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

In the Matter of	)	
	)	
Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service ("WCS")	)	GN Docket No. 96-228

MEMORANDUM OPINION AND ORDER

Adopted: March 31, 1997 **Released: April 2, 1997**

By the Commission: Commissioners Quello and Ness issuing separate statements; Commissioner Chong approving in part, dissenting in part, and issuing a statement.

I. INTRODUCTION AND BACKGROUND

1. The Omnibus Consolidated Appropriations Act, 1997 ("Appropriations Act")[1] directed the Commission to "reallocate the use of frequencies at 2305-2320 megahertz and 2345-2360 megahertz to wireless services that are consistent with international agreements concerning spectrum allocations," and to "assign the use of such frequencies by competitive bidding pursuant to Section 309(j) of the Communications Act of 1934."[2] In making these bands of frequencies available for competitive bidding, we were directed to "seek to promote the most efficient use of the spectrum" and to "commence the competitive bidding" for the assignment of these frequencies no later than April 15, 1997.[3]

2. On February 19, 1997, we adopted a *Report and Order* in this proceeding establishing the Wireless Communications Service ("WCS").[4] Specifically, we allocated the 2305-2320 MHz and 2345-2360 MHz bands to the fixed, mobile, and radiolocation services on a primary basis and maintained the primary allocation for the broadcasting-satellite service (sound) in the 2310-

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[1] Omnibus Consolidated Appropriations Act, 1997, P.L. 104-208, 110 Stat. 3009 (1996) ("Appropriations Act").

[2] Appropriations Act, Section 3001(a). *See also* 47 U.S.C. § 309(j).

[3] Appropriations Act, Section 3001(b), (c).

[4] *See Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service ("WCS")*, GN Docket No. 96-228, *Report and Order*, FCC 97-50 (released February 19, 1997), 62 Fed.Reg. 09636 (March 3, 1997) ("*Report and Order*").

2320 MHz and 2345-2360 MHz bands. WCS licensees will be permitted to provide any of these services. We did not adopt any limitations on transmitter power, except to require that the equipment comply with our radiofrequency ("RF") safety program. We also declined to impose any technical restrictions on WCS licensees aimed at protecting the multipoint distribution service and the instructional television fixed service ("MDS/ITFS") reception because, based on the record before us at that time, we were not persuaded that the operation of WCS facilities would irreparably harm the MDS and ITFS services. We also noted that MDS/ITFS block downconverters traditionally have employed an inexpensive design that has minimal frequency selectivity, and observed that the industry appears to be converting to newer, more robustly designed downconverters that would not receive WCS signals. We concluded that it would be improvident to adopt a requirement for WCS licensees to protect MDS/ITFS operations before having a more complete understanding of the nature and extent of problems that may actually arise.

3. Also in the *Report and Order*, in order to protect satellite digital audio radio service ("Satellite DARS" or "DARS") operations in the 2320-2345 MHz band, the Commission adopted stringent out-of-band emission limits[5] that we believed would, at least in the foreseeable future, make mobile operations in WCS spectrum technologically infeasible. Specifically, all emissions into the 2320-2345 MHz band from fixed WCS transmitters must be attenuated below the transmitter output power ("p") by at least 80 + 10 log (p) dB and all emissions from mobile WCS transmitters must be attenuated below p by at least 110 + 10 log (p) dB.

4. On March 10, 1997, the Wireless Cable Association International, Inc. ("WCA") filed an Emergency Motion for Stay and a Petition for Expedited Reconsideration of the *Report and Order*.[6] On March 11, 1997, the PACS Providers Forum and DigiVox Corporation ("PPF/DigiVox") jointly filed a Petition for Expedited Reconsideration of the *Report and Order*.[7] On March 13, 1997, the Wireless Telecommunications Bureau placed the petitions on public notice and established an expedited pleading cycle.[8] By this *Memorandum Opinion and Order*,

[5] Out-of-band emissions are emissions on a frequency or frequencies immediately outside the necessary bandwidth which result from the modulation process, but exclude spurious emissions. *See* 47 C.F.R. § 2.1.

[6] Concurrent with the adoption of this *Memorandum Opinion and Order*, we are denying WCA's Emergency Motion for Stay, ruling that the Appropriations Act does not afford the Commission the authority to defer the commencement date of the WCS auction. *See Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service ("WCS")*, GN Docket No. 96-228, *Order*, FCC 97-111 (released April 1, 1997).

[7] On March 13, 1997, the PACS Providers Forum and DigiVox Corporation filed a corrected version of their Petition.

[8] *See Public Notice* entitled "Expedited Pleading Cycle Established for Oppositions and Replies to Oppositions to Petitions for Reconsideration filed by the Wireless Cable Association International, Inc. and by PACS Providers Forum and DigiVox Corporation," DA 97-548, released March 13, 1997. Oppositions were due on March 21, 1997, and Replies to Oppositions were due on March 25, 1997. Appendix A hereto lists the submissions filed in response to each of the petitions.

we amend certain aspects of our rules governing the WCS in response to these two petitions for reconsideration.

5. Specifically, based on a better understanding of the potential for WCS operations to interfere with MDS/ITFS reception, we are specifying limits on WCS operating power and are requiring that, for a limited time, WCS licensees assume responsibility under certain circumstances for interference they may cause to MDS/ITFS operations. We also are requiring WCS licensees to provide advance notification to nearby MDS/ITFS licensees of certain technical parameters and are encouraging voluntary coordination among affected licensees. Additionally, though reaffirming the original out-of-band emission limits as generally appropriate across the broad range of flexible WCS systems and uses, we are adopting an alternative, less stringent out-of-band emission limit for portable WCS transmitters in the 2305-2315 MHz band (the lower portions of Blocks A and B) that meet specific power, duty cycle[9] and other technical restrictions. We believe that providing WCS applicants and licensees with this additional design choice will facilitate certain potentially beneficial uses of WCS spectrum that may not otherwise be feasible, or would incur unnecessary higher costs, under the general, more stringent out-of-band emission limits. We wish to caution prospective WCS licensees, however, to consider carefully whether their anticipated uses and business plans can be successfully implemented under the additional technical and operational restrictions necessary to qualify for the less stringent out-of-band emission limit. In particular, wide area, full mobility systems and services such as those being provided or anticipated in the cellular and PCS bands are likely to be of questionable feasibility under either the alternative restrictions or the general out-of-band emission limits.

II. DISCUSSION

WCS Interference to MDS/ITFS

6. *Petition.* WCA requests that WCS transmitters be limited to equivalent isotropically radiated power ("EIRP")[10] of 20 watts. WCA argues that its proposed 20 watt EIRP limit will avoid "destructive blanketing interference" to MDS/ITFS operations.[11] WCA states that the Commission's decision not to impose a power limitation on WCS was based on incorrect assumptions. Specifically, WCA argues that interference would occur not because of a lack of

[9] Duty cycle (radio transmitter performance) is a criterion defining the ratio of average to peak power from a transmitter as a function of carrier-on-time versus time available. *See* IEEE Standard Dictionary of Electrical and Electronics Terms (IEEE Std 100-1972) at 175.

[10] EIRP is defined as the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna. *See* 47 C.F.R. § 2.1.

[11] WCA Petition at ii. We will refer to the phenomenon WCA describes as "blanketing" interference as "overload" of the block downconverter.

any frequency selectivity in MDS/ITFS downconverters but because existing downconverters were designed to operate in the current environment and that without power limits on WCS operations, it is impossible for equipment manufacturers to design new equipment to provide adequate protection in a changed environment. WCA also states that the use of digital technology will not enable the wireless cable industry to completely protect against interference from WCS licensees operating at excessive power. Further, according to WCA, many wireless cable systems, particularly those serving more rural communities, are unlikely to convert to digital modulation because the cost associated with digital operations cannot be borne by their limited subscriber base. WCA adds that, for similar reasons, ITFS licensees that operate independently of wireless cable systems have not announced any plans to convert to digital technology and thus should not be expected to replace their installed base of downconverters any time soon. WCA states that no known technology will provide infinite frequency selectivity to ensure that downconverters will not receive signals from WCS transmitters operating with unlimited power. Thus, in WCA's view, the Commission's statement in the *Report and Order* that it will examine WCS interference on a *post hoc* basis does not provide adequate protection for MDS/ITFS licensees. WCA argues that wireless cable subscribers will switch to alternative sources of multichannel video programming if they get interference. Noting that the recent MDS auction raised over $200 million, WCA claims that, if the Commission does not grant the relief requested, the Commission will have engaged in a regulatory taking without just compensation in violation of the Fifth Amendment.

7. In addition, WCA states that, although the installed downconverters have been designed to avoid interference by filtering out signals from currently authorized users of the 2305-2320 MHz and 2345-2360 MHz bands, the installed downconverters may suffer destructive blanketing interference if WCS signals are transmitted at power levels exceeding 20 watts EIRP. Thus, WCA argues that, if it does nothing else, the Commission should in the interim assure protection of existing MDS/ITFS downconverters. Ultimately, WCA urges the Commission to impose a specific power limitation on WCS licensees to allow equipment manufacturers to design, manufacture and market newer downconverters that will be protected against WCS interference. Moreover, since WCS licensees may use WCS spectrum to provide MDS service, WCA argues that a power limit is needed to promote regulatory parity.

8. *Opposition.* Metricom, Inc. ("Metricom") opposes WCA's proposal to limit WCS operations to 20 watts EIRP.[12] Metricom states that the Commission has already considered and rejected the arguments raised in the WCA petition. Specifically, Metricom argues that the Commission expressly considered BellSouth's request (made in *ex parte* filings) to limit WCS operations to 20 watts and declined to adopt such a limitation. Metricom states that WCA has not raised any new arguments for imposing a 20 watt limit and, thus, reconsideration of this issue is not warranted. In addition, Metricom argues that BellSouth's technical showing was filed in late-filed *ex parte* comments and, thus, no potential WCS applicants had an opportunity to respond to the assertions. Metricom believes that any interference problems created by WCS

[12] *See* Metricom, Inc.'s Opposition to Petition for Reconsideration at 1.

operations under the adopted rules will be minimal. Metricom notes that the WCS and MDS/ITFS facilities practically need to be co-located for the alleged interference to occur. Metricom avers that because of the anticipated point-to-point operations that will largely comprise WCS service, antenna sites will need to be carefully engineered and strategically placed at optimum positions. Therefore, Metricom believes that the likelihood of WCS fixed transmitters being located a mere 300 feet away from any particular downconverter, which will generally be located in a residential area, is minimal at best. Metricom argues that the small percentage of downconverters which may be affected certainly does not justify Commission action which affects the entire WCS service. Metricom states that because WCS will operate in a different frequency band than MDS/ITFS, matters of alleged interference should be able to be resolved with technological fixes. Metricom argues that since MDS/ITFS downconverters currently operate with other "high power" operations in the 2.1 to 2.7 GHz band, there is no reason why the downconverters cannot be redesigned to tolerate interference from another out-of-band operation, that is, WCS. Finally, Metricom argues that the Commission must provide adequate power for WCS operations.

9. *Replies.* BellSouth, Pacific Telesis Group, and WCA filed Reply Comments, urging us to establish a 20 watt EIRP limit for WCS operations.[13] BellSouth urges us to adopt a WCS power limitation, above which WCS licensees would, prior to beginning operations, be required to notify nearby MDS/ITFS licensees and negotiate with them a mutually acceptable transmitter siting arrangement.[14] Specifically, BellSouth suggests 20 watts as this WCS power limit and suggests 60 days prior to commencement of WCS operations as the minimum time for notification. BellSouth also urges that the specification of an absolute power limit for WCS operations is necessary as a design prerequisite for the development of MDS/ITFS downconverters that will not be susceptible to signal overloading caused by WCS operations.

10. WCA argues that restricting WCS licensees to 20 watts EIRP absent consent of potentially affected MDS and ITFS licensees would provide WCS licensees with sufficient flexibility.[15] WCA agrees with Metricom that the Commission should provide for enough EIRP to make WCS attractive and viable. WCA observes, however, that no one has presented the Commission with any factual evidence that a 20 watt EIRP limit would adversely impact the development of WCS and that DigiVox -- the only party in this docket that specifically addresses the power level necessary for the successful employment of its technology -- requires far less than 20 watts EIRP.[16] Moreover, WCA states that the adoption of its proposal need not preclude higher power WCS operations in the future should a demand arise, so long as the WCS licensee and affected MDS/ITFS licensees are able to negotiate mutually-acceptable arrangements designed

[13] *See, e.g.*, Reply Comments of Pacific Telesis Group at 1.

[14] *See* Reply of BellSouth Corporation and BellSouth Wireless Cable, Inc. at ii.

[15] *See* Reply of The Wireless Cable Association International, Inc. at ii.

[16] DigiVox's PACS system requires 800 milliwatts ("mW") for base stations and 200 mW for handsets.

to mitigate harmful WCS interference. WCA also states that Metricom's contention that interference from WCS to MDS/ITFS receivers would be minimal is based on a flawed reading of WCA's Petition. WCA states that Metricom bases its analysis upon flawed assumptions regarding the power levels of WCS transmitters, the configuration of WCS networks, and the potential proximity of MDS/ITFS receivers to WCS transmitters. Given the possible WCS system configurations, WCA argues that the possibility of interference is far greater than Metricom surmises. WCA states that the size of the area in which interference to MDS/ITFS reception will occur expands dramatically as WCS power, number of WCS transmitters, and their radio horizon increases.[17] WCA also states that Metricom is wrong in implying that MDS/ITFS receivers are already subject to significant interference from ISM and Amateur operations. Specifically, WCA states that ISM equipment must protect MDS/ITFS reception and, as a practical matter, does not cause interference because ISM equipment generally is designed to contain RF emissions. Likewise, WCA states that amateur operations are obligated to transmit at the lowest possible power, rarely transmit at maximum authorized power, are few and far between, and transmit intermittently in any event.

11. In addition, we have received numerous comments supporting the WCA petition from MDS/ITFS licensees and applicants. These parties, citing WCA's petition, urge the Commission to adopt a 20-watt EIRP limitation on WCS operations in order to prevent blanketing interference to MDS and ITFS facilities. These parties further argue that WCA's proposed power limitation would not substantially hinder WCS development because WCS has yet to be launched and, thus, adoption of the power limit will not adversely impact any existing facilities. In addition, these parties state that the adoption of a power limit at the inauguration of this new service will prevent the later need to overlay on the WCS service a patchwork quilt of technical regulations.

12. *Our Analysis of the Problem.* MDS and ITFS operate in the 2150-2162 and 2500-2690 MHz bands.[18] Nonetheless, MDS/ITFS downconverters have minimal frequency selectivity and, thus, some models are designed to operate throughout the entire 2.1-2.7 GHz band. In the *Report and Order*, we stated that the digital downconverters to which the MDS/ITFS industry are expected to convert over the next several years are expected to be better designed and not subject to overloading from WCS signals.[19] Nonetheless, in order to better understand the interference concerns of the MDS/ITFS industry, staff from the Commission's Office of Engineering and Technology obtained block diagrams from Pacific Monolithics, a manufacturer of MDS/ITFS equipment, for three of their MDS downconverters. All have similar construction and, according

[17] WCA cites EdNet Comments, Exhibit E.

[18] *See* 47 C.F.R. Part 21, Subpart K and Part 74, Subpart I. MDS in the 2596-2644 MHz band is sometimes referred to as the Multichannel Multipoint Distribution Service ("MMDS").

[19] *See generally* BellSouth News Release, "BellSouth Acquires Wireless Cable of Atlanta," released February 12, 1997 (BellSouth expects to "begin providing digital cable TV service to households in the Atlanta area in late 1997").

to Hardin Associates,[20] the downconverter construction for all the major manufacturers is essentially identical. The interference issues raised by the WCA petition relate to the possibility that WCS signals could overload the Low Noise Amplifier ("LNA") input stage of this equipment. This stage is directly fed by the receive antenna and thus has little or no isolation.[21] Between the receive antenna and the LNA, this equipment does not employ any filtering related to the block of frequencies between 2162 MHz and 2500 MHz. Interference protection from the WCS service to the MDS downconverter would have to be provided at this point to prevent signal overload of the LNA. This could be accomplished by trapping out the WCS signal in the 2305-2360 MHz band or by moving the RF diplexer from the output of the LNA to the input of the LNA.[22] The MDS industry is currently designing equipment to protect against interference caused by high input power from PCS operations in the 1850-1990 MHz band,[23] and it seems reasonable that the industry could also design these downconverters to protect against interference from WCS equipment operating with similar high power levels. We estimate that such a filter is likely to cost about $5 to $10 per unit. We believe, however, that filters could not be economically installed in existing units due to the design and construction of these downconverters. A MDS/ITFS subscriber receiving interference would thus have to have the entire unit replaced at a substantially higher unit cost.

13. *Decision.* After careful consideration of this issue, we find that the public interest would be best served by setting limits on WCS operating power. We will therefore restrict WCS fixed, land[24] and radiolocation land stations to 2,000 watts peak EIRP and WCS mobile and radiolocation mobile stations to 20 watts EIRP. Setting maximum power limits on WCS operations will provide MDS/ITFS equipment manufacturers and service providers with the

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[20] T. Lauriston Hardin, P.E., is the Chair of WCA's Engineering Committee and his firm, Hardin Associates, prepared an Engineering Statement in support of the WCA Petition.

[21] Following the LNA is an RF Diplexer which consists of two bandpass filters, one to pass 2150-2162 MHz and one to pass 2500-2686 MHz. This output feeds another RF amplifier, bandpass filter, mixer, and intermediate frequency ("IF") stage. The local oscillator is set to 2278 MHz, which provides a 116-128 MHz output from the 2150-2162 MHz band and a 222-408 MHz output from the 2500-2686 MHz band.

[22] The penalty from either of these solutions is a reduced signal to noise ratio ("S/N") for the downconverter, which translates to a reduced coverage area for the MDS/ITFS service provider. A reduction in S/N ratio of 1 dB to 1.5 dB from insertion of a filter between the antenna and LNA would likely be acceptable performance-wise. However, the filter loss will be related to the design required to provide protection from the maximum WCS permitted power.

[23] We note that MDS/ITFS interference issues have been raised in a petition to deny filed against a number of applications for broadband PCS licensees in the D, E and F blocks. We wish to make clear that our resolution of MDS/ITFS interference issues with respect to WCS is based solely on the totality of the circumstances presented here.

[24] The mobile service is defined as a radiocommunication service between mobile and land stations, or between mobile stations. A land station is a station in the mobile service not intended to be used while in motion. *See* 47 C.F.R. § 27.4. A base station is a land station in the land mobile service. *See* 47 C.F.R. § 2.1.

necessary certainty regarding the potential WCS environment to enable them to design and purchase more robust receiving installations, including better designed downconverters. We do not, however, wish to unnecessarily limit the service offerings that can be provided using WCS spectrum, and therefore do not adopt the 20 watt EIRP power limit suggested by WCA. Instead, as more fully discussed below, we will assign to WCS licensees certain responsibilities to cure actual interference to existing and soon-to-be-installed MDS/ITFS downconverters. With respect to the power limits we are setting, we believe it is unlikely that, in the foreseeable future, any potential WCS operator would consider employing power levels greater than these limits given the considerable economic cost of developing high power transmitters that would comply with the stringent out-of-band emission limits adopted in this proceeding. We also observe that the maximum EIRP of a transmitter station in the MDS and ITFS services with an omnidirectional antenna is limited to 2,000 watts (33 dBW),[25] and that wireless cable service is a potential use for WCS spectrum.[26] In addition, we note that WCA has concluded that 20 watts EIRP will not cause destructive interference to MDS/ITFS reception. Thus, WCS mobile stations, to the extent mobile services are or become technologically feasible, should be able to operate ubiquitously without substantial risk of interference to MDS/ITFS reception.

14. We agree with WCA that MDS/ITFS equipment that was designed to operate in a pre-WCS environment should be afforded some degree of protection from interference. The introduction of possibly a large number of transmitters in WCS spectrum will increase the potential for interference to existing MDS/ITFS receivers that were designed with different expectations about the extent and nature of use of nearby bands. Given sufficient notice and time to adjust to allocation changes in nearby bands, licensees might be expected to mitigate interference costs by voluntarily introducing better, more selective receivers in new installations and in the normal replacement of older receivers. Such a response has not been possible in this instance, however, because of the accelerated rule making and licensing procedures that are required for WCS under the Appropriations Act. Considering these circumstances, and that the WCS auction has not yet occurred, we believe it appropriate and equitable to shift to WCS licensees some of the cost and responsibility for remedying interference to MDS/ITFS operations.

15. Nonetheless, we also believe that the MDS/ITFS industry should be encouraged to employ equipment in the future which will not require undue power restrictions on users of nearby spectrum. To balance these objectives, we are establishing an interference protection rule for MDS/ITFS receivers, based on aspects of the existing FM blanketing rule.[27] Specifically, WCS licensees will bear full financial obligation to remedy interference to MDS/ITFS block

[25] *See* 47 C.F.R. § 21.904. If a MDS station uses a transmitting antenna with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP in dBW in a given direction is determined by the following formula: EIRP = 33 dBW + 10· log (360 ÷ beamwidth), where 10 · log (360 ÷ beamwidth) $\leq$ 6 dB.

[26] We note that broadband PCS base stations are limited to 1640 watts EIRP, and that, as explained below, PACS base stations would operate in WCS spectrum with 800 mW EIRP at a height of 25 feet.

[27] *See* 47 C.F.R. § 73.318.

downconverters if all of the following conditions are met: (1) the complaint of interference is received by the WCS licensee prior to February 20, 2002; (2) the MDS/ITFS downconverter was installed prior to August 20, 1998; (3) the WCS operation transmits at 50 or more watts peak EIRP;[28] (4) the MDS/ITFS downconverter is located within a WCS transmitter's power flux density contour of -34 dBW/m^2;[29] and (5) the MDS/ITFS customer or licensee has informed the WCS licensee of the interference within one year from the initial operation of the WCS transmitter or within one year from any subsequent power increase at the WCS station. If the WCS licensee cannot otherwise promptly eliminate interference caused to MDS/ITFS reception, then that licensee would be required to cease operations from the offending WCS facility. In addition to this blanketing-type rule, we will require WCS licensees, at least 30 days before commencing operations from any new WCS transmission site or with increased power from any existing WCS transmission site, to notify all MDS/ITFS licensees in or through whose licensed service areas they intend to operate of the technical parameters of the WCS transmission facility. We emphasize, however, that WCS licensees have no obligation to remedy interference unless all of the conditions are met. If the WCS licensees and the MDS and ITFS licensees coordinate voluntarily, we believe that WCS fixed and land stations can generally be located in a manner to avoid causing interference to MDS/ITFS receivers. We expect the WCS and MDS/ITFS licensees to coordinate voluntarily and in good faith to avoid interference problems and to allow the greatest operational flexibility in each other's operations.

16. We believe that the above approach appropriately apportions the burdens and incentives between the WCS and MDS/ITFS licensees. WCS licensees will have an incentive to coordinate voluntarily with the MDS/ITFS industry in order to prevent interference problems from occurring, and the 30-day notification requirement will afford MDS/ITFS licensees an opportunity to alert their subscribers to the potential for interference and explain what to do in the event it occurs. In turn, MDS/ITFS licensees will have an incentive to develop and use better technology for new receiving installations. The MDS/ITFS industry will have 18 months from the release date of the *Report and Order* in this proceeding to deplete inventories of existing equipment and to design more robust replacement equipment, and WCS licensees will be obligated for five years to remedy actual interference. Beyond that time, it is reasonable to expect the MDS/ITFS industry to bear full financial responsibility for any necessary equipment replacement costs. Further, we believe that basing MDS/ITFS protection on a power flux density contour rather than a restrictive power limitation serves the public interest. This approach will provide WCS licensees with greater flexibility to design and implement new wireless services. WCS licensees operating at power levels higher than 50 watts will have a larger zone within

[28] The 50 watts EIRP allowance provides a 2 dB margin of protection against overload of the frequency converter.

[29] We calculated the power density, F, contour by the following method: Assume, per WCA's Petition, a 24 dBi antenna (numeric of which is 251.2 = G_r) and that the maximum allowable input to the MDS/ITFS downconverter, P_r, is -12 dBm. Then $P_r = F\lambda^2 G_r \div (4\pi)$, where wavelength, λ, = c ÷ f. F = -37 dBW/m^2. However, in a matched system, only half of the average antenna power is delivered to the load (downconverter). Therefore, the power density contour is increased by 3 dB, which is -34 dBW/m^2.

which they will be obligated to remedy interference to MDS/ITFS downconverters, but they will be able to make that choice given the particular characteristics of the market in which they will operate. From our experience in addressing technically analogous issues of blanketing interference caused by FM broadcast transmitters, we believe that the "technological fixes" contemplated by the blanketing-type rule coupled with the 30-day notification requirement will adequately protect MDS/ITFS operations and yet allow WCS substantially greater operational flexibility than would be possible under the power limit approach suggested by the petitioner. We therefore conclude that the approach we adopt here to address concerns about WCS signal overloading of MDS/ITFS downconverters will best serve the overall public interest.

WCS Out-of-Band Emission Limits

17. *Petition.* In their joint Petition, PPF and DigiVox[30] request that we reconsider the WCS out-of-band emission limits with respect to the dedicated Satellite DARS band, 2320-2345 MHz.[31] PPF/DigiVox argues that the adopted out-of-band emission limits are much

[30] DigiVox desires to be a WCS licensee and, if successful at the WCS auction, would employ its licensed spectrum for the provision of low power service by means of Personal Access Communications System ("PACS") technology. The PACS system is a well defined technology for operations in the broadband PCS spectrum that is nearing final adoption in the standards setting process. *See* Telecommunications Industry Association's Standards Proposal No. 3418, Proposed New Standard "Personal Access Communications System Air Interface Standard" (if approved, to be published as J-STD-014), dated February 13, 1995. According to the PACS Standards Proposal, PACS architecture consists of fixed or portable subscriber units communicating through radio ports ("base stations") that, typically, have wireline access via a radio port control unit and an access manager to the public switched telephone network. PACS uses separate channels for base station transmit and subscriber unit transmit, that is, the duplexing technique used in PACS is frequency division duplexing ("FDD"). PACS channels are 300 kHz wide, subscriber units transmit in the lower band, and base stations transmit in the upper frequency band. The base stations transmit continuously using Time Division Multiplexing ("TDM"), which is a multiplexing technique whereby two or more channels are derived from a transmission medium by dividing access to the medium into sequential intervals. Each transmitter uses one 300 kHz channel to send several bit streams of information. The maximum allowable transmitter output power as measured at the base station antenna connection is 800 mW, but, over time and with temperature variations, power is allowed to vary $\pm$ 20%, that is, the base station power could go as high as 960 mW. The subscriber unit transmits in bursts (Time Division Multiple Access ("TDMA")) with a burst power level determined by the adaptive power control process. (TDMA is a multiple access technique whereby users share a transmission medium by being assigned and using (one-at-a-time) for a limited number of time division multiplexed channels; several transmitters thus could use one channel for sending several bit streams.) The subscriber unit adjusts its output power in steps of 1 dB in response to the power control signal received from the base station. The total adjustment range is required to be at least 30 dB. If the subscriber unit's power control does not function properly, the subscriber unit defaults to its highest transmit power level. When the subscriber unit is off, the emissions of the subscriber unit must not exceed 80 nanowatts when measured in a 300 kHz band. The maximum allowable burst transmitter output power as measured at the subscriber unit's antenna connection is 200 mW, but, over time and with temperature variations, this power is allowed to vary as much as $\pm$ 20%, that is, the subscriber unit's power could go as high as 240 mW.

[31] In the *Report and Order*, we required that all emissions into the 2320-2345 MHz band from fixed WCS transmitters be attenuated below the transmitter output power ("p") by at least 80 + 10 log (p) dB and all such emissions from mobile WCS transmitters be attenuated below p by at least 110 + 10 log (p) dB.

more restrictive than necessary to protect Satellite DARS reception, and would effectively preclude any use of the WCS spectrum for portable communications. PPF/DigiVox argues that it is possible to protect Satellite DARS reception while allowing for the use of specific segments of the WCS bands for portable services by adopting the allocations and operating parameters discussed below. Specifically, PPF/DigiVox recommends that the 2305-2310 MHz band (Band A) and the 2310-2315 MHz (Band B) be designated for subscriber portable unit transmit and that the 2350-2355 MHz band (Band A) and the 2355-2360 MHz band (Band B) be designated for base station transmit. For systems that conform to specific parameters, PPF/DigiVox proposes that the power of emissions into the 2320-2345 MHz band from portable units transmitting in the 2305-2315 MHz band be limited to 81 + 10 log (p) dB and that the power of emissions into the 2320-2345 MHz band from base stations transmitting in the 2350-2360 MHz band be limited to 75 + 10 log (p) dB. PPF/DigiVox then provides the following technical parameters, which it avers will afford Satellite DARS reception with adequate protection:

Additional Technical Parameters	
Handset Duty Cycle	12.5% duty cycle: 312.5 microsecond pulses every 2.5 milliseconds
Subscriber unit transmit power	200 milliwatts ("mW")
Base station transmit power	800 mW at a height of 25 feet. For base stations mounted higher, it will be possible to raise the power in accordance with the additional path loss afforded by the greater distance
Polarization	Linear

PPF/DigiVox states that portable services are specifically distinguished from mobile services in that portable handset antennas are by definition not mounted on vehicles. Rather, the handset and its transmitting antenna will be operated within 20 cm of the subscriber's head. PPF/DigiVox argues that, under its proposed out-of-band emission limits, an operating WCS handset would have to come within twelve feet of an operating Satellite DARS antenna for there to be any interference to Satellite DARS reception. PPF/DigiVox states that, given the real-world practicalities of the operations of the two systems, it is highly improbable that they will come into such close contact. PPF/DigiVox argues that even in the case of urban areas in the eastern United States, the interfering contact would on average last no more than one second for every 200 minutes of listening. Additional assumptions upon which PPF/DigiVox relies to justify its proposed alternative WCS out-of-band emission limits include a 5 dB loss due to proximity of

the portable unit to the user's head, a 9 dB reduction claimed to result from the handset duty cycle of 12.5%, and a variety of other complex, technical factors.[32]

18. *Oppositions.* All four Satellite DARS applicants oppose the PPF/DigiVox Petition.[33] The Satellite DARS applicants challenge PPF/DigiVox's analysis and contend that unreasonable interference with DARS reception would result even under WCS operations that meet the petitioner's suggested technical restrictions. For example, Digital Satellite Broadcasting Corporation ("DSBC") and Primosphere Limited Partnership ("Primosphere") state that duty cycle related benefits accrue only to systems employing pulsed transmissions. Further, DSBC states that the interference caused by portable unit pulsed transmissions cannot be mitigated by averaging techniques, because the pulses cause repetitive spikes of interference at the peak level that will be quite harmful to perceived audio quality.[34]

19. American Mobile Radio Corporation ("AMRC"), DSBC and Primosphere state that use of duty cycle/pulsed based transmissions may still cause harmful effects. Specifically, AMRC states that reliance on a portable handset transmit duty cycle of 12.5% to reduce the effect of interference by 9 dB is not appropriate because whenever interference from portable unit emissions at a given level causes severe interference, a Satellite DARS receiver will suffer the loss of 12.5% of its received information rate.[35] AMRC avers that reliance on duty cycle to reduce the effective interference is appropriate only where the interference results overall from the composite effects of a large number of transceivers operating with a random distribution of transmit start times. In the instant case, however, AMRC states that it is necessary to analyze the effect of a single PACS transmitter, and no credit for interference reduction may be obtained from consideration of the duty cycle.

20. DSBC observes that HNS assumes an average 5 dB loss due to signal blockage by the user's head. DSBC argues, however, that there is no basis for assuming that a WCS subscriber's head will always be located between the WCS portable handset transmit antenna and the DARS receive antenna.[36] To the contrary, DSBC believes that this situation would arise only about 50% of the time. Likewise, AMRC asserts that the attenuation of WCS transmitted signals resulting from energy absorption by the human head will vary widely, and can be zero over a

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[32] *See* PPF/DigiVox Petition at pp. 11-13 and Exhibit A.

[33] In addition, 21st Century Telesis, Inc., a Block C Broadband PCS licensee intending to deploy PACS technology, filed reply comments urging the denial of the PPF/DigiVox Petition.

[34] DSBC Opposition at 4.

[35] AMRC Opposition, Technical Statement at 1. Hughes Network Systems ("HNS") averaged power as follows: when the handset is on, it is permitted to transmit only one-eight of the time, that is, 312.5 microseconds every 2.5 milliseconds. Since power is halved every 3 dB, Hughes concludes that duty cycle will reduce PACS interference potential by 9 dB.

[36] DSBC Opposition at 4.

range of directions around the side of the head where the transceiver is held.[37] AMRC adds that since a single WCS portable transmitter can cause interference, no analytical benefit is obtained from averaging the emissions from a number of such units over a statistical distribution of orientations. Accordingly, AMRC posits that 0 dB head loss should be assumed in the interference analysis. Primosphere adds that the interference situation is even worse. It states that recent testing demonstrates that the human head not only absorbs energy at these frequencies but also acts as a reflector. Specifically, Primosphere states that though the signal strength in the direction through the head is reduced by 2 to 5 dB, it is increased in the direction away from the head by 1 to 2 dB. Primosphere concludes that "head effects" may cause increased WCS interference to Satellite DARS dependent upon the WCS subscriber's geographic orientation relative to a Satellite DARS receive antenna and, therefore, should be considered in the link budget.

21. In addition, the Satellite DARS applicants disagree with other assumptions of the petitioner. For example, AMRC states that the polarization loss assumed by the petitioner is optimistic.[38] AMRC observes that while 3 dB of isolation between linear and circular polarizations can be obtained in the main beam of the antenna, the HNS analysis presented is for a side lobe. AMRC states that in an antenna side lobe, polarization isolation is much less than in the main beam, and should not be counted on. AMRC argues that HNS underestimates interference from PACS base station transmitters as well as portables. AMRC states that while isolation from base antenna directivity may be 20 dB directly below the antenna, HNS has not demonstrated that the worst case location for interference is directly below the antenna. AMRC notes that the radiation pattern from a dipole antenna is quite broad. At 60° away from the minimum, AMRC states that the radiation pattern is near its maximum, while separation distance has increased only from the assumed 24 feet to 48 feet. Thus, AMRC concludes that doubling the separation increases path loss by 6 dB, but also decreases the antenna directivity by 20 dB, resulting in a net increase in interference of 14 dB.

22. AMRC, Primosphere, DSBC, argue that the supposed improbability of close proximity of WCS and DARS receivers should be discounted.[39] Finally, Satellite CD Radio, Inc. ("CD Radio") argues that requests to operate under less stringent emission limits should only be considered, after the close of the WCS auction, as requests for waiver of the rules.

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[37] AMRC Opposition, Technical Statement at 1.

[38] AMRC Opposition, Technical Statement at 1-2.

[39] In particular, AMRC states that many of the parameters in Dr. Harstad's (PPF/DigiVox's consultant's) analysis cannot be known with any precision, and assumptions or approximations must be made. AMRC Opposition, Technical Statement at 2. AMRC states that one assumption appears to be that Satellite DARS equipped vehicles would be within interference range of PACS users only briefly while passing them. AMRC believes that this assumption is unreasonable since vehicles can remain side-by-side for relatively long periods of time, even in moderate traffic. AMRC also states that Dr. Harstad assumes that 12 feet is sufficient isolation to prevent interference to Satellite DARS without justifying that assumption.

23. *Reply.* PPF/DigiVox states that its proposed out-of-band emission limits coupled with its proposed technical criteria will cause no greater interference to Satellite DARS operations than the generally applicable out-of-band emission limits. PPF/DigiVox argues that PACS is an important, LEC-competitive service and that the narrow exception requested would enable PACS to be provided in the WCS bands. PPF/DigiVox states that the general out-of-band emission limits were set at what it describes as "a draconian level" because other technical rules are so liberal. For example, while the WCS rules permit unlimited power, PPF/DigiVox states that its proposal is limited to operations with a subscriber unit peak power of 200 mW. PPF/DigiVox argues that the low power, 12.5% duty cycle for the portable units, a requirement that portable units employ TDMA technology, and other limitations mean that the effect of a PACS handset on a DARS receiver is less than that produced by a single overhanging tree. PPF/DigiVox states that it is critical to note that the technical objections raised by the DARS applicants are general in nature, and do not address the specific features of their own service proposals. The suggestion that any relaxation of the rule must be done through waiver at some unspecified later date, according to PPF/DigiVox, is simply a ruse to postpone the final determination of this issue until after the WCS auction and thereby preclude additional services from operating in the WCS spectrum. PPF/DigiVox argues that it is appropriate to average the power when using a duty cycle for a system that uses TDMA-based portable units; that 5 dB is the generally recognized standard for signal loss attributable to the human head, taking into account the variability of direction; that 3 dB is in fact the correct isolation factor between circular and linear polarized antennas; that the error correction and interleaving techniques used by all DARS applicants to mitigate highway and foliage obstructions will also be sufficient to mitigate the expected interference from WCS portable units; and that the 5 MHz separation is sufficient to protect DARS without the need for specific roll-off requirements. PPF/DigiVox also states that, although the low noise floor for DARS systems may rest on insupportable assumptions, a conservative assumption would give a 2 dB rise in the DARS noise floor. PPF/DigiVox concludes that a WCS portable unit will create a rise of only 6 dB in the DARS floor over a 12 foot radius -- which, it believes, the DARS systems should be able to accommodate. Beyond 12 feet, the amount of interference would be so drastically reduced as to be of no concern to DARS reception.

24. *Decision.* We have dedicated considerable staff engineering expertise and resources to evaluate the proposal set forth by PPF/DigiVox and find that it is appropriate to adjust the WCS out-of-band limits for systems that comply with certain parameters. Accordingly, we will permit WCS systems that operate in accordance with the specific parameters set forth below to reduce their portable unit emissions into the 2320-2345 MHz band by a factor not less than 93 + 10 log (p) dB, where p is the transmitter power in watts.[40] While this is considerably more permissive than the limit for WCS mobile operations that we adopted in the *Report and Order*, we believe that the specific operating parameters set forth by PPF/DigiVox will limit the potential for such a system to interfere with DARS to a reasonable level generally equivalent to that provided by the stricter limits for more general WCS operations.

[40] We are maintaining the out-of-band emission limit of 80 + 10 log (p) dB for base stations.

25. In authorizing DARS, it was our desire to ensure a high quality radio service. However, a desire for an interference-free radio service must be balanced with the need to provide reasonable operating parameters for adjacent services. Accordingly, our intention in determining out-of-band emission limits for WCS into the spectrum used by DARS has been to limit the potential for interference to a reasonable level -- not to provide a pure, interference-free environment. In determining the out-of-band emission limits adopted in the *Report and Order* we had to take into consideration the wide flexibility that we are providing WCS licensees to provide any services consistent with the Table of Frequency Allocations. Because we are unable to determine the specific operating parameters of a WCS service until the service is actually implemented, we found it appropriate to adopt limits that take into account any possible system configuration. Such limits are necessary to ensure the viability of Satellite DARS, which will operate with very low signal levels at the receive antennas, in a frequency band adjacent to a terrestrial service that will likely employ much higher powers and whose transmitters may be in the immediate vicinity of a DARS receiver. Accordingly, we affirm our decision generally to require WCS operations to reduce their emissions in the 2320-2345 MHz band by not less than 80 + 10 log (p) dB for fixed, land, and radiolocation land station transmissions and 110 + 10 log (p) dB for mobile and radiolocation mobile station transmissions, where p is the transmitter power in watts.[41]

26. We recognize, however, that it is possible to provide a reasonable level of protection to DARS by taking into account a specific WCS system, although it may exceed the out-of-band emission limits adopted in the *Report and Order*. A specific system configuration may have certain attributes that were not taken into account when developing the general emission limits but which reduce its potential to interfere with DARS. For instance, a system may have reduced gain in the direction of Satellite DARS receiver, or the probability of the transmitters of a certain type of WCS system being close enough to interfere with Satellite DARS systems may be very low. PPF/DigiVox has provided a specific set of operating parameters that we can take into account in our analysis of potential interference to DARS. By taking these specific parameters into account, we believe that is possible for a system to operate with less stringent out-of-band limits than those originally adopted.

27. The system described by PPF/DigiVox is a low power, low mobility portable system that will provide voice and data service from fixed and portable units. No vehicle mounted units would be permitted. In reaching our decision to reduce the out-of-band limits for WCS systems that operate in a manner consistent with that described by PPF/DigiVox, we take into account both the technical and operational factors specific to the interaction of this specific system and a DARS system. One of the greatest difficulties in performing this type of analysis, however, is the fact that neither system has yet been deployed. Accordingly, our analysis must take into consideration what we believe to be realistic assumptions about system equipment and operations.

[41] We are, however, clarifying that the out-of-band emission limits specified in the *Report and Order* for "fixed operations" pertain to transmissions from fixed, land, and radiolocation land stations and that the emission limits specified for "mobile operations" pertain to transmissions from mobile and radiolocation mobile stations.

While we based our analysis on the record of the proceeding, we recognize that there is some uncertainty inherent in trying to evaluate two systems that have not yet been deployed and for which equipment designs are not yet final. We also recognize that the 2320-2345 MHz frequency band is the only spectrum specifically available for provision of Satellite DARS in the United States. Accordingly, if Satellite DARS in this spectrum is subject to excessive interference, the service will not be successful and the American public will not benefit from the service. In contrast, PACS can be provided in other spectrum currently available for use by services including cellular and PCS. Thus, should the potential for WCS operations to interfere with DARS prove to be greater when the systems are implemented than our analysis indicates, we would of course revisit this issue and make appropriate adjustments.[42]

28. PPF/DigiVox questions some of the technical parameters of the DARS system. One area of contention is the Satellite DARS receiver noise temperature used in the analysis. Primosphere used a 200 Kelvin noise temperature in its analysis, which is greater than the 120 Kelvin noise temperature proposed in its application. PPF/DigiVox contends that 370 Kelvins is more realistic. Based on the type of antenna proposed for DARS use and the need for cost effective equipment, we believe that a receiver noise temperature of 250 Kelvins is realistic and that is what our calculations are based upon.[43]

29. PPF/DigiVox contends that a rise in noise floor from a single interferer of 2 dB should be allowed, rather than the 0.2 dB rise considered by Primosphere. Considering the limited power that the satellite systems will be able to operate with and the potential for a DARS receiver to be affected by more than one interfering source, whether it is another WCS transmitter, out-of-band emissions from another source, or signal blockage, we believe that a 2 dB allowable rise is too great a contribution from a single source. We also, however, believe that a 0.2 dB allowable rise is overly conservative. Accordingly, we have based our calculations on a 1.0 dB allowable rise, which corresponds to a 25% rise in receiver noise. These values are consistent with those used in determining the out-of-band limits adopted in the *Report and Order*.

30. In determining the potential for interference from its portable units, PPF/DigiVox takes into account a number of factors. These include the duty cycle of the WCS handset, the antenna pattern of a Satellite DARS antenna, isolation due to differences in polarization between DARS and WCS, and losses due to the proximity of a WCS portable unit to the head of the user. Users of portable units for the system described by PPF/DigiVox will generally be to the side and, in many instances, slightly below the roof of an automobile. We therefore agree with PPF/DigiVox that the antenna pattern can be taken into account in performing an interference

[42] Specifically, parties should note that per 47 C.F.R. § 27.53(c), when emissions outside of the authorized bandwidth cause harmful interference, we may, at our discretion, require greater attenuation than that specified in the Rules.

[43] We note that, in an *ex parte* filing, TRW Inc. states that "200 deg-K for an S-band vehicular radio is a bit optimistic, but that a temperature of 250 deg-K would be readily achievable." *See Ex parte* Comments of TRW Inc., filed on March 28, 1997, at 5 and Erratum to Comments of TRW Inc., filed on March 31, 1997, at 1.

analysis. While antenna patterns can vary greatly, thereby affecting the strength of the undesired signal into the DARS receiver, we believe that the values proposed by DigiVox are reasonable.[44] We also agree that the isolation realized between the circularly polarized DARS signal and the linearly polarized WCS operations can be taken into consideration. We disagree, however, with the contention that the out-of-band limits should be reduced by 9 dB due to the duty cycle of the WCS handset. Because the symbol time used by DARS is shorter than the WCS burst of 312 microsecond, the DARS data will be disrupted by the WCS operations. While it may be possible for the DARS operators to employ error correction techniques that take into account the limited duty cycle of the WCS operations, any reduction in interference potential does not correlate directly to the reduction in power claimed by PPF/DigiVox. We do believe, however, that DARS operators will be able to use the duty cycle to their advantage and are therefore requiring WCS operations to employ a 12.5% duty cycle in order to qualify for the reduced out-of-band emission limits. Finally, we do not agree that any isolation can be assumed for energy absorbed by the human head. As Primosphere points out (pg. 7), the subscriber's head often will not be positioned between the WCS transmitter and the Satellite DARS receiver and, in some positions, may add to, rather than subtract from, undesired radiation. No statistical information was provided as to the probability of head loss occurring, or of its magnitude at those times. Due to the mobility of the hand-held units, it is highly unlikely that head loss is always present.

31. In its analysis, PPF/DigiVox assumes a separation of 12 feet between the WCS user and the DARS receiver. We have reviewed the statistical analysis provided in support of this assumption and, while we do not necessarily agree with all aspects of the analysis, 12 feet is a reasonable distance to assume in evaluating the potential interaction of DARS listeners and users of portable WCS operations as described by PPF/DigiVox. While we believe that there will be interference to the DARS service from these WCS operations, we believe that actual instances of interference will be sufficiently limited as to not unduly jeopardize the commercial viability of DARS. Based on this analysis, we find it reasonable to allow portable WCS units that meet the criteria described in paragraph 16 to reduce their emission into the 2320-2345 MHz band by only 93 + 10 log (p) dB.

32. PPF/DigiVox has also requested that we relax the out-of-band limits for base stations used in the type of system they describe. PPF/DigiVox bases its argument on the relative gain of the WCS antenna with respect to the position of the DARS receiver. As pointed out by Primosphere, depending on the exact antenna employed by the WCS station, the greatest potential for interference is not directly under the antenna as claimed by PPF/DigiVox. Although the path loss does increase as the DARS receiver moves away from the WCS base station, the gain of the

[44] In a March 28, 1997, *ex parte* filing, Primosphere states that it will use a trunk mounted whip antenna which will place the interfering signal in the main lobe of its antenna. Primosphere contends that DigiVox should have taken this into consideration when it did its calculations. We note, however, that the application filed by Primosphere specifically states that it intends to use a flat antenna design. We reiterate that one of the primary difficulties in performing this evaluation is the number of unknowns due to changing designs of systems that are not yet deployed. Our analysis must, therefore, necessarily depend on what we believe to be reasonable assumptions. We also anticipate that our decision here will affect how DARS licensees design and deploy their systems.

WCS antenna will also increase. It is not possible to determine the precise relationship between these two factors without knowing the gain pattern for the specific antenna to be employed. In addition, if we made such an adjustment, we would have to require that any WCS licensee operating under the reduced emission limits use an antenna meeting those characteristics. We also note that in its evaluation, PPF/DigiVox considered a separation of 24 feet between its base station and a DARS receiver directly underneath. The system described by PPF/DigiVox may employ antennas mounted as low as 25 feet. If a DARS antenna is mounted on the roof of a vehicle it will be closer than 24 feet to the WCS antenna, resulting in reduced path loss. Accordingly, fixed WCS stations will continue to be required to reduce their emissions into the 2320-2345 MHz band by 80 + 10 log (p) dB.

33. For the reasons discussed above, we are permitting WCS Block A and B licensees to employ portable devices[45] that transmit in the 2305-2315 MHz band only to attenuate all emissions into the 2320-2345 MHz band by a factor of not less than 93 + 10 log (p) dB and to employ base stations that transmit in the 2350-2360 MHz band only to attenuate all emissions into the 2320-2345 MHz band by a factor of not less than 80 + 10 log (p) dB. These less stringent out-of-band emission limits may be used only if the average portable transmit power is limited to 25 mW, the peak portable transmit power is limited to 200 mW, the portable devices employ means to limit the power to the minimum necessary for successful communications, the portable devices have a duty cycle of 12.5% or less, and the portable devices use time division multiple access ("TDMA") technology. In addition, we prohibit the installation of vehicle-mounted units, require that transmitting antennas employ linear polarization or another polarization that provides equivalent or better discrimination with respect to a Satellite DARS antenna, require that the average base station transmit output power be limited to 800 mW, and require that base station antennas be located at a height of at least 8 meters (26.25 feet) above ground.

III. ORDERING CLAUSE & EFFECTIVE DATE

34. Accordingly, IT IS ORDERED, That Part 27 of the Commission's Rules IS AMENDED, as set forth in Appendix B, and that, in accordance with the Omnibus Consolidated Appropriations Act, 1997, P.L. 104-208, 110 Stat. 3009 (1996), these Rules shall be effective immediately upon publication in the Federal Register. This action is taken pursuant to Sections 4(i), 7(a), 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), 303(c), 303(f), 303(g), and 303(r) and the Omnibus

[45] For the purposes of this decision, portable devices are defined as transmitters designed to be used within 20 centimeters of the body of the user.

Consolidated Appropriations Act, 1997, P.L. 104-208, 110 Stat. 3009 (1996). 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: Parties and Submissions

Wireless Cable Association Petition

Comments in Support of Petition

1. Alliance for Higher Education, Arizona State Board of Regents for Benefit of the University of Arizona, Board of Regents of the University of Wisconsin System, Board of Trustees of Governors State University, California State University, Calnet, Catholic Television Network of the San Francisco Bay Area, Daytona Beach Community College District, Hawkeye Community College, INTELCOM Intelligent Telecommunications, KCTS Television, Lane Community College, Linn-Benton Community College, Network for Instructional TV, New Orleans Educational Telecommunications Consortium, Northeastern Educational Television of Ohio, Inc., the Ohio State University, Oregon State System of Higher Education, Oregon State University, Pasadena Unified School District, Portland State University, Regents of the University of California, Regents of the University of Minnesota, San Diego County Superintendent of Schools, San Diego State University, San Jose State University, Santa Ana Unified School District, Santa Clara County Office of Education, South Carolina Educational Television Commission, Southern Oregon State College, St. Bernard Parish Schools, St. Louis Community College District, St. Louis Regional Educational and Public Television Commission, State of Wisconsin--Educational Communications Board, University of Maine System, University of Oregon, University of Wyoming, University System of the Ana G. Mendez Educational Foundation, and Western Oregon State College
2. Archdiocese of Los Angeles Education and Welfare Corporation, the Diocese of Orange Education and Welfare Corporation, Caritas Telecommunications, Inc., and Genesee Intermediate School District
3. Asheville Christian Academy
4. Asheville-Buncombe Technical Community College
5. Blue Ridge Community College
6. Brunswick Community College
7. CAI Wireless Systems, Inc.
8. Cape Fear Community College
9. College of the Albemarle
10. Edgecombe Community College
11. Fayetteville Technical Community College
12. Forsyth Community College
13. Gaston College
14. George Mason University
15. James Sprunt Community College
16. Lenoir Community College
17. Meredith College
18. Mississippi EdNet Institute, Inc.
19. Mitchell Community College
20. Nash Community College

21. Pamlico Community College
22. Queens College
23. Randolph Community College
24. Roanoke Bible College
25. Roanoke Rapids Graded School District
26. Sampson Community College
27. Sandhills Community College
28. University of North Carolina
29. Wilson Technical Community College

Opposition

1. Metricom, Inc.

Replies

1. Pacific Telesis Group
2. Bellsouth Corporation and BellSouth Wireless Cable, Inc.
3. Wireless Cable Association International, Inc.

PACS Providers Forum/DigiVox Corporation Petition

Oppositions

1. American Mobile Radio Corporation
2. Digital Satellite Broadcasting Corporation
3. Primosphere Limited Partnership
4. Satellite CD Radio, Inc.

Replies

1. 21st Century Telesis, Inc.
2. American Mobile Radio Corporation, Digital Satellite Broadcasting Corporation, Primosphere Limited Partnership and Satellite CD Radio, Inc.

Appendix B: Final Rules

Part 27 of title 47 of the Code of Federal Regulations is amended as follows:

PART 27 -- WIRELESS COMMUNICATIONS SERVICE

1. The authority citation continues to read as follows:

AUTHORITY: 47 U.S.C. sections, 154, 301, 302, 303, 307, 309, and 332.

2. **§ 27.4 Terms and definitions.**

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Base Station. A land station in the land mobile service.

* * * * *

Portable Device. Transmitters designed to be used within 20 centimeters of the body of the user.

* * * * *

Radiolocation Land Station. A station in the radiolocation service not intended to be used while in motion.

Radiolocation Mobile Station. A station in the radiolocation service intended to be used while in motion or during halts at unspecified points.

* * * * *

Time Division Multiple Access (TDMA). A multiple access technique whereby users share a transmission medium by being assigned and using (one-at-a-time) for a limited number of time division multiplexed channels; implies that several transmitters use one channel for sending several bit streams.

Time Division Multiplexing (TDM). A multiplexing technique whereby two or more channels are derived from a transmission medium by dividing access to the medium into sequential intervals. Each channel has access to the entire bandwidth of the medium during its interval. This implies that one transmitter uses one channel to send several bit streams of information.

* * * * *

3. Section 27.50 is added to read as follows:

§ 27.50 Power limits.

(a) Fixed, land, and radiolocation land stations transmitting in the 2305-2320 MHz and 2345-2360 MHz bands are limited to 2000 watts peak equivalent isotropically radiated power (EIRP).

(b) Mobile and radiolocation mobile stations transmitting in the 2305-2320 MHz and 2345-2360 MHz bands are limited to 20 watts EIRP peak power.

(c) Peak transmit power shall be measured over any interval of continuous transmission using instrumentation calibrated in terms of rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

4. Section 27.53 is revised to read as follows:

§ 27.53 Emission limits.

(a) The power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (p) within the licensed band(s) of operation, measured in watts, by the following amounts:

(1) For fixed, land, and radiolocation land stations: By a factor not less than 80 + 10 log (p) dB on all frequencies between 2320 and 2345 MHz.

(2) For mobile and radiolocation mobile stations: By a factor not less than 110 + 10 log (p) dB on all frequencies between 2320 and 2345 MHz.

(3) For fixed, land, mobile, radiolocation land and radiolocation mobile stations: By a factor not less than 70 + 10 log (p) dB on all frequencies below 2300 MHz and on all frequencies above 2370 MHz; and not less than 43 + 10 log (p) dB on all frequencies between 2300 and 2320 MHz and on all frequencies between 2345 and 2370 MHz that are outside the licensed bands of operation.

(4) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or less, but at least one percent of the emission bandwidth of the fundamental emission of the transmitter, provided the measured energy is integrated over a 1 MHz bandwidth.

(5) In complying with the requirements in § 27.53(a)(1) and § 27.53(a)(2), WCS equipment that uses opposite sense circular polarization from that used by Satellite DARS systems in the 2320-2345 MHz band shall be permitted an allowance of 10 dB.

(6) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the edges, both upper and lower, of the licensee's bands of operation as the design permits.

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

(8) Waiver requests of any of the above out-of-band emission limits shall be entertained only if interference protection equivalent to that afforded by the limits is shown.

(9) In the 2305-2315 MHz band, if portable devices comply with all of the following requirements, then paragraph (a)(2) shall not apply to portable devices, which instead shall attenuate all emissions into the 2320-2345 MHz band by a factor of not less than 93 + 10 log (p) dB:

(i) The portable device has a duty cycle of 12.5% or less, with at most a 312.5 microsecond pulse every 2.5 milliseconds;

(ii) The portable device must employ time division multiple access (TDMA) technology.

(iii) The nominal peak transmit output power of the portable device is no more than 200 milliwatts (25 milliwatts average power);

(iv) The portable device operates with the minimum power necessary for successful communications;

(v) The nominal average base station transmit output power is no more than 800 milliwatts when the base station antennas is located at a height of at least 8 meters (26.25 feet) above the ground;

(vi) Only fixed and portable devices and services may be provided: vehicle-mounted units are not permitted; and

(vii) Transmitting antennas shall employ linear polarization or another polarization that provides equivalent of better discrimination with respect to a DARS antenna.

(10) The above out-of-band emissions limits may be modified by the private contractual agreement of all affected licensees, who shall maintain a copy of the agreement in their station files and disclose it to prospective assignees or transferees and, upon request, to the Commission.

(b) For WCS Satellite DARS operations: The limits set forth in section 25.202(f) of this chapter shall apply, except that Satellite DARS operations shall be limited to a maximum power flux density of -197 dBW/m^2/4 kHz in the 2370-2390 MHz band at Arecibo, Puerto Rico.

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

5. Section 27.58 is added to read as follows:

§ 27.58 Interference to MDS/ITFS receivers.

(a) WCS licensees shall bear full financial obligation to remedy interference to MDS/ITFS block downconverters if all of the following conditions are met:

(1) The complaint is received by the WCS licensee prior to February 20, 2002;

(2) The MDS/ITFS downconverter was installed prior to August 20, 1998;

(3) The WCS fixed or land station transmits at 50 or more watts peak EIRP;

(4) The MDS/ITFS downconverter is located within a WCS transmitter's free space power flux density contour of -34 dBW/m^2; and

(5) The MDS/ITFS customer or licensee has informed the WCS licensee of the interference within one year from the initial operation of the WCS transmitter or within one year from any subsequent power increase at the WCS station.

(b) Resolution of complaints shall be at no cost to the complainant.

(c) Two or more WCS licensees collocating their antennas on the same tower shall assume shared responsibility for remedying interference complaints within the area determined by paragraph (a)(4) unless an offending station can be readily determined and then that station shall assume full financial responsibility.

(d) If the WCS licensee cannot otherwise eliminate interference caused to MDS/ITFS reception, then that licensee must cease operations from the offending WCS facility.

(e) At least 30 days prior to commencing operations from any new WCS transmission site or with increased power from any existing WCS transmission site, a WCS licensee shall notify all MDS/ITFS licensees in or through whose licensed service areas they intend to operate of the technical parameters of the WCS transmission facility. WCS and MDS/ITFS licensees are expected to coordinate voluntarily and in good faith to avoid interference problems and to allow the greatest operational flexibility in each other's operations.