCA)
53. Southwestern Bell Corporation
54. SpectraLink Corporation
55. Sprint Corporation
56. State of Texas - Office of the Attorney General Petition
57. Telecommunications Industry Association - Fixed Point-to-Point Communication Section of the Network Equipment Division (TIA-NED)
58. Telecommunications Industry Association - Mobile and Personal Communications Division (TIA-Mobile)
59. Telephone and Data Systems, Inc. (TDS)
60. Personal Communications Industry Association (PCIA; formerly Telocator)
61. Time Warner Telecommunications (Time Warner)
62. TRW, Incorporated
63. U.S. Intelco Networks, Inc. (Intelco)
64. US West, Incorporated
65. Unlicensed PCS Ad Hoc Committee for 2 GHz Microwave Transition and Management (UTAM)
66. Utilities Telecommunications Council (UTC)
67. Wireless Information Networks Forum (WINForum)

II. Opposing and Commenting Parties

1. Advanced MobileComm Technologies, Inc. and Digital Spread Spectrum Technologies,
2. Alcatel
3. APC
4. API
5. Apple
6. Association of American Railroads (AAR)
7. Association of Independent Designated Entities (AIDE)

8. APCO
9. Bell Atlantic
10. Cablevision Systems Corporation (Cablevision)
11. Cellular Information Systems, Incorporated (CIS)
12. Cellular Telecommunications Industry Association (CTIA)
13. Citizens Utilities Company (CUC)
14. Ericsson
15. TIA-Fixed
16. General Communication, Incorporated (GCI)
17. GTE
18. Hill & Welch
19. Interdigital Communications Corporation (Interdigital)
20. KSI, Incorporated
21. Massachusetts Emergency Telecommunications Board (Mass-Emergency)
22. McCaw
23. MCI
24. Motorola
25. Murray
26. National Emergency Number Association (NENA)
27. Nextel
28. Northern Telecom
29. NYNEX
30. Omnipoint Corporation, Incorporated (Omnipoint)
31. PacBell
32. PCS Action
33. PMN
34. Qualcomm Incorporated
35. Rand McNally & Company (Rand McNally)
36. ROLM Company (Rolm)
37. SpectraLink
38. Sprint
39. TDS
40. PCIA
41. United States Telephone Association (USTA)
42. UTAM
43. UTC
44. WINForum

III. Replying Parties

1. Alcatel
2. Alliance
3. APC
4. API
5. AT&T
6. American Wireless Communication Corporation (AWCC)
7. Ameritech
8. AMSC
9. Apple
10. AIDE
11. Association of Maximum Service Television, Incorporated (AMSTV)
12. Association of Public-Safety Communications Officials-International, Incorporated (APCO)
13. Bell Atlantic
14. CTIA
15. Comcast
16. Comsat
17. Encompass
18. Ericsson
19. Federal Communications Bar Association (FCBA)
20. GCI
21. GTE
22. Hill & Welch
23. Industrial Telecommunications Association, Inc. (ITA)
24. Loral Qualcomm Satellite Services, Incorporated (LQSS)
25. McCaw
26. MCI
27. Metricom
28. Motorola
29. National Emergency Number Association (NENA)
30. National Rural Telecom Association (NRTA)
31. NCS
32. Nextel
33. Northern Telecom
34. NYNEX
35. PacBell
36. Pacific Telecom
37. PCS Action
38. PMN
39. Radiofone
40. Rand McNally
41. Rolm

42. RCA
43. Southwestern Bell
44. Sprint
45. PCIA
46. TIA-Fixed
47. Time Warner
48. Texas Advisory Commission on State Emergency Communications (Texas Emergency)
49. TRW
50. UTAM
51. UTC
52. Intelco
53. US West
54. WINForum

IV. Opposing and Commenting Parties on Apple Emergency Petition

1. Alcatel
2. APC
3. API
4. Apple
5. AT&T
6. Business Software Alliance (BSA)
7. Compaq Computer Corporation (Compaq)
8. Comsearch
9. Cox Enterprises, Inc. (Cox)
10. Hewlett-Packard Company (HP)
11. MCI
12. Metricom
13. Microsoft Corporation
14. Northern Telecom
15. Spectralink
16. UTAM
17. UTC

V. Replying Parties on Apple Emergency Petition

1. Alcatel
2. Apple
3. AT&T
4. BSA
5. Ericsson

6. HP
7. Motorola
8. Northern Telecom
9. PacBell
10. Rolm
11. UTAM

Appendix C: Final Regulatory Flexibility Analysis

Pursuant to 5 U.S.C. Section 603, an initial Regulatory Flexibility Analysis was incorporated in the Notice of Proposed Rule Making and Tentative Decision in combined ET Docket No. 92-100 and GEN Docket No. 90-314. Written comments on the proposals in the Notice of Proposed Rule Making, including the Regulatory Flexibility Analysis, were requested. A Final Regulatory Flexibility Analysis was incorporated in the Second Report and Order in GEN Docket No. 90-314.

A. Need for and Objective of Rules: Our objective is to provide spectrum allocations, licensing and authorization rules, and technical standards for broadband PCS at 2 GHz. Authorizing this new service will make available a broad range of new services and technologies to both business users and consumers. The revised PCS rules will provide licensees and developers of unlicensed equipment the flexibility to introduce a wide variety of new and innovative telecommunications services and equipment.

B. Issues Raised by the Public in Response to the Initial and Final Analyses: A number of parties supported regulations that would facilitate participation in PCS by small businesses. Specifically, these parties argue that small frequency blocks, small service areas, and special consideration for small businesses in the licensing of PCS would facilitate small businesses participation in providing PCS services. The FCC empaneled a Small Business Advisory Committee (SBAC) that also assessed the policy implications of this proceeding for small businesses and filed a report with the Commission on September 15, 1993. The SBAC concluded that small frequency blocks with multiple licensees in each service area and a frequency block designated for qualified small, female, and minority businesses would assist entrepreneurial entry in PCS. The SBAC also suggested that the Commission consider other mechanisms to foster entry opportunities and capital formation for such groups. These issues and associated filings have been considered and addressed in the Second Report and Order and this Memorandum Opinion and Order, except issues related to licensee selection procedures. Licensing issues are the subject of a separate proceeding (PP Docket No. 93-253) that will establish rules to implement competitive bidding in broadband PCS. A Report and Order in that proceeding will be issued in the near future.

C. Any Significant Alternative Minimizing Impact on Small Entities and Consistent with Stated Objectives: We have reduced burdens wherever possible. The regulatory burdens we have retained are necessary to ensure that the public receives the benefits of broadband PCS in a prompt and efficient manner. We will continue to examine alternatives in the future with the objectives of eliminating unnecessary regulations and minimizing any significant impact on small entities.

Appendix E: A Procedure for Calculating PCS Signal Levels at Microwave Receivers

The new Rules adopted in Part 24 stipulate that estimates of interference to fixed microwave operations from a PCS operation will be based on the sum of signals received at a microwave receiver from the PCS operation. This appendix describes a procedure for computing this PCS level.

In general, the procedure involves four steps:

1. Determine the geographical coordinates of all microwave receivers operating on co-channel and adjacent frequencies within the coordination distance of each base station and the characteristics of each receiver, i.e., adjacent channel susceptibility, antenna gain, pattern and height, and line and other losses.

2. Determine an equivalent isotropically radiated power (e.i.r.p.) for each base station and equivalent e.i.r.p. values for the mobiles and portables associated with each base station. Determine the values of pertinent correction and weighting factors based on building heights and density and distribution of portables. Close-in situations, prominent hills, and extra tall buildings require special treatment.

3. Based on PCS e.i.r.p. values, correction and weighting factors, and microwave receiving system characteristics determined above, calculate the total interference power at the input of each microwave receiver, using the Longley-Rice propagation model.

4. Based on the interference power level computed in step 3, determine interference to each microwave receiver using criteria described in Part 24 and EIA/TIA Bulletin 10-F.

The interference from each base station and the mobiles and portables associated with it is calculated as follows:

$$P_{rbi} = 10\text{Log}(p_{tbi}) - L_{bi} - UC_i + G_{mwi} - C_i - BP_i$$

$$P_{rmi} = 10\text{Log}(n_{mi} \times p_{tmi}) - L_{mi} - UC_i + G_{mwi} - C_i$$

$$P_{rpsi} = 10\text{Log}(n_{psi} \times p_{tpsi}) - L_{psi} - UC_i + G_{mwi} - C_i$$

$$P_{rpbi} = 10\text{Log}(n_{pbi} \times p_{tpbi}) - L_{pbi} - UC_i - (BP_i - BH_i) + G_{mwi} - C_i$$

$$P_{rpri} = 10\text{Log}(n_{pri} \times p_{tpri}) - L_{pri} - (UC_i - BH_i) + G_{mwi} - C_i$$

where:
P refers to Power in dBm
p refers to power in milliwatts

P_{rbi} = Power at MW receiver from ith base station in dBm
p_{tbi} = e.i.r.p. transmitted from ith base station in milliwatts, which equals average power
L_{bi} = Path loss between MW and base station site in dB
UC_i = Urban correction factor in dB
G_{mwi} = Gain of MW antenna in pertinent direction (dBi)
C_i = Channel discrimination of MW system in dB
P_{rmi} = Power at MW receiver from mobiles associated with ith base station
p_{tmi} = e.i.r.p. transmitted from mobiles associated with ith base station
n_{mi} = Number of mobiles associated with ith base station
L_{mi} = Path loss between MW and mobile transmitters in dB
P_{rpsi} = Power at MW receiver from outdoor portables (s for sidewalk)
p_{tpsi} = e.i.r.p. transmitted from outdoor portables associated with ith base station
n_{psi} = Number of outdoor portables associated with ith base station
L_{psi} = Path loss between MW and outdoor portables in dB
P_{rpbi} = Power at MW receiver from indoor portables (b for building)
p_{tpbi} = e.i.r.p. transmitted from indoor portables associated with ith base station
n_{pbi} = number of indoor portables associated with ith base station
L_{pbi} = Path loss in dB between MW and base station site (using average building height divid
P_{rpri} = Power at MW receiver from rooftop portables (r for rooftop)
p_{tpri} = e.i.r.p. transmitted from rooftop portables associated with ith base station
n_{pri} = Number of rooftop portables associated with ith base station
L_{pri} = Path loss in dB between MW and base station site (using average building height as effective ant
BP_i = Building penetration loss at street level in dB
BH_i = Height gain for portables in buildings dB = 2.5 x (nf-1), where nf is number of floors

Note: where C_i varies from channel-to-channel, which often is the case, the summation process is more complex, requiring summation at a channel level first.

Finally, the total PCS interference power at a given microwave receiver from all the base stations in a given frequency band is found by summing the contributions from the individual stations. Likewise, the total interference power at a given microwave receiver from all mobiles and portables operating in a given frequency band is found by summing the contributions from the mobiles and portables associated with each cell.

$$p_{rb} = \varphi_i \; p_{rbi} \quad \text{milliwatts}$$

$$p_{rm} = \varphi_i \; (p_{rmi} + p_{rpsi} + p_{rpbi} + p_{rpri}) \quad \text{milliwatts}$$

$$P = 10 \, \text{Log}(p) \quad \text{dBm}$$

Base Stations. Interference from each base station to each microwave should normally be considered independently. A group of base stations having more or less (within $\pm$ 50 percent) the same height above average terrain, the same e.i.r.p., basically the same path to a microwave receiving site, and subtending an angle to that receiving site of less than 5 degrees, may be treated as a group, using the total power of the group and the average antenna height of the group to calculate path loss, L.

Mobile Stations. The e.i.r.p. from mobile transmitters is weighted according to the number of base station channels expected to be devoted to mobile operation at any given time. The antenna height of mobiles used in calculating path loss, L, is assumed to be 2 meters.

Portable Stations. The e.i.r.p. from the portable units associated with each base station is weighted according to the estimated portion of portables associated with that cell expected to be operated inside buildings at any given time and the portion which could be expected to be operating from elevated locations, such as balconies or building rooftops. For example, in the case of service intended for business use in an urban area, one might expect that perhaps 85 percent of the portables in use at any given time would be operating from within buildings and perhaps 5 percent might be operating from rooftops or balconies. The remaining 10 percent would be outside at street level.

Calculation of an equivalent e.i.r.p. for cells in suburban areas will involve different weighting criteria.

Urban Correction Factor. The urban correction factor (UC) depends on the height and density of buildings surrounding a base station. For the core area of large cities, it is assumed to be 35 dB. For medium size cities and fringe areas of large cities (4- to 6-story buildings with scattered taller buildings and lower buildings and open spaces) it is assumed to be 25 dB; for small cities and towns, 15 dB, and for suburban residential areas (one- and two-story, single family houses with scattered multiple-story apartment buildings, shopping centers and open areas), 10 dB.

The unadjusted urban correction factor, UC, should not be applied to base station antenna heights that are greater than 50 percent of the average building height for a cell.

Building Height and Building Penetration Factors. The building height correction, BH, is a function of the average building height within the nominal coverage area of the base station. It is used in conjunction with the building penetration loss, BP, to adjust the expected interference contribution from that portion of the portables transmitting from within buildings. The adjustment is given by:

BP = 20 dB in urban areas
BP = 10 dB in suburban areas

BH = 2.5 x (nf-1) dB

where nf is the average height (number of floors) of the buildings in the area.

(Note that this formula implies a net gain when the average building height is greater than 8 floors). All buildings more than twice the average height should be considered individually. The contribution to BH from that portion of portables in the building above the average building height should be increased by a factor of 20Log(h) dB, where h is the height of the portables above the average building height in meters.

Channel Discrimination Factor. A factor based on the interference selectivity of the microwave receiver.

Propagation Model. The PCS to microwave path loss, L, is calculated using the Longley-Rice propagation model, Version 1.2.2., in the point-to-point mode. The Longley-Rice [1] model was derived from NBS Technical Note 101 [2], and updated in 1982 by Hufford [3]. Version 1.2.2 incorporated modifications described in a letter by Hufford [4] in 1985. Terrain elevations used as input to the model should be from the U.S. Geological Survey 3-second digitized terrain database.

Special Situations. If a cell size is large compared to the distance between the cell and a microwave receiving site so that it subtends an angle greater than 5 degrees, the cell should be subdivided and calculations should be based on the expected distribution of mobiles and portables within each subdivision.

If terrain elevations within a cell differ by more than a factor of two-to-one, the cell should be subdivided and microwave interference calculations should be based on the average terrain elevation for each subdivision.

If a co-channel PCS base station lies within the main beam of a microwave antenna ($\forall$5 degrees), there is no intervening terrain obstructions, and the power at the microwave receiver from that base station, assuming free space propagation, would be 3 dB or less below the interference threshold, interference will be assumed to exist unless the PCS licensee can demonstrate otherwise by specific path loss calculations based on terrain and building losses.

If any part of a cell or cell subdivision lies within the main beam of a co-channel microwave antenna, there is no intervening terrain obstructions, and the accumulative power of 5 percent or less of the mobiles, assuming free space propagation would be 3 dB or less below the interference threshold, interference will be assumed to exist unless the PCS licensee can demonstrate otherwise by specific path loss calculations based on terrain and building losses.

If a building within a cell or cell subdivision lies within the main beam of a co-channel microwave antenna, there is no intervening terrain obstructions, and the cumulative power of 5 percent or fewer of the portables, assuming free space propagation, would be 3 dB or less below the interference threshold, interference will be assumed to exist unless the PCS licensee can demonstrate otherwise by specific path loss calculations based on terrain and building losses.

References:

1. Longley, A.G. and Rice, P.L., "Prediction of Tropospheric Radio Transmission Loss Over Irregular Terrain, A Computer Method-1968", ESSA Technical Report ERL 79-ITS 67, Institute for Telecommunications Sciences, July 1968.

2. Rice, P.L., Longley, A.G., Norton, K.A., Barsis, A.P., "Transmission Loss Predictions for Tropospheric Communications Circuits," NBS Technical Note 101 (Revised), Volumes I and II, U.S. Department of Commerce, 1967.

3. Hufford, G.A., Longley, A.G. and Kissick, W.A., "A Guide to the use of the ITS Irregular Terrain Model in the Area Prediction Mode", NTIA Report 82-100, U.S. Department of Commerce, April 1982. Also, Circular letter, dated January 30, 1985, from G.A. Hufford, identifying modifications to the computer program.

4. Hufford, G.A., Memorandum to Users of the ITS Irregular Terrain Model, Institute for Telecommunications Sciences, U.S. Department of Commerce, January 30, 1985.