

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 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. Discussion. 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

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 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.

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.

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-91 1) 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-91 1) **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 Luce and **SpectraLink**.

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 1850-1 990 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.

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

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:** 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.

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.

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 191 O-1 920 MHz for asynchronous or data devices, and 10 MHz at 1920-1 930 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.

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

³¹⁶ **See** **Second Report and Order** at ¶ 88.

³¹⁷ **See** Apple Petition at 3.

³¹⁸ **See** Apple Petition at 3.

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.

2 12. 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 either prevent activation of equipment or to disable its use upon relocation without prior coordination with **UTAM**.³²⁴

³¹⁹ Section 15.3.11 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 15.3.11 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.

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 Tekcom, 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 Tekcom also opposes AT&T's request, stating that the current rules are adequate to allow products to be developed

³²⁵ **See** AT&T Petition at 2.

³²⁶ **See** AAR Petition at 7; Microsoft Comments at 1; Rohn 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.

and deployed and 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.

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

³³² **See** Northern Telecom Comments at 16.

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**.

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.

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.

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 1920-1 930 MHz band, but provided for up to 5 MHz channels in the 1890-1 900 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 spectmm etiquette.

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

³³⁴ See Sections 15.321, 15.323 of the Commission’s Rules.

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.

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

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 bend until **an** unoccupied window is **located**.³⁴¹ Apple, **Metricom** and **SpectraLink** request that this **requirement** be **deleted**. Apple and **SpectraLink** argue that it in- 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 **±3 dB** accuracy and impose a **±6 dB** tolerance or one-sided 3 **dB** tolerance in measuring the

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.

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

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.

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, 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 transmit&r 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 perfii the search.

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 15.3 19(c)(4) of the Commission's Rules.

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.

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 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 $+10^{\circ}$ C to $+40^{\circ}$ 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

³⁴⁹ See Northern Telecom Petition at 24.

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

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 $+50^{\circ}$ 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.

bandwidth³⁵⁵ 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 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.

235. Rohn 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 T&corn'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.

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.

³⁵⁸ **See** Ericsson Comments at 8.

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

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.

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 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 $+50^{\circ}$ 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.

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 $+50^{\circ}$ C at normal **supply** voltage, and far variation in the primary voltage of ± 15 percent at a temperature of $+20^{\circ}$ C. See e.g., Sections 15.231, 15.233 of the Commission's Rules.

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.

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,

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. 9362, 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.

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 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 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?

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

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.

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

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

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.

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 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 File~~Regulatory Analysis ~~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
William F. Caton
Acting Secretary

Appendix A: Final Rules

I. Part 2 of Chapter I of Title 47 of the Code of Federal Regulations is 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. Subpart B is amended by revising Section 2.106, the Table of Frequency Allocations, as follows:

a. In the 1850-1990 MHz band: delete NG153 **from** column 5; and in column 6 replace PERSONAL COMMUNICATIONS SERVICES (99) with PERSONAL COMMUNICATIONS SERVICES (24). In the 21 **10-21** 50 and **2160-2200** MHz bands: delete US331 from column 5; and in column 6 delete PERSONAL, COMMUNICATIONS SERVICES (99).

International table			United States table		FCC use designators	
Region 1-allocation MHz	Region 2-allocation MHz	Region 3-allocation MHz	Government Allocation MHz	Non-Government Allocation MHz	Rule part(s)	Special-use frequencies
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1710-1930	FIXED. MOBILE 740A. 722 744 745 746 746A					
1930-1970 FIXED. MOBILE. 746A	1930-1970 FIXED. MOBILE. Mobile-Satellite (Earth-to-space). 746A	1930-1970 FIXED. MOBILE. 746A	1850-1990	1850-1990 FIXED. MOBILE. US331	PERSONAL COMMUNICATIONS SERVICES (24). PRIVATE OPERATIONAL-FIXED MICROWAVE (94). RADIO FREQUENCY DEVICES (15).	EMERGING TECHNOLOGIES
1970-1980 FIXED. MOBILE. 746A	1970-1980 FIXED. MOBILE. MOBILE-SATELLITE (Earth-to-space). 746A 746B 746C	1970-1980 FIXED. MOBILE. 746A				
1980-2010	FIXED. MOBILE. MOBILE-SATELLITE (Earth-to-space). 746A 746B 746C		1990-2110	1990-2110 FIXED. MOBILE.	AUXILIARY BROADCAST (74). CABLE TELEVISION (78).	
2010-2025	FIXED. MOBILE. 746A					
2025-2110	FIXED. MOBILE 747A. SPACE RESEARCH (Earth-to-space) (space-to-space). SPACE OPERATION (Earth-to-space) (space-to-space). EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space). 750A		US90 US111 US219 us222	US90 US111 US219 us222 NG23 NG118		

Region 1-allocation MHz (1)	International table			United States table		FCC use designators	
	Region 2-allocation MHz (2)	Region 3-allocation MHz (3)		Government	Non-Government	Rule part(s) (6)	Special-use frequencies (7)
				Allocation MHz (4)	Allocation MHz (5)		
2110-2120	FIXED. MOBILE. SPACE RESEARCH (deep space)(Earth-to-space). 746A			2110-2200	2110-2150 FIXED. MOBILE.	DOMESTIC PUBLIC FIXED (21). PRIVATE OPERATIONAL-FIXED MICROWAVE (94). PUBLIC MOBILE (22).	EMERGING TECHNOLOGIES
2120-2160 FIXED. MOBILE.	2120-2160 FIXED. MOBILE. Mobile-Satellite (space-to-Earth).	2120-2160 FIXED. MOBILE.			US111 US252 NG23 NG153		
746A	746A	746A			2150-2160 FIXED. NG23	MULTIPOINT DISTRIBUTION (21). PRIVATE OPERATIONAL-FIXED MICROWAVE (94).	
2160-2170 FIXED. MOBILE.	2160-2170 FIXED. MOBILE. MOBILE-SATELLITE (space-to-Earth).	2160-2170 FIXED. MOBILE.			2160-2200 FIXED. MOBILE.	DOMESTIC PUBLIC FIXED (21). PRIVATE OPERATIONAL-FIXED MICROWAVE (94). PUBLIC MOBILE (22).	EMERGING TECHNOLOGIES
746A	746A 746B 746C	746A					
2170-2200	FIXED. MOBILE. MOBILE-SATELLITE (space-to-Earth). 746A 746B 746C				US111 US252 US331 NG23 RG153		

• ☒☒☒☒☒☒☒

b. The text of footnote US33 1 in the United States footnotes and footnote NG153 in the Non-Government footnotes is revised to read as follows:

UNITED STATES (US) FOOTNOTES

* * * * *

US33 1 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 211 O-2 150 MHz and 2 160-2200 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.

* * * * *