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FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

FCC 92-333

MAIL BRANCH

In the Matter of)
) GEN Docket No. 90-314
) ET Docket No. 92-100 ✓
)
) RM-7140, RM-7175, RM-7617,
) RM-7618, RM-7760, RM-7782,
 Amendment of the Commission's) RM-7860, RM-7977, RM-7978,
 Rules to Establish New Personal) RM-7979, RM-7980
 Communications Services)
) PP-35 through PP-40, PP-79
) through PP-85

NOTICE OF PROPOSED RULE MAKING AND TENTATIVE DECISION

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By the Commission: Commissioner Quello concurring and issuing a statement; Commissioners Marshall and Barrett issuing separate statements.

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I. INTRODUCTION

1. Today the Commission takes a significant step towards making personal communications services (PCS) a reality. This Notice seeks comprehensive comment on how we should structure the regulatory treatment of PCS, including a variety of possible spectrum allocation and licensing schemes, so as to bring that family of services known as PCS to the public expeditiously and with the least amount of regulatory delay.

2. The increasing availability of mobile communications over the past decade is freeing business and residential consumers from the physical constraints of a wholly wired telecommunications network. Cellular, together with paging and other complementary services, brought mobility to the Nation's telecommunications services for the first time. In licensing mobile services, the Commission has squarely placed its faith in competitive markets and service flexibility as the best path to provide greater choice and low prices for consumers -- a faith which has been amply justified by the nationwide availability of cellular service; the competition among cellular providers for customers; the diverse array of service and equipment options; and the aggressive behavior of cellular providers in implementing new technologies such as digital transmission and providing a variety of new services using the cellular spectrum.

3. The revolution in mobile and portable technologies has continued unabated in the decade since cellular first was authorized. Significant technological advances have expanded substantially the number and types of wireless telecommunications services that can be made available to the American people. These services include advanced forms of cellular telephone service, in addition to advanced digital cordless telephone service, portable facsimile services, wireless private branch exchange (PBX) services, and wireless local area network (LAN) services, among others. These services are potentially revolutionary; depending on their application, they can be used through the existing public switched network or through alternative local networks such as cable television systems. PCS can even exist independently of local wired networks, filling gaps in existing communications and creating new markets.

4. The advent of PCS will have a great impact on the future development and configuration of all telecommunications networks by improving significantly their flexibility and functionality. Many PCS applications should create new markets and in others provide competition for the first time. PCS also could provide a greater overall level of competition in many already competitive segments of the telecommunications industry. The many applications of PCS also could increase productivity and efficiency across a broad array of industries and have a positive

impact on the international competitiveness of the Nation's economy.

5. The Commission has devoted significant effort and resources in gathering information on PCS and educating itself on this communications development. Following the submission of comments in the Notice of Inquiry in this proceeding, the Commission issued a policy statement on PCS, held an en banc hearing on PCS, and opened a proceeding designed to make available spectrum in the 2 GHz band for a variety of emerging technologies including PCS.

6. It is essential that our decisions on PCS spectrum and regulatory structure furnish PCS providers the ability to reach and serve existing and new markets in an economic and responsive manner. We intend to ensure that all mobile services are provided with the highest quality at low-cost, reasonable rates to the greatest number of consumers, consistent with the goals of the Communications Act. Our experiences with mobile communications, as well as our information about the developing PCS services, lead us to conclude that we should attempt to optimize and balance four values in providing spectrum and a regulatory structure for PCS:

- universality;
- speed of deployment;
- diversity of services; and
- competitive delivery.

7. Fulfillment of the goals listed above also should ensure that PCS deployment and delivery does not become bogged down in a regulatory morass that may delay the delivery, or even threaten the existence, of PCS. The years-long process culminating in cellular's birth is one of the prime examples of how the Commission's regulatory processes can be manipulated to delay the initiation of a new service. We are determined to avoid that result in this proceeding. We will resolve the many issues and proposals presented here in a thorough and reasoned manner, but one that also allows PCS to be brought to the public with the least possible regulatory delay.

II. BACKGROUND

8. The Commission initiated this proceeding in 1989 after receiving several petitions for rule making. The Commission has since issued a Notice of Inquiry and a Policy Statement, held an en banc hearing that addressed PCS, and proposed allocating spectrum for emerging technologies, including PCS. The Commission also made recommendations and participated in negotiating

international allocations that recognize and permit use of this spectrum for PCS.¹ Various telecommunications companies also have been active in participating in our PCS proceedings, and over 100 companies are conducting more than 150 experiments pursuant to experimental licenses to develop and test PCS services and technologies.

Commission Actions

Petitions and Notice of Inquiry

9. This proceeding was initiated after the Commission received petitions for rule making from Cellular 21, Inc. (Cellular 21) and PCN America, Inc. (PCN America)² requesting that the Commission allocate spectrum for the implementation of new personal communication services.³ On June 14, 1990, the Commission adopted a Notice of Inquiry (Notice) soliciting comment on a broad array of issues that address making PCS available to the American public.⁴ Most commenters to the Notice support the Commission's decision to initiate a rulemaking on PCS and predict great demand for PCS services or devices such as CT-2, PCNs, wireless PBXs, wireless data transfer and advanced paging.⁵ However, incumbent users of the 2 GHz spectrum express concern that the introduction of PCS would have an adverse effect on their current operations.

¹See Report, GEN Docket No. 89-554, 6 FCC Rcd 3900 (1991); International Telecommunication Union, Final Acts of the World Administrative Radio Conference (WARC-92), Malaga-Torremolinos, 1992, and Addendum + Corrigendum to the Final Acts of the World Administrative Radio Conference (WARC-92), Malaga-Torremolinos, 1992.

²See Petitions for Rule Making, RM-7175, filed by PCN America on November 7, 1989, and RM-7140, filed by Cellular 21 on September 22, 1989.

³On April 30, 1990, the Personal Communications Section of the Telecommunications Industry Association (TIA) petitioned the Commission requesting allocation of 25 duplex channel pairs in the 46/49 MHz bands for conventional cordless telephones (CT-1). We treated the petition as a comment to the Notice of Inquiry in this proceeding. However, the Commission will consider allocating additional 46/49 MHz spectrum for CT-1 services spectrum in a separate proceeding.

⁴See Notice of Inquiry, GEN Docket No. 90-314, 5 FCC Rcd 3995 (1990).

⁵See definitions of these services at note 16, infra.

10. Subsequent to the Notice, the Commission received a number of related petitions that proposed new PCS services or technologies. On February 13, 1991, Apple Computer, Inc. proposed that 40 MHz from the 1850-1990 MHz band be allocated for high-speed local-area data communications services connecting personal computers (Data-PCS).⁶ Because the petition proposed a service significantly different than that addressed in the Notice, we accepted this petition and received separate comment on it. With the record before us, it appeared that the services proposed by Apple came within the PCS family of services defined in our Policy Statement, infra, and accordingly we incorporated the petition into this Docket when we adopted the Policy Statement.⁷ More recently, on March 26, 1992, Broadband Communications Corporation filed a petition for rulemaking proposing use of 2 GHz spectrum for competitive-access wireless local loops. We would classify wireless local loop service as a type of PCS, and because Broadband proposes use of the same spectrum being considered herein, the substance of Broadband's proposal is incorporated in this proceeding.

11. We also have received ten separate petitions for rulemaking that request using the 930-931 MHz advanced paging reserve for a variety of new applications, principally advanced paging and messaging services. These petitions have been or are being accepted, consolidated within ET Docket No. 92-100, and considered in this Notice of Proposed Rule Making.⁸ However, if

⁶RM-7618.

⁷After the PCS proceeding was initiated and comments received on the Notice, Advanced Wireless Communications, Inc. and American Personal Communications (APC) filed petitions that addressed issues already under consideration in the PCS docket (GEN Docket No. 90-314). Accordingly, both petitions were denied without prejudice, but accepted as late-filed comments and, with the other comments that address PCS issues, have been fully considered. APC filed for reconsideration, arguing that its petition merited consideration separate from that accorded the broad array of PCS issues in this proceeding. APC later agreed that its petition could be "folded into" this Notice without a separate comment period, see APC, Supplement to Petition for Rule Making, GEN Docket No. 90-314 at note 3 (filed May 4, 1992). The issues raised by APC in its petition are discussed in this Notice, and therefore its petition for reconsideration is dismissed as moot.

⁸The petitions were filed by: 1) Telocator on January 23, 1991 (RM-7617); 2) Montauk Telecommunications on June 6, 1991 (RM-7760); 3) Echo Group, L.P. on July 30, 1991 (RM-7782); 4) PacTel Paging on August 2, 1991 (advanced architecture paging, RM-7979); 5) Dial Page, L.P. on October 11, 1991 (RM-7977); 6) PacTel Paging on October 15, 1991 (ground-to-air paging, RM-7860); 7) Mobile

it appears that ET Docket No. 92-100 will be delayed by this action, we will consider separating ET Docket No. 92-100 from this combined proceeding.

Policy Statement

12. On October 24, 1991, the Commission adopted a Policy Statement and Order to provide preliminary guidance for the development of PCS in the United States and to serve as a basis for an en banc hearing on PCS.⁹ In the Policy Statement and Order, the Commission recognized that the concept of PCS has grown in scope and complexity since the initial PCS petitions were filed with the Commission. Therefore, the Commission stated that it intends to broadly define PCS to encompass a family of services that would include services other than voice, such as data, imaging, and other new services. The Commission also stated that it would adopt regulations that promote the rapid development of PCS, encourage significant flexibility in the development of technologies and services, and promote competition in PCS and in telecommunications in general.

13. The Commission further set the framework for PCS by concluding that an adequate amount of spectrum should be made available for PCS to foster the development of innovative and competitive markets. It stated that the allocation should facilitate local, regional, national and international uses and that the spectrum should be allocated in phases to prevent early developments precluding later ones. Finally, it stated that important equipment, cost, and international considerations suggest that a portion of the spectrum to be allocated for PCS should come from the 1.8 to 2.2 GHz band.

En Banc Hearing

14. In the Policy Statement and Order the Commission recognized that the record in this proceeding did not provide sufficient information on the many difficult regulatory issues for the Commission to propose tentative regulations. Therefore, on December 5, 1991, the Commission held an en banc hearing to

Telecommunication Technologies Corporation on November 12, 1991 (RM-7978); 8) PageMart, Inc. on February 28, 1992 (RM-7980); 9) Skycell Corporation on May 29, 1992; and, 10) Paging Network, Inc. on June 1, 1992. The Skycell and Paging Network petitions were received too late to obtain separate comment, but the substance of their proposals is incorporated into ET Docket No. 92-100 and has been considered herein. See Appendix C for a summary of the related 900 MHz pioneer's preference requests.

⁹See Policy Statement and Order, GEN Docket No. 90-314, 6 FCC Rcd 6601 (1991).

further develop the record. Testimony was solicited on the following topics: definition of service, including the types of service anticipated and the potential demand for each service type; spectrum requirements, including the amount of spectrum required, where it should be located in the spectrum, and the ability to share with incumbents; technologies, including the degree of technical flexibility that should be granted PCS licensees, the role of unlicensed devices, and the need for mandated standards; and regulatory issues, including the method of assigning licenses, the size and location of service areas, and the advantages and disadvantages of common versus private carriage for PCS.

15. In addition to the testimony of the panelists, the Commission received 134 comments that addressed the issues raised at the hearing. The presentations and comments confirm that there is significant interest in PCS and strong support for a substantial spectrum allocation for PCS. Commenters argue that such an allocation is required to provide the many developing services that American consumers are demanding and to allow American manufacturers to develop equipment that could be marketed throughout the world. Commenters also argue that an allocation is required to provide competition to existing cellular services. Some commenters raise concerns that an allocation in the 2 GHz fixed microwave bands would result in interference to incumbent users and require them to replace these communications links, but other commenters argue that the 2 GHz fixed microwave bands could be shared.

Emerging Technologies Spectrum

16. On January 16, 1992, the Commission adopted a Notice of Proposed Rule Making in ET Docket No. 92-9, proposing to allocate 220 megahertz of spectrum between 1850 and 2200 MHz to meet the spectrum requirements of innovative new services, such as PCS, made feasible by emerging technologies.¹⁰ The Commission found that allocating spectrum for emerging technologies would further its Congressional mandate to encourage the provision of new technologies and services to the public,¹¹ encourage the larger and more effective use of radio in the public interest,¹² and complement our recently adopted Pioneer's Preference rules¹³

¹⁰7 FCC Rcd 1542 (1992).

¹¹47 U.S.C. § 157.

¹²47 U.S.C. § 303(g).

¹³47 C.F.R. §§ 1.402, 1.403, 5.207. See Report and Order in GEN Docket No. 90-217, 6 FCC Rcd 3488 (1991), recon., 7 FCC Rcd 1808 (1992), pets. for further recon. pending. These rules

intended to foster the development of new technologies and services.

Related Matters

WARC-92

17. A worldwide allocation for PCS was discussed at the International Telecommunication Union (ITU) World Administrative Radio Conference in Torremolinos, Spain. At the conference it was decided to maintain the primary fixed and mobile allocations at 2 GHz in Region 2,¹⁴ add additional mobile-satellite service (MSS) allocations in the 1930-2010 and 2120-2200 MHz bands, and add a footnote stating that future public land mobile telecommunications systems (FPLMTS), which are similar in concept to PCS, are expected to use the 1885-2025 MHz and 2110-2200 MHz bands on a worldwide basis.¹⁵

PCS Experiments

18. The Commission has authorized over 150 PCS experimental licenses in the past three years. These experiments are developing and testing equipment in several different frequency bands. A number of the experiments also are authorized to perform market studies on a variety of technologies and service concepts. The services or devices being tested include CT-2, CT-2 Plus,

encourage the development of new technologies and services by offering a licensing preference to entities that develop an innovative new service or a substantial enhancement to an existing service, see infra paras. 140 et seq.

¹⁴For the purpose of the Radio Regulations, the world is divided into three regions: Region 1 (Europe/Africa), Region 2 (Americas) and Region 3 (Asia and Australasia).

¹⁵See note 1, supra. The WARC also allocated spectrum for MSS in the band 1610-1626.5 MHz (Earth-to-space) on a worldwide primary basis. An additional worldwide allocation in the band 1613.8-1626.5 MHz (space-to-Earth) was made on a secondary basis for MSS as well as an additional primary allocation in the band 1675-1710 MHz for Region 2. A new primary MSS allocation in the band 1626.5-1631.5 MHz (Earth-to-space) also was made for Region 2 and 3. In the 2 GHz portion of the spectrum, Region 2 received a primary allocation for MSS in the bands 1970-2010 (Earth-to-space) and 2160-2200 MHz (space-to-Earth) and a secondary allocation in the bands 1930-1970 (Earth-to-space) and 2120-2160 MHz (space-to-Earth).

CT-3, PCN, Wireless PBX, and Wireless Local Loop.¹⁶

19. The modulation schemes and access technologies being tested include frequency division multiple access (FDMA)¹⁷, time division multiple access (TDMA)¹⁸, and narrowband and broadband spread spectrum technologies with associated code division multiple access (CDMA)¹⁹ technology. The majority of experiments propose to operate in the 800/900 MHz and 2 GHz bands, although AT&T is conducting experiments in the 6 GHz band and cable companies in the 12 GHz band. Additional experiments are being conducted by cellular operators in the cellular bands. At 2 GHz, the emphasis has been on propagation analysis and examination of spectrum sharing feasibility between PCS and fixed microwave users.

¹⁶The acronym CT-2 stands for a "cordless telephone, second generation." A CT-2 device is a digital telephone that functions as a cordless telephone at home and in the office, but additionally can be used as a portable pay phone to initiate calls when in range of a CT-2 microcell (known as a "telepoint"). CT-2 Plus is CT-2 service with the ability to handoff calls between cells in low-speed environments and the ability to receive and display paging messages. CT-3, which stands for "cordless telephone, third generation," includes control channels that permit the handset to receive as well as to initiate calls. PCN is a proposed advanced voice and data communications system that would be totally independent of, but permit connection to, the existing wireline public switched telephone network and cellular systems. Wireless PBX service is proposed to permit telephone portability in office environments, and wireless local loop service could replace the last mile to the home with a radio link to reduce servicing and maintenance costs.

¹⁷FDMA is a communications technique that divides the bandwidth of a frequency assignment into separate channels for communications among multiple users by allocating unique channels to the different users.

¹⁸TDMA is a communications technique that utilizes a common channel for communication among multiple users by allocating unique time slots to the different users.

¹⁹CDMA is a form of modulation whereby digital information is encoded in an expanded bandwidth format. Several transmissions can occur simultaneously within the same bandwidth with the mutual interference reduced by the degree of orthogonality of the unique codes used in each transmission. It permits a high degree of energy dispersion in the emitted bandwidth.

20. The stage of testing and progress of individual experiments varies greatly. Many licensees are in the early planning stage of their experiments. Other licensees are conducting propagation tests to determine coverage areas, developing computer models to determine geographic areas where sharing and coordination with existing microwave operations will be required, and performing market studies to determine consumer demands for PCS-type services. Most experiments that are actively testing equipment are doing so in the 800/900 MHz bands, due to the availability of British CT-2 equipment. Narrowband systems, particularly for advanced messaging services (advanced paging), also are being tested in the 900 MHz range.

21. Most experiments in the 2 GHz band are focusing on the development of propagation data. PCN America and APC are actively testing prototype 2 GHz equipment. PCN America is testing a broadband spread spectrum system in an effort to demonstrate that PCS can coexist with microwave users. This system would overlay the microwave frequencies and make use of notch filters, automatic power control and cell engineering to minimize interference. APC is pursuing a narrowband approach with its Frequency Agile Sharing Technology (FAST). The FAST system would use spectrum not used by existing microwave operations to avoid interference with the microwave operations.

Cellular and SMR Experience

22. The Commission's reallocation in the 1970's of a large amount of spectrum from UHF-TV broadcasting and the federal government in the 800/900 MHz region provided opportunities for the development of new technologies.²⁰ This spectrum has been used primarily for new land mobile technologies, including common carrier cellular radio and private trunked operations such as specialized mobile radio (SMR) service. The cellular and trunked technologies pioneered by American companies not only have met domestic telecommunication requirements, but also have been exported and implemented abroad. As a result, U.S. domestic telecommunications products lead the world in meeting public demand and in using innovative technology. Further, because of the opportunities created by this allocation, American companies enjoy a position of global leadership in radio technology that has resulted in strengthening our competitiveness in international markets, particularly with regard to trunked and cellular radio

²⁰See generally First Report and Order and Second Notice of Inquiry, Docket No. 18262, 35 Fed. Reg. 8644 (June 4, 1970); Second Report and Order, 46 FCC 2d 752 (1974); reconsidered, Memorandum Opinion and Order, 51 FCC 2d 945 (1975); Order (on further reconsideration), FCC 78-854 (1978); aff'd sub nom. NARUC v. FCC, 525 F. 2d 630 (D.C. Cir. 1976), cert. denied, 425 U.S. 992 (1976).

systems. Rapid development and delivery of PCS technology to the marketplace will help enable the United States to maintain its position as a global telecommunications leader.

23. Based on our experience in issuing cellular licenses, we hope to avoid some causes of delay in the PCS licensing and regulatory process. For example, as discussed infra, the comparative hearings held to award early cellular licenses proved to be unacceptably complex, costly, and slow. Once cellular lottery procedures were implemented, licenses were issued more rapidly and the cellular industry grew at an unprecedented rate, with service currently available in every market in the country with some 9,000,000 subscribers.

24. Further, in GEN Docket 87-390, the Commission found it in the public interest to modify the cellular regulatory structure to facilitate the implementation of a new generation of cellular technology.²¹ The Commission recognized that the initial detailed technical and compatibility standards governing the cellular service provided for a rapid and highly successful development of the service but subsequently impeded both development of new services and accommodation of the large number of additional subscribers anticipated in the future. The rules adopted in that proceeding allowed cellular providers flexibility in the introduction of advanced digital technologies and auxiliary common carrier services such as wireless PBXs. Our experience suggests that we should adopt a PCS regulatory structure that allows similar flexibility in implementing new services and technologies. In sum, we are proposing policies for PCS licensing that respond to the needs of the marketplace.

III. DISCUSSION

Need for PCS

25. Personal communications requirements in the United States are rapidly changing as our society becomes more mobile and the demand for instantaneous communications increases. There is steadily increasing consumer and business interest in new mobile services and technologies for numerous, sometimes incompatible, applications. These include wireless PBXs; smaller, lighter, portable cellular phones; portable fax machines; multi-channel cordless telephones; and services that facilitate contacting an individual instead of a particular station. Current radio equipment and services (cordless telephones, radio paging, and cellular radio) cannot fully meet the demands for these new services. Cordless telephones are used in and around the home or

²¹See Report and Order, GEN Docket No. 87-390, 5 FCC Rcd 1138 (1990).

office, operate on only a few channels that are congested, and are limited in use to the immediate vicinity of their base stations. Radio paging services are only one-way and generally require another communications link. While cellular and specialized mobile radio services will be able to provide some of the new communications requirements within their currently allocated spectrum, they cannot meet the full range of demand for PCS within a competitive framework.

26. The establishment of PCS also is warranted as a way of introducing additional competition to current mobile radio services. Taking into account the wide range of proposed service functionality and cost, several consumer studies project that there could be over 60 million PCS users in the U.S. within ten years.²² Parties have suggested that such services may provide competition to existing cellular, paging and private radio services and result in lowering the cost of these services. PCS also could augment emergency communications when disasters, such as earthquakes or tornadoes, render the public switched telephone network inoperable.

27. In addition to domestic use, consumer requirements for PCS increasingly are international. Some highly mobile consumers of PCS can be expected to want their PCS handsets to be portable internationally and for the scope of service to be global. The international communications community appears to be moving toward establishing PCS operations in the 1800 to 2200 MHz band. To allow PCS providers to meet the consumer's expectation of worldwide service availability, the public interest would be served best by a U.S. allocation for PCS in or near this portion of the spectrum. Finally, establishing services in the same spectrum as other countries would facilitate the export of American products and services and decrease the price of equipment due to economies of scale. This would allow American manufacturers to maintain their lead in developing innovative mobile radio-based communications equipment and services. A domestic allocation that differed from the allocation in the rest of the world could retard domestic development and implementation by forcing manufacturers to develop incompatible equipment for smaller markets.

28. Accordingly, for both domestic and international considerations, we propose the establishment of a new PCS service. We believe that the establishment of PCS is warranted and will provide a family of new and innovative services to meet consumers' demands and needs for mobile and portable communication services. It is our goal to allocate sufficient spectrum and establish rules to allow the widest possible range of such services.

²²See, e.g., "Market Researchers See Large Demand For PCS In U.S.," Microcell News, March 25, 1992.

Service Definition

29. PCS concepts expressed in the comments submitted in this proceeding, the experimental applications and reports, and the requests for pioneer's preferences encompass a wide range of capabilities and technologies. Proposed new services range from wireless replacements for ordinary residential and office telephones to communication devices capable of sending and receiving voice and data to and from virtually anywhere. Therefore, we propose that personal communications services be defined as a family of mobile or portable radio communications services which could provide services to individuals and business, and be integrated with a variety of competing networks.

30. We propose that spectrum allocated for PCS not be used for broadcasting service²³ and that fixed services generally be allowed only as ancillary to the mobile PCS services. There is only a limited amount of spectrum for these new PCS services, and fixed service uses generally can be accommodated by other means or in other frequency bands. Therefore, the primary focus of PCS will be to meet communications requirements of people on the move.

Spectrum Allocations

31. Allocation decisions are among the most difficult that the Commission must make because virtually all of the usable spectrum already is allocated to specific services, and most of it has been assigned to specific licensees. Therefore, to provide for new services, the Commission must identify spectrum that can be shared between a new service and an existing service, or that can be reallocated to a new service and the incumbent licensees relocated.

32. The Commission began the process of identifying spectrum for PCS in its Policy Statement, *supra*. In ET Docket No. 92-9, the Commission proposes that 220 MHz of spectrum in the 1850-1990, 2110-2150, and 2160-2200 MHz bands be allocated for emerging technologies.²⁴ Consistent with that proceeding, and conditioned upon its outcome, we propose that 110 MHz of this 2 GHz spectrum be allocated for PCS services. We also propose that 3 MHz of 900 MHz spectrum be allocated for narrowband PCS operations, as discussed below.

²³As broadcasting is defined at Section 3(o) of the Communications Act, 47 U.S.C. § 153(o).

²⁴The future use of these bands by the fixed microwave service will be addressed in ET Docket 92-9.

2 GHz Allocation

33. Licensed PCS Services. Proponents of PCS estimate that several hundred megahertz of spectrum will be required to support all of the services envisioned.²⁵ They state that a substantial allocation of spectrum is required to provide the greatest opportunity for PCS services to develop and to provide for competition among PCS service providers. Several commenters argue that the allocation should be sufficient to provide for competition among licensed PCS providers. However, others argue that the number of licensed providers should be limited due in part to the cost of developing a PCS infrastructure.²⁶ A number of commenters state that PCS services at 2 GHz will compete with existing cellular radio service and, therefore, suggest that PCS licensees be provided at least a comparable amount of spectrum. Most parties favoring PCS argue that a large initial allocation would increase the opportunity for economies of scale and integration, further enhancing the prospect that PCS entrants will be competitive with established carriers.

34. Number of Providers. It is our goal to provide an allocation that allows for the provision of the widest range of PCS services at the lowest cost to consumers. The most desirable allocation to accomplish this goal would be one large enough to accommodate all entities interested in providing PCS services. Such an allocation would allow market forces to determine the optimum number of service providers. In view of the limited spectrum available for all emerging technologies, however, we necessarily must limit the size of any PCS allocation; this in turn will limit the number of potential PCS providers. Nevertheless, we tentatively conclude that an allocation that provides sufficient spectrum to support at a minimum three service providers per market will be necessary to ensure a wide and rich range of PCS services that meet consumer needs at reasonable prices. However, we are aware of the possible benefits of more competitors, and we recognize that innovation could result from the licensing of additional PCS service providers. Thus, we seek comment on the merits of authorizing four or five PCS operators per market.

²⁵See for example, written testimony of Motorola Inc. to the en banc hearing, presented by John E. Major on December 5, 1992, at page 3 of the executive summary.

²⁶See for example, written testimony of American Personal Communications (APC) to the en banc hearing presented by J. Barclay Jones on December 5, 1992, at p. 7. APC argued that two licensees would provide sufficient competition and allow for a flourishing market in personal communications.

35. Size of Spectrum Blocks. We also believe it important that each PCS licensee be provided enough spectrum to be competitive with existing telecommunications services such as cellular, SMRs, and others, both in terms of existing service as well as new PCS-like services cellular operators are deploying. Currently, the cellular service is allocated 50 MHz, with each licensee assigned 25 MHz. We believe that PCS licensees should be assigned a comparable amount of spectrum. However, we anticipate that the outcome of ET Docket No. 92-9 will determine if PCS services will share spectrum with incumbent fixed microwave operations and how PCS services would protect those operations from interference. If sharing is required, the capacity of spectrum available to PCS services would be limited and spectrum blocks larger than 25 MHz may be needed at 2 GHz.

36. On the other hand, 2 GHz systems will not have to accommodate the older analog mobile units used in cellular today, and thus may be able to provide service at costs comparable to those that currently exist with less spectrum than assigned cellular operators. On balance, our preferred option is that each PCS licensee be assigned a total of 30 MHz of spectrum at 2 GHz. Other options include 20 MHz or 40 MHz blocks. We request comment on whether either of these options could provide a better competitive balance between PCS and existing telecommunications services. Blocks of 40 MHz would provide PCS licensees with greater capacity and flexibility to develop new services and to compete with cellular and other existing services. Blocks of 20 MHz, in contrast, would permit the Commission to license more competitors in the identified spectrum.

37. Taking these issues into consideration, we propose to allocate a minimum of 90 MHz, 1850-1895/1930-1975 MHz, for licensed services.²⁷ Such an allocation could provide three licensees 30 MHz of spectrum each. Further, we believe that such an allocation, in concert with a flexible regulatory approach, could allow for the implementation of a number of innovative new services. Should we ultimately decide to issue four or five PCS licenses per area or to assign blocks of 20 MHz or 40 MHz to each licensee, the overall spectrum allocation to PCS would be adjusted accordingly.

38. Block Allocations. Based on three licensees with 30 MHz each, we propose that the licensed portion of the 2 GHz PCS spectrum be divided into three 15 MHz frequency block pairs per geographic area as follows:

²⁷We note that the 1970-1975 MHz portion of this band recently was allocated on a primary basis for MSS in Region 2 at the WARC. See note 15, supra.

Channel Block A - 1850-1865/1930-1945 MHz;
Channel Block B - 1865-1880/1945-1960 MHz; and
Channel Block C - 1880-1895/1960-1975 MHz.

We further propose to allow the licensees of these frequency block pairs to have the flexibility to channelize the frequency blocks to accommodate the technologies and services that they wish to provide. This channeling plan will permit the use of channel pairings as well as allow for single frequency technologies such as one-way services or for two-way time division duplex.

39. Our proposed frequency block pairing is consistent with the existing fixed microwave channelization plan that provides an 80 MHz separation between transmit and receive frequencies. This will provide PCS operators some advantages and flexibility in designing their systems. First, channels not used by the microwave service in an area should be immediately available on both transmit and receive frequencies for PCS operations. A different separation for the PCS services than the current fixed microwave channelling plan likely would result in cases in which half of the frequency pair (*i.e.*, either transmit or receive) is used by a fixed microwave user, and therefore not immediately available for PCS service. In these cases the PCS operator could not take advantage of unused microwave channels for paired operation without first negotiating for use of the other half of the pair. Second, maintaining the same separation as for fixed microwave services simplifies the negotiation process; successful negotiations with a microwave user will clear a channel pair for the PCS operator.

40. We note this same separation consistency can be maintained within the 1850-1990 MHz band with other combinations of block size and number of licenses, *e.g.*, three licenses with 20, 30 or 40 MHz each; four licenses with 20 or 30 MHz each; or five licenses with 20 MHz each. The remaining combinations on which we seek comment, *i.e.*, four licenses with 40 MHz and five licenses with 30 or 40 MHz, would require different separations for at least some of the licenses as well as the allocation of additional spectrum from one of the other proposed emerging technologies bands. Commenters supporting such alternative configurations should specifically address separation issues that are likely to arise.

41. Unlicensed Devices. Some commenters, including Apple and AT&T, discuss a need for forms of personal communications services that might best be used on an unlicensed basis. For example, Apple Computer, Inc., proposes a concept for a high-speed, unlicensed data communications service.²⁸ It suggests that we amend Part 15 of the Commission's rules to accommodate families

²⁸See note 6 and para. 10, *supra*.

of PCS devices that will be particularly useful for the transmission of high and low speed data between computing devices, cordless telephones and wireless PBXs. On the other hand, several incumbent fixed microwave licensees oppose unlicensed PCS operations. Specifically, UTC argues that such an unlicensed approach would not ensure reimbursement of existing users' relocation costs.²⁹

42. We find considerable merit in the potential use of unlicensed PCS devices. We tentatively conclude that permitting the use of PCS devices on an unlicensed basis would be in the public interest, and therefore propose to allocate spectrum for the operation of such PCS devices. This approach should foster the rapid introduction of new PCS technologies by permitting manufacturers to experiment with, and directly market to the general public, products using new designs and technologies, without the delays associated with the licensing of a radio service.

43. We also believe interference with existing fixed microwave users can be minimized by employing appropriate technical standards and making use of specific portions of the 2 GHz spectrum. We propose that unlicensed PCS operation be co-primary with Part 94 operations. We would add the condition that such devices may not cause harmful interference to stations for which license applications are on file as of the adoption date of this proposal.³⁰ Commenters should address questions of interference and how existing users could be compensated should they wish to move. We are proposing that the 1910 to 1930 MHz band be designated for use by unlicensed PCS devices. This band currently is used for one-way transmissions by private fixed microwave systems operating under Part 94 of the Commission's rules. The band is divided into two unpaired channels and is

²⁹See Comments of the Utilities Telecommunications Council to the en banc hearing at footnote 42.

³⁰Part 94 operations for which a license application is filed after the adoption of this proposal if final rules are adopted in this proceeding would have to accept any interference received from unlicensed PCS operations. This is somewhat more restrictive than the Commission's policy regarding licensing of new microwave facilities in the 2 GHz bands, see Notice of Proposed Rule Making in ET Docket No. 92-9, supra note 10; and Public Notice released May 14, 1992, Two Gigahertz Fixed Microwave Licensing Policy, Mimeo No. 23115. However, we believe that proposed unlicensed services will require relatively clear spectrum. We believe that this approach is appropriate and will eliminate or minimize, as much as practicable, the need for coordination between private fixed microwave systems and unlicensed operations.

relatively lightly loaded.³¹ It appears that this band can be made available for unlicensed operations with minimal impact on the private fixed microwave community. We seek comment on this conclusion.

44. We tentatively conclude that there is a need to accommodate three broad types of PCS technologies within these bands, each of which has different spectrum requirements: broadband technologies requiring at least 10 MHz, technologies requiring at least 1.25 MHz channels, and narrowband technologies requiring 100 kHz channels. In light of these requirements, we are proposing to divide the 20 MHz of unlicensed spectrum into three blocks: a 10 MHz block for broadband technologies, a 5 MHz block divided into four 1.25 MHz channels, and a 5 MHz block divided into fifty 100 kHz channels. An alternative scheme would be to overlay several blocks of spectrum: two 10 MHz blocks, overlaid by sixteen 1.25 MHz blocks, in turn overlaid with two hundred 100 kHz channels. Overlaying different PCS devices that have different technical characteristics would provide greater flexibility to avoid conflicts with existing Part 94 users and may increase spectrum utilization, but also may increase potential interference between PCS devices.

45. We invite comment on the above channelization proposals and solicit other proposals for channelizing this spectrum. We specifically request commenters to address benefits and impact of any channelization approach based on our desire to provide protection to incumbent fixed microwave licensees and flexibility for unlicensed PCS devices.

Negotiations

46. In ET Docket No. 92-9, the Commission proposed that new service providers be empowered to negotiate with the existing users for access to the 2 GHz frequencies and, conversely, to permit incumbents to negotiate with the new service providers for continued use of the spectrum. Assuming the Commission moves forward with ET Docket No. 92-9 and contingent on actions taken in that docket, we propose in this proceeding to adopt specific negotiation procedures for use in the PCS context. It appears that such a mechanism would permit marketplace forces to achieve a balance between the immediate need for spectrum to permit implementation of new services and the requirements of existing

³¹For example, currently there are only 28 microwave receivers in the 1910 to 1930 MHz band located within a 10 mile radius of the center of the top 50 Metropolitan Statistical Areas (MSAs). This figure was computed by counting all microwave receivers within a ten mile circle centered on the reference coordinates of the first city listed for each MSA, as listed at Section 76.53 of the Commission's Rules.

fixed microwave operators. Financial arrangements with existing licensees should encourage reaccommodation and help underwrite the cost of transition. In return, the new licensees should receive access to the frequencies used by the fixed microwave operators that are reaccommodated through this process. Also consistent with ET Docket No. 92-9, we propose that incumbent licensees be protected during a transition period should a transition period ultimately be adopted in that proceeding.

47. In ET Docket No. 92-9, proponents of PCS argue that the Commission should adopt a fixed transition period, at the end of which existing users would revert to secondary status. They argue this is necessary for new licensees to successfully negotiate relocation agreements.³² Another approach was suggested by the Utilities Telecommunications Council (UTC) in comments it filed addressing voluntary and involuntary negotiations. With regard to involuntary negotiations, UTC states:

"To the extent there is concern over the feasibility of voluntary negotiations, [the Commission should] provide for an involuntary relocation program, to commence 10 years from now, based on the MMDS/ITFS relocation plan adopted in GEN Doc. 90-54:

- (1) A new user may request involuntary modification of an existing user's license to specify operation on different frequencies;
- (2) The new user is responsible for all relocation costs, and must set up an escrow account or buy a performance bond to guarantee relocation costs;
- (3) The proposed system must provide equal or better reliability than the existing system;
- (4) Existing user has an opportunity to oppose the relocation proposal; and
- (5) If the new facilities prove to be unsatisfactory in practice, the user must be relocated back to its original facilities at the new user's expense."³³

We solicit comment in this proceeding on the merits of implementing such a negotiated relocation program, and on how the negotiation process should be implemented specifically with regard to PCS services. Further, we solicit specific comment on

³²See, e.g., Comments of Personal Communications Network Services of New York, Inc. at ii.

³³See Comments of Utilities Telecommunications Council in ET Docket No. 92-9, "Recommended FCC Action Plan for Accommodating New Technologies" (filed March 3, 1992).

what restrictions, if any, the Commission should place on such negotiated arrangements.

900 MHz Allocation

48. The proposals that relate to 900 MHz include a variety of narrowband PCS services such as advanced paging, messaging, data, and CT-2. These services include one-way systems with relatively low power transmissions from a subscriber to a base station, one-way systems with relatively high power transmissions from a base station to a subscriber, and one-way services that include facsimile, graphics, and other imaging services. Also proposed are two-way systems that would provide subscribers both longer and more diverse message services than are available with current paging services, including for example, tracking and acknowledgment. In addition, two-way advanced cordless telephone service is proposed. In some respects these 900 MHz proposals are similar to some of the proposals for use of the 2 GHz band. They differ, however, in that all require only relatively narrow bandwidths for transmission, generally from 5 to 50 kHz per individual channel. Consequently, the information would be transmitted at slower rates.

49. We recognize the increasing demand for the services that reasonably and efficiently can be provided at 900 MHz. Accordingly, we propose to allocate three megahertz in the 900 MHz spectrum for narrowband PCS services: 901-902, 930-931, and 940-941 MHz. These frequencies currently are reserved for advanced paging³⁴ and general purpose mobile services.³⁵

50. The petitioners propose many types of services that have different spectrum requirements. In determining how best to divide and assign these bands, it is important to provide spectrum that will allow flexibility in the design and implementation of different and innovative systems and still allow for competition among systems. As an initial matter, we tentatively conclude that dividing the 900 MHz spectrum into both paired and unpaired blocks would provide for competitive services as well as for future flexibility. We propose, therefore, to pair blocks of spectrum from the 901-902 and 940-941 MHz bands; and to provide for unpaired use in the 930-931 MHz band. We request comment on providing both paired and unpaired spectrum at 900 MHz, and on the amount provided for each configuration.

³⁴See First Report and Order, GEN Docket No. 80-183, 47 Fed. Reg. 24577 at para. 14 (1982).

³⁵See Report and Order, GEN Docket Nos. 84-1231, 84-1233, and 84-1234 at para. 118 (1986), allocating 901-902 MHz and 940-941 MHz to a General Purpose Mobile Service.

51. As a first alternative, we propose that the size of the blocks in these bands be 50 kHz. This would provide 20 paired blocks in the 901-902/940-941 MHz band and 20 unpaired blocks in the 930-931 MHz band in each service area. This division is amenable to accommodating the proposals for advanced paging and messaging in ET Docket No. 92-100 (See Appendix C).³⁶ By providing for multiple licensees, our proposal also provides an opportunity for competition among the services. We also request comment on permitting aggregation for those providers that may need more than 50 kHz for their systems, and on whether an upper limit per provider should be required.

52. A second alternative to this plan would be to divide the 901-902 MHz and 940-941 MHz frequency bands into four paired blocks of 250 kHz each (500 KHz per pair), and to divide the 930-931 MHz band into four 250 kHz blocks. A third alternative would be to divide the 901-902 MHz and 940-941 MHz frequency bands into two paired blocks of 500 kHz each (1 MHz per pair), and to assign 930-931 MHz as a single 1 MHz block. While this would reduce the number of potentially competing systems, it would provide a greater amount of spectrum to each licensee, and thus possibly increase flexibility of use and reduce cost. We solicit comment on these proposed alternative channeling plans and on any other proposals that commenters may recommend.

PCS Support Spectrum

53. For PCS services operating in a cellular configuration, the PCS cell sites, like cellular cell sites, must be connected to a central switching node. This connecting link is commonly referred to as a "backhaul link" and could be either a wired link, such as a fiber optic cable or cable television plant, or a wireless link (radio). Additionally, there will be requirements for connecting one cell to another. These links that provide support services, if wireless, generally do not use the spectrum allocated to a service, but use different frequencies allocated for fixed microwave. Currently there are a number of fixed microwave bands that can support these requirements.³⁷ However, parties have requested that additional fixed microwave spectrum be allocated to support, inter alia, PCS connection requirements.

54. APC, in its filings accepted as comments in this proceeding, proposes that the 37.0-39.5 GHz band be used to

³⁶Aggregation of spectrum blocks could be accomplished in the marketplace through aftermarket sales or, if authorized, through competitive bidding.

³⁷The fixed microwave bands are 3.7-4.2, 5.925-6.425, 6.525-6.875, 6.875-7.125, 10.7-11.7, 11.7-19.7, 21.2-23.6, 27.5-29.5 and 37.0-40.0 GHz.

connect PCS base stations and that the Commission adopt a channeling plan.³⁸ APC states that the 37.0-38.6 GHz fixed microwave band currently has no licensed use, and that use of this band to support PCS would permit PCS licensees to begin service without overburdening other microwave frequencies. Similarly, the Harris Corporation has requested that we channelize the 27.5-29.5 GHz (28 GHz) band and make it available for private operations in addition to common carrier operations to support both cellular and PCS operations.³⁹ Suite 12 Group opposes the petition, stating that it would harm 28 GHz point-to-multipoint operations such as wireless cable and that unmet demand for short distance microwave links has not been demonstrated. Motorola Microwave also opposes the petition and states that it would hinder the ability of U.S. manufacturers to compete in the international market for PCS equipment, will unnecessarily raise the cost of PCS to the American public, and will make inefficient use of critical spectrum. Instead, Motorola Microwave agrees with APC that the 37-39.5 GHz band is the most appropriate for microcell interconnection and will provide the necessary capability for future growth. Also, Motorola Microwave states that any additional applications that could not be serviced by the 37-39.5 GHz band because of propagation limitations could utilize the existing, uncongested 21.2-23.6 GHz band. TeleSciences, Inc. agrees with Motorola Microwave, and adds that the 38 GHz band provides superior frequency reuse capabilities as compared to the 28 GHz band, which will be valuable in interconnecting the numerous cell sites of a PCS system.

55. We tentatively conclude that adequate spectrum already is allocated for fixed microwave to provide for PCS support services, and therefore decline to propose allocating additional spectrum for this purpose. However, we request comment focused on whether additional spectrum is required, and whether rule changes as requested by APC are needed for more efficient channeling plans in the bands already allocated for fixed microwave.

³⁸See APC's "Petition for Rule Making," filed on May 3, 1991, its "Supplement to Petition for Rule Making," filed May 4, 1992 and its "Further Supplement to Petition for Rule Making," filed May 21, 1992. These filings have been accepted as comments in GEN Docket No. 90-314, see note 7, supra.

³⁹Harris petition filed on April 19, 1991, and placed on public notice on May 15, 1991 (RM-7722). Six parties commented and there were two reply comments.

Licensing Issues

PCS Service Areas

56. 2 GHz Service Areas. In addition to determining the amount of spectrum to be assigned to each PCS licensee, the Commission also must determine the geographic scope of each license area. In creating the cellular telephone service eleven years ago, the Commission decided to license 734 metropolitan and rural service areas. However, the system that exists today has effective operating service areas that are much larger than the initial division would imply. This is for two reasons. First, because one license in each market was set aside for LECs, a de facto system of large, regional licenses (at least for the larger LECs) has emerged. Second, over the past few years, the cellular industry has been consolidating rapidly. A number of large cellular firms each serve substantial portions of the U.S. population (although not necessarily with contiguous service areas).⁴⁰

57. This consolidation seems to have been driven by the greater economies of scale and scope in larger cellular operations. However, high transaction costs have been incurred in achieving these economies. Such transaction costs may have been over \$100 million in 1991 alone, and total transaction costs to consolidate systems ultimately may be over one billion dollars.⁴¹ In addition, the large number of licenses initially assigned seems to have delayed unnecessarily the assignment process for cellular, perhaps by several years.

⁴⁰See generally, "Cellular Network's Big Step," New York Times, October 15, 1991, p. D1.

⁴¹In 1991, 75 MSA licenses were traded, involving cellular franchise areas with a total population of 26.4 million (pops) at an average price of \$189 per pop, and 238 RSA licenses involving 22.2 million pops at an average price of \$61 per pop. Paul Kagan Associates, Cellular Investor, January 21, 1992, p. 4. This implies that total transactions were \$6.3 billion. If, as is typical in this market, brokers worked on a 3% commission, sales commissions alone were \$190 million in 1991. Aggregate transactions costs would be even greater since they also include costs incurred directly by the buyers and sellers, as well as by the FCC. If only half of these transactions were related to consolidating systems, the consolidation costs would still have been about \$100 million in 1991. Since about 10% of the potential pops nationwide (for two systems) traded in 1991, if half of all pops were to trade to achieve greater geographic coverage, total transactions costs would be about one billion dollars.

58. The same economies that are driving cellular toward larger service areas may exist in PCS. Therefore, licensing larger PCS service areas at the outset may minimize unproductive regulatory and transaction costs and associated delay. Large PCS service areas also may facilitate regional and nationwide roaming; allow licensees to tailor their systems to the natural geographic dimensions of PCS markets; reduce the cost of interference coordination between PCS licensees; and simplify the coordination of technical standards.

59. On the other hand, smaller service areas may permit a broader participation by firms of all sizes in the PCS market. Some potential PCS licensees may be interested in serving only their local areas, including smaller communities that are less economic to serve. This approach may minimize certain transaction costs associated with having larger areas, such as subcontracting with other companies to provide service in these smaller cities and communities. Broader participation also may produce a greater diversity and degree of technical and service innovation than would be expected from a few large firms. Diversity may be an important benefit during the initial implementation of PCS when the market is still being defined.

60. Based on the above considerations, we tentatively conclude that PCS service areas should be larger than those initially licensed in cellular, although how much larger is not entirely clear at this time. Therefore, we wish to present for comment a range of service area options:

Option 1: The 487 "Basic Trading Areas" defined in the Rand McNally Commercial Atlas and Marketing Guide; plus Puerto Rico.⁴² This option offers the widest participation by firms with limited resources but provides the least economies of scale and scope.

Option 2: The 47 "Major Trading Areas" defined in the Rand McNally publication referenced above (adding Alaska and Puerto

⁴²Rand McNally 1992 Commercial Atlas & Marketing Guide, 123rd Edition, pp. 36-39. This option would be analogous to other Commission rules in which we have utilized commercially available reference materials such as the Arbitron publication "Television Markets and Rankings Guide." See, e.g., (1) Sec. 73.658K (Note 1) of our Rules in which we utilize the Arbitron publication to identify the "Top 50" television markets for application of our "Prime Time Access Rules," Competition and Responsibility in Network Television Broadcasting, 23 FCC 2d 382 (1970); and (2) Sec. 76.51 of our Rules, in which we also utilize the Arbitron publication for the purpose of designating the "Top 100" television markets for the application of our cable television rules, Cable Television Report and Order, 36 FCC 2d 141 (1972).