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

In the Matter of	)	
	)	
Amendment of Parts 21 and 74 to Enable	)	MM Docket No. 97-217
Multipoint Distribution Service and	)	
Instructional Television Fixed Service	)	File No. RM-9060
Licensees to Engage in Fixed	)	
Two-Way Transmissions	)	

REPORT AND ORDER

Adopted: September 17, 1998 **Released: September 25, 1998**

By the Commission:

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I. INTRODUCTION AND SUMMARY

1. In this *Report and Order*, we amend Parts 21 and 74 of our Rules to provide Multichannel Multipoint Distribution Service ("MDS") and Instructional Television Fixed Service ("ITFS") licensees with increased technical and operational flexibility. We believe this action will facilitate the provision of a wide array of new, enhanced services including new digital and two-way communications services. Specifically, we are: (1) permitting both MDS and ITFS licensees to provide two-way services on a regular basis; (2) permitting increased flexibility on permissible modulation types; (3) permitting increased flexibility in spectrum use and channelization, including combining multiple channels to accommodate wider bandwidths, dividing 6 MHz channels into smaller bandwidths and channel swapping; (4) adopting a number of technical parameters to mitigate the potential for interference among service providers and to ensure interference protection to existing MDS and ITFS services; (5) simplifying and streamlining the licensing process; and (6) modifying the ITFS programming requirements in a digital environment. Attached to this *Report and Order* is a set of amendments to the Commission's Rules implementing these changes.[1]

2. We believe our adoption of these new Rules will provide increased service to consumers, upgrade the tools available to educational institutions and enhance the competitive position of MDS operators.[2] We also believe the changes to our Rules will further the mandate of Section 257 of the Telecommunications Act of 1996, which requires the Commission to identify and eliminate market entry barriers for entrepreneurs and other small businesses to promote diversity of media voices, vigorous economic competition, technological advancement and promotion of the public interest.[3]

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[1] *See* Appendix C.

[2] Ohio Valley Wireless, Ltd. ("OVW") has proposed that we amend the attribution rules regarding MDS systems in this proceeding. That issue has already been raised in our *Review of the Commission's Regulations Governing Attribution of Broadcast and Cable/MDS Interests*, MM Docket No. 94-150, FCC 96-436 (Nov. 7, 1996). Therefore, we will not address the attribution rules in this proceeding.

[3] *Telecommunications Act of 1996*, P.L. 104-104, 110 Stat 56 (1996).

II. BACKGROUND

3. Our Rules permit educational institutions to obtain licenses to use spectrum in the 2500-2686 MHz band, which is divided into groups of 6 MHz channels, for the operation of facilities for the transmission of educational and instructional material.[4] This spectrum is shared with that used by MDS operators, also primarily divided into 6 Mhz channels, for the provision of services, including wireless cable, to subscribers.[5] Currently, the ITFS/MDS spectrum is primarily used for the provision of either one-way video service to students, in the ITFS context, or wireless cable service to subscribers, in the MDS context. As discussed more fully below, even in the current, typically one-way video environment, some of the subject spectrum has been used in recent years for the provision of two-way service by licensees and users.[6]

4. Subject to certain technical limitations and programming requirements, ITFS entities may lease channel-capacity on the spectrum that is licensed to them, but which they are not using, to MDS operators. As a result, ITFS and MDS systems typically operate in a symbiotic relationship, with MDS operators providing funding used by ITFS licensees for their educational mission in exchange for the extra channel capacity needed to make most MDS systems viable. This symbiotic relationship has resulted in a history of cooperation that has allowed MDS and ITFS entities to reach their mutual goals. It also creates an environment that is appropriate for the deregulatory approach we adopt here, which is itself premised on cooperation between all the parties involved rather than on the Commission acting as an arbiter of every possible dispute that may arise, especially in regard to interference resolution.

5. This proceeding was commenced in response to a petition for rulemaking filed by a group of over one hundred participants in the wireless cable industry,[7] including wireless cable system operators, MDS and ITFS licensees, equipment manufacturers and consultants, (collectively "Petitioners"),[8] who requested that

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[4] 47 C.F.R. § 74.932.

[5] 47 C.F.R § 74.902.

[6] *See Report and Order on Amendment of Parts 21 and 74 of the Commission's Rules With Regard to Filing Procedures in the Multipoint Distribution Service and in the Instructional Television Fixed Service and Implementation of Section 309 (j) of the Communications Act - Competitive Bidding*, MM Docket No. 94-131 and PP Docket No. 92-253, 10 FCC Rcd 9589, 9619 (1995) ("*MDS Auction Order*"); 47 C.F.R. § 21.903(b).

[7] This group includes the Wireless Cable Association International, Inc., now the Wireless Communications Association International, Inc. ("WCA").

[8] A complete list of the Petitioners can be found in Appendix A. Petitioners filed their Petition for Rulemaking on March 14, 1997 and it was placed on Public Notice March 31, 1997. Pleading Cycle Established for Comments on Petition for Rulemaking to Amend Parts 21 and 74 of the Commission's Rules to Enhance the Ability of Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions,*Public Notice* RM 9060, DA 97-637 (rel. March 31, 1997). The Commission considered the comments and reply comments filed in response to the March 31 Public Notice in its formulation of the proposals advanced in the *Notice of Proposed Rulemaking in the Matter of Amendment of Parts 1, 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions*, 12 FCC Rcd 22174 (1997) ("*NPRM*"). A complete list of commenters and reply commenters on the NPRM also is found in Appendix A. On June 12, 1998, the Commission released a Public Notice requesting comment on several *ex parte* presentations made subsequent to the release of the *NPRM* under our "permit-but-

the Commission amend its Rules to facilitate the provision of two-way communication services by MDS and ITFS licensees. Virtually all of the comments we received in response to that petition, as well as virtually all of the comments we received in response to the *NPRM* that we subsequently released, strongly supported amending our Rules to enhance the ability of licensees to provide two-way service. Although there was some disagreement on the specifics of how best to proceed in a two-way digital environment, support for the basic two-way concept was close to unanimous.[9] Following the release of the *NPRM*, the WCA and the National ITFS Association ("NIA") crafted a *Joint Statement* which set forth a series of positions on various issues including application processing, programming, recapture requirements and lease considerations in a two-way digital environment. We commend the parties to the *Joint Statement* for cooperating in this manner and thereby demonstrating their commitment to facilitating a viable two-way environment, a commitment which we share.

6. We agree with the Petitioners, the bulk of the commenters and the parties to the *Joint Statement* that amending our Rules to enhance the ability of MDS and ITFS licensees to provide two-way service will benefit commercial operators, educational institutions and the public. As we stated in the *NPRM*, our goals in instituting this proceeding were to facilitate the most efficient use of the affected spectrum, to enhance the competitiveness of the wireless cable industry, and to provide benefits to the educational community through the use of two-way services, such as high-speed Internet service. We believe the Rules we adopt today will facilitate the realization of these goals, while still permitting traditional use of the spectrum, and will give both MDS and ITFS licensees the flexibility they need to best serve the public interest.

7. In our order in *Request for Declaratory Ruling on the Use of Digital Modulation by Multipoint Distribution Service and Instructional Television Fixed Service Stations, Declaratory Ruling and Order*, 11 FCC Rcd 18839 (1996) (petitions for clarification and partial reconsideration pending) ("*Digital Declaratory Ruling*"), we authorized wireless cable operators to employ digital compression technology in order to increase the number of usable channels available to them, and also encouraged the use of digital technology by the educational community.[10] In spite of the increased capacity offered by digital compression that the *Digital Declaratory Ruling* was intended to facilitate, growth in the industry has remained limited due

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disclose" *ex parte* rules. *See* 47 C.F.R. § 1.1206. Those comments were due by July 2, 1998. *See* Establishment of Period to Comment on *Ex Parte* Presentations, Public Notice, MM Docket No. 97-217, DA 98-1119 (rel. June 12, 1998). A list of parties filing comments (the "July 2 Comments") in response to that Public Notice is also contained in Exhibit A.

[9] WebCel Communications, Inc. ("WebCel"), an LMDS operator, has opposed Petitioners' proposal on the grounds that the contemplated rule changes would fundamentally alter the nature of MDS and ITFS, undermine the auction process, and unfairly harm potential competitors. We disagree with WebCel's arguments. Webcel overlooks the fact, discussed below, that the types of two-way service that the rule changes would encourage already have been authorized to MDS licensees. *See*, ¶ 11, *infra*.

[10] *Digital Declaratory Ruling*, 11 FCC Rcd at 18840. Digitization is the process by which analog signals are digitized (converted to streams of "1"s and "0"s) using an encoding process that extracts the information necessary for reconstruction of the input signal at its destination. By transporting only essential information, the amount of bandwidth the signal occupies is dramatically reduced. The ratio of compression determines the effective digital rate. For example, a high compression ratio permits the operator to offer six or more program streams over one 6 MHz channel that would accommodate only one program without digital compression. *Id.* Although, the number of digital channels which can be accommodated by the bandwidth of a single analog channel varies with the digital bandwidth demands of the specific programming, at a six to one ratio, 198 digital channels could be delivered using the bandwidth allocated to the 33 analog channels available to MDS.

to economic and technological constraints.[11] As we discussed in our *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming, Fourth Annual Report*, 13 FCC Rcd 1034 (1998) ("*1997 Competition Report*"), the number of homes capable of receiving an MDS operator's signal (commonly referred to as "homes seen") did not increase in the first half of 1997.[12] In that same period, MDS subscribership decreased by 6.8% from 1,180,000, to 1,100,000.[13] Likewise, MDS penetration (the number of homes seen that actually subscribe) decreased from 3.7% to 3.5% from the end of 1996 through June 1997.[14] On the financial side, the MDS industry's negative cash flow increased from $3.9 million in 1995 to $40.5 million in 1996.[15]

8. MDS operators also face challenges posed by the convergence of different information delivery systems. For example, the cable operators with which MDS operators compete previously operated as providers of one-way video programming, but now are increasingly providing a variety of two-way services, including Internet access.[16] As has been discussed in the press and as we noted in the *1997 Competition Report*, other services, including direct broadcast satellite ("DBS")[17], satellite master antenna television services ("SMATV"), and the nascent local multipoint distribution services ("LMDS"),[18] are also moving toward the provision of Internet services. The MDS industry will need to be able to offer comparable, competitively-priced services to compete against these players. We believe the rule changes we adopt in this proceeding will enable the industry to meet this competitive challenge.

9. The rules we adopt today will also provide significant benefits to consumers. A new, competitive group of players will now enter the market for high speed two-way communications service. Both individual and business consumers will be able to use the high-speed and high-capacity data transmission and Internet service that will be available through the new systems. Also, consumers will be able to take advantage of new video-conferencing, distance learning and continuing education opportunities. Commenters have also suggested cutting edge applications like tele-medicine for the new two-way systems.[19] Most importantly from a consumer perspective, there will be another choice of provider for these services, helping to drive down the costs in a more competitive market.

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[11] *Wireless Cable Investor*, at 9 (Dec. 31. 1996).

[12] *1997 Competition Report*, 13 FCC Rcd at 1081.

[13] *Id*.

[14] *Id*.

[15] *Id*.

[16] *See, e.g.,* "Wireless Cable Futures," *Wireless Cable Investor*, at 8 (Dec. 31, 1996); Tedesco, "Cable Modems Move from Concept to Reality," *Broadcasting and Cable*, at 106 (Dec. 9, 1996).

[17] *1997 Competition Report*, 13 FCC Rcd at 1075.

[18] *1997 Competition Report*, 13 FCC Rcd at 1088 and 1081.

[19] *See, e.g.*, comments of San Francisco/San Jose Educator/Operator Consortium.

10. In addition to the competitive benefits to the MDS industry, and the resulting benefit to consumers because of a larger number of choices, increased two-way capacity over the frequencies at issue will benefit educational institutions. By enhancing the flexibility of the ITFS spectrum, our revised Rules should increase the value of that spectrum to ITFS licensees both for their own use and as a leasable asset.[20] Furthermore, the increased Internet access abilities available to ITFS licensees as a result of this rulemaking will help further the goal of providing fast, reliable and affordable Internet access to every student in the country.[21] Although there is some chance that implementation of digital two-way operations may restrict the ability of ITFS licensees of new stations to provide service due to the interference protections we adopt, we believe this risk of restricting some future service is greatly outweighed by the enormous benefits to existing ITFS licensees, both in increasing the value of their licensed spectrum and in permitting them to provide an array of new services.[22]

III. DISCUSSION

11. Although our Rules permit MDS operators to provide "any kind of communications service consistent with the Commission's Rules,"[23] including non-video services, the industry has generally limited itself to the provision of video primarily because of technical restraints. However, as far back as 1974, when the Commission established the MDS service, we specifically listed the transmission of high speed computer data as a potential use of MDS facilities.[24] Since then, we consistently have recognized that MDS licensees enjoy the flexibility to provide a variety of video and non-video services, subject to compliance with, or the grant of a waiver of, our Rules.[25] For example, the Mass Media Bureau has made clear that leased ITFS frequencies (as well as MDS channels) can be used for asymmetrical high speed digital data applications, including Internet access, if that usage complies with our technical rules and the *Digital Declaratory Ruling*.[26] We now

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[20] ITFS licensees, MDS licensees, and wireless cable operators may be eligible in some instances to receive universal service support for providing eligible services to elementary and secondary schools under §254(h) of the Communications Act. 47 U.S.C. §254(h).

[21] *See* "Background on Clinton-Gore Administration's Next-Generation Internet Initiative: Qs and As on Next-Generation Internet Initiative," *Office of the Vice President*, at 4 (rel. Oct 10, 1996); Remarks of Chairman Reed Hundt, Technology and Learning Conference, National School Board Association, Dallas, Texas (October 24, 1996).

[22] *See* ¶¶ 75 to 109, *infra*.

[23] *See, e.g.,* 47 C.F.R. 21.903(b); *MDS Auction Order*, 10 FCC Rcd at 9619.

[24] *Amendment of Parts 1, 2, 21, and 43 of the Commission's Rules and Regulations to Provide for Licensing and Regulation of Common Carrier Radio Stations in the Multipoint Distribution Service*, 45 FCC 2d 616, 617 (1974) ("*MDS Order*").

[25] *See, e.g., Amendment of Parts 21 and 74 of the Commission's Rules With Regard to Filing Procedures in The Multipoint Distribution Service and in the Instructional Television Fixed Service*, 10 FCC Rcd 13821, 13825 (1995).

[26] *See* "The Mass Media Bureau Implements Policy for Provision of Internet Service on MDS and Leased ITFS Frequencies," *Public Notice*, DA 96-1720 (rel. Oct. 17, 1996).

implement a series of technical rule changes that will give MDS and ITFS licensees the needed flexibility to fully exploit digital technology in delivering two-way communications services.

12. Although MDS licensees are permitted under our existing Rules to provide two-way service, commenters in this proceeding have argued that those rules are too cumbersome and impose too great a financial burden on operators to lead to large-scale system development.[27] For example, in a recent authorization for two-way operation in the MDS band, each subscriber location had to be individually licensed.[28] We have received comments that argue this type of approach is not commercially viable for most two-way wireless applications and that it is an example of the impediments to expansion. In contrast, under the system we adopt here, licensees will be permitted to use all or part of a 6 MHz channel for return path transmissions from subscriber premises, to cellularize their transmission systems to take advantage of spectrally efficient frequency reuse techniques, and to employ modulation schemes consistent with bandwidths either larger or smaller than 6 MHz, all while providing incumbent MDS and ITFS licensees interference protection equivalent to what they currently receive.

13. We emphasize that we are not reallocating the spectrum at issue. The ITFS spectrum remains allocated for the use of educators and any use of it by MDS operators is subject, within the parameters of our Rules, to the needs of those educators. This proceeding modifies the technical rules governing the spectrum already allotted to MDS and ITFS and creates greater flexibility in terms of programming and other requirements so that MDS operators and ITFS licensees can maximize the value of their spectrum resources. We also re-emphasize, noted above, that the types of service that we anticipate will be offered as a result of this Order are already permitted and these new Rules are designed to better facilitate their deployment.

A. Revised Definition of MDS

14. In the *NPRM*, we proposed to create a regulatory system that will facilitate the use of response stations and response station hubs to enhance the ability of wireless cable systems and ITFS licensees to engage in two-way operations. Under this system, response stations will be the means of transmission from a subscriber's premises and may be used as separate transmitters or as parts of a transceiver (combined transmitter and receiver). These response stations may use either separate transmitting antennas for return paths or combined transmitting/receiving antennas. Response station hubs will serve as the collection points for signals from the response stations in a multipoint-to-point configuration for upstream[29] signal flow.

15. Under our current regulatory scheme, MDS operators typically only provide two-way service to subscribers using telephone return links or individually licensed subscriber premises stations. This is an outgrowth of the basic one-way approach to MDS transmission from which our current Rules originated. We now expand the definition of the Multipoint Distribution Service in Section 21.2 of our Rules to fully incorporate the concept of two-way transmission. This changed definition represents the reorientation of the regulatory treatment of MDS, no longer regarding it as a one-way service with two-way service permitted on

[27] *See* Comments of Petitioners.

[28] *See* Applications of Atlantic Microsystems, Inc., File Nos. BMDP-9701115KI through BMDP-970115KM (granted Jan. 27, 1997).

[29] "Upstream" transmission are transmissions from the subscriber to the hub station or the main station. "Downstream" transmissions are transmissions from booster stations or the main station to the subscriber.

a limited basis, but instead as a fully flexible service in which licensees can provide either one-way or two-way service in response to the demands of the competitive marketplace.

16. As fully set out in Appendix C, we also amend the definition for a "Multipoint distribution service response station," to indicate that licensees will be permitted to use all or part of any 6 MHz MDS (4 MHz for MDS channel 2A) or ITFS channel as a response channel consistent with the other technical and service rules adopted by this order.

17. A key element of two-way systems will be the use of "response station hubs," facilities that receive the transmissions of response stations. These hubs are intended to permit MDS response stations to operate at lower power because the response stations hubs will be located closer to subscriber premises than are current transmitter sites. The hubs are expected to improve service reliability and permit greater frequency reuse than if each subscriber were required to communicate directly with their associated main transmitter site. Channels adjacent to the channels received at response station locations most probably will be used for response station transmissions. Since the adjacent channels used in a wireless cable system are usually assigned to different licensees as a result of the interleaved channel allocation pattern in the 2.5 GHz band, it is likely that most hubs and associated response stations will be facilities shared by multiple licensees. In other words, a response station hub and associated response stations will operate under multiple authorizations, which will be identical in all respects other than in the name of the licensee and the authorized channels of operation.

18. By our action today, we also expand the definition for "signal booster stations" such that it will be clear that those stations will be authorized to originate transmissions, as well as to relay transmissions from other stations. Booster stations will be used to cellularize wireless cable operations, which now may operate in areas too large to be served by a single station. Permitting boosters to originate as well as relay programming facilitates frequency reuse, cellular configurations, two-way high speed Internet access, and other services. The location restriction in the current definition will be removed because it unnecessarily duplicates a restriction already contained in § 21.913 that is retained essentially intact.[30] We agree with the comments of several parties that all licenses for all downstream booster stations and any associated return paths that employ ITFS licensed channels should be held by the ITFS licensee. This approach will be administratively efficient and will help to prevent the anomalous situation of an ITFS licensee being in conflict with a booster station on its own licensed frequency. Booster station signals will receive interference protection within the booster station's protected service area. Booster stations will not be permitted to have overlapping service areas, and, although a booster station may provide service to receive sites beyond its service area, those sites will not be entitled to interference protection.

B. Technical Standards

1. Channelization

19. In our current MDS and ITFS rules, channels are fixed at bandwidths of 6 MHz for downstream (*i.e.*, point-to-multipoint) transmissions (except for MDS channel 2A, which is 4 MHz wide) and 125 kHz for upstream (*i.e.*, point-to-point) response signals. These bandwidths were selected several decades ago because they represented the common bandwidths then necessary, respectively, for NTSC analog video signals and high quality FM audio signals. In typical systems, licensees are assigned the use of one or more non-contiguous 6 MHz channels and the associated (paired) 125 kHz response channels, and do not alter their

[30] *See* 47 C.F.R. § 21.913(b).

channel bandwidths or otherwise deviate from the mandated channelization scheme.[31] In the *Digital Declaratory Ruling*, the Commission amended its channel utilization policy to permit the transmission of more than one video (and composite audio) signal within each 6 MHz channel, so long as it was done using an approved digital emission (*i.e.* VSB or QAM) with uniform power spectral density.[32] However, the channelization plan was not changed, despite the fact that a video (and composite audio) signal could be transmitted by either of these emissions in only a fraction of 6 MHz. In the *NPRM*, we proposed to amend our rules to permit licensees to both "subchannelize" and "superchannelize" the 6 MHz and 125 kHz channels to take advantage of the flexibility offered by the use of digital emissions. By subchannelize, we mean the division of a standard channel of fixed bandwidth into multiple (but not necessarily equal) channels of lesser bandwidth. For example, a 6 MHz channel could be divided into four subchannels of 1.5 MHz bandwidth, each of which might carry a video and associated audio signal, or into two channels, one with a 2 MHz bandwidth and the other with a 4 MHz bandwidth. For narrow bandwidths, the 6 MHz channel might be divided into many smaller non-video channels, such as 120 channels of 50 kHz each. A 125 kHz response channel could be similarly divided, either symmetrically or non-symmetrically, to form narrower channels of equal or unequal bandwidths. By superchannelize, we meant the aggregation of multiple contiguous channels of standard bandwidth into channels of larger bandwidth, *e.g.*, three 6 MHz channels could be combined to form a single channel with an 18 MHz bandwidth, or four 125 kHz channels could be combined to form a 500 kHz channel.

20. Subchannelization and superchannelization were broadly supported in the Comments and Replies to the *NPRM*. For example, Wireless One stated that allowing this flexibility would enhance wireless cable two-way service because "An operator, in consultation with the licensees, could combine channels or subchannelize as needs of the public dictate the market."[33] In some areas of the country, all of the MDS and ITFS channels are already in use and thus no additional spectrum is available. With channelization flexibility and the use of digital emissions, licensees can create very large numbers of 'virtual' channels to carry their current and future communications needs. Of course, the creation of superchannels will typically involve the participation of multiple licensees, each of whom will contribute some portion of the combined spectrum. These voluntary spectrum sharing arrangements will clearly benefit all of the parties, in that it will give all of them the means to communicate at the data rates optimal for their particular operations and at speeds greater than would currently be permissible within a single 6 MHz channel. We believe this flexibility to subdivide and combine channels is essential in order to take maximum advantage of the digital emissions with uniform power spectral density that MDS and ITFS licensees will be using in the years to come. We are therefore adopting our proposals in this regard to permit the maximum possible flexibility for digital subchannelization and superchannelization at individual MDS and ITFS systems, and between multiple licensees who wish to share their spectrum and configure their bandwidths in accordance with agreements among themselves. This flexibility will include permitting the use of individual and aggregated 125 kHz channels for both response (upstream) use and point-to-multipoint (downstream) use, and the subchannelization of superchannels, *e.g.*, an 18 MHz superchannel could be redivided into two 9 MHz channels or any other combination which sums to 18 MHz.[34] We will continue to issue individual authorizations to individual systems for 6 MHz and 125 kHz

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[31] Exceptions to the routine channelization were provided in certain circumstances. See *e.g.* Rule Sections 21.940(d)(6) and former 21.940(a).

[32] *Declaratory Ruling and Order*, 11 FCC Rcd 18839 (1996).

[33] Comments of Wireless One of North Carolina, L.L.C. ("Wireless One").

[34] Because the 125 kHz channels may be used for both upstream and downstream transmissions, we have, for ease of identification, assigned each of these 31 channels a specific channel designation, specifically, I1 through I31.

channels and will not issue specific authorizations for superchannels or subchannels, nor will we require licensee notification in this regard.[35] For purposes of interference protection and other responsibilities, each licensee of a channel comprising a superchannel will be held individually accountable, as well as jointly accountable with other contributing licensees, for ensuring all operations comply with the Commission's Rules.

21. Although implicit in the *NPRM* at Appendix C, but not explicitly discussed in the text of the *NPRM*, the rules we proposed and are now adopting will permit licensees to both "statically" and "dynamically" choose the bandwidths in use at their stations. What we mean is that a licensee may configure its system so that the bandwidths in use at all of its stations are fixed and unchanging, *i.e.*, static, or a licensee may configure its system so that, at one or more (or all) stations, the bandwidths in use are not fixed and may change rapidly over time, *i.e.*, dynamically. The advantage of such flexibility is that, on a real-time basis, a licensee or system operator can control and allocate bandwidth among its transmitters so as to optimize the efficiency and speed of information flow. For example, if a response station were located at a business site, a narrow bandwidth might be used one moment to send a short outgoing query and a wide bandwidth might be used the next moment (or an hour later) in order to respond to a request to upload the business' Internet home page resident on site. Different emissions/emitters might be used at the same station, depending on the type and volume of message flow and bandwidth requirements at any particular time, and simultaneous transmissions (*e.g.*, one narrowband and one wideband signal) could be used if needed. This form of flexibility is a natural outgrowth of the use of digital emissions and the fact that, no matter what bandwidth is in use at a given moment, the power spectral density of the digitally transmitted signal per unit of bandwidth will be uniform and fixed.[36]

2. Modulation Methods

22. In the MDS/ITFS *Digital Declaratory Ruling*, the Commission interpreted its rules as enabling the use of digital modulation formats, provided such use would not result in harmful interference.[37] Based on test data submitted in that proceeding, we examined the interference potential of VSB and QAM emissions *vis-a-vis* the current 45 dB cochannel and 0 dB adjacent channel D/U interference standards for NTSC analog modulation and concluded that these two digital emissions should be permitted at MDS and ITFS stations because they presented no greater interference potential than NTSC. Therein, we stated that we would consider authorizing additional emissions based on similar demonstrations of noninterference. In the *NPRM* in the instant proceeding, we solicited comment on "whether there is a basis for concluding that use of particular modulation types by MDS and ITFS stations other than VSB and QAM would not be prone to interference, based on the current 45 dB/0 dB protection ratios for cochannel and adjacent channel interference respectively, *i.e.*, that such modulation formats should be permitted without requiring test data."[38] In response, several commenters specifically addressed the issue of permissible emissions, arguing for flexibility in the

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[35] Petitioners have also requested that superchannels be divisible into partially overlapping subchannels which sum to greater than the width of the superchannel, *e.g.*, an 18 MHz channel subdivided into 3 channels each 8 MHz wide, thus producing 2 overlapping areas of 3 MHz each. We agree that this form of rechannelization was within the proposals in the *NPRM* and will be permitted under the rules we are adopting, although we caution that it introduces yet another level of complexity into the interference calculations which must be performed.

[36] For the purposes of interference calculations, the licensee or system operator will have to assume "worst-case" parameters for each station using dynamic bandwidth allocation, *i.e.*, will have to assign to that station the widest bandwidth at which it may operate, even if that bandwidth is not the one at which it typically operates.

[37] *Declaratory Ruling and Order*, 11 FCC Rcd at 18848

[38] *NPRM*, 12 FCC Rcd at 22187.

selection of modulation methods. Furthermore, on December 2, 1997, ADC Telecommunications, ATI, CAI and PCTV ("ADC") submitted a request for declaratory ruling asking that the Commission expand the scope of its original July 10, 1996 *Digital Declaratory Ruling* to permit the use of two additional forms of digital modulation, QPSK and CDMA.[39] ADC noted that, in the July 10, 1996 ruling, the Commission had authorized only VSB and QAM because those modulation types were the only ones for which test data was submitted, and that the Commission specifically deferred consideration of the adoption of other modulation techniques, noting that future requests for declaratory rulings would be considered "where the requesters demonstrate that their proposals satisfy the MDS and ITFS technical rules" and where requesters demonstrated that the proposed modulation techniques "could be used in a manner that would not interfere with MDS and ITFS analog operations." In the filing, ADC stated that adequate test data has now been compiled with respect to CDMA to justify its inclusion on the list of permissible modulation methods, and that QPSK should be added to the list because it is "essentially an alternative designation for 4-QAM," which the Commission has already authorized.

23. We agree with ADC that use of QPSK should be permissible without submission of test data because 4-QAM is already permitted. With respect to CDMA, ADC submitted, as an attachment to the declaratory ruling request, a document entitled "Rationale for Authorization of Additional Modulation Types (CDMA and QPSK) Under the Wireless Cable Digital Declaratory Ruling." This document presented the results of a detailed study involving laboratory tests designed to evaluate the interference potential of CDMA as compared to VSB and QAM. The outcome of those tests was characterized as showing "that CDMA undesired signals provide substantially the same performance levels of the desired analog signals as do QAM and VSB when the same interference protection ratios are used," and that variations present "fall well within the threshold performance levels used to evaluate the protection ratios of QAM and VSB." BellSouth urged the Commission to authorize QPSK and CDMA without further testing, and Wireless One supported QPSK and CDMA and stated that "any emission should be permissible for any channel of any bandwidth for any class of MDS or ITFS station, utilizing permissible power, so long as the emission meets applicable out-of-band emission requirements and is capable of causing no greater interference than 8-VSB or 64-QAM."[40] Upon reviewing and evaluating ADC's submission, we believe that the CDMA interference test results, together with the revised interference protection methodology which will apply to systems using CDMA assure that no greater interference potential will exist with CDMA than now exists for QAM or VSB. For the above reasons, we are amending our rules to permit use of QPSK and CDMA on a regular basis at all MDS and ITFS stations.

24. We will continue our policy of authorizing the use of other digital modulation formats where such use can be demonstrated to be within the confines of the interference protection standards for the MDS and ITFS services. Given the large numbers of existing stations and the sizeable financial investments in these services, we do not want to authorize routinely the use of untested emissions that could possibly result in harmful interference. As licensees and system operators gain experience in digital system design and operation, we expect that test data will be submitted leading to a further expansion in permitted modulation types. However, we also seek to facilitate, to the extent possible, the variety of service offerings available to MDS and ITFS licensees through use of different digital emissions. Moreover, we wish to create opportunities for such emissions to be tested through actual operations, but without risking unwanted interference.

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[39] Request for Declaratory Ruling on the Use of Code Division Multiple Access and Quadrature Phase Shift Keying Digital Modulation by Multipoint Distribution Service and Instructional Television Fixed Service Stations, December 2, 1997

[40] Comments of BellSouth Corporation and BellSouth Wireless Cable, Inc.; Comments of Wireless One.

25. Accordingly, we will permit licensees and system operators to use any digital emission in circumstances where interference is unlikely, or where all parties potentially affected by interference have consented to such use. In such cases, licensees and operators could choose emission or emissions most suitable for their particular system architecture and message traffic, so long as these have channel-edge power rolloff characteristics which conform to the general emission masks required for all MDS and ITFS operations[41], and meet the requirements for uniform power spectral density set out in the *Digital Declaratory Ruling*. Specifically, we will permit the use of any such emission in the following circumstances: (1) at any main or booster transmitter located more than 100 miles from the nearest boundary of all co- and adjacent channel ITFS and MDS protected service areas, including Basic Trading Areas and partitioned service areas (as these protected areas are specified in Section 21.938 of the Commission's Rules); (2) at response stations within a response service area whose boundary is, at all points, at least 100 miles from the nearest boundary of all co- and adjacent channel ITFS and MDS protected service areas, including Basic Trading Areas and partitioned service areas; or alternatively, (3) where all parties potentially affected by interference in an area (*i.e.*, parties at lesser distances than those set out in (1) and (2), above) have consented to use of the emission(s).

3. Spectral Mask

26. In the *Digital Declaratory Ruling*, the Commission determined that the spectral mask[42] for digital signals should be different than that applied to analog signals of the same bandwidth because the digital signals had been demonstrated to have less interference potential, given that their power is uniformly distributed across occupied bandwidth, rather than concentrated in one or more segments of the bandwidth. This principle was applied in the spectral mask proposed for digital signals in the *NPRM*, where the proposed edge-of-channel and out-of-channel power suppression requirements for digital signals are less stringent than those for analog signals. Specifically, we proposed that the out-of-band power of each main station transmitter, booster transmitter (with EIRP>-9 dBW) and response station transmitter using digital emissions and operating on a single 6 MHz channel must be attenuated (relative to the average power level within the channel) by at least 38 dB at the channel edges, increasing linearly to an attenuation of 60 dB at all frequencies more than 3 MHz above the upper edge and below the lower edge of the channel.[43] For booster transmitters using analog or digital modulation and capable of operating on multiple channels simultaneously carrying separate signals (*i.e.*, broadband booster), similar attenuation requirements with slightly relaxed parameters were proposed. For low power booster transmitters (EIRP $\leq$ -9 dBW) using analog or digital modulation, no attenuation requirements were proposed. Instead, a requirement was proposed that such transmitters be shut down if it is determined that they are causing harmful interference. For response stations utilizing digital modulation on the 125 kHz channels, we proposed to require 35 dB of attenuation at the channel edges, increasing to 60 dB of attenuation at all frequencies more than 125 kHz above the upper edge and below the lower edge of the channel.

27. For main, booster and response stations utilizing digital emissions on more than one contiguous channel (*i.e.*, a superchannel), we proposed that the out-of-band power suppression requirements be applied only at the upper and lower edges of the superchannel. For example, if three 6 MHz channels were combined to form an 18 MHz superchannel, then 38 dB of attenuation would be required at the upper and lower edges

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[41] *See* ¶26, *et seq.*, *supra*.

[42] The spectral mask establishes the amount attenuation which is required for the portions of the transmitted signal which fall beyond the upper and lower edges of the channel in use.

[43] In addition, only for response station transmitters, we proposed to permit the occurrence of a limited number of discrete spurious emissions above and below the channel edges so long as these are attenuated by at least 40 dB.

of the superchannel, as would the 60 dB attenuation requirement for frequencies more than 3 MHz removed from the upper and lower edges of the superchannel. If the 18 MHz superchannel were redivided into two 9 MHz channels, the out-of-band attenuation requirements would still apply only at the upper and lower edges (and beyond) of the superchannel, and would not apply at the intra-channel boundary which forms between the upper edge of one 9 MHz channel and the lower edge of the other 9 MHz channel. Similarly, when a 6 MHz channel is subchannelized, the out-of-band power suppression requirements would only be applicable at the upper and lower edges (and beyond) of the 6 MHz channel. For example, if the 6 MHz channel were divided into 120 channels of 50 kHz bandwidth, the lowermost channel (*i.e.*, 50 kHz channel No. 1) and the uppermost channel (*i.e.*, 50 kHz channel No. 120) would be the only channels to which any explicit attenuation standards would apply, as required to meet the overall standards applicable to the edges of the 6 MHz channel. In this example, the lower edge of channel No. 1 and the upper edge of channel No. 120 would have to meet the attenuation requirements, while no particular requirements would apply to channels 2 through 119, so long as all of the power from these channels was contained within the 6 MHz bandwidth.[44] As a practical matter, licensees may choose not to utilize a few of the lowermost and uppermost narrowband subchannels, in effect creating a guardband that isolates the out-of-band power of the inner subchannels from the edges of the 6 MHz channel. In this circumstance, the power spectral density requirement for the 6 MHz channel would still be applied as if the entire bandwidth were in use, *i.e.*, the creation of intra-channel guardbands or unused interior subchannels does not alter the calculation for power spectral density over the entire channel.

28. In response to the spectral mask proposals, CTN argued that the exception in the mask which permitted response stations to emit discrete spurious emissions with a suppression of only 40 dB presented an unacceptable interference threat to ITFS receivers.[45] In certain circumstances, CTN stated that these emissions will be present as cochannel interference at ITFS receive sites at signal levels as great as +23 dBm for response stations operating at an EIRP of +63 dBm. CTN suggested that greater suppression of these emissions is needed, on the order of 60 dB for response stations operating at +48 dBm, up to 75 dB for response stations operating at +63 dBm. Replying to CTN's concerns, Petitioners stated that "as a result of technological advances in the year since the Petition was filed, the proposed exception to the emission mask for discrete spurious signals is no longer necessary."[46] Petitioners proposed that it be eliminated when final rules are adopted "so as to provide a more interference-free operating environment." The General Instrument Corporation ("General Instrument") (formerly NextLevel Systems, Inc.) suggested that the digital emission mask "be modified to incorporate a maximum attenuation for spurious emissions of 43 + 10 log(power) or 60 dB, whichever is less stringent."[47] General Instrument calculated that this mask cutoff would result "in an absolute emission power limit of -43 dBW in a 100 kHz reference bandwidth." General Instrument's proposal was

[44] The EIRP limit per 50 kHz channel would be the same for each channel and would be 1/120 of the power limit for the 6 MHz channel. For a subchannel of any bandwidth B (in kHz), the maximum permissible power is (B/6000) x (6 MHz EIRP limit). For a superchannel composed of N 6 MHz channels, the maximum permissible power is N x (6 MHz EIRP limit), and if the superchannel is redivided into subchannels, then a subchannel of bandwidth B (in kHz) would have a power limit of (B/6000) x (6 MHz power limit).

[45] Comments of Catholic Television Network ("CTN").

[46] Petitioners' *ex parte* letter of March 6, 1998.

[47] Comments of General Instrument.

supported by Gulf Coast, which said that this change would "conform the MDS/ITFS rules with the rules of other radio services, including PCS."[48]

29. General Instrument requested that the Commission clarify its specification of the proposed emission mask for digital emissions, in particular asking for confirmation that the references to 38 dB and 60 dB attenuation "mean that the measured power in the measurement bandwidth at an out-of-band channel frequency is to be attenuated by those amounts with respect to the total in-channel power in a 6 MHz bandwidth."[49] Spike Technologies, Inc. ("Spike") sought a similar clarification.[50] Petitioners addressed this issue in both their Comments and Reply Comments to the *NPRM*. [51] Petitioners argued that the emission mask interpretation put forward by General Instrument "would result in shifting the emission mask by 17.78 dB from the mask used in all of the testing done in support of the Petition that led to the *Digital Declaratory Ruling* and upon which the currently proposed rules are based," an outcome which "would result in increased interference from digital transmissions absent a corresponding reduction in the average power utilized." Petitioners stated that the best way to clarify the specification and measurement procedures for the attenuations required by the emission masks is to utilize the formulas which they provided in their Comments, which take into account the spectrum analyzer resolution bandwidth used and whether the transmitter power output measurement is absolute or relative.

30. General Instrument also suggested that the emission mask power suppression requirement should be slightly modified within the first 250 kHz beyond the upper edge and lower edge of the 6 MHz channel.[52] Specifically, General Instrument proposed that, rather than 38 dB attenuation at the channel edges, there should be 25 dB of attenuation at the edges, increasing linearly to 40 dB of attenuation at 250 kHz above and below the edges, and then increasing linearly to 60 dB at 3 MHz above and below the edges. General Instrument argued that the transmitters used for the tests performed in connection with the *Digital Declaratory Ruling* actually produced an occupied bandwidth pattern conforming to their proposed revised emission mask, rather than to that proposed in the *NPRM*. This occurred, according to NextLevel, because the actual occupied bandwidth of the test signal was 6.5 MHz, not 6 MHz, thus creating a discrepancy of 500 kHz, or 250 kHz on each side of the 6 MHz channel. Petitioners supported General Instrument's proposal, saying that General Instrument "correctly notes that the testing that supported the initial *Petition for Declaratory Ruling* used some equipment that essentially followed the mask proposed by General Instrument." Petitioners also agreed with General Instrument's conclusion that such an amendment to the emission mask would have no practical effect on the MDS/ITFS interference environment because it would not alter in any way the actual interference test results using this gear, which demonstrated its limited interference potential.

31. With respect to the spectral mask for digital emissions, the Commission emphasized in the *Digital Declaratory Ruling* that the essential requirement is that the power spectral density of the digital signal

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[48] Reply Comments of Gulf Coast MDS Service Company.

[49] Comments of General Instrument.

[50] Reply Comments of Spike.

[51] Petitioners' Comments and Reply Comments.

[52] Comments of General Instrument.

be as uniform as possible across the bandwidth in use, no matter what that bandwidth might be.[53] For the purposes of this proceeding, because we will permit the routine use of channels of essentially any bandwidth, we believe it is important to specify the maximum permissible transmitter power in units of bandwidth, something which, until now, has been implicit in the rules for discrete emissions within fixed bandwidths. For example, the maximum power for a main station transmitter is 33 dBW EIRP for an NTSC video signal within a standard 6 MHz channel.[54] The power distribution for this signal is very non-uniform, varying several orders of magnitude depending upon which part of the channel is examined. For digital signals, power uniformity is essential for producing a 'noise-like' signal which can be evaluated for interference purposes as if no portion of the signal had any greater (or lesser) interference impact than any other portion of the signal. For digital transmitters operating under the rules we are adopting, we will continue the policies for uniform power spectral density, including the requirement for continuous energy dispersal during times of no modulation, as set out in the *Digital Declaratory Ruling* and 6 MHz will be used as the reference bandwidth for power limitations. With respect to the spectral mask to be used for the time being, we are adopting the mask parameters specified in the *NPRM*, except that we have amended them to take into account the issue raised by General Instrument concerning the first 250 kHz above and below the channel edges. We agree that the test data support a slight modification to the suppression levels set out in our proposals and we are incorporating that modification into the rules being adopted. We do not believe that this minor adjustment at the edges of the channels will have any impact on the interference environment in the services, inasmuch as the interference tests conducted for the *Digital Declaratory Ruling* encompassed this slightly greater spectral occupancy.

32. We also agree with General Instrument and others who raised concerns about the proper interpretation of how out-of-band suppression levels were to be measured and interpreted. The text of the *NPRM* was not precise concerning where and how the attenuation requirements should be applied to the digital emission's spectrum and we believe this should be resolved. As Petitioners noted in their Comments, there are numerous ways to measure the power spectrum inside and outside the digital emission's designated channel, and each of these measurements could result in the calculation of different suppression levels. In order to avoid this situation, we are incorporating into our rules the two formulas provided by Petitioners. These formulas take into account all the relevant factors necessary to assure that, no matter what exact measurement procedure is used, the results of the tests will be interpreted uniformly and in accordance with the rules we are adopting. We are not, however, adopting General Instrument's suggestion that a maximum suppression limit be placed on digital emitters which would, in effect, remove the out-of-band attenuation requirements for power levels below a certain minimum. Although this approach has been used in some other radio services, such a relaxation of out-of-band limits, in the context of a cellularized CDMA system, could result in an adverse impact on the interference environment. With respect to CTN's concern about discrete spurious emissions and their potential interference impact, we are adopting Petitioners' recommended modification to the spectral mask for response stations which completely eliminates the exception proposed in the *NPRM* for such emissions. As Petitioners noted, such an exception should not now be necessary for the new equipment which will become available for two-way MDS/ITFS systems.

4. Frequency Tolerance and Equipment Certification

33. In the *NPRM*, we sought comment on Petitioners' request that the existing +/- 1 kHz frequency tolerance requirement be retained for all main station digital and analog transmitters and for all digital and analog booster transmitters with an EIRP exceeding -9 dBW, and that for all booster transmitters with less than -9 dBW EIRP and for all response station transmitters, no frequency tolerance requirement be imposed. These

[53] *Declaratory Ruling and Order*, 11 FCC Rcd at 18857

[54] Slightly higher EIRP is permitted if a directional antenna is used.

concepts were generally supported in the Comments and Replies and we are adopting them in our rules. The extra interference potential of individual low power boosters and response stations which might arise from frequency instability is very limited, and thus imposing a tolerance requirement on them would result in added equipment cost and complexity with no corresponding benefit to the interference environment. This would be especially true for narrowband response stations which operate on subchannels within, and removed from the edges of, larger channels. For main station and high power booster transmitters, there is a much more significant potential interference impact and we believe that requiring the emissions from these stations to be held steady within their assigned channels is much more important. With respect to certification of devices used in these services, we proposed and are adopting rules which would require that all response station transmitters receive certification and we are retaining our rules requiring type certification of main and booster transmitters. In addition, we are continuing the interim policy set out in the *Digital Declaratory Ruling* allowing the use, without certification, of existing analog equipment for digital emissions so long as the emissions generated by this equipment conform to the appropriate spectral mask specifications.[55]

5. Protection from RF Emissions

34. In the *NPRM*, we sought comment on whether to follow the Petitioners' suggestion and amend the provisions of Section 1.1307 to provide rules, similar to those adopted for LMDS licensees, to govern radio frequency ("RF") emissions for MDS/ITFS return path transmissions.[56] We noted that all FCC-regulated transmitters, including the subscriber terminals used in LMDS systems, are required to meet the applicable guidelines regarding RF exposure limits.[57] We recognized that subscriber antennas are very small and can be mounted in a variety of places at subscriber locations.[58] However, we found that the RF exposure could be mitigated by the fact that these antennas are ordinarily mounted so that neither subscriber nor passersby will venture into their transmit beams, because the person will block the signal and interrupt the transmissions between the hub and subscriber transceivers.[59] Therefore, we decline to adopt special RF rules for return path transmissions. In addition, we found that exposure could be mitigated by the fact that LMDS subscriber equipment probably will be installed by professional personnel, thereby minimizing the possibility that subscribers or passersby will intercept the transceiver signal.[60] At the same time, we recognize that due to the frequency reusage and greater permissible power limits there are differences between these services and LMDS that may warrant greater care in the installation and deployment of subscriber units. We, therefore, will require such devices to be installed by the hub station licensee, its employees or its agents.

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[55] *Declaratory Ruling and Order*, 11 FCC Rcd at 18862

[56] *NPRM* at ¶ 27.

[57] *Id* at 12669-70 (*citing* Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, ET Docket No. 93-62, *Report and Order*, 11 FCC Rcd 15123, 15124, 15152 (1996) (*RF Report and Order*) and 47 C.F.R. § 1.1307(b)(1)).

[58] *Id* at 12670.

[59] *Id.*

[60] *Id.*

35. Further, we stated that it was incumbent upon LMDS licensees to exercise reasonable care to protect users and the public from exposure from the operation of LMDS transceivers.[61] We noted that LMDS licensees are required to provide user and installation information, to label subscriber antennas properly, and to provide adequate notice regarding the potential safety hazards of LMDS subscriber transceivers.[62] While we declined to require interlock features, we found that such features could enhance the safety of LMDS subscriber transceivers and we strongly encouraged their use.

36. With the exception of the Cellular Phone Taskforce ("CPT"), most parties commenting on this issue support our proposals. While not specifically opposing our plan, CPT states that "[B]ecause of health concerns familiar to the Commission . . . [CPT] opposes the introduction any more new, or the expansion of existing digital cellular networks of any type within the United States of America."[63] CPT states that its members "are already suffering profound disability and disease because of such existing service networks."[64] CPT notes that it filed these comments in both this proceeding and ET Docket No. 93-62, the Commission's rulemaking proceeding concerning guidelines for evaluating the effects of RF emissions.[65] We agree with the Petitioners that this is not the appropriate venue for considering CPT's concerns.[66] CPT does not provide any discussion concerning the potential impact of adoption of the specific rules proposed in the *NPRM*. The appropriate proceeding for resolving CPT's concerns is ET Docket No. 93-62, where CPT has been an active participant.[67] We find that the public interest will not be served by delaying the introduction of two-way service by MDS and ITFS licensees pending further decisions in that proceeding.

37. We are generally adopting the proposals contained in the NPRM. We will adopt our proposal and modify the provisions of Section 1.1307 of our Rules for MDS and ITFS in a manner similar to the approach we adopted for LMDS.[68] We will require MDS and ITFS licensees employing two-way technology to attach labels to every subscriber transceiver in a conspicuous fashion. Such labels should include reference to the Commission guidelines that apply. In addition, MDS and ITFS licensees employing two-way technology must include a full explanation of the labels that appear on their transceivers, as well as reference to the applicable Commission guidelines in the instruction manuals and other information accompanying their subscriber transceivers. This information should include advice as to the minimum separation distances

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[61] *Id.*

[62] *Id.*

[63] Comments of CPT.

[64] *Id.*

[65] *Id.*

[66] *See* Reply Comments of Petitioners.

[67] *See* "Appeal" of CPT, ET Docket No. 93-62 (filed October 6, 1997); "Petition of CPT for Reconsideration," ET Docket No. 93-62 (filed November 28, 1997); and "*Ex Parte* Comments of CPT," ET Docket No. 93-62 (filed December 29, 1997).

[68] *See* Comments of Petitioners and of Wireless One.

required between users and radiating antennas to meet the Commission's exposure guidelines. As we declined to do with LMDS, we will not mandate the specific language that must be used, however, we will require use of the ANSI-specified warning symbol for RF exposure.

38. As with LMDS, we encourage MDS and ITFS licensees employing two-way technology to use safety interlock features on their subscriber units to the extent that such features can be made available at a reasonable cost. We expect that MDS and ITFS licensees will work with all interested parties to achieve the protection intended and, in the future, if we find that the requirements and procedures adopted herein do not provide adequate protection from RF emissions, to subscribers and the general public, we may revisit this issue.

C. Interference

39. As discussed in the *NPRM*, the interference standards in the MDS and ITFS services are intended to minimize the occurrence of destructive interference between neighboring systems. We proposed to carry over the existing 45 dB/0 dB D/U co- and adjacent channel protection ratios and the -73 dBW/m^2 contour protection criterion and apply them to the digital cellularized systems proposed by the Petition, although with adjustments which account for the particular bandwidths involved in the calculations.[69] Additional adjustments were proposed to account for the fact that multiple cochannel transmitters will be operating simultaneously in some systems and for the fact that the actual locations of response stations in two-way communications systems will not be used for interference calculations. With respect to the operation of simultaneous cochannel transmitters, we proposed to calculate the total power flux density radiated by all such transmitters per channel and use that total flux in calculating conformance with the required D/U ratios and contour flux limits at service area boundaries. Because the digital signals to which this process is being applied are 'noise-like' with uniform power spectral density across each channel, subchannel and superchannel, a straightforward process can be applied whereby the power per channel per station is arithmetically added to the power per channel for all other stations pertinent to the interference calculation. If a main station transmitter, one or more booster station transmitters and one or more response station transmitters in a given system are simultaneously active on channels which fully or partially overlap, then the calculation of aggregated power would involve all such simultaneously active stations on all of the overlapping portions of the channels.[70] This procedure for interference calculations for cellularized systems was proposed because Petitioners expect, and we believe it is reasonable to assume, that these systems will involve large numbers of transmitters with heavy frequency reuse and simultaneous operation, and that the interference effects of such large numbers of emitters must be taken into account in a manner drastically different than is now done on a site-specific basis under our current interference protection rules.

40. With respect to calculating the interference effects of response stations in cellularized systems, we proposed to implement a process proposed by the Petitioners which utilizes theoretical estimations and

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[69] For example, the -73 dBW/m^2 contour protection limit for a 6 MHz digital channel corresponds to -89.8 dBW/m^2 for a 125 kHz digital channel. For digital channels of any width, the required contour protection limit is expressed by the following formulation: -73 dBW/m^2 + 10log(digital channel width in MHz/6). We also proposed, for the sake of uniformity, to conform the -75.6 dBW/m^2 contour protection limit of Part 74 (see *e.g.* former 74.985(c)) to the -73 dBW/m^2 limit of Part 21.

[70] For example, a given channel or superchannel might be used simultaneously at more than one booster station to service separate response service areas. The same channel or superchannel might be used in a yet another response service area for response station transmissions. To the extent that such operations involve simultaneously active transmitters on partially or completely overlapping channels, the power emitted by all such transmitters must be aggregated per channel in order to calculate the total power flux density to be used for interference calculations.

statistical modeling of response station locations, necessitated by the fact that the locations of the individual response stations will not be known at the time the interference calculations for the overall system are made. This situation arises because, in the type of system proposed, the application for licensing of the system will contain specific site locations for only the transmitters at main and booster stations. All response station transmitters would be licensed under blanket authorizations which specify only the locations of the receiving hub stations associated with the response stations. The response stations themselves would be installed and activated over an indefinite period of time commencing after the system was licensed. This sequence of system design, development and authorization thus necessitates a radical departure from the customary process whereby interference calculations are made based on specific information concerning specific stations at specific locations with specific operating parameters.

41. The process devised by Petitioners for calculating response station interference, entitled "Proposed Text of Attachment to Report and Order Setting Forth Method for Predicting Accumulated Signal Power From a Multiplicity of Statistically-Located Transmitters," ("Methodology") was attached to the *NPRM* as Appendix D. This Methodology involves essentially two tasks; first, a theoretical model is constructed for use in estimating the amount of interference likely to be generated by the response stations operating within a system; and second, this estimate of response station interference is combined with specific calculated interference levels from main and booster stations and the total is used to determine compliance with the Commission's interference standards. A detailed description of the proposed Methodology is given in the *NPRM*, beginning at paragraph 34, and will not be repeated here. The essential elements of the theoretical model are as follows: A system of intersecting lines in checkerboard fashion ("the grid") is created within a selected response station service area within the system. Each grid point (*i.e.*, each point where lines intersect) is considered to be the location of one or more hypothetical response stations with defined parameters for a class of response station, *e.g.*, frequency, EIRP and antenna pattern/orientation/polarization/height AGL.[71] A number of theoretical measurement points are established at locations surrounding the grid and the theoretical signal strengths of all assumed response stations at all of the measurement points are calculated and evaluated for sufficient uniformity to test the adequacy of the grid.[72] Once the uniformity test is met, all subsequent interference calculations involving response station transmitters are based on the hypothetical equivalent response stations located at the grid points.

42. Numerous parties took issue with all or part of the Methodology and some parties suggested various alternatives to it. Dallas County was critical of the proposed techniques, arguing that the proposal presents insufficient details for an incumbent to evaluate or validate the conclusions as to no potential

[71] The Methodology implicitly included a worst-case assumption that large numbers of response station transmitters for each region and class would be operating simultaneously, and thus each grid point would represent many simultaneously active emitters. To estimate the geographic dispersion of response stations among grid points, Petitioners proposed to use U.S. Census population data in such a way as to correlate the location densities of response stations with population densities within U.S. Postal Service ZIP Code areas. With respect to station technical parameters, each hypothetical equivalent station for a regional class was assigned worst-case parameters *vis-a-vis* all the actual stations it was intended to represent. Thus, a theoretical station would be assumed to have the highest antenna height, greatest power, widest bandwidth, longest duty cycle, and the highest "combined worst-case" antenna horizontal radiation pattern of all the stations for which it is a proxy.

[72] The test for uniformity was described in detail in the *NPRM* at Appendix D. Once the uniformity test is met, it provides a reasonable indication that the density of the grid points is sufficient that no greater number of grid points would significantly improve the accuracy of the interference model.

interference from a two-way application.[73] BellSouth supported the use of models to predict interference, but recommended the establishment of a working group to refine the modeling process as actual systems are tested and interference issues are resolved.[74] EDX argued that the approach to establishing the grid is flawed in several ways, including the omission of terrain considerations in performing field strength calculations and the fact that multiple grids, each with different point densities, are possible within a given service area and could lead to different interference calculation results that would be incompatible.[75] EDX suggested that the spacing of grid lines be based on fixed latitude/longitude increments, rather than mileage as proposed by Petitioners, and that terrain be used as a determinant of grid point density. EDX also proposed an alternate interference methodology in which all response station transmitters within a defined area would be represented by "a single hypothetical aggregate response station located at the RSA hub location, using an omnidirectional antenna, and with a power level set as a function of the maximum power level and number of response stations associated with that RSA hub."[76] Spike commented that the EDX methodology, while flawed in Spike's opinion, might prove useful in areas where terrain shielding is not an important factor.[77] Spike argued that Petitioners' use of census data for estimating the distribution of response stations is flawed, and that Petitioners' Methodology does not properly account for Time Division Multiple Access ("TDMA") type systems, where transmitters operate sequentially rather than simultaneously.[78] Spike suggested that there should be more flexibility in the way interference is calculated, with applicants free to choose their own particular methodologies as long as they adequately describe their procedures and the assumptions used to reach their conclusions. With reference to hub stations, Spike proposed that the definition of hubs be expanded to permit transmission as well as reception of signals.[79] CTN, in addition to challenging the use of census data, argued that the proposal "raises many questions which have not been answered," and that "there is no procedure for ensuring that the actual installation of response stations corresponds to what the applicant predicted."[80]

43. In response to criticism of their Methodology, Petitioners proposed to make several modifications to the way the grid system is configured and the theoretical transmitter parameters established.[81] Petitioners proposed to specify the separation of grid points in terms of latitude and longitude rather than miles; to revise the grid uniformity test to eliminate the possibility that increasing the density of points in a grid already meeting the uniformity test could result in the grid failing the test; to increase the number of grid points

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[73] Joint Comments of Dallas County Community College District, *et. al.*

[74] Comments of BellSouth Corporation and BellSouth Wireless Cable, Inc.

[75] Comments of EDX Engineering, Inc.

[76] *Id.*.

[77] Reply Comments of Spike.

[78] Comments of Spike.

[79] *Id.*.

[80] Comments of CTN.

[81] Reply Comments of Petitioners.

within a sector if the number falls below a predetermined minimum; to revise the methods of considering terrain blockage and of the sharing of channels by response stations; and to use a fewer analytical steps for TDMA systems. In addition, responding to parties who asked for a more detailed explanation of exactly how the procedures in the Methodology would be applied to the calculations of response station interference, Petitioners submitted a sample interference study which, they said, "provides a step-by-step description of how an engineer can employ software products that are readily available in the marketplace to perform analyses of the potential for interference from response stations."[82] In response to Spike and others who challenged Petitioners' use of census data for predicting the geographical distribution of response station locations, Petitioners agreed that this data reflects residential, not business, populations, but argued that this "will result in the creation of additional regions within response service areas in order to meet the uniformity of population test required by the methodology," and, thus "the more regions that are created, the more accurate predictions of interference tend to be." In a subsequent filing, Petitioners proposed further modifications to their Methodology, wherein the actual terrain elevations at, and around, all grid points are taken into account in the specification of the theoretical response station parameters used at each grid point for interference calculations.[83] Additionally, Petitioners proposed to eliminate the use of census data for estimating response station locations in CDMA systems.[84] With reference to CTN's concern that the numbers or types of response stations actually put into operation may differ from what was contained in the system application and interference analysis, Petitioners responded that the Commission relies upon licensees to construct their systems in accordance with the terms of their authorizations which would provide a maximum number of response stations for each class, and that the Commission has a number of tools, including license revocation, to sanction unlawful operation.[85]

44. With respect to Spike's suggestion that Petitioners' methodology should be more flexible, and to EDX's proposed alternative to the Methodology, Petitioners argued that neither proposition has merit.[86] Petitioners stated that the use of a standard methodology "will provide a high degree of certainty to applicants and licensees and will avoid unnecessary disputes before the Commission regarding the efficacy of any particular model."[87] Petitioners further argued that if a common, Commission-mandated, methodology is not established, then the licensees of neighboring systems will not only have to verify the calculations within an interference analysis submitted to the Commission, but also will have to verify the assumptions and formulations which went into development of whatever methodology is being used. Such an approach, Petitioners said, would be antithetical to the goals of applicants and the Commission of providing the most expeditious possible processing of applications within the services, in that the number and complexity of disputes which might arise with the use of a common methodology will be far less than would arise if there were multiple unspecified methodologies. With respect to EDX's proposed alternative methodology, Petitioners argued that it is "fundamentally flawed," in that EDX's use of a single emitter at each hub station location as

[82] *Id.*

[83] Petitioners' *ex parte* letter of May 13, 1998.

[84] *Id.*

[85] Reply Comments of Petitioners.

[86] *Id.*

[87] *Id.*

a proxy for all response stations within the associated response station service area ("RSA") does not take into account the actual interference effects along the various line-of-sight and obstructed paths within the RSA, and thus will inevitably misstate the interference potential of the response stations in a way that could not be corrected by adjustments to the parameters set for the hypothetical hub station transmitter.[88] Additionally, Petitioners argued that EDX's methodology is "flawed by its failure to provide any mechanism for modeling the potential for interference from a non-circular RSA," nor does EDX's methodology "accurately model the potential for interference in those situations where response station transmitters are located in close proximity to an adjacent market receive site or PSA boundary." Responding to Spike's request that hub stations be permitted to transmit, as well as receive, signals, Petitioners argued that such a change would fundamentally alter the type of interference analysis necessary for hub stations, and that Spike has erroneously assumed that booster stations cannot be co-located with hub stations.[89]

45. In addition to concerns about the response station interference Methodology, CTN contended that interference could be caused to ITFS receive sites by nearby response stations as a result of brute force overload ("BFO") to broadband downconverters used at these sites.[90] CTN pointed out that WCA petitioned the Commission for expedited reconsideration of the *Report and Order* which established the Wireless Communications Service ("WCS") in the 2.3 GHz band, where WCA raised concerns about BFO interference and asked for immediate relief to avoid serious and irreparable injury.[91] CTN cited WCA's request that WCS stations be limited to 20 watts EIRP, although the WCS is separated from MDS/ITFS spectrum by 140 MHz, and contrasted it to Petitioners' request that response stations be permitted an EIRP of 2000 watts, and concluded that "surely response station transmitters operating at 2000 watts with no guardband at all would present a much greater problem to ITFS downconverters."[92] CTN also questioned how response stations can be properly installed so as to minimize BFO interference if customer-installed equipment is permitted.

46. As a solution to the potential problem of interference from response stations, including BFO interference, CTN proposed that a spectrum buffer be created which "places a 24 MHz guardband between downstream ITFS and upstream MDS operation, in which only downstream MDS operations are permitted."[93] CTN argued that such a guardband would have several benefits, in that it would: (1) moot the need for

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[88] *Id.*

[89] *Id.*

[90] BFO interference results from response stations transmitting on channels which are neither cochannel with, nor directly adjacent to, the channels in use at the ITFS receive site. A broadband downconverter used at an ITFS receive site is a device connected to the receiving antenna which takes the microwave signals from the antenna and converts them to signals of lower frequency. This downconversion is necessary as a preliminary step before the signals are demodulated. CTN defined BFO interference to exist if greater than a 1 dB degradation to the carrier-to-noise ratio of the downconverted NTSC analog ITFS signal is observed due to the operation of one or more response stations using digital modulation.

[91] *WCA Petition for Expedited Reconsideration*, GN Docket No. 96-228, (March 10, 1998); *Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service*, 12 FCC Rcd 10785 (1997).

[92] Comments of CTN.

[93] Request for Supplemental Comment Period and Extension of Time by Catholic Television Network, November 25, 1997, Appendix at 3.

calculating response station interference into ITFS receive sites; (2) allow the installation of bandpass filtering, when needed, at ITFS receive sites to give broadband downconverters greater immunity to BFO interference; and (3) confine the risk of BFO interference, as well as conventional cochannel and adjacent channel interference, solely to the MDS spectrum authorized to MDS licensees and wireless cable operators, where it could more readily be solved on an intrasystem basis. To implement this plan, CTN proposed to "refarm" (*i.e.*, change specific channels used by certain stations, but with no net reduction in the number of channels available to any station) the E, F, G and H Group channels to create a contiguous band of spectrum for ITFS use at 2500--2620 MHz and a contiguous band of spectrum for response station use at 2644-2690 MHz. As an alternative to their 24 MHz guardband plan, CTN proposed a plan whereby a 6 MHz guardband between downstream ITFS and upstream MDS operations would be combined with a notification and testing procedure for all response stations installed in proximity to ITFS receive sites.[94] Under this procedure, no response station could be installed until a notification was sent to each ITFS licensee with any receive site within a distance of 1960 feet of the of the location of the proposed response station. In addition, for proposed response stations located within 300 feet of any ITFS receive site, or within 300 feet either side of the boresight azimuthal orientation of any ITFS receive site antenna along a line extending from the antenna for a distance of 1960 feet, an on-air test would be required in order to establish that, in fact, no interference would result from operation of the response station.[95] CTN stated that the notification and testing procedure is necessary in order to compensate for the fact that bandpass filters are not usable if the guardband is reduced from 24 to 6 MHz. As a second alternative to the 24 MHz guardband plan, CTN proposed that the Commission designate eight 6 MHz channels, A4, B4, C1, D1, E4, F4, G1 and H1, for upstream use at response stations. Single channel guardbands, consisting of channels B3, C2, F3 and G2, would be established to separate response station upstream channels from downstream ITFS channels.[96] In addition, under this plan, response stations would also be required to perform the notification/testing procedure set out above for the other 6 MHz guardband proposal. In a filing in response to the Commission's establishment of a comment period on *ex parte* pleadings, CTN reiterated their requests for a 6 MHz guardband and for notification and testing procedures.[97]

47. A number of parties disputed CTN's allegations that interference would be a serious problem and questioned the need for guardbands. Region IV Educational Service Center ("Region IV") argued that CTN had created a "theoretical monster," coupled with a "staggeringly complicated and restrictive solution which could well result in a still birth of the basic two-way service concept."[98] ITFS Parties argued that the guardband proposal and refarming of spectrum "creates a host of problems," and that "this cure would be much

[94] Comments of CTN.

[95] *Id.*

[96] Reply Comments of CTN.

[97] July 2 Comments of CTN. CTN specified that the 6 MHz guardband would apply geographically within a radius of 35 miles from each ITFS main transmitter site. Their earlier guardband proposals were geographically indeterminate.

[98] Comments of Region IV, UT Television, George Mason University Instructional Foundation, Inc., Humanities Instructional TV Educational Center, Inc., the Denver School District, Butler Community College and Minnesota Public Radio.

worse than the purported disease."[99] ITFS Parties urged CTN to "focus more on simply crafting rules that require proponents of a two-way, cellularized system to resolve interference problems caused by the system, and to shut down any interfering operations until a resolution can be achieved." Petitioners argued that the risk of BFO interference is *de minimis*, saying that "detailed analyses conducted by Petitioners demonstrate that under any realistic scenario, ITFS receive sites located in less than 1% of a protected service area would even be at risk, and mitigation techniques generally can eliminate any interference at those few sites."[100] Petitioners presented calculations made for four different system architectures (*i.e.*, configurations of response station transmitters and ITFS receive sites) which they claim demonstrate that, under typical real-world conditions, the amount of vulnerable area within a PSA is always less than 1% and sometimes as little as 0.003%.[101] Petitioners also described numerous techniques which they claim can be used alone, or in combination, to mitigate the effects of any BFO interference which might occur within the small areas of a PSA which are vulnerable.[102]

48. With respect to CTN's guardband proposals, Petitioners argued that restrictions on the channels available for upstream use would "unnecessarily hamper the commercial viability of two-way services."[103] Petitioners charged that CTN "has provided the Commission with absolutely no technical analysis which even purports to show that the operation of response stations within 6 MHz of an ITFS channel will invariably lead to interference," and that "CTN would have the Commission sacrifice the ability of ITFS licensees to deploy their spectrum flexibly merely to avoid the need for the development of interference protection rules."[104] With respect to the notification and testing procedures advocated by CTN, Petitioners said that these measures are "both unnecessary and so onerous that they would threaten the commercial viability of two-way service offerings," and that it is "impossible to establish an inflexible zone around each ITFS receive site that reflects the area in which a response station installation threatens to result in [BFO interference]."[105] Petitioners argued that there are many variables, "including orientation and polarization of the antennas relative to each other, distance between antennas, sidelobe suppression of the antennas, [downconverter] dynamic range and response station power" that all determine whether interference might occur.[106] In response to CTN's arguments concerning WCA's action seeking reconsideration of the power limits in the WCS, Petitioners argued that the reconsideration applied only to mobile stations and that the power limit

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[99] Comments of ITFS Parties.

[100] Comments of Petitioners.

[101] *Id.*

[102] *Id.* The techniques are cross polarization, antenna offset, improved antenna performance, attenuation, improved downconverter dynamic range, field tunable notch filter, bandpass filter, reorientation of response station antenna, microwave absorption material and phased antenna arrays.

[103] Reply Comments of Petitioners.

[104] *Id.*

[105] *Id.*

[106] *Id.*

for fixed WCS stations remained at 2000 watts EIRP, identical to that proposed for response stations. Petitioners also cited six differences between the interference protection requirements placed on WCS stations as compared to those proposed for MDS/ITFS response stations, saying that all six place heavier burdens on, and insure greater protection from, response stations.[107]

49. In addition to the issues discussed above relating to the response station interference Methodology and the creation of guardbands, Petitioners and various other parties raised concerns about, and/or counterproposals for, several other technical issues in the *NPRM*, specifically:

Response Station Power Limit Petitioners requested that the response station power limit be fixed at 33 dBW, identical to that already permitted for main stations and proposed for high-power booster stations. In the *NPRM*, we proposed to apply an EIRP limit of 18 dBW to response stations, citing concerns about the extremely complex interference environment in which such stations would be functioning.[108] Petitioners responded that the proposed 18 dBW limit is "far too low to permit wireless cable to be a commercially viable service."[109] Petitioners submitted a technical analysis which contained detailed calculations which, they argued, supported their proposal for the higher power level.[110] Responding to Petitioners' argument, CTN did not dispute Petitioners' calculations, but did question the basis for Petitioners' assumption that response stations would transmit with 33 dBW EIRP into hub stations with +10 dBi gain receiving antennas, arguing that equal results could be obtained with 23 dBW EIRP and +20 dBi hub receiving antennas.[111] Petitioners disputed CTN's claim that the larger antennas could be used at hub stations, saying that "it may be physically impossible to mount a sufficient number of antennas with high horizontal gains at a hub location to provide the necessary omnidirectional coverage."[112] CTN replied that they found Petitioners' arguments unpersuasive, and "find Petitioners' claims of tower loading constraints, the lack of tower vertical real estate, and tower sway, to be particularly unpersuasive."[113]

Protection of Hub Stations In the *NPRM*, the Commission proposed that the protected signal level at a hub station receiver would be "the minimum received signal level that the proposed hub can actually utilize in the provision of service, specified in dBW/m^2/Hz."[114] Commenters were requested to respond specifically concerning whether "such an important element in the interference analysis [should] be permitted to be specified by a system operator without some objective basis which could be validated, or alternatively, [whether] a

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[107] *Id.*

[108] *NPRM*, 12 FCC Rcd at 22194

[109] Comments of Petitioners.

[110] *Id.*, Attachment B, "Power Limitations for Response Station Transmitters: An Analysis"

[111] Reply Comments of CTN.

[112] Petitioners' *ex parte* letter of March 6, 1998.

[113] CTN ex *parte* letter of April 9, 1998.

[114] Proposed Section 21.909(c)(2)(iii).

suitably representative value [could] be determined for this purpose." CTN objected to this specification of hub protection, saying that this would mean that an ITFS applicant "would have to show that its proposed modification or newcomer ITFS station would be 45 dB or 0 dB (as appropriate) below the weakest level signal that the Response Station Hub licensee's receivers could conceivably detect," and that requiring such protection for omnidirectional Response Station Hubs "would either result in a *de facto* freeze to the ITFS service, or would give Response Station Hub licensees such powerful leverage as a result of the need for "no objection" letters from those licenses that any semblance of a "level playing field" would be lost."[115] In response, Petitioners proposed to revise the interference protection for hub stations, eliminating the minimum-received-signal criterion and substituting for it a specification for the maximum permissible degradation of the 'noise floor' of the hub receiver.[116] Specifically, Petitioners proposed that a response station hub receiver be deemed protected from interference when the interfering power flux density generated by a neighboring system (accumulating the signals of the main station and any booster stations or simultaneously operating response stations) received by the hub antenna is no greater than -190 dBW/m^2/Hz if the interfering signal is cochannel, or -151 dBW/m^2/Hz if the interfering signal is adjacent channel, with a 20 dB reduction in either case when the interfering signal is cross-polarized. Petitioners also proposed to amend the protection standard to take into account the actual antennas in use at the hub station, rather than assuming an omnidirectional antenna.[117] These modifications, Petitioners argued, should satisfy the Commission's concern "that an applicant could specify an inappropriate required receive signal level in order to secure undue protection to the response station hub." Gulf Coast and Spike agreed with Petitioners' proposal to use the noise floor, while CTN stated that the proposed numbers "appear to be technically valid for uniform density signals, but not for conventional NTSC analog signals," and that the proposed numbers would penalize NTSC signals because of their nonuniform power spectral distribution.[118] CTN also argued that the proposed numbers posed a 3 dB disadvantage for NTSC signals because they referred to the peak, rather than average, power of the NTSC signal. Petitioners responded that using peak power for NTSC signals and average power for digital signals "continues the practice established in the *Digital Declaratory Ruling* of licensing just one power level for a station and calculating interference the same way for both analog and digital signals."[119] In their comments on the Petitioners' *ex parte* filings, CTN reiterated their contention that Petitioners' protection criteria for hub stations would have a preclusionary effect on future expansion or modification of ITFS facilities, and, as a solution, proposed that response station hubs be given secondary status with respect to all ITFS facilities more than 35 miles away.

Terrain Shielding Petitioners questioned the justification in the current interference protection rules for providing protection to receive sites from response stations if the signal strength of the response station is beneath the noise floor of the victim receiver, noting that "in areas where the desired signal has significant excess path loss due to terrain blockage between the receiver and desired transmitter, it can be impossible to

[115] Comments of CTN.

[116] Comments of Petitioners.

[117] Petitioners' *ex parte* letter of May 13, 1998.

[118] Reply Comments of Gulf Coast MDS Service Company, Spike and CTN.

[119] Petitioners' *ex parte* letter of March 6, 1998.

provide the 45 dB protection required."[120] Petitioners proposed that, in conducting interference studies where the desired signal falls below the appropriate noise floor, "no calculations of compliance with the 45 dB benchmark should be required." Spike and BellSouth both supported this proposal, although BellSouth added a caveat that the undesired signal should not add more than 1 dB to the aggregate C/N+I of the desired signal.[121] CTN also supported the proposal and would extend it to apply to situations where the desired signal is above the noise floor but is nevertheless so weak that "there would be no reasonable expectation of useful service at that low level."[122]

Propagation Formulas/System Data Dallas County raised a concern, also expressed by others, that the Methodology developed by Petitioners and proposed in the *NPRM* is insufficiently detailed to permit independent verification of interference analysis results.[123] Dallas County wants Petitioners to "make available to the Commission for application evaluation purposes a set of step-by-step calculations for all to follow, including all assumptions and equations, if not the derivative software itself." ITF argued that the Commission "can assume an important role by making public the databases and engineering software which it uses to evaluate MDS and ITFS applications."[124] ITF stated that it will "petition the FCC to postpone filing windows if the ITFS community cannot gain reasonable access to the essential engineering tools." The University of Maryland ("Maryland") requested that the software and databases used by the Commission for conducting interference analyses be made available to the public in order to "alleviate the burden placed on all ITFS operators in evaluating numerous booster and response station proposals."[125] In response to these concerns, Petitioners proposed to amend their Methodology to increase "the level of specificity in the proposed rules as to the substance and format of information required to be filed with an application for a response station hub license (particularly information regarding the channel plan and the methodology employed for calculating potential interference), and the possible requirement that filings be made on computer diskettes in order to provide the Commission and interested parties improved access to relevant data."[126]

50. Our proposals to continue, as well as extend, use of the 45 dB/0 dB D/U interference protection ratios and the -73 dBW/m^2 contour protection standard were unopposed. Therefore, we are adopting rules requiring their use in calculating interference from multiple response stations licensed under blanket authority of hub station licenses, as well as in situations where the signals from main, booster and/or response

[120] Comments of Petitioners.

[121] Comments of BellSouth Corporation and BellSouth Wireless Cable, Inc.

[122] Reply Comments of CTN.

[123] Joint Comments of Dallas County Community College District, *et. al.*

[124] Reply Comments of Instructional Telecommunications Foundation, Inc. ("Foundation")

[125] Comments of Maryland.

[126] Petitioners' *ex parte* letter of May 13, 1998.

stations (for both analog and digital systems) must be combined to determine interference levels.[127] With respect to the Methodology proposed by Petitioners for calculating the interference potential of response stations, we agree with EDX and others who pointed out that the original formulation of the proposed grid system ignored terrain data and thus may not be representative of the actual interference potential of the response stations in the grid. Petitioners have, we believe, corrected this deficiency with their proposal to assign to each grid point the highest elevation AMSL of all the geographic area surrounding that grid point, thus making the theoretical stations assigned to each grid point much more likely to result in more sensitive interference calculations. With respect to the use of census data, we agree with Spike and others who argued that this procedure would not produce results that were necessarily accurate or representative of the actual distribution of response stations. Petitioners have, we believe, corrected this deficiency with their proposal to drop the use of census data and, instead, to assume a worst-case distribution of response stations in CDMA systems by assigning all of the simultaneously active cochannel response stations to the grid points in an RSA which have the greatest interference potential. For TDMA systems, we concur with Petitioners' proposal to also modify their Methodology to conduct interference analyses from the grid points which have the greatest interference potential.[128]

51. With the major modifications discussed above, we believe that Petitioners' Methodology for calculating response station interference is sufficiently comprehensive and conservative that we are adopting it as a requirement of our rules.[129] We are also adopting other modifications to the Methodology, including two provisions involving the receiver noise floor. We agree with CTN and others who argued that Petitioners' original 'minimum receivable signal' hub receiver protection standard would have, in some instances, overprotected the hub station and thus potentially precluded the construction of other stations. We believe that Petitioners' amended proposal to protect the hub receiver's noise floor, and to take into account the actual antenna(s) in use at the hub, is a better way to protect hubs without penalizing other potential operations and we are therefore adopting it in our rules. We reject CTN's request to protect hub receivers only to a distance of 35 miles and make them secondary beyond that distance. We understand CTN's concerns with respect to hub station protection acting as a possible brake on ITFS growth in certain circumstances. However, we believe that the detailed interference analysis and other safeguards we have adopted in this Order will minimize any such effects to the most reasonably possible extent.

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[127] We are also adopting our proposal to replace the -75.6 dBW/m^2 contour standard found in Part 74 with the -73 dBW/m^2 contour standard of Part 21. We believe it would be impractical, if not impossible, to apply both standards simultaneously when channels from both MDS and ITFS will be combined in cellularized systems.

[128] For both TDMA and CDMA systems, interference analyses will be conducted by the generation of a matrix of interference calculations consisting of all potential interfering transmitters and all potential victim sites and boundaries, and, from this matrix, the worst-case interference levels will be selected in order to determine if the appropriate protection criteria have been met. Thus, in this procedure, the grid point which causes the highest level of interference at one receive site or boundary may be, and probably will be, different from the grid point which causes the highest level of interference at a different receive site or boundary.

[129] The text of the Methodology is being incorporated by reference into Rule Parts 21 and 74. As we gain experience with the licensing and operation of two-way systems, we intend to review the Methodology and make any appropriate and necessary revisions to it which might enhance spectrum usage and communications capabilities without sacrificing necessary interference protection. As now constructed, the Methodology incorporates worst-case procedures which, in the light of future real-world experience, may be partially or wholly unnecessary. We invite input from licensees and the engineering community in this process. Any amendments to the Methodology will be announced by Public Notice.

52. With respect to response station protection of nearby systems, we agree with Petitioners' proposal to take into account the actual received signal levels of the desired and undesired signals in the system receiving protection and we are adopting this procedure as an amendment to the Methodology. We do not believe that EDX's alternative to Petitioners' response station interference Methodology is usable because, for many two-way system configurations, EDX's interference calculations will inevitably give erroneous results, a shortcoming conceded by EDX itself.[130] Nor do we agree that applicants should be free to choose any methodology they wish for making interference calculations, as this would drastically slow the evaluation of applications and almost certainly result in many Petitions to Deny, as licensees and applicants struggled to understand the differing and potentially incompatible assumptions and calculations incorporated into the various methodologies. We also decline to adopt Spikes' recommendation that hub stations be redefined to include transmitting capability. This is not necessary because booster and main stations may be co-located with hub stations to provide transmission capability, and permitting hubs to also transmit would simply add redundancy and unnecessary complexity to the interference protection requirements of the rules. With respect to CTN's concern that the actual numbers and types of response stations may not conform to those for which application was made and interference calculated, it should be understood that the assumptions for these items used by an applicant in the interference analysis become, upon grant of the license, terms of the authorization and, as such, must be observed. We do, however, agree with CTN that response stations should not be installed by end users and we are therefore adopting a requirement that all response stations be installed by the hub station licensee or its employees or agents. Given the interference environment in which response stations will operate, we do not believe it would be prudent to permit them to be installed by nonprofessionals with no knowledge of the protection requirements for nearby ITFS receive sites.

53. With respect to response station power limits, we have decided to grant Petitioners' request to permit the use of up to 33 dBW EIRP. Although we continue to be concerned about interference, we concur with the conclusions of Petitioners' propagation analysis that the proposed 18 dBW power limit would adversely impact system range and reliability, thereby increasing the number of stations needed and increasing system costs. The 33 dBW power limit is predicated on a bandwidth of 6 MHz, and the power limit for stations using lesser bandwidth must be reduced proportional to that bandwidth. For the 125 kHz channels, for example, the EIRP limit will be 16 dBW.[131] As a practical matter, we do not expect that all, or even most, response stations will utilize the maximum power permitted. The most efficient operation of hub station receivers will typically occur when the received signal levels from the multiplicity of associated response stations are roughly equal. We would therefore expect that maximum facilities would be used only on paths which are relatively long and/or paths with unfavorable intervening terrain. Main station and high power booster stations will be permitted to operate at a maximum EIRP of 33 dBW, except that, when directional antennas are utilized at either type of station, a maximum EIRP of up to 39 dBW will be permitted, depending upon the directivity of the antennas used.[132]

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[130] In comments in response to Petitioners' *ex parte* filings, EDX reiterated its arguments that Petitioners' Methodology for calculating response station interference is unduly and needlessly complex and pressed again for consideration of EDX's own, simpler, interference calculation methodology. However, EDX provided no new information about its preferred methodology, or modifications to that methodology, which would reduce the likelihood that its use could result in significant levels of error when applied to a variety of 2-way system configurations.

[131] 33 dBW - 10 log (6000/125) = 16 dBW; this is equivalent to a 250 milliwatt transmitter utilizing an antenna with 22 dBi gain.

[132] For main and booster stations with sectorized service areas, a maximum EIRP of 39 dBW would be permitted per sector, based upon the horizontal plane pattern of the sector antennas.

54. After carefully considering CTN's concerns about potential interference problems, we have decided to deny their request that guardbands be established separating upstream (response station) transmissions from downstream ITFS transmissions. CTN's first proposal, involving the creation of 24 MHz-wide guardbands, could result in partially or completely eliminating many MHz of potentially useful upstream spectrum on the speculative assumption that such action was necessary to protect ITFS receive sites from interference. CTN's second and third proposals, involving 6 MHz guardbands, while precluding less upstream spectrum on the same assumption, would involve establishing notification and testing procedures for response stations in proximity to ITFS receive sites.[133] In their fourth guardband proposal, requiring 6 MHz guardbands within a 35 mile radius of ITFS main transmitters, CTN argued that the proposed response station interference Methodology is "unduly complex" and will be ineffective in determining interference when the potential victim ITFS receive site is within a hub station's RSA. This is not the case, however, because the Methodology, as amended in Petitioners' most recent *ex parte* submission, now calculates interference from both TDMA and CDMA systems based on identification of worst-case matrix grid points. In this way, calculations to potential victim receive sites inside, as well as outside, the RSA can be made. With respect to the complexity of the Methodology, it is, of necessity, not a simple procedure and CTN offered no alternative methodology to its use, nor any explanation of how guardbands would eliminate the need for its use for interference calculations beyond whatever geographic radius was set for the use of guardbands.[134] In summary, we believe guard bands would deprive parties the flexibility to design and operate their systems in a manner that best meets their needs, and would deprive them of spectrum which, in some, if not most, geographical areas could be partially or wholly utilized for two-way operations without danger of interference to ITFS sites.

55. With respect to the potential for BFO interference, we agree with CTN that, in certain limited circumstances, ITFS receive sites could be adversely affected by downconverter overload and that some appropriate relief should be available. CTN is correct that the interference from digital response stations will be 'noise like' and thus will present significantly greater problems than current analog emissions in terms of evaluation and location of the responsible transmitters. Additionally, as it is highly likely that, in many instances, the interference will be intermittent, as various response stations alternate transmissions with each other and with booster and/or main stations, solving such interference problems will clearly require a highly coordinated and cooperative effort between system licensees. For these reasons, we are adopting CTN's request to require a hub station licensee to formally notify an ITFS licensee when a response station is to be located in the vicinity of any of the ITFS licensee's receive sites. Specifically, we are creating a notification zone with a radius of 1960 feet around each ITFS receive site, and we will require that, at least 20 days prior to the activation of any response station within such a zone, the hub station licensee notify, by certified mail, the appropriate ITFS licensee. The notification must contain the street address and geographic coordinates of the response station, a specification of the station's EIRP, antenna pattern, orientation, polarization and height AMSL, channels to be used, as well as the name and telephone number of a contact person who will be responsible for coordinating the resolution of any interference problems. We expect, and will require, that licensees of stations causing interference fully cooperate with other licensees by promptly and thoroughly responding to any notifications that their systems are causing interference. In that event, we would expect that the licensee of the offending station would *immediately* commence a cooperative effort with any licensees

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[133] The precise amount of spectrum rendered unavailable for upstream transmissions would depend on the specific channels in use in an area and on the geographical distribution of the stations involved. Inasmuch as protected ITFS channels would require guardband spectrum both above and below their edges, protecting a single channel with 6 MHz guardbands could affect 12 MHz of spectrum.

[134] For example, even if guardbands of 6 MHz were required within a 35 mile radius of an ITFS transmitter, the techniques set out in the Methodology, or some other similar set of techniques, would still be necessary for interference calculations from response stations more than 35 miles from the ITFS transmitter.

receiving interference to solve the problem as quickly as possible at the expense of the offending licensee. If a licensee fails to promptly and adequately perform these obligations, the Commission will require appropriate remedial action by that licensee. *It should be understood clearly that the Commission is prepared to, and will, order the immediate de-activation of part, or all, of a system if that system is causing interference and the licensee has not cooperated fully and in a timely manner to eliminate the interference*. We do not find the additional burden of mandatory response station testing is necessary at this time. We believe the best course of action now would be to permit an adequate and thorough evaluation of the notification procedure prior to any consideration of a testing requirement or other more restrictive actions.

56. With reference to the technical sufficiency of the formulations, calculations and data requirements necessary for utilization of Petitioners' Methodology, we are satisfied that Petitioners' most recent proposed revisions in this regard are adequate and we are making them part of the Methodology being adopted. The last section of the Methodology now consists of information and examples relating to the formatting of data and information to be submitted to the Commission in connection with applications for cellularized systems. We will require that, beyond the information contained on FCC Forms 304 and 330, additional data be filed in the specified formats and submitted on diskettes accompanying the application forms. This additional information must be sufficiently complete and accurate for any competent party to verify the validity of the interference analyses. Good engineering practice must be followed in the performance of these analyses and, in the event that an examination of the analyses submitted by any applicant demonstrates that due diligence was not given, the Commission may dismiss the associated applications, or, in the event the applications have been granted, order that the system be de-activated and/or take steps for suspension or revocation of those licenses.

D. Proposals Specifically Regarding Use of 125 kHz Channels

57. Under current rules, the bulk of the 2686-2690 MHz band is comprised of 125 kHz channels which are utilized at response stations. In the *NPRM*, we proposed to amend our rules in accordance with the most flexible framework requested by Petitioners for use of the 125 kHz channels.[135] Pursuant to these proposals, the 125 kHz channels could continue to be used at response stations, but we also would permit them to be used for point-to-multipoint transmissions, in which case they would be licensed and afforded interference protection in the same manner as other point-to-multipoint MDS and ITFS channels. In addition, we proposed to permit the 125 kHz channels to be superchannelized or subchannelized regardless of whether they are used as response stations or for point-to-multipoint transmissions. We further proposed to remove the requirements of current Section 74.939(d)[136] that each 125 kHz channel be used solely in conjunction with a specifically associated 6 MHz channel, and noted the proposal of the Instructional Telecommunications Foundation, Inc. ("Foundation") that we allow ITFS licensees to swap 125 kHz channels on a routine basis, to create larger bandwidth channels. Moreover, to avoid confusion, we advanced the suggestion that each of the 125 kHz channels receive an independent designation, rather than be referenced to the primary 6 MHz channel with which it is associated. Finally, we clarified suggested changes to Section 74.902(d)(1)[137] of the Commission's Rules to provide that an ITFS licensee is limited to the assignment of no more than four 6 MHz and four 125 kHz channels for use in a single area of operation.

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[135] *NPRM*, 12 FCC Rcd at 22199-201.

[136] 47 C.F.R. § 74.940(d).

[137] 47 C.F.R. § 74.902(d)(1).

58. Wireless One supports most of the *NPRM*'s proposals for increased flexibility in use of the 125 kHz channels, though Wireless One does not address specifically the issues of using 125 kHz channels other than in conjunction with their associated 6 MHz channels, nor of providing each 125 kHz channel an independent designation.[138] The Bay Area Consortium agrees with the proposed use of the 125 kHz channels for downstream transmissions, "upon proper application to the Commission by the associated primary channel licensee," in order to promote efficient use of the spectrum.[139] The Foundation supports the *NPRM*'s proposals regarding the 125 kHz channels, and adds that the Commission should allow the content of those channels to be independent of that transmitted on related 6 MHz channels. The Foundation also specifically supports our clarification in the *NPRM* with respect to Petitioners' suggested changes to Section 74.902(d)(1).[140] A few commenters, however, appear to take issue with the concept of licensees swapping 125 kHz channels. HITN, for instance, requests that all existing and currently proposed response stations associated with ITFS licenses continue to be licensed to, controlled by, and exclusively associated with those ITFS licenses pursuant to currently existing rules.[141] While Maryland supports sub- and superchannelization of the 125 kHz channels, as well as their use for upstream or downstream transmissions, it states that use of 125 kHz channels licensed to ITFS entities "for purposes other than for ITFS should be secondary to ITFS operations."[142] And CTN, as part of its "refarming" plan, advocates that all 125 kHz channels be reallocated to ITFS and used only for response transmissions.[143] Petitioners "vehemently oppose" the suggestion by CTN, and add that CTN has not discussed how the MDS auction winner, who has the rights to the channels to be reallocated, would be compensated, nor how the reallocated channels would be assigned amongst ITFS licensees.[144]

59. We believe that this approach will provide licensees with the maximum possible flexibility will enhance the architecture of two-way systems in the MDS/ITFS bands, we adopt all of the proposed changes in the *NPRM* with respect to the rules governing the 125 kHz channels. For instance, removing requirements that each 125 kHz channel be used solely in conjunction with a specifically associated 6 MHz channel offers flexibility to create channels with bandwidths exceeding 125 kHz, and we amend Section 74.939(i) of the Commission's Rules[145] to eliminate such requirements. For the sake of simplicity and consistency with the

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[138] Comments of Wireless One.

[139] Comments of the San Francisco - San Jose Educator/Operator Consortium ("Bay Area Consortium").

[140] Comments of the Foundation.; *see NPRM*, 12 FCC Rcd at 22200 n.51.

[141] Comments of Hispanic Information and Telecommunications Network ("HITN"); *see also* Comments of Maryland.

[142] Maryland Comments.

[143] CTN Comments. In the engineering statement appended to its comments, Maryland goes even further than CTN, posing that if the Commission were to reallocate the entire 2686-2690 MHz band to MDS/ITFS response stations, that might be sufficient for the two-way services contemplated by the *NPRM*. Currently, the response channels associated with Channels E3-4, F3-4 and H1-3 are also allocated to the Private Operational Fixed Point-to-Point Microwave Service. *See* 47 C.F.R. § 101.147(g).

[144] Comments of Petitioners.

[145] 47 C.F.R. § 74.939(i).

MDS/ITFS database, we also amend the frequency table in new Section 74.939(i) to redesignate the 125 kHz channels as the I Channels.[146] Furthermore, we amend Section 74.939(i) to reflect greater flexibility with respect to uses of the I Channels, such as sub- and superchannelization, provision for point-to-multipoint transmissions, and swapping of I channels between licensees. We see no reason to disallow swapping of the I Channels where we allow swapping of 6 MHz channels. In response to concerns expressed by some commenters, we reiterate, as reflected in our amended rules, that use of any specific 125 kHz channel is completely at the discretion of the licensee, who remains licensed for, and whose main station is associated with, that particular channel.[147] Moreover, such use may encompass swapping of I Channels between licensees, and leasing of I Channels to a wireless cable operator or another licensee in the market. We also find that the Foundation's suggestion of allowing the content of those channels to be independent of that transmitted on related 6 MHz channels is consistent with our flexible approach, and is a corollary to our elimination of the requirement that each 125 kHz channel be used solely in conjunction with its specifically associated 6 MHz channel.

60. Further consistent with our flexible approach, we deny CTN's request to reallocate all of the 125 kHz channels to ITFS and to use them solely for response transmissions. As we stated in the *NPRM* with respect to a similar proposal similar, we believe that such a reallocation and the ensuing complications are unduly restrictive and counter-productive.[148] Moreover, allowing the I channels to be used for point-to-multipoint transmissions promotes greater options for two-way system design and more efficient use of the spectrum, as described above. Where the I channels are used for point-to-multipoint transmissions, they will be afforded interference protection in the same manner as other point-to-multipoint MDS and ITFS facilities including adjustment of the protection ratios for bandwidth.[149] A licensee who wishes to use its associated I channels for downstream transmissions should file with the Commission a modification application, using FCC Form 331. In the modification application, the licensee should state that it is applying for authority to use the I channels for downstream transmissions, and specify which of its associated I channels it intends to operate in that manner.[150] Specific instructions for filing the application will be set out in a Public Notice prior to the

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[146] Redesignating the 125 kHz channels as the I channels, rather than categorizing them as a species of the H channels, also will prevent any confusion over whether current rules providing for certain H Channel licensee responsibilities likewise apply to 125 kHz channels licensed to an ITFS entity.

[147] Traditional 125 kHz response stations licensed pursuant to new §§ 21.940 and 74.940 must provide interference protection in accordance with §§ 21.902, 21.938 and 74.903 and new §§ 21.909, 21.913(f), 74.939(h) and 74.985(f), of the Commission's Rules, and receive interference protection in accordance with §§ 21.902, 21.938 and 74.903.

[148] *See NPRM*, 12 FCC Rcd at 22200.

[149] Likewise, where I channels are used for response transmissions to hubs under a hub license, the hubs will be afforded interference protection in the same manner as other MDS and ITFS hubs.

[150] For the sake of maximum flexibility, licensees may elect to use some or all of their associated I channels for point-to-multipoint transmissions, and some or all of them for response channels. The same application procedures that we outline for conversion of I channels to point-to-multipoint transmissions shall be utilized by licensees seeking to return the status of an I channel back to response channels from point-to-multipoint usage. Likewise, while we set forth downstream transmissions application procedures by reference to modification applications, the same procedures shall be utilized by new MDS or ITFS station applicants who seek to use their associated I channels for point-to-multipoint transmissions.

date such applications are accepted for filing. However, we note here that these modification applications will be considered minor changes for I channels associated with ITFS stations, including ITFS stations licensed to wireless cable entities pursuant to Sections 74.990-92 of the Commission's Rules,[151] in order to enhance flexibility by avoiding relegation of the filing of such applications to filing windows. While applicants for minor changes to ITFS facilities normally are not required to prepare interference showings or serve them on potentially affected parties, we will require preparation and service of interference analyses by ITFS licensees who seek to use their associated I channels for downstream transmissions, particularly in light of the potential for having I channels with upstream and downstream transmissions on adjacent channels within a market or on cochannels in adjacent markets.[152] Finally, for the same reasons that we decline CTN's request to render low power boosters secondary, we also deny Maryland's request that we mandate that any non-ITFS use of I channels licensed to an ITFS entity be secondary to ITFS use.

E. Application Processing Issues

61. In the NPRM, we tentatively rejected the automatic grant proposal made by Petitioners in which the Commission would grant without review any unopposed two-way license application after a 60-day comment period. Instead, we proposed to adopt a system under which the staff would review the filed applications and issue a grant or denial. We were concerned that Petitioners' proposed process would not allow a sufficient opportunity for either interested parties or for the Commission to review applications and, where necessary, to evaluate the potential for interference to existing sites. A number of commenters, both ITFS and MDS parties, have raised concerns that this approach will unnecessarily delay the introduction of two-way service and prove so cumbersome that such service may never be implemented.[153] Upon review of these comments, we have been persuaded that failure to adopt an expedited processing system will be seriously detrimental to the provision of two-way service.[154] Therefore, we have revised our proposed application processing system, as discussed below, and will adopt a certification procedure that we believe will dramatically expedite the licensing process.

62. The certification procedure we are adopting is a modification of the automatic grant system that was proposed by the Petitioners, which was discussed in the *NPRM* and on which we solicited comments. As such, adoption of it complies with the requirements of the Administrative Procedure Act ("APA") regarding adequate notice "of either the substance of the proposed rule or a description of the subjects and issues

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[151] 47 C.F.R. §§ 74.990-92.

[152] MDS and ITFS applicants and licensees applying to use their associated I channels for downstream transmissions shall comply with the requirements of § 21.902 and § 21.938 where appropriate, using the appropriately adjusted interference protections values based upon the ratio of the 125 kHz bandwidth to 6 MHz.

[153] *See*, *e.g.*, Comments of the Foundation, Region IV, Wireless One and BellSouth. Although some parties did oppose the concept of an automatic grant, see, *e.g.*, Comments of HITN, the majority of commenters on the subject supported some type of streamlined process, especially when coupled with a complete guarantee of protection against interference, discussed *infra*. *See*, Comments of Alliance for Higher Education and the *Joint Statement*.

[154] *See, e.g.*, Comments of NIA and MDS Alliance and Reply Comments of Petitioners. Indeed, in their Reply Comments, Petitioners stated that failure to adopt an expedited processing system will constitute a "death knell" for the MDS industry. *See also*, *Joint Statement* and July 2 Comments of George Mason Instructional Foundation, Inc.

involved."[155] Courts have held that this notice requirement is satisfied where the final rule is a "logical outgrowth" of the rulemaking proposal.[156] Moreover, notice has been held to be sufficient where the description of the "subjects and issues involved" affords interested parties a reasonable opportunity to participate in the rulemaking.[157] In this instance, we both solicited and received comments on the Petitioners' automatic grant proposal. A requirement that parties certify that their applications comply with the Commission's technical and notice rules, and thereby take full responsibility for the accuracy and completeness of their applications, is a logical requirement in an environment where the staff is not performing an in-depth review of the applications.[158] This is especially appropriate where, as here, the consequences of an application containing engineering errors include a complete and immediate shut-down of any site that causes interference to existing or previously proposed sites. Therefore, the certification process we adopt here is consistent with the requirements of the APA.[159]

63. The process we adopt today for two-way applications represents a fundamental shift from the Commission's traditional review function in MDS/ITFS licensing and from our review function in other areas of MDS/ITFS licensing, for example in applications for new ITFS stations. It will require increased diligence by MDS and ITFS licensees in tracking and monitoring the impact of applications by other parties on their own services. However, we believe this new approach is needed to facilitate two-way service to the public and that without it two-way service by MDS operators and/or ITFS licensees may not become a reality. This approach is consistent with methods we have adopted in other proceedings where similar certification procedures rely primarily on the certifications of the applicants as the basis for the licensing system.[160] However, this approach is not necessarily appropriate for all services. MDS and ITFS licensees have a long history of mutual cooperation in their operations. The realities of their operations compel such cooperation. An MDS operator trying to run a system across its BTA must cooperate with the various ITFS licensees in its BTA. Likewise, many ITFS licensees depend on the compensation paid by their local MDS operator to make their own systems a reality. Therefore, the viability of the services depends on the parties working together in good faith, a situation which reinforces the appropriateness of a certification system in this context. Furthermore, MDS is a subscription service, only reaching paying subscribers. Unless it can provide reliable and interference free service to those subscribers the MDS operator will be out of business. We believe the imperative to provide such reliability, in the face of a shut-down threat should interference occur, will compel honest and reliable certifications. Neither the history of cooperation like that between the MDS/ITFS services nor the same type

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[155] 5 U.S.C. § 553(b)(3).

[156] *See, e.g., Aeronautical Radio, Inc. v. FCC*, 928 F.2d 428, 445-46 (D.C. Cir. 1991).

[157] *Transpacific Freight Conference of Japan/Korean v. Federal Maritime Commission*, 650 F.2d 1235, 1248 (D.C. Cir. 1980).

[158] The Commission will rely on an applicant's certification as a material representation.

[159] We note that we are also considering a certification procedure *In the Matter of 1998 Biennial Review--Streamlining of Radio Technical Rules*, MM Docket 98-93, FCC 98-117 (released June 15, 1998).

[160] *See, e.g.,* 47 C.F.R. § 25.132 (Certifications required concerning performance testing of earth station antennae.); 47 C.F.R. § 22.603 (Certification required that planned channel usage has been coordinated with existing licensees and previously filed applicants.); 47 C.F.R. § 76.1502 (Open video system certification procedure.).

of business imperatives faced by those services necessarily exist in other services. Therefore, this licensing model may not be appropriate in other areas despite its suitability here. We also believe that our existing sanctions for misrepresentation, including designation for hearing and license revocation, will protect the integrity of the certification process.

64. We note here, however, that no changes have been made in this proceeding to Sections 74.901, 74.913, and 74.932 of our Rules which would modify the basic eligibility requirements or responsibilities of ITFS licensees. Similarly, no changes have been made in this proceeding with respect to Section 74.990 of our Rules, pertaining to the use of available ITFS frequencies by wireless cable entities and, therefore, no changes have been proposed to Section 74.990(e), which will govern the preferences between mutually exclusive ITFS licensees seeking two-way authorization and MDS applicants for vacant ITFS channels.

65. The procedure we adopt will use the rolling, one-day filing window discussed in the *NPRM* to govern the filing of MDS/ITFS applications for response station hubs or boosters. Each applicant will have to provide interference protection to all facilities existing or proposed prior to the filing of its application, but its application will take precedence over all subsequently filed applications. As suggested by the Petitioners in their initial request for rulemaking and reiterated in their comments, applications filed on the same day will not be treated as mutually exclusive by the Commission and it will be the responsibility of the parties to resolve any conflicts. Because parties will be unable to offer reliable service without resolving such conflicts, we believe the incentive to reach a resolution will be so great that Commission involvement will be unnecessary to resolve disputes.

66. The applicant will be required to certify that it has met all requirements regarding interference protection to existing and prior proposed facilities. The applicant will also be required to certify that it has served all potentially affected parties with copies of its application and with its engineering materials. The engineering analysis must comply with the methodology set out in Appendix D. The applicant must also certify that it has obtained any necessary consent letters in lieu of interference protection. Any application that does not contain the proper certifications will be dismissed with prejudice and will lose its priority over subsequently filed applications.

67. The Commission will rely on the applicant's certifications in issuing licenses and will not conduct an independent engineering review of each application filed. The applicant will only be required to file the application form with the Commission. However, in the interest of making sure that engineering information is available to all present and future affected parties, applicants will be required to provide copies of their applications, with all of their engineering materials, in both hard copy and on disk,[161] to the Commission's contractor for public service records duplication, International Transcription Services, Inc. ("ITS"), 1231 20th Street, N.W., Washington, DC 20036 and to certify on their application they have done so. Because the ready availability of complete applications to interested parties is essential to the functioning of the application processing system, failure to certify that the application and supporting material have been provided to ITS will result in dismissal.

68. In order to monitor applicant compliance with our Rules and to protect the integrity of the certification process, the staff will conduct random audits, either prior to the expiration of the 60 day petition to deny period, described below, or after a license has been issued in reliance on a certification. In the event that an audit reveals that an applicant improperly certified or that an application is incomplete or contains a material error, the staff shall dismiss the application or revoke the license. In addition, if there is evidence that

[161] The document is to be filed in hard copy and on a 3.5" computer diskette in ASCII, and shall contain all necessary engineering showings as set out in Appendices C and D.

a certification was made in bad faith, we delegate to the Mass Media Bureau the authority to impose a monetary forfeiture or it may refer the matter to the Commission for designation for hearing.

69. The staff will review applications to make sure all required materials are included, excluding the interference analysis submitted to ITS. Complete applications filed with the proper certifications will be placed on public notice without further review. As we stated in the *NPRM*, we believe placing the applications on public notice without prior staff interference analysis will serve to speed the review process by making the relevant data available to all interested parties as quickly as possible. Parties will have 60 days from the date of the public notice to file petitions to deny against the application. Due to the complex nature of the engineering matters, we believe a 60 day petition to deny period is more reasonable than the usual 30 day period. If no petitions to deny are received, the application shall be granted. However, after a complete and properly certified application is granted, if a new facility operated pursuant to that grant causes unauthorized interference to any protected facility it must immediately cease operations, regardless of whether any petitions to deny were filed against the application during the application process. The burden of proving that a two-way facility is not causing unauthorized interference lies on the two-way licensee following the filing of a documented complaint of interference by an affected party.[162]

70. In the *NPRM*, we expressed concern that ITFS licensees would not have adequate time or resources to evaluate a two-way applicant's proposed service plan. We were concerned that this would occur because of the limited technical, legal and financial resources of educational institutions.[163] However, a number of commenters, including ITFS licensees, stated that the Petitioners' automatic grant proposal contained adequate safeguards to protect ITFS licensees.[164] These commenters believed that the notice provisions contained in the proposal, coupled with the requirement that a two-way system immediately cease operation in the event of interference to another party, discussed *supra*, would protect the interests of ITFS parties. We believe that the certification process we adopt here, which is very similar to the automatic grant procedure discussed in the *NPRM*, provides equal protection. The combination of service requirements, staff audits and

[162] BellSouth has proposed a mechanism for expedited resolution of interference complaints by the Commission. We understand the need to expeditiously resolve interference complaints in order that service to subscribers may either begin or be reinstated as quickly as possible and we emphasize that we will strive to resolve such disputes as quickly as possible. However, we find BellSouth's system to be too restrictive and are concerned that it would not allow us to resolve complaints in the most reasonable and beneficial manner possible.

[163] In its comments, the Foundation proposes that two-way digital applications and interference consents be reviewed by an independent counsel who is responsible only to an ITFS licensee and does not represent commercial interests. Those advisors would certify that grant would not be harmful to future ITFS service. However, we agree with commenters Ashville-Buncombe Technical Community College, et.al., that such a requirement is unnecessary. Indeed, in light of the limited number of engineers available who are qualified to evaluate the types of proposals to be submitted in these proceedings, we believe it might hurt ITFS licensees to require independent engineering counsel by depriving them of the opportunity to use the engineers they believe are the most qualified. Furthermore, we are very concerned about undertaking to limit a party's ability to secure counsel of its own choosing.

[164] *See, e.g.*, Comments of Wireless One and Region IV.

the potential for punitive actions in response to applicant misconduct, along with the requirement for automatic shut-down in the case of interference, provides sufficient protection to the interests of ITFS licensees.[165]

71. As discussed in the *NPRM*, it is likely that a large number of applications will be filed once the new rules become effective and that many of the applications submitted at that time may conflict with others filed simultaneously. In order to smooth the transition to the rolling one-day filing window application processing system, we are adopting a special one-week initial filing window, the opening of which will be announced by public notice. All applications filed during that week will be deemed filed as of the same day. Following the publication of a public notice announcing the tendering for filing of applications submitted during that window, applicants would have a period of 60 days to amend their applications to resolve conflicts, provided such amendments do not result in any increase in harmful interference to any previously proposed or authorized station (including facilities proposed during the window), absent consent of the applicant for or licensee of the station that would receive such interference. During this 60-day period, no additional applications could be filed, affording those who filed during the one-week window an opportunity to resolve any conflicts without fear that, during the pendency of settlement discussions, third parties will propose facilities that will have to be protected.

72. At the conclusion of that 60-day period, we will release a public notice of the acceptance for filing of all applications submitted during the initial window, as amended during the 60-day period. Interested parties will then have 60-days from the date of that public notice to file petitions to deny. Following the 60-day period, all properly certified, unopposed applications shall be granted. On the 61st day after the date of the second public notice, the rolling one-day filing window will be in effect.

73. We believe our adoption of the one-week initial filing window will lessen the burden on all affected parties, including the Commission's staff, during the first round of application filing. We also believe that providing parties with an initial 60-day period during which they can resolve any apparent conflicts and then amend their applications without prejudice will serve to expedite service to the public by allowing parties to resolve their differences without the need to seek Commission review through the petition to deny process.

74. In the *NPRM*, we solicited comment on whether an applicant who has obtained authorization for two-way service should be permitted to switch from common carrier to non-common carrier service and back without seeking subsequent authorizations.[166] In order to be eligible for this type of flexibility, an applicant would have had to have requested it at the time it filed its application. We also sought comment on whether operators should be required to give the Commission notice when they are switching back and forth between common carrier and non-common carrier service, even if prior approval is not required. What little

[165] CTN has proposed an alternate application processing system which, although streamlined from our present system, we believe would create unnecessary delay and uncertainty for two-way applicants. Under this system, an unopposed application would result in a conditional license following the 60-day comment period. This conditional license would become a final authorization if there have been no complaints of actual interference for 180 days after the applicant certifies completion of construction or if any such complaints have been resolved to the satisfaction of the Commission and the complainant. Other commenters, *e.g.*, the Petitioners, complain that this will create a level of uncertainty in the application process that will make it extremely difficult for two-way applicants to obtain financing. Regardless of the very real possibility that employing CTN's proposal will create an unacceptable level of uncertainty in the capital market, we believe it is unnecessarily cautious in light of the requirement that two-way stations causing interference to existing or previously proposed sites be required to shut down until such interference is resolved.

[166] For existing requirements for MDS licensees to provide common-carrier service, *see* 47 C.F.R. § 21.903.

comment we received on this subject was supportive of providing the requested flexibility.[167] Because we are attempting to provide the maximum possible flexibility to two-way service, we will permit licensees to switch from common carrier to non-common carrier service and back without seeking subsequent authorizations. However, in keeping with our oversight functions, we will also require such licensees to provide the Commission with 30-days advance notice of such changes.

F. Proposals and Issues Primarily Involving ITFS

75. Section 74.931 of the Commission's Rules describes the purpose and permissible service of ITFS stations, and also sets forth the minimum ITFS programming requirements for ITFS licensees.[168] ITFS stations are operated by educational organizations and are "intended primarily to provide a formal educational and cultural development in aural and visual form," to students enrolled for credit in accredited secondary schools, colleges and universities.[169] Currently, section 74.931(e)(9) specifies that an ITFS licensee who leases excess channel capacity to a wireless cable operator must provide a total of at least 20 hours per channel per week of ITFS programming on its authorized channels. ITFS licensees in such lease arrangements also retain the right to recapture "an average of an additional 20 hours per channel per week for simultaneous programming on the number of channels for which it is authorized."[170] In addition, Section 74.931(e)(9)now allows an ITFS licensee to shift its required educational programming onto fewer than its authorized number of channels via channel loading or channel mapping. The licensee may further agree to transmission of recapture time on channels not authorized to it but which are included in the wireless cable system of which it is a part.

76. All of the commenting ITFS parties support the concepts and goals underlying the *NPRM*. Nonetheless, even within the ITFS community, the tenor of the call for rule changes differs dramatically between some commenters. Generally, these differences are reflected in the tension between allowing ITFS licensees maximum flexibility in tailoring their relationships with wireless cable operators, and imposing ITFS-protective lease restrictions designed to safeguard the primary educational purpose of the ITFS spectrum.[171]

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[167] *See* Comments of Corporation for Public Broadcasting and Gulf Coast MDS.

[168] *See* 47 C.F.R. § 74.931.

[169] 47 C.F.R. § 74.931(a)(1). While ITFS programming generally is transmitted to receive sites at accredited schools, it still also may qualify to meet programming requirements under certain circumstances when delivered to enrolled students of accredited schools at businesses, homes, or any other sites. *See* 47 C.F.R. § 74.931(a)(2); *Amendment of Part 74 of the Commission's Rules and Regulations in Regard to the Instructional Television Fixed Service, Second Report and Order (Proceeding Terminated)*, 101 FCC 2d 49, 80-81 (1985) ("*Second Report and Order in MM Docket No. 83-523*"). In addition, recognizing that "ITFS use by health care facilities requires special consideration," the Commission has considered as satisfying programming requirements the specialized formal education that hospitals provide to their staffs as training for state or national licenses, or to students to earn medical and allied health degrees and certificates. *Id*. at 81-82; *Memorandum Opinion and Order*, 59 RR 2d 1355, 1378 (1986).

[170] 47 C.F.R. § 74.931(e)(9).

[171] *Compare, e.g.* Comments of Alliance for Higher Education, *et al.* ("Higher Education Alliance") and Comments of Region IV ,*with* CTN November 1997 *Ex Parte* Presentation, and Comments of Schwartz, Woods and Miller ("SWM"). SWM represents several ITFS entities, listed in an Attachment to its Comments.

The commenting parties, including ITFS entities such as CTN and NIA who tend to seek a structured and protective approach towards use of the ITFS spectrum, generally are unified, however, in acknowledging the symbiotic relationship between wireless cable operators and most ITFS licensees. CTN recognizes that the Commission's policy on leasing ITFS spectrum to wireless cable operators is based on the financial benefits that ITFS entities acquire in such arrangements, and states that the policies permitting these benefits should be preserved.[172] While asserting that ITFS licensees should not be required to lease excess capacity for commercial use, NIA nevertheless observes that if ITFS channels are leased for commercial two-way offerings, there could be "substantial new revenues to be shared with ITFS."[173] Other ITFS parties discuss more specifically the benefits to ITFS licensees from leasing excess capacity to wireless cable operators.[174]

77. In the *NPRM*, the Commission asserted the belief that enhancing the competitive viability of wireless cable service through maximization of flexibility and service offerings promotes the underlying educational purpose of ITFS.[175] Indeed, the growth of wireless cable has led to the continued development of ITFS by supporting and funding approximately 95 percent of all new ITFS applicants.[176] As the Commission has stated, "revenues are key to this ITFS-MMDS partnership. Leasing channel capacity . . . generates revenues that may be vital to the continuing operations of authorized ITFS systems, to the successful deployment in many markets of ITFS service, and to the service's public interest benefits."[177] By our actions here, we intend to balance the maximization of flexibility for all MDS and ITFS applicants, licensees and operators with the need to accommodate ITFS growth where new uses or needs may be unforeseen now but may arise later, or where the ITFS licensee's relationship with the wireless cable operator ends.

1. ITFS Programming Requirements

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[172] *See* Letter from William D. Wallace to Magalie Román Salas (May 27, 1998).

[173] Comments of NIA.

[174] *See, e.g.*, Bay Area Consortium Comments; Comments of the Corporation for Public Broadcasting.

[175] 12 FCC Rcd at 22202.

[176] *Id.; see MDS Auction Order*, 10 FCC Rcd at 9594.

[177] *Amendment of Part 74 of the Commission's Rules Governing Use of the Frequencies in the Instructional Television Fixed Service, Report and Order*, 9 FCC Rcd 3360, 3364 (1994) (*"ITFS Channel Loading Order"*). We have elaborated previously that wireless cable strengthens ITFS significantly by providing a source of funds to promote the educational purposes of ITFS, even if educational programming is not transmitted on all ITFS channels. *Id.* We also have agreed that the 20 hours per channel per week ITFS programming standard for licensees leasing excess capacity helps to insure that ITFS licenses are not secured merely to realize financial gain from wireless cable operators. *Amendment of Parts 21, 43, 74, 78, and 94 of the Commission's Rules Governing Use of the Frequencies in the 2.1 and 2.5 GHz Bands Affecting: Private Operational-Fixed Service, Multipoint Distribution Service, Multichannel Multipoint Distribution Service, Instructional Television Fixed Service, & Cable Television Relay Service, Order on Reconsideration*, 6 FCC Rcd 6764, 6773-74 (1991) ("*Wireless Cable Reconsideration Order*"). *See Amendment of Part 74 of the Commission's Rules Governing Use of the Frequencies in the Instructional Television Fixed Service, Notice of Proposed Rulemaking*, 8 FCC Rcd 2828, 2829 (1993) ("*ITFS Channel Loading NPRM*").

78. In the *NPRM*, the Commission sought comment on several issues related to the question of whether to change our ITFS programming requirements in light of the use of digital technology by ITFS licensees.[178] It asked whether there should be different rules depending on whether the wireless cable system employs digital or analog transmissions, or some combination of both. It further asked whether our existing program content requirements should be retained or whether they should be modified. Specifically, the Commission sought comment on whether data transmission and voice transmission should count toward the fulfillment of minimum programming requirements, and if they were to count, how they would be measured. The Commission also welcomed suggestions on whether education-related upstream transmissions should be applied towards satisfaction of minimum ITFS programming requirements, and, if so, how they should be measured for that purpose.

79. The *Joint Statement* takes positions on many of the issues relating to ITFS programming and content requirements on which we sought comment. While proposing to retain the current minimum ITFS programming requirements regardless of whether analog or digital transmissions are utilized, the *Joint Statement* provides that each ITFS licensee utilizing digital transmissions, shall, at a minimum, have the right to use 25% of the capacity of its channels.[179] Of this 25% of capacity, at least 5% would be absolutely reserved for immediate ITFS usage and ineligible for leasing, and the licensee also would be required to maintain the ability to recapture for the transmission of ITFS programming at least an additional 20% of the capacity of the channels it leases.[180] To the extent that the *Joint Statement* and its supporters represent an agreement by most of the parties in the wireless cable industry and MDS and ITFS services, we have accorded it deference in formulating our policies. Nonetheless, while we find some of its approaches sound, as elaborated upon below, we find some of its provisions unworthy of adoption.[181] Thus, notwithstanding the *Joint Statement*'s self-characterization of its "series of compromises" as "inextricably intertwined," as well as its plea that we adopt it "en toto without change," we will adopt some of its resolutions and modify or reject others.

a. Redefinition of Eligible Content

80. We received several comments on how to change the educational content requirements of Section 74.931, and these comments unanimously supported the proposal that spectrum usage beyond video programming should be eligible to satisfy ITFS educational usage requirements.[182] For example, the Bay Area Consortium suggests that transmissions, including Internet and other interactive services, should qualify as fulfilling educational usage requirements as long as the use is part of an academic program for students enrolled in an accredited institution, and within the ITFS licensee's reasonable judgment is directly related to the

[178] *See* 12 FCC Rcd 22204-05.

[179] *Id.* at ¶ 1.

[180] *Id.* at ¶¶ 2-3.

[181] Indeed, the *Joint Statement* is not without significant detractors within the industry. For instance, BellSouth "strongly objects" to its recapture provisions. BellSouth Reply Comments.

[182] In light of the interactive nature of many data and voice applications anticipated for ITFS in a digital environment, henceforth we will refer to required ITFS transmissions as ITFS "educational usage requirements" in lieu of ITFS "programming requirements," where the transmissions do not solely consist of video programming.

education of students.[183] HITN proposes that educational usage requirements should be defined with respect to "any transmissions originated or controlled by the ITFS licensee which are used to further the educational objectives of the ITFS licensee."[184] In addition, HITN contends that qualifying educational service should not be limited to that offered by accredited institutions. HITN suggests that limiting eligible educational service providers to accredited institutions deprives populations of educational techniques such as distance learning, continuing education, ESL instruction, refresher courses, and "life long learn[ing]."[185] We disagree with HITN. Accredited institutions can and do provide such useful educational techniques, and requiring that a qualified licensee be an accredited institution provides greater certainty of the integrity of the licensee's educational function. The accreditation of the appropriate state department of education or national accrediting organization is uniquely geared towards recognizing the educational institutions fit to meet those needs. Furthermore, accredited schools have been the intended users of ITFS since the origin of the service.[186] Thus, we will keep intact our eligibility requirements of Section 74.932(a).[187]

81. The Commission has long been loath to substitute its judgment for the judgment of educational authorities concerning what precise ITFS usage is regarded as educational, where such usage otherwise complies with Commission requirements that it be provided to students enrolled in accredited institutions.[188] We believe that availability of advanced technologies dictates that it is now time to accord ITFS licensees increased flexibility in determining which transmissions qualify as satisfying ITFS educational usage requirements, so long as such transmissions are in furtherance of the educational mission of an accredited public or private school, college or university, or other eligible institution,[189] offering courses to enrolled students. Such uses may include downstream or upstream video, data and voice transmissions. In addition,

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[183] Bay Area Consortium Comments. *See also* BellSouth Reply Comments; CTN Comments; Wireless One Comments (supporting the counting of data and voice transmissions towards minimum educational usage requirements, and implying that upstream and booster station transmissions also should count).

[184] HITN Comment. HITN also stresses that qualifying transmissions would encompass Internet access.

[185] *Id.*

[186] *See id*. at 852-53.

[187] 47 C.F.R. § 74.932(a).

[188] *See, e.g., Second Report and Order in MM Docket No. 83-523*, 101 FCC 2d at 80 ("putting the responsibility for deciding what is educational not on the Commission, but on the accrediting institutions, where it rightly belongs"). While the Bay Area Consortium seeks to codify this approach in the Commission's rules, we decline to establish such a carte blanche, because there may be instances where the Commission is called upon to adjudicate a challenge to the bona fides of an ITFS licensee's purported educational usage, or there may be instances where the Commission chooses to audit such usage. Nevertheless, as a general matter the Commission intends to maintain a deferential approach to the ITFS licensee's reasonable judgment. We also provide some examples, below, of what will and what will not pass muster, though these examples are by no means exhaustive.

[189] *See* 47 C.F.R. § 74.932(a). In addition, uses by health care facilities in furtherance of formal staff or medical student training likewise will qualify.

while heretofore not qualifying to satisfy educational usage requirements,[190] qualifying uses now may include, but are not limited to, teacher conferencing, remote test administration, distribution of reports and assignments, research towards and sharing works of progress in projects for courses, professional training, continuing education, and other similar uses. Furthermore, in light of the myriad of possible uses of the spectrum for courses by accredited schools, we no longer need a separate rule pertaining to where transmissions are not to on-campus receive sites.[191] Because we fully expect several qualifying transmissions to and from homes and other off-campus sites, retention of such a rule would be unduly burdensome to ITFS applicants and licensees. We will amend Section 74.931 and other pertinent ITFS rules to reflect all of these changes.

82. We also will subject ITFS signal booster stations to educational usage requirements, in conjunction with those to which main ITFS stations are subject. High power ITFS signal booster stations originating signals on ITFS channels are hardly distinguishable from main instructional television fixed stations, and subjecting booster stations to educational usage requirements preserves the primary purpose of ITFS by ensuring that licensees have no incentive to "crowd out" required educational usage on main instructional television fixed stations by overlapping transmissions which otherwise would not be subject to such requirements. We note that, like main ITFS stations, educational usage requirements for h boosters may be shifted off of the channels served by the booster. Furthermore, boosters may satisfy these requirements through retransmission of signals from the main ITFS station. We will not, however, subject ITFS response stations or response station hubs to educational usage requirements, because the ITFS licensee has no control over which upstream transmissions would qualify to satisfy the requirements. Moreover, the educational usage requirements attached to an ITFS main station and booster station will be based on the number of channels allocated to the main station,[192] including channels which the licensee "turns around" for upstream transmissions. Nevertheless, as stated above, qualifying ITFS upstream transmissions may be utilized to fulfill an ITFS licensee's educational usage requirements.

83. HITN recommends that ITFS licensees be permitted to satisfy educational usage requirements by providing 20 hours per week of qualifying services "per 6 MHZ block" on their ITFS systems.[193] The Mass Media Bureau found in *Comband II*,[194] that it was useful where digital compression technologies are employed to conceptualize a channel as a 6 MHz block, capable of being compressed into multiple "paths." Henceforth, unless otherwise specified in the Rules, a "channel" shall refer to any of the 6 MHz frequency blocks assigned pursuant to Sections 21.901(b) and 74.902(a) of the Commission's Rules,[195] and we will add definitions to

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[190] *See* 47 C.F.R. § 74.931(b) and (c) (1997).

[191] *See* 47 C.F.R. § 74.931(a)(2) (1997).

[192] No separate educational usage requirements, however, will attach to the 125 kHz channels assigned to an ITFS licensee.

[193] HITN Comments.

[194] *General Electric Co.*, 61 RR 2d 143, 146-47 (Mass Media Bur. 1986).

[195] 47 C.F.R. §§ 21.901(b) and 74.902(a). This definition will apply to all of the frequency blocks assigned in the MDS and ITFS bands, except with respect to MDS channel 2A, where the definition of "channel" shall be a 4 MHz block. *See* 47 C.F.R. § 21.901(b)(3). In addition, each "channel" in the I Channel Group, located in the 2686-2690 MHz band, shall refer to a 125 kHz block. *See* new Section 74.939(i) of the Commission's Rules.

Sections 21.2 and 74.901 to reflect this clarification.[196] This clarification is a necessary frame of reference for the sub- and superchannelization scheme that we set forth here, and where common parlance may refer, for example, to a video programming path or data stream as a channel. Thus, this clarification should encourage certainty, preventing future confusion over what is a "channel."

b. Analog Programming Requirements

84. Commenters who addressed analog programming requirements unanimously believe that the current programming requirements should be retained for ITFS licensees solely engaged in transmission of downstream analog programming.[197] We agree, and we will impose no changes to programming requirements where licensees solely utilize analog transmissions. However, for some commenters there is still discord over what the extent is of the recapture time requirement. In the *NPRM*, the Commission rejected Petitioners' proposed changes to Section 74.931(e) that sought to revise the absolute 20 hours per channel per week recapture time requirement to provide that the ITFS programming requirements constitute a total of 40 hours per channel per week, including both actual programming and recapture time.[198] Under the proposed changes, if an ITFS licensee were to actually provide more than an average of 20 hours per channel per week of ITFS programming, reserved recapture time would only need to make up the difference to achieve a total of 40 hours per channel per week. The Commission explained that while the recapture time requirement originally was to bring the total, including actual programming, to 40 hours per channel per week, the Commission subsequently, in the *Wireless Cable Reconsideration Order*, added the absolute 20 hour recapture time language in its revisions to Section 74.931(e)(2). While the Commission acknowledged the great value to wireless cable operators of maximization of spectrum available for leasing, it also emphasized the primary educational purpose of ITFS and the importance of maintaining sufficient capacity for programming by ITFS licensees which fulfills that purpose.[199]

85. Petitioners argue that in an analog environment, an absolute requirement for 20 hours of recapture per channel per week deters investment.[200] BellSouth fears that under the Commission's interpretation, recapture could continue until all of the excess capacity initially made available was recaptured, presumably with no financial or operational detriment.[201] In contrast to these commenters, Mississippi ETV sees no reason for us to adopt Petitioners' proposed requirement for 40 total hours per channel per week for

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[196] Furthermore, we reject the recommendation of the MDS Licensees that we define "channel" to mean "any substantially distinct packet or stream of content (excluding system administration information) transmitted to an end user by an MDS or ITFS licensee." Comments of Alliance of MDS Licensees ("MDS Licensees"). As Petitioners argue, such a definition could lead to absurd results under certain excess capacity leases. Nevertheless, the Commission will not get involved in any disputes between capacity lessors and lessees over their rights pursuant to lease provisions which rely on the use of "channel(s)."

[197] *See, e.g.*, Comments of Petitioners and CTN Comments and BellSouth Reply Comments.

[198] 12 FCC Rcd at 22203-04.

[199] *NPRM*, 12 FCC Rcd at 22203-04.

[200] Comments of Petitioners, Bay Area Consortium Comments and Wireless One.

[201] BellSouth Comments.

ITFS programming and recapture.[202] We agree with Mississippi ETV, for the same reasons presented in the *NPRM*.[203] However, we clarify that the 20 hours recapture time requirement is also a maximum over the duration of the lease for systems that continue in an analog environment, unless the lease allows for more recapture time. The rules do not require that 20 hours always be reserved without accounting for the amount of recapture already exercised.

c. Digital Educational Usage Requirements

86. We received extensive comment on the ability of ITFS licensees currently to meet programming requirements, and on whether we should increase educational usage requirements when ITFS licensees employ digital transmissions. The overwhelming majority of commenters on these issues is in favor of retaining the current minimum educational usage requirements in a digital environment. One strain of comment is represented by BellSouth's observation that "there is no direct correlation between technological advancements and the need for ITFS programming."[204] BellSouth relies on *Comband II*, where the Mass Media Bureau declined to increase ITFS programming requirements despite the increased capacity resulting from use of Comband analog compression technology.[205] BellSouth reports that in some cases, it has entered into channel lease agreements providing for ITFS airtime usage in excess of the minimum educational usage requirements.[206] In other cases in BellSouth's experience, the ITFS licensee negotiated for benefits other than airtime above the minimum required, such as increased compensation, construction of additional receive sites, or furnishing of special equipment.[207] Wireless One observes that in many cases under the current rules ITFS licensees are having difficulty fulfilling their programming obligations, and Wireless One maintains that increasing educational usage obligations would help neither ITFS licensees nor wireless cable operators, and in fact could discourage ITFS licensees from taking advantage of advanced technologies by instituting unrealistic burdens upon them.[208] However, in contrast to most of the commenters on this issue, CTN insists that educational usage requirements must be modified to reflect increased capacity arising from use of digital technology, and argues that a proportionate increase in instructional usage is needed to prevent the dilution of the instructional nature of ITFS channels.[209]

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[202] Mississippi ETV Comments.

[203] *See* 12 FCC Rcd at 22203-04.

[204] Comments of BellSouth, Bay Area Consortium, and Higher Education Alliance.

[205] 61 RR 2d at 147.

[206] Similarly, the Bay Area Consortium cites the specific example of one of its members successfully negotiating for additional airtime well beyond that required. *See* Bay Area Consortium Comments.

[207] *See* BellSouth Comments.

[208] Wireless One Comments and Reply Comments.

[209] CTN Comments.

87. Several commenters assume the posture reflected in the *Joint Statement*: that while the educational usage requirements should not be changed, 25% of an ITFS licensee's capacity should be immediately available to the ITFS licensee or subject to recapture. While supporting the *Joint Statement* and the overall 25% ITFS capacity reservation, Petitioners nonetheless respond to the arguments justifying a 25% reservation as proportional to current requirements for educational usage,[210] by noting that the 25% reservation is more effective than in an analog environment in light of the efficiencies created through use of digital compression techniques.[211] BellSouth, which operates digital video wireless cable systems in New Orleans and Atlanta, "strongly opposes" the proposed 25% set-aside.[212] It argues that subjecting a full 25% of a licensee's channel capacity to ITFS immediate use or recapture could have the unintended effect of encouraging many operators to abandon their digital video plans and focus exclusively on less capacity intensive uses such as data services, which in turn could undermine the plans of many ITFS licensees seeking to provide traditional video services.[213] Instead, BellSouth is willing to support a reservation of 5% of the capacity of ITFS digital channels.[214]

88. BellSouth also "strongly objects" to the *Joint Statement*'s proposal to set aside 20% of ITFS digital capacity for recapture purposes beyond the 5% minimum retention amount.[215] BellSouth explains:

> An operator that places video programming or other content on capacity that is subject to recapture does so at the risk that this capacity could be lost down the road, potentially resulting in an operational and customer relations nightmare that could have serious financial repercussions. A prudent operator either refrains from making substantial use of capacity subject to recapture, or factors these risks and uncertainties into such use. Either way, capacity encumbered by recapture rights is inherently less valuable to the operator than unencumbered capacity, whether or not the ITFS licensee ever exercises its recapture rights. As such, ITFS licensees necessarily will receive fewer benefits for encumbered capacity. . . . This situation will only be exacerbated if recapture time is substantially increased.[216]

BellSouth adds that if the *Joint Statement*'s recapture provisions are adopted by the Commission, "the complicated terms . . . would reduce the operational flexibility of educators and commercial operators, would redirect limited resources from more productive efforts and, in the end, would preclude parties from agreeing

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[210] Comments of Maryland, Foundation, SWM and Wireless One.

[211] Petitioners Comments.

[212] BellSouth Reply Comments.

[213] *Id.*

[214] *Id.*

[215] *Id.*

[216] *Id.*

to terms that maximize desired benefits of ITFS and MDS partners."[217] The Bay Area Consortium observes further that few ITFS licensees have completely developed their systems to fully utilize the recapture time presently required under the Commission's rules, and argues that an increase in recapture time requirements also would conflict with the *Comband II* precedent.[218] Region IV supports additional digital recapture rights to allow for a total of four program tracks per four channel ITFS group, but states that requiring more would undermine the incentive for wireless cable operators to digitize.[219]

89. In light of the varied market strategies that different wireless cable operators will implement in a digital environment, and likewise in light of the broad range of educational uses to which different ITFS licensees will seek to devote their channels, it is not a simple matter to arrive at a "one size fits all" approach towards minimum ITFS educational usage requirements and reservation of spectrum solely for instructional purposes, whether immediate or future.[220] Therefore, because we seek to maximize the flexibility of educators and wireless cable operators to design systems which best meet their varied needs, we will adopt ITFS excess capacity leasing rules which best promote this flexibility while at the same time safeguarding the primary educational purpose of the ITFS spectrum allocation. After a careful review of the comments in this proceeding, we decide that these goals are best harmonized where digital transmissions are utilized[221] by

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[217] Letter from Karen Possner to Magalie Román Salas (April 22, 1998), *Ex Parte* Presentation.

[218] Bay Area Consortium Comments.

[219] Region IV Comments.

[220] For instance, while many of the wireless cable operators commenting in this proceeding have declared a substantial interest in rapid deployment of two-way services, BellSouth's comments evidence at least a near-term intent to focus on digital video wireless cable services. Similarly, while some commenting ITFS licensees appear to indicate a current interest in utilizing two-way transmissions in their educational offerings, others seem intent for now on maintaining downstream video instructional service. *Compare* Reply Comments of Ashville-Buncombe Technical Community College, *et al.* ("North Carolina ITFS") ("Reply Commenters believe the flexibility to utilize their frequencies for two-way transmissions will enhance their offerings to their students and those at their receive sites"); *with* SWM Comments (commenters are "vitally concerned" that rules governing two-way transmissions "protect the interests of ITFS licensees providing traditional ITFS service through proven and relatively inexpensive analog transmission technology").

[221] In the *NRPM*, the Commission sought comment on how to resolve the scenarios where licensees employ digital operations on one or more, but not necessarily all, of their authorized channels, and where licensees switch from analog to digital and digital to analog modulation among channels and on the same channel. The Commission noted that in the *Digital Declaratory Ruling*, we allowed licensees to play out these scenarios. *NPRM*, 12 FCC Rcd at 22204 n.61; *see Digital Declaratory Ruling*, 11 FCC Rcd at 18865. In comments related to these issues, Petitioners contend that the proposed rules embodied by the *Joint Statement* should govern ITFS licensees that lease excess capacity "in whole or in part for digital" uses. Petitioners Comments. We agree that the rules that we set forth here pertaining to excess capacity leases where digital transmissions are used shall apply also when such transmissions are used in part, as in the scenarios described above.

retaining the current 20 hours per channel per week educational usage requirements,[222] adopting the *Joint Statement*'s proposed absolute reservation of a minimum of 5% of an ITFS station's capacity for instructional purposes only, and eliminating requirements setting aside capacity for ready recapture by ITFS licensees. This 5% reservation shall apply spectrally over the ITFS licensee's whole protected service area. Therefore, a minimum of 5% of an ITFS licensee's capacity is guaranteed to be available to the licensee immediately at all times.[223] Eliminating recapture requirements eliminates the potential for uncertainty about which BellSouth is concerned. We emphasize that the 20 hours per channel per week minimum educational usage requirement is independent from, but concurrent with, the minimum 5% capacity reservation; further, the reserved capacity can be devoted to satisfying minimum educational usage requirements. We will add provisions to Section 74.931 of the Commission's Rules to reflect these new standards.

90. We believe that taken together, these complementary standards are in the public interest. In retaining the 20 hours per channel per week requirement, we insure the immediate devotion of ITFS spectrum to formal educational usage, and the provision by ITFS licensees of at least as much educational usage as they provide under the current rules. In addition, the Commission long has been concerned with providing for expansion of ITFS service offerings.[224] While henceforth where digital transmissions are employed we no longer will require reservation of recapture time, which heretofore has been the primary mechanism for providing capacity to meet expanding needs, this minimum 5% absolute reservation of ITFS capacity should embody the same balance which is the basis for recapture provisions; namely, maximizing the spectrum available for leasing to wireless cable operators, while maintaining sufficient capacity for expanded educational usage by ITFS licensees.[225] To what extent the minimum 5% reserved capacity actually is utilized by the licensee, and whether such utilization is sufficient to meet the 20 hours per channel per week minimum usage requirements, let alone provide for future expansion of service, will depend both on the digital compression ratio employed by the licensee, and on the particular form of transmissions utilized by the licensee to meet its usage requirements. For instance, at a low (*e.g.*, 2:1) compression ratio where the licensee is transmitting video to satisfy its usage requirements, the licensee would need to reserve at least 6% of its capacity just to satisfy its educational usage requirements, and this would not allow for any future expansion of service. This demonstrates that where a licensee utilizes a low digital compression ratio, it may need to reserve more than 5% of its capacity in order to fulfill the 20 hours per channel per week bedrock educational usage requirement.

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[222] However, in light of our broadening in this proceeding of eligible educational usage, which especially will benefit licensees which employ digital transmissions, we will not allow new licensees utilizing digital technology to avail themselves of the "phase-in" reduced educational usage requirements of Section 74.931(e)(3). We already had eliminated the availability of that reduced requirement to any licensee taking advantage of channel loading techniques. *See ITFS Channel Loading Order,* 9 FCC Rcd at 3365. We will modify Section 74.931 to reflect both of these principles.

[223] Regarding this minimum 5% ITFS capacity reservation, Petitioners request that there be no restriction on the ITFS licensee's ability to permit the wireless cable operator access to unused portions, so long as such access can be terminated immediately upon notice from the ITFS licensee. Given that we have eliminated recapture requirements where digital transmissions are utilized, allowing wireless cable operators unfettered access to up to 95% of an ITFS licensee's channel capacity should the licensee choose to lease that much, we do not believe it necessary nor prudent to heed Petitioners' request, and we reject it.

[224] *See, e.g., Second Report and Order in MM Docket No. 83-523,* 101 FCC 2d at 90 n.46 ("an ITFS licensee cannot surrender all future rights to adjust to changing needs").

[225] See *NPRM,* 12 FCC Rcd at 22203-04.

However, at a 5:1 ratio and reserving just 5% of its capacity, the licensee would both be able to fulfill its 20 hours per channel per week usage requirements, and provide for more room to expand than is provided for by our current recapture rules.[226]

91. Thus, depending on the form of the transmissions and the compression ratio employed, a 5% spectrum reservation may lead to some spectrum, beyond that necessary to meet educational usage requirements, being used for other purposes by the ITFS licensee or lying in wait for immediate usage upon future need by the ITFS licensee. Or, a licensee may need to reserve more than 5% of its capacity in order to satisfy minimum educational usage requirements or to provide room for future expansion of services by the licensee. However, we believe that the combination of increasingly efficient compression techniques, coupled with our adoption here of a broad definition of what content satisfies ITFS educational usage requirements, will result in future growth of ITFS educational usage. We also emphasize that an ITFS licensee may reserve for itself in excess capacity lease negotiations more than the minimum required reservation of capacity,[227] and is free not to lease its excess capacity at all if it does not wish to do so. We urge ITFS licensees to exercise cautious judgment in lease negotiations pertaining to the amount of spectrum to be made available for future educational needs.

d. Measurement of Educational Usage

92. We did not receive extensive comment on this issue, and the comments that we did receive did not provide much by way of specificity. Mississippi ETV suggests measuring data transmission on "an hour-by-hour basis," and education-related upstream transmissions through "traditional logging," but provides no further insights into these proposals.[228] Higher Education Alliance urges the Commission to find that educational usage requirements are satisfied where Internet access is available "at ITFS receive sites during the entire school day at a data transmission rate satisfactory to an ITFS licensee, together with a reasonable expectation on the part of such ITFS receive sites that Internet access use will collectively amount to at least 20 hours per channel per week."[229] Petitioners express preference for measuring non-video educational usage with respect to an amount equivalent to the current 20 hours per channel per week requirement; and with respect to a requirement which instead would utilize a percentage of capacity gauge. However, Petitioners concede that both proposed requirements are difficult to measure, and conclude that at least for now, the Commission should defer to good faith efforts by the ITFS licensee to comply with the requirements.

93. In addition, Petitioners "strongly oppose" time-of-day requirements. They argue that when the Commission repealed its former such requirements, the record at that time established that there were a variety of legitimate uses of ITFS outside the mandated hours. Petitioners further assert that college and university students have been known to study at unusual hours. Or, in order to conserve bandwidths, schools may utilize their ITFS capacity at off-peak hours to download, using the Internet, educational material from a central location to multiple schools, where such material will be stored on a local file server and accessed by

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[226] Technology already exists to employ 6:1 compression ratios.

[227] As depicted in several of the comments, the ability of ITFS licensees to retain more than the minimum required educational capacity in their leases with wireless cable operators is not illusory. *See, e.g.*, Bay Area Consortium Comments.

[228] Mississippi ETV Comments.

[229] Higher Education Alliance Comments.

students the next day via an intranet within each school.[230] The Foundation challenges Petitioners' grounds for opposing time-of-day requirements for ITFS educational usage, out of concern that unscrupulous licensees would seek to satisfy all educational usage requirements between the hours of midnight and 6 A.M. Rather, the Foundation envisions that educational usage should be on a steady, 24 hour basis, and not relegated to obscure times of day.[231] Consistent with the revised ITFS content requirements that we adopt in this proceeding, which seek to fulfill our goal of according ITFS licensees maximum flexibility in determining which uses of their spectrum enhance their formal educational mission, we decline to adopt time-of-day requirements for measuring educational usage.

94. In the foregoing, we have retained two different but complementary requirements of ITFS spectral usage: a minimum of 20 hours per channel per week for educational usage, and a minimum reservation of 5% of a licensee's capacity that it may not lease. As reflected in the comments of Petitioners and others, both are difficult to measure in light of the varied forms that such usage can take. We agree with those parties commenting on this issue that at least for now, the best course is to rely on the good faith efforts of ITFS licensees to meet the requirements set forth here. We are not instituting any new, formal, proof of compliance reporting submissions in this area. However, under certain circumstances, ITFS licensees may bear the burden of proving compliance with these requirements, such as a Commission audit. In responding to audits, licensees must be ready and able to describe and document how they complied with these requirements. We find that this approach to enforcing the minimum amounts of educational usage and absolute capacity reservation required of ITFS licensees utilizing digital transmissions will preserve the formal educational goals which underlie ITFS. Moreover, as suggested by Petitioners,[232] if we find that experience dictates the necessity for a more structured mechanism for measuring compliance, for instance in order to curb abuses and/or to promote certainty, we can revisit this issue in a future rulemaking proceeding.

2. Channel Loading, Shifting and Swapping

95. In the *NPRM*, the Commission advanced Petitioners' proposal to amend Section 74.931(e)(9) to allow ITFS licensees, at their sole discretion, to satisfy their educational usage requirements on other channels within the wireless cable system ("channel loading"), and not mandate that licensees meet these

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[230] Petitioners' Comments. Petitioners urge that for this reason, the Commission should, in conjunction with this proceeding, grant pending petitions for reconsideration of a 1994 decision that only programming transmitted for ‹real time' viewing by students counts towards minimum educational usage requirements. Petitioners contend that whatever merit that decision may have had before, it is becoming obsolete with the introduction of advanced digital services. *Id*. at 140 n.225. *See* Petition of Wireless Cable Ass'n Int'l for Reconsideration and Clarification, MM Docket No. 93-106, at 6-11 (filed August 12, 1994); Petition of Alliance for Higher Education, *et al*., MM Docket No. 93-106 (filed August 5, 1994). We agree with Petitioners. In the *ITFS Channel Loading Order*, the Commission declared that the "videotaping of ITFS programming which is transmitted in the early hours of the day for later replay during the school day appears . . . ‹unredeemably wasteful of the spectrum' and libraries for such taped presentation can be readily assembled without the use of ITFS facilities." 9 FCC Rcd at 3367 (citation omitted). However, in light of the fundamental changes in service available for deployment by ITFS licensees as a result of this proceeding, as reflected in our changed content requirements, we agree that the Commission's previously enunciated stance is today unduly restrictive and obsolete, and we will grant those portions of the cited pending petitions for reconsideration addressing that decision. However, to any extent that these petitions are inconsistent with our ruling in this proceeding, they are denied.

[231] Foundation Reply Comments.

[232] *See* Petitioners Comments.

requirements using at least one of their own channels ("channel shifting.).[233] Petitioners promoted this proposal as being of utmost importance to construction of two-way systems. Petitioners also propose that ITFS licensees be allowed to trade some or all of their licensed spectrum for spectrum licensed to MDS operators ("channel swapping."). Petitioners anticipate that system developers will attempt to utilize contiguous 6 MHz channels for two-way services in order to minimize the amount of spectrum that would be lost to the proposed spectral mask whenever a return path is adjacent to a downlink channel. Furthermore, depending on the demand for two-way services, entire ITFS channel groups may need to be devoted for return paths.[234] The Commission described how this channel "shifting" proposal would be the next step in a progression of rule changes that have afforded ITFS licensees increased flexibility in the implementation of their minimum educational usage requirements.[235] The Commission found this progression consistent with the view that "it is most practicable to view a licensee's group of four ITFS channels as an integral constituent of a market-wide set of channels."[236]

96. The Commission inquired regarding what restrictions on channel shifting, if any, should be adopted.[237] Responding to comments received leading up to the *NPRM*,[238] the Commission further proposed to allow the trading of channels between licensees, channel "swapping." The Commission also solicited comment on the effects of allowing complete flexibility in the number of channels "turned around" for return paths, and on whether we should require ITFS licensees to retain one or more channels for downstream transmissions and the ramifications of such a requirement. Finally, the Commission welcomed further proposals for providing flexibility in usage of ITFS channels while ensuring that ITFS licensees are not deprived of capacity for downstream programming.[239]

97. The *Joint Statement* addresses all of these issues. It supports channel shifting, so long as the educational usage is on another ITFS channel within the same wireless cable system.[240] It would permit any

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[233] 12 FCC Rcd at 22205-08.

[234] Petitioners reiterate these supporting arguments in their comments on the *NPRM*. *See* Petitioners Comments.

[235] 12 FCC Rcd 22205-06. *See Wireless Cable Reconsideration Order*, 6 FCC Rcd at 6774 (allowing the use of channel mapping technology); *ITFS Channel Loading Order*, 9 FCC Rcd 3360 (allowing the use of channel "loading," which is the functional equivalent of channel mapping but more cost efficient).

[236] 12 FCC Rcd 22206; *see ITFS Channel Loading Order*, 9 FCC Rcd at 3365.

[237] 12 FCC Rcd at 22208.

[238] These comments are summarized in the *NPRM* at 12 FCC Rcd 22206, 22207.

[239] *Id*. at 22208.

[240] *Id*. at ¶ IV. The *Joint Statement* broadly characterizes the channel shifting concept as "channel loading." While this characterization exceeds the channel loading which the Commission first authorized in 1994, *see ITFS Channel Loading Order*, 9 FCC Rcd 3360, the *Joint Statement*'s characterization likewise encompasses approval of the previously authorized channel loading concept. We refer to channel loading as the transmission by an ITFS licensee of all of its required educational usage on its own channels, but using fewer than its authorized number of channels.

ITFS licensee to swap channels with any other ITFS or MDS licensee in the 2.5 GHz band operating in the same geographic area, and calls for expedited consideration by the Commission of channel swap applications.[241] Furthermore, it provides that each ITFS licensee leasing channels to be used for return paths shall be required to maintain at least 25% of its licensed channels to be used for downstream transmissions both during the term of the lease and following termination of its leasing arrangement.[242] The general concepts of channel loading, shifting, and swapping similarly are supported by several commenting parties who do not expressly endorse the *Joint Statement*;[243] in fact, very few commenters express any opposition to these general concepts.[244] With the exception of our channel loading rules and intra-ITFS channel swaps between licensees utilizing analog transmissions only, the concepts which we permanently adopt in this section apply only to licensees utilizing digital transmissions, leasing excess capacity to an operator which utilizes digital transmissions, or swapping channels with a licensee which utilizes digital transmissions.[245]

a. Channel Loading

98. In the *NPRM*, the Commission revisited its channel loading rules because, in the *ITFS Channel Loading Order*, we provided that the channel loading rules adopted there would remain in effect until the Commission assessed the impact of digital compression on MDS and ITFS in a future notice and comment rulemaking proceeding.[246] The Commission recognized in the *NPRM* that the continued allowance of channel loading is "an almost necessary component" of the scheme to devote significant blocks of the MDS and ITFS

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[241] *Joint Statement* at ¶ V.

[242] *Id.* at ¶ VI.

[243] *See, e.g.*, BellSouth Comments (supports "so long as they are voluntary"); Bay Area Consortium Comments (supports so long as "both ITFS and MDS licensees have full access," and likewise stresses voluntariness).

[244] However, one of the few commenters who does express some opposition is Mississippi ETV, which is concerned that channel shifting and channel swapping may confuse viewers who have become accustomed to finding specific instructional programs on specific channels. Therefore, Mississippi ETV urges that if these concepts are approved by the Commission, and channel shifting or swapping is necessary to accommodate a two-way system, the wireless cable operator should be required to commit the necessary financial resources to properly inform all ITFS viewers of channel changes. Mississippi ETV Comments. We decline to implement any such requirement, and find that such matters are properly addressed between the affected licensee and its system operator.

[245] In this regard, Region IV pushes for the permissibility of channel loading, shifting and swapping in both the analog and digital modes. Region IV Comments. However, we decline to authorize channel shifting and cross-service swapping in a purely analog system other than by waiver, because the efficiencies of digital use or general need for contiguous blocks are not present. Furthermore, to the extent that channel shifting involves some ceding of control by the licensee whose educational usage is shifted, there are insufficient benefits to outweigh such a risk in a purely analog system. Similarly, any benefits of cross-service channel swaps between MDS and ITFS licensees solely utilizing analog transmissions would be outweighed by the muddling of the regulatory picture which would ensue from such swaps.

[246] *NPRM*, 12 FCC Rcd at 22206; *see ITFS Channel Loading Order*, 9 FCC Rcd at 3368.

spectrum to return paths.[247] While expressing the belief that our channel loading rules have provided additional much-needed flexibility to ITFS licensees and wireless cable operators, and proposing to retain the rules, the Commission requested that interested parties comment on whether the rules have been beneficial to ITFS licensees and wireless cable operators, or whether they have been detrimental.

99. Those parties commenting on our channel loading rules unanimously support their retention, and we shall do so as modified below.[248] Petitioners believe that, consistent with promoting ITFS licensee flexibility, the Commission should eliminate the portion of Section 74.931(e)(9) that requires each ITFS licensee engaged in channel mapping or channel loading to preserve the ability to transmit all of its ready recapture time simultaneously on the number of channels for which it is licensed. "Simply put, the Commission should defer to the local educator to determine the best method for scheduling the capacity available for recapture."[249] BellSouth echoes Petitioners' request, and adds that the simultaneous recapture provision "unnecessarily requires educators to set aside limited resources for unlikely contingencies," resulting in devaluation of the spectrum and a lost opportunity cost to the ITFS licensee.[250] We agree with Petitioners and BellSouth for the reasons advocated by them, and we note that with our abolition in this proceeding of recapture requirements where the ITFS licensee employs digital technology, there would be much less occasion for invoking the simultaneous recapture rule anyway. We will amend Section 74.931(e)(9) to reflect its elimination.[251] Furthermore, in light of our broadening in this proceeding of eligible educational usage for all licensees, regardless of what technology they utilize, we clarify that to the extent the *ITFS Channel Loading Order* is concerned with the time of day of loaded usage, these concerns no longer apply. In accord with the *ITFS Channel Loading Order*, however,[252] we reiterate that channel loading remains permissive only, and not mandatory, for all licensees, regardless of whether they utilize analog or digital transmissions.

b. Channel Shifting

100. The overwhelming majority of commenters on this proposal wholeheartedly support it. BellSouth states that channel shifting offers considerable benefits to licensees and operators even when

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[247] 12 FCC Rcd at 22206.

[248] Because we are permanently incorporating our channel loading and mapping rules, we eliminate the requirement specified in the *ITFS Channel Loading Order* that lease agreements permitting channel loading and mapping acknowledge that those practices are subject to any future Commission rule changes. *See* 9 FCC Rcd at 3368.

[249] Petitioners Comments.

[250] BellSouth Reply Comments.

[251] We acknowledge that the simultaneous recapture right was deemed to be "essential" to educators agreeing to the industry-wide compromise which served as the foundation for the *ITFS Channel Loading Order*, and that we previously concluded it to be a restriction on the use of channel loading necessary to maintain the primary purpose of ITFS. 9 FCC Rcd at 3368. However, with the advent of digital technologies, including two-way transmissions, in the wireless cable industry, much has changed in the four years since the *ITFS Channel Loading Order* was adopted, and we no longer deem this restriction necessary. Nevertheless, those educators who continue to consider the right essential may insist upon it in their lease negotiations with wireless cable operators.

[252] *See id*., 9 FCC Rcd at 3367.

downstream-only digital services are offered, and is particularly critical to maximizing spectrum efficiencies. For example, BellSouth describes how channel shifting will allow ITFS usage to be grouped with all other local content in each market, permitting use of remote encoding, compression, encryption and multiplexing systems in each market. These systems, in turn, reduce costs and network complexity, and improve reliability and efficiency of spectrum use.[253] BellSouth also, like several other commenters, emphasizes that channel shifting must be voluntary.[254] Higher Education Alliance supports channel shifting so long as the licensee's "legitimate expectation of renewal" is not adversely affected by the fact that none of its required educational usage was transmitted on its own licensed channels.[255] As summarized above, the *Joint Statement* is supportive of channel shifting so long as the usage is shifted onto channels licensed to other ITFS entities.

101. We are amending Section 74.931(e)(9) to permit maximum flexibility in channel shifting for an ITFS licensee which itself utilizes, or leases excess capacity to a wireless cable operator which utilizes, digital transmissions. Such flexibility encompasses the right of an eligible ITFS licensee to shift its required educational usage onto any other channel(s) within the same wireless cable system, regardless of whether licensed to an MDS or ITFS entity. As the Commission expressed in the *NPRM*, channel shifting greatly assists in assembling the contiguous frequency blocks which are essential to a two-way architecture. We further hope that the flexibility we accord to ITFS licensees to lease their channel capacity, along with the maintenance of minimum ITFS educational usage requirements, also encourages educators to apply for new ITFS stations and leads to more educational usage.[256] We believe that such benefits of allowing eligible licensees maximum flexibility outweigh any issues relating to licensee control, and we emphasize that an ITFS licensee's decision to enter into a channel shifting arrangement is completely voluntary. In the event that an ITFS licensee is dissatisfied with the transmission of its educational usage over others' channels, we expect the wireless cable operator to work with the licensee in good faith to resolve the conflict. Given that some or all of the ITFS licensee's channels may have been turned around for upstream transmissions, for example, returning those channels to downstream transmissions may be extremely disruptive to the two-way system. However, we will entertain complaints where the downstream channels devoted to ITFS educational usage are subject to harmful interference such that the ITFS licensee cannot meet its service obligations. In fact, the pursuit of complaints under such circumstances is consistent with the ITFS licensee's responsibilities.[257]

c. Downstream Channel Reservation

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[253] *See* BellSouth Comments and Reply Comments. To the extent that these benefits result from deployment of digital "super" headends that can serve multiple markets or an entire region, BellSouth maintains that the entire area served by the "super" headend should be considered an integrated "system" for purposes of channel shifting. *Id*. We disagree, because where the "super" headend serves multiple markets, conceivably a market could be deprived of its ITFS educational content where such content is wholly shifted to channels in a different market served by the "super" headend.

[254] BellSouth Comments.

[255] Higher Education Alliance Comments.

[256] *See Notice*, 12 FCC Rcd at 22207.

[257] *See ITFS Channel Loading Order*, 9 FCC Rcd at 3366: "ITFS licensees must undertake the obligation of insuring that their . . . programming, if it is to be transmitted over channels other than their own, actually reaches their students."

102. In the *NPRM*, the Commission solicited comment on proposals that each ITFS licensee be required to preserve at least one downstream channel, and that each ITFS licensee devote at least half of its capacity for downstream use.[258] Of the few comments that we received on this issue, the majority favors a mandatory preservation of one downstream channel. Wireless One, for instance, believes that it should alleviate concerns over how ITFS entities will be able to continue operations after terminating their relationship with a wireless cable operator.[259] Higher Education Alliance likewise supports the required preservation of one downstream channel per each ITFS licensee, though it diverts from the *Joint Statement*'s similar position by allowing that the channel need not necessarily be from amongst the licensee's own channel group.[260] The Foundation, which was the original proponent of the half-capacity downstream preservation, reiterates that position.[261] The Bay Area Consortium, on the other hand, generally "opposes the proposals discussed in the [*NPRM*] which would dedicate specific channels to upstream or downstream use."[262]

103. We are adopting the *Joint Statement*'s proposal, as modified by the Higher Education Alliance comments, and we are adding appropriate provisions to Section 74.931. Specifically, each ITFS licensee leasing channels to be used for return paths shall be required to maintain at least 25% of its capacity to be used for downstream transmissions both during the term of the lease and following termination of its leasing arrangement. This 25% of capacity downstream preservation need not be over the licensee's own licensed channels. We believe that this solution provides maximum flexibility in usage of the channels within a wireless cable system, while at the same time safeguarding the continued reservation of spectrum for downstream transmission of ITFS educational programming so that the licensee can continue to deliver such programming if its relationship with the wireless cable operator ends. In order to provide additional safeguards of the ITFS spectrum allocation, we stipulate further that in the event this relationship ends, the wireless cable operator must return to the ITFS licensee unfettered use of as many 6 MHz channels as are authorized to the licensee; only 25% of these channels, however, must be devoted to downstream transmissions. Finally, when none of these returned channels are from the licensee's originally licensed channel group, the Commission will expeditiously grant channel swap applications reflecting the channel return, shortly after mutual submission of such applications by all relevant licensees.

d. Channel Swapping

104. In the *NPRM*, the Commission solicited comment on whether ITFS channel swaps should only be just between ITFS channels, or whether ITFS licensees should be able to swap their spectrum for channels in the MDS band. The Commission also sought input on related proposals, including a requirement that wherever an exchange of ITFS channels is permitted, reimbursement of all costs of channel changes should occur; and a reallocation counter-proposal that the Commission institute a five to ten year plan to convert MDS channels 1, 2, and 2A from their current point-to-multipoint use to upstream multipoint-to-point transmissions, leaving the rest of the ITFS and MDS spectrum for point-to-multipoint use.

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[258] 12 FCC Rcd at 22207.

[259] Wireless One Reply Comments.

[260] Higher Education Alliance Comments.

[261] Foundation Comments.

[262] Bay Area Consortium Comments.

105. All of the comments that we received on channel swapping issues are in favor of the concept. Aside from its initial "refarming" plan,[263] CTN merely comments in favor of channel swaps among ITFS licensees.[264] However, most of those commenting on these issues indicate full support for swaps both between ITFS channels, as well as between ITFS and MDS channels. The *Joint Statement* seeks to limit swaps to those channels in the 2.5 GHz band, but most of the comments do not contain this stipulation. SWM supports channel swaps so long as they are voluntary, and views them as a method to decrease the interference risks attendant to two-way transmissions. SWM also reiterates its cost reimbursement proposal on which the *NPRM* sought comment.[265] Wireless One, one of a couple of commenters expressing support for SWM's cost reimbursement proposal, adds that channel swapping, like channel shifting, will help to allow the wireless cable operator and the ITFS licensee to group channel usage to their best advantage.[266]

106. In light of the overwhelming support for channel swapping and its obvious benefits particularly where two-way transmissions are envisioned, the question here is not whether to allow it; rather, the focus must be on the nature and breadth of the rules governing it. We note that Part 21 of our Rules already allows within-service MDS channel swaps.[267] We emphasize that channel swapping is completely voluntary, and we also will allow nearly maximum flexibility in the types of swaps that may take place: First, parties may swap any ITFS channels and parties may swap almost any ITFS and MDS channels in the same market or geographic area.[268] Second, we do not limit swaps to channels within the 2.5 GHz band; rather, ITFS channels also may be swapped with MDS channels 1 & 2.[269] Third, a licensee may swap as many or as few of its channels as it chooses. Furthermore, we specify that channel swaps represent a change in the licensee of the swapped channels, and are not tied to the duration of any excess capacity lease or other agreement. This will provide certainty both to wireless cable operators, that their systems will not be disrupted, and to ITFS licensees, who can plan post-relationship issues accordingly, and with certainty that others' swaps also are permanent. In this regard, we agree with the Foundation's suggestion that "[i]f an ITFS channel is swapped for a channel which is normally assigned to MDS/MMDS, the former MDS/MMDS channel should be regulated as an ITFS channel, and *vice versa*."[270]

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[263] *See* ¶ 46, *supra.*

[264] *See* CTN Comments.

[265] SWM Comments.

[266] *See* Wireless One Comments.

[267] 47 C.F.R. § 21.901(d)(6).

[268] The only exception to this flexibility is where it is a swap between MDS and ITFS channels, and both stations are utilizing analog transmissions only.

[269] However, ITFS channels may not be swapped with MDS channel 2A, because it is only a 4 MHz channel.

[270] Foundation Comments. *See also* Petitioners Comments. We also agree with Petitioners' additional specification that an ITFS licensee who swaps to the E or F Group channels should not be subject to the restrictions on ITFS licensees who were authorized to operate on the E and F Group channels prior to May 26, 1983. *See Amendment of Parts 2, 21, 74, and 94 of the Commission's Rules and Regulations in Regard to Frequency Allocation to the Instructional Television Fixed Service, the Multipoint Distribution Service, and the Private*

107. Because channel swapping is voluntary and its terms negotiable, contrary to SWM's proposal we see no need to require that the wireless cable operator cover all of the costs of it. However, we anticipate that as the system coordinator, the wireless cable operator usually will be the proponent of the channel swap, and an ITFS licensee requested to swap its channels is free to seek payment in its lease negotiations or otherwise.[271] In addition, CTN has suggested that when accommodating channel relocations, exchanges, or shared-time agreements, Section 74.902(d)(1) of the Commission's Rules should not apply.[272] While it is not clear to which exact element of that rule CTN is referring,[273] rather than carve out broad exceptions to the application of the rule, we believe that the scenarios contemplated by CTN will be facilitated by amending the rule to stipulate that a licensee initially must select its maximum of four channels from amongst the same channel group, but that subsequently it may be licensed to channels within different channel groups through Commission authorized channel swaps.

108. While the Commission sought comment in the *NPRM* on the proposal to convert MDS channels 1, 2, and 2A from their current point-to-multipoint use to upstream multipoint-to-point transmissions, leaving the rest of the ITFS and MDS spectrum for point-to-multipoint use, the Commission tentatively rejected the proposal, because it would artificially limit the amount of spectrum that could be used for upstream transmissions and unnecessarily prevent ITFS licensees from using their own channels for upstream transmissions.[274] For the same reasons cited by the Commission, the parties commenting on this proposal unanimously support the Commission's rejection of it. Some commenters also argue that the proposal would harm existing licensees relying on downstream use of channels 1, 2, and 2A.[275] Based on the comments and on our own further consideration, we see no reason to limit response channels to MDS channels 1, 2, and 2A. We also decline to adopt other proposals limiting the location of response channels.[276]

109. Regarding channel swap application and processing procedures, the few comments that we received suggest that channel swaps be governed by current rules and procedures for formal license

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Operational Fixed Microwave Service, 98 FCC 2d 129, 132-34 (1984).

[271] In order to maximize flexibility in compensation that ITFS licensees may seek from wireless cable operators, we will impose no limits at this juncture on the amount or types of compensation that ITFS licensees may demand in exchange for agreeing to swap their channels, other than to specify that such demands must be in good faith.

[272] *See* Request of Catholic Television Network for Supplemental Comment Period and Extension of Time, MM Docket No. 97-217, at 6 (filed November 25, 1997) ("CTN NPRM Comment Extension Request").

[273] Section 74.902(d)(1) is a lengthy set of rules, which, in its current form, begins: "A licensee is limited to the assignment of no more than four channels for use in a single area of operation, all of which should be selected from the same Group listed in paragraph (a) of this section."

[274] *NPRM*, 12 FCC Rcd at 22180.

[275] *See* Bay Area Consortium Comments; MDS Licensees Comments.

[276] *See* ¶ 46, *supra*, addressing CTN's "refarming" plan; and ¶ 57, *supra*, addressing reallocation proposals for the 125 kHz channels.

assignments.[277] Commenters also urge that we adopt specific expedited procedures for processing assignment applications filed pursuant to channel swap agreements.[278] We will implement simple procedures for channel swap applications: Each licensee seeking to swap channels shall file a *pro forma* assignment application with the Commission, attaching an exhibit which clearly specifies that the application is filed pursuant to a channel swap agreement.[279] Because *pro forma* assignment applications typically are processed rapidly, however, we do not believe that special expedited processing procedures are necessary at this juncture.

e. Effects on ITFS License Renewal

110. Several commenters seek to impress upon us that it is important that we clarify that channel shifting, in particular, will not constitute a basis for, or be a factor in, a license renewal proceeding.[280] The *Joint Statement* also contains a provision to this effect.[281] This concern arises over possible effects of an ITFS licensee not providing any educational usage over its own licensed channels, even if it satisfies its educational usage requirements on other channels in the same wireless cable system. BellSouth relies on notions of fairness, arguing that "ITFS licensees should not be jeopardized because shifting has occurred in order to use the technology more efficiently."[282] The Foundation presents a more dire observation, suggesting that ITFS licensees will be unlikely to allow use of their channels for two-way operation "unless renewal expectancy is assured."[283]

111. In the *NPRM*, the Commission stated its belief that consideration of renewal expectancy is beyond the scope of this proceeding. While we do believe that the issue of renewal expectancy in ITFS is best to be considered fully in another proceeding, we also recognize that two-way system design may be based largely on the implementation of channel shifting, and that wireless cable operators and their ITFS lessors may be deterred from utilizing these efficiencies without assurances that doing so will not have an adverse effect at the time the ITFS licensee seeks renewal. In other contexts, we have assured ITFS licensees that so long as they meet their overall educational usage requirements, they will not be penalized for not providing educational usage on each of their authorized channels, where their scheme for meeting their requirements will

[277] *See, e.g.*, BellSouth Comments.

[278] *See* Bay Area Consortium Comments.

[279] *See* new §§ 21.901(d) and 74.902(f).

[280] *See, e.g.*, BellSouth Reply Comments; Higher Education Alliance Comments.

[281] *Id*. at ¶ IV (channel shifting "shall not be considered negatively at the time the ITFS licensee seeks renewal of its authorization").

[282] BellSouth Reply Comments.

[283] Foundation Comments.

promote the wireless cable system in their market and prevent "'balkanization of the ITFS spectrum.'"[284] We find it wise to provide similar assurances to ITFS licensees which employ channel shifting, which we have described above as the next step in an increasingly flexible progression of rule changes concerning fulfillment of minimum educational usage requirements. Accordingly, we amend Section 74.93 to reflect that the fact that an ITFS licensee utilizes channel shifting will not itself be considered adversely to the licensee in seeking a license renewal.[285] However, we steadfastly maintain that any other consideration of renewal expectancy is beyond the scope of this proceeding. Furthermore, we note that we have struck the words "or otherwise" from the language that we add to Section 74.931, because we also do not believe it appropriate in this proceeding to evaluate what treatment channel shifting techniques should be accorded, for example, in initial licensing of new ITFS stations.

3. Autonomy of ITFS Licensees and Agency Role

112. When the Commission solicited comments in preparation for the *NPRM*, several of the ITFS parties who commented at that time expressed concern that the proposed two-way scheme would threaten the independence of ITFS licensees and their future ability to use spectrum capacity for instructional purposes. Some of those concerned commenters focused on the effect that the proposed rules could have on the engineering autonomy of ITFS licensees. Concerned commenters also identified issues relating to possible encroachment upon the financial autonomy of ITFS licensees by implementation of the proposed two-way framework. Recognizing the symbiosis between the MDS and ITFS worlds, and the increasing entanglement that they believed will result from wireless cable two-way operations, these commenters sought precautions to ensure that no ITFS licensee would be forced to engage in two-way operations, and that those ITFS licensees that do cellularize can continue to provide educational services should their relationship with their wireless cable lessee end or should their wireless cable lessee become insolvent. While the Commission, in the *NPRM*, sought comment on the effects that cellularization would have on the engineering and financial autonomy of ITFS licensees, we also acknowledged that any proposed solutions inherently would implicate the fundamental question of what degree of oversight the Commission should maintain in regulating the wireless cable industry and ITFS. The Commission solicited views on this fundamental question, and on one of its principal offshoots, the question of what impact the proposed two-way rules should have on the Commission's requirements regarding excess capacity lease agreements.[286]

113. The comments that we received in response to the *NPRM* evince many of the same concerns expressed by some of the ITFS commenting parties in earlier rounds of comment, and likewise are met with opposing comments conveying responses comparable to those previously conveyed. For example, the Foundation argues that the need for safeguards over post-termination aspects of leases increases in a two-way

[284] *See ITFS Channel Loading Order*, 9 FCC Rcd at 3364. There, the Commission amended Section 74.902(d) of its rules to allow new ITFS applicants to satisfy presumptively, when proposing employment of channel loading techniques, their obligation to demonstrate need for all four channels in the sought channel group.

[285] While only ITFS licensees utilizing digital transmissions, or leasing excess capacity to a wireless cable operator utilizing digital transmissions, are eligible under our revised rules to avail themselves of channel shifting techniques, the assurances that we add to Section 74.931 encompass the concepts of channel loading and channel mapping, techniques which may be utilized by any ITFS licensee, regardless of what form of transmissions it utilizes.

[286] *See generally*, 12 FCC Rcd at 22208-13.

environment "which makes licensees depend more than ever on the facilities of third parties."[287] Wireless One counters that threats to ITFS autonomy in a two-way system are minimal, because "[i]n reality, there will be no greater dependence than exists currently, and that which exists currently was based on a multitude of individual decisions made by ITFS licensees."[288] Similarly, while Petitioners reiterate that post-relationship arrangements should be addressed by contract, not by regulation, in part because there is no "one size fits all" approach and educators' needs will vary, the Foundation "could not disagree more."[289] CTN charges that "there can be no dispute that it is the Commission's responsibility, rather than the responsibility of individual ITFS licensees or wireless cable operators, to preserve the essential educational character of ITFS and to promote its use consistent with the public interest."[290] Some of our decisions here, such as requiring ITFS licensees to retain 25% of their capacity for downstream transmissions, and generally prohibiting involuntary modifications to ITFS stations in a two-way environment, should help address some of the concerns of ITFS licensees regarding their autonomy and ability to continue providing service should they no longer be in a relationship with a wireless cable operator. However, as our decisions below will show, while we will continue to require certain provisions in excess capacity leases between ITFS licensees and wireless cable operators, and likewise will continue to prohibit certain provisions, we believe generally that ITFS licensees can -- and should -- in their negotiations with wireless cable operators arrange for lease terms that best protect their own individual interests and needs.

114. As a starting point, we reiterate the ultimate safeguard of the autonomy of ITFS licensees and their ability to maintain the provision of educational services. The Commission declared in the *NPRM*:

> Those ITFS licensees desiring to abstain from cellularization are free to deny efforts by wireless cable lessees to modify leases for cellularization, and ITFS licensees also may decline altogether to lease their excess airtime. We emphasize that cellularization would be permissive only. We will not authorize a two-way framework which involves the mandatory participation of any ITFS licensee.[291]

The significant number of commenters addressing this directive unanimously support it.[292] Some commenters ask that we endorse the closely related concept, as stated by the MDS Licensees, that "lessees may not *compel* licensees without their consent to file for any of the new facilities made possible by the two-way proposal."[293]

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[287] Foundation Reply Comments.

[288] Wireless One Comments.

[289] Petitioners Comments.

[290] CTN Reply Comments.

[291] 12 FCC Rcd at 22210.

[292] *See, e.g.*, Petitioners Comments (stating the "fundamental precept" that no ITFS or MDS licensee should be forced to cellularize); Wireless One Comments (suggesting that the "fact" that cellularization is not mandatory should be included in the Commission's rules).

[293] Comments of Alliance of MDS Licensees ("MDS Licensees") (emphasis in original). *See also, e.g.*, SWM Comments.

We reiterate that only the licensee may file an application for a two-way facility or application to modify a facility on the licensee's authorized channels, so it is impossible for any two-way facility license to be obtained without that licensee's consent.[294] The Foundation seeks redress of a more subtle form of coercion of ITFS licensees, specifically, that under the rules proposed in the *NPRM*, an ITFS licensee that offered high-speed Internet service pursuant to a lease with a wireless cable operator would enjoy protected service area (PSA) protection, but an ITFS licensee that provided exactly the same service on its own would not. The Foundation argues that the effect of this "anomaly" is to mandate the leasing of excess channel capacity if an ITFS entity is to be able to operate with any assurance that it will remain free of interference.[295] In recognition of concerns such as those expressed by the Foundation, we have decided to grant all ITFS licensees psa protection.[296]

115. Other commenters in addition to the Foundation seek to protect the rights of ITFS licensees which do not lease excess capacity. For instance, Higher Education Alliance states that the Commission's rules must permit, and observes that the rules proposed in the *NPRM* appear to permit, ITFS licensees to implement two-way services on their own. It goes on to say that ITFS licensees will provide such services to enhance distance learning interactivity, provide students with high speed Internet access, or fill in downstream coverage gaps.[297] HITN argues that the Commission recognize that many stand-alone ITFS providers offer a number of telecommunications services which are not educational services, and that more ITFS providers will desire to provide such services.[298] We reaffirm the ability of stand-alone ITFS licensees to provide communications services that are not specifically educational over their frequencies, so long as they meet the educational usage requirements set forth in our Rules.

a. Engineering Autonomy

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[294] The Commission, however, will not get involved in resolving any disputes over whether a lease contemplated two-way operations.

[295] Foundation Comments.

[296] 47 C.F.R. §74.903(d) of the new rules. This psa protection, which shall comprise an area within a 35 miles radius of the licensee's registered receive sites, shall be in addition to the registered received site protection currently enjoyed by ITFS licensees.

An ITFS entity which did not receive psa protection prior to September 17, 1998 shall be accorded such protection by a cochannel or adjacent channel applicant for a new station or station modification, including a booster station, response station or response station hub, where the applicant is required to prepare an analysis of the potential for harmful interference.

[297] Higher Education Alliance Comments. Higher Education Alliance notes that the Commission's previous Public Notice allowing downstream-only data services, including Internet access, over ITFS channels limited the privilege to ITFS licensees who lease excess capacity. *See* "The Mass Media Bureau Implements Policy for Provision of Internet Service on MDS and Leased ITFS Frequencies," *Public NPRM*, DA 96-1720 (rel. Oct. 17, 1996). *But see, e.g.*, proposed Section 74.931(a)(1), which provides for use of ITFS channels for response channels employed in connection with formal educational courses, without distinguishing between stations that lease excess capacity and stations that do not. 12 FCC Rcd at 22248-49. *See also* MDS Licensees Comments.

[298] HITN provides as an example the case of George Mason University, which currently provides a commercial wireless cable service over ITFS frequencies that, among other things, broadcasts Commission proceedings.

116. Petitioners concede that it is "inevitable" that MDS licensees and ITFS licensees in a market all will lose some degree of autonomy when they choose in their own discretion to have their channels combined into a two-way system, and they may find it impossible to return to their pre-lease configuration upon termination of their lease.[299] Higher Education Alliance echoes Petitioners' observations, and adds that if the prospect of two-way ITFS use is sufficiently attractive to an ITFS licensee, however, "the risk of not being able to return to the status quo ante may simply be a price that is worth paying."[300] Nonetheless, we received suggestions on how an ITFS licensee may be able to continue providing educational services should its relationship with the wireless cable operator terminate. One commenter proposes that we require site leases to provide that the ITFS licensee can continue to operate its facilities from such locations upon reasonable terms.[301] Another commenter concludes that if the excess capacity lease terminates, the ITFS licensee should recover "full unencumbered usage of its originally licensed spectrum."[302] While we acknowledge that our solution requires substantial foresight on the part of the ITFS licensee, we believe that these post-relationship configuration issues should be arranged by the ITFS licensee in the course of negotiating the terms of its excess capacity lease with the wireless cable operator. We also agree with the commenters who recognize that our requirement that each ITFS licensee retain 25% of its capacity for downstream transmissions will present significant assistance to ITFS licensees in continuing to provide downstream educational services.[303]

117. Another issue related to engineering autonomy is the issue of licensee control. Some commenters specify that ITFS licensees must maintain independent control of all of their ITFS facilities and licenses, whether or not they participate in the cellularized system.[304] It is axiomatic, as these commenters suggest, that an ITFS licensee have ultimate control over its facilities and license. While two-way services will increase the entanglement of the wireless cable system operating environment, particularly when techniques such as channel shifting are employed, nevertheless we anticipate that, given the system-wide coordination necessary to successfully design and operate a two-way system, as well as the fact that the ITFS licensee must initially consent to take part in cellularization, conflicts over control and use of ITFS facilities will be minimal. In addition, as the Commission has observed previously, "[o]peration of facilities by lessees is not necessarily inconsistent with the performance of an ITFS licensee's responsibilities, and no . . . loss of control need occur when an ITFS physical plant is leased from an MDS operator. . . . [L]icensees will continue to be held

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[299] Petitioners Comments. *See* Foundation Comments (describing specific scenarios where a licensees may be unable to return to its pre-lease configuration).

[300] Higher Education Alliance Comments.

[301] Foundation Comments. Similarly, MDS Licensees argue that given the siting problems faced by many licensees in different services, the Commission should require that MDS and ITFS licensees use their best efforts to make space available at their sites, whether by requiring that space be leased at reasonable terms on licensee-owned towers or by requiring non-exclusive and non-preclusive arrangements with the tower lessors. MDS Licensees' Comments. While we encourage cooperation between parties on siting issues, we believe such issues to be beyond the scope of this proceeding.

[302] HITN Comments.

[303] *See* Higher Education Alliance Comments; Wireless One Reply Comments.

[304] *See* Maryland Comments; HITN Comments; SWM Comments.

ultimately responsible for full compliance with . . . Commission rules."[305] We also will continue to review excess capacity leases to ensure that they contain no provisions abdicating ultimate licensee control. Therefore, we are not concerned that an ITFS licensee's ultimate control over its facilities and licenses will be jeopardized significantly by two-way operations.

118. SWM additionally asserts that the ITFS licensee must at all times preserve "ultimate legal control over broadcast and content of the specified bandwidth."[306] While we note that in the past, the Commission has placed primary emphasis on a licensee's programming control,[307] we believe that attempting to measure a licensee's control over the content transmitted over its licensed bandwidth is an unduly difficult standard to meet in an environment where, for instance, an ITFS licensee may shift all of its required educational usage off of its own licensed channels, leaving control over the content transmitted over those channels to the wireless cable operator. Furthermore, with the provisions that we adopt for flexible alteration between common carrier and non-common carrier service offerings, the issue of a licensee's control over content on its authorized bandwidth may be rendered irrelevant, where the operator is providing service on a common carrier basis. We conclude that, particularly in light of the primary educational function of ITFS licensees, where an ITFS licensee is not the source of transmissions over its licensed bandwidth, we will not regard the ITFS licensee as having legal control over the content of such transmissions. We believe that the originating source of such transmissions should be regarded as having legal control over their content.[308] At most, an ITFS licensee's legal control over content transmitted over its authorized bandwidth is a contractual matter between the leasing parties. Nevertheless, we strongly encourage ITFS licensees to incorporate into their excess capacity leases provisions specifying that responsibility over the content transmitted by a lessee over bandwidth licensed to an ITFS entity is borne by the lessee. We do emphasize, however, that control over and responsibility for the content and amount of an ITFS licensee's educational usage is solely vested in the ITFS licensee, no matter whose channels it uses to transmit the educational usage.

b. Involuntary Modifications

119. In the *NPRM*, the Commission solicited comment on whether it should prohibit the filing of involuntary modification applications. The Commission asked commenters to recount the extent to which they are currently employed, and to anticipate to what degree they likely would be utilized in a two-way digital environment, and whether such utilization would constitute abuse of the mechanism. The Commission further asked whether it should restrict the scope of Section 74.986[309] of the Commission's Rules to involuntary modifications that are consistent with downstream transmissions only.[310]

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[305] *Second Report and Order in MM Docket No. 83-523*, 101 FCC 2d at 90.

[306] SWM Comments.

[307] *See Second Report and Order in MM Docket No. 83-523*, 101 FCC 2d at 90.

[308] Thus, for example, while a wireless cable operator transmitting obscene language or other matter over frequencies leased from an ITFS licensee could be prosecuted for such transmissions pursuant to 18 U.S.C. § 1464 and/or §1468, we believe that the ITFS licensee in such a case should not be subject to prosecution.

[309] 47 C.F.R. § 74.986.

[310] 12 FCC Rcd at 22210 n.70.

120. In their comments, Petitioners argue that the Commission "must take care to avoid empowering any one licensee in a market with the ability to unreasonably frustrate the introduction of new technologies by its neighbors," as, Petitioners believe, too often occurs under the current rules.[311] Petitioners assert that given the ease of retuning ITFS and MDS transmitters to other frequencies in the 2.5 GHz band, the Commission should coordinate the retuning of transmitters to other frequencies in the band at the expense of the proponent of such retuning, when doing so promotes the introduction of advanced technologies in a spectrally efficient manner and where "comparable facilities" in the 2.5 GHz band are available.[312] Petitioners note that the Commission already requires ITFS licensees to make certain involuntary modifications "in order to promote the most efficient use of the spectrum under certain circumstances," and likewise has required licensees in other services to do so in a similar or more intrusive manner than retuning to other frequencies within the same band.[313] Acknowledging that voluntary agreements certainly are to be promoted, Petitioners outline a three-step process for handling retuning proposals.[314] Finally, Petitioners comment that it "is specious" to suggest that the involuntary modification mechanism either has been abused, or will be abused upon implementation of two-way digital services, because only a handful of such applications pursuant to Section 74.986 have been filed, and the Commission apparently never has denied such an application.[315]

121. While not opposing the concept of involuntary retuning, the Foundation nonetheless points to several flaws in Petitioners' proposal. Some of these flaws include the lack of provisions for the affected ITFS licensee to oppose retuning applications;[316] the inefficiency of maintaining multiple mechanisms for involuntary modifications;[317] and the lack of provision for involuntary retuning of MDS channels.[318] We note that Petitioners' involuntary retuning proposal is at odds with their initial emphasis that no ITFS licensee would be required even to shift educational usage off of its own channels,[319] let alone be forced to trade its licensed frequencies, safeguards which received support from some commenters.[320] CTN opposes involuntary retuning

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[311] Petitioners Comments.

[312] *Id*. at 107-08, 111. Petitioners also suggest that involuntary retuning may be justified in order to eliminate harmful interference caused to an incumbent station by a newcomer. *Id*. at 24 n.40.

[313] *Id*. at 24 n.40, 108-11.

[314] *Id*. at 111-12. Petitioners' proposed involuntary retuning process received some support in the comments, both in the initial round, and in the round of comments established to address the numerous *ex parte* submissions in this proceeding. *See, e.g.*, Wireless One Reply Comments; NIA Ex Parte Comments.

[315] Petitioners Comments. *See also* Bay Area Consortium Comment.

[316] *See* Foundation Reply Comments.

[317] *See* Foundation Reply Comments.

[318] Foundation Comments.

[319] *See NPRM*, 12 FCC Rcd at 22205.

[320] *See, e.g.*, Maryland Comments.

of ITFS stations on ITFS autonomy grounds,[321] and, although our existing rules permit some involuntary retuning, we agree with CTN that disallowing involuntary retuning modifications is another measure that will protect the autonomy of ITFS licensees in a two-way environment.[322] In addition, because of the complex interference environment inherent where there are two-way operations, we also will not grant involuntary modifications under Section 74.986 in any market where response station hubs have been proposed or are operating. Such involuntary modifications may render it more difficult for a licensee to later modify its station voluntarily than it would be had the involuntary modification never occurred. Finally, rejecting the proposal for involuntary retuning and discouraging many other involuntary modifications will keep us from getting more involved in relationships between participants in the industry, at a time when we are taking measures to become less involved in such relationships and attempting to let the market dictate outcomes where possible.

c. Financial Autonomy

122. In the *NPRM*, the Commission recounted the concerns of several commenters at that stage of the proceeding that ITFS licensees will be unable to sever their relationship with the wireless cable operator and acquire the equipment to either continue cellular operations or return to non-two-way transmissions. The Commission sought comment on that matter and on what type of equipment MDS lessees of ITFS channels should be required to make available to the ITFS licensees upon termination of a lease.[323] The Commission also solicited comment on what solutions, if any, it should implement to combat potential encroachment upon the general financial autonomy of ITFS licensees resulting from a two-way framework.[324]

123. CTN reiterates its concern that dependence of ITFS licensees on wireless cable operators will be fostered in a two-way environment, because the cost of installation and maintenance of two-way systems is likely to be far beyond the means of ITFS licensees.[325] Such dependence also leads some commenters to express concern regarding an ITFS licensee's welfare and continuation of operations should the wireless cable operator become insolvent.[326] Some commenters propose as a solution the required establishment by two-way wireless cable operators of a performance bond or escrow account, with sufficient funds to ensure the uninterrupted operation of participating ITFS stations for a given period.[327] Opposed commenters argue that any ITFS licensee is free to negotiate for a performance bond when it enters into the lease, but that it should not be required and ITFS licensees should retain the flexibility to negotiate whatever consideration under the

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[321] *See* CTN Reply Comments. ("Wireless cable operators are invitees within the ITFS spectrum, and they should not be allowed to dictate the nature of ITFS facilities.")

[322] We will, however, retain the very narrow provisions of 47 C.F.R. § 74.902(h)-(j), which allow for mandatory retuning of point-to-point ITFS stations.

[323] 12 FCC Rcd at 22212.

[324] *Id.* at 22210-11.

[325] CTN Comments.

[326] *See, e.g.*, CTN Reply Comments.

[327] *See, e.g.*, CTN Comments. SWM Comments; Foundation Comments.

excess capacity lease best suits their needs.[328] We agree with the opposed commenters' stance on this issue, and believe that the same approach and rationale applies towards other proposals that would have transmission systems transfer automatically to the ownership and control of the ITFS licensee upon termination of the lease,[329] or upon commencement of a lease term.[330]

124. Citing our *Turner* precedent,[331] the *NPRM* asserted that the Commission consistently has maintained that an ITFS licensee should be permitted to purchase the ITFS equipment necessary to maintain its operation in the event the excess capacity lease is terminated.[332] However, in a two-way environment where several licensees may be using common equipment, or where ITFS licensees may shift their required educational usage off of their own channels, the application of the *Turner* principle is not as clearly defined as it was at the time it was enunciated. CTN argues that upon termination of a lease, an ITFS licensee should have access to all equipment necessary for continued distribution of its signal consistent with that during the lease term. CTN further maintains that the Commission's policy should include reference to dedicated (individual station) and common (shared by stations) equipment, or the equivalent thereof, and the parties can negotiate more specific terms.[333]

125. We believe that the *Turner* principle is still good policy, in order to assure as seamless a transition as possible for the ITFS licensee to continue providing educational services following termination of the lease.[334] Furthermore, we agree with CTN's approach, and will require that each excess capacity lease contain a provision assuring the ITFS licensee's right to purchase the actual equipment, or equipment comparable to that, used by the ITFS licensee during the lease for educational purposes. This means, for example, that if the ITFS licensee was providing educational services during the lease period utilizing digital transmissions, the wireless cable operator is not obligated to retain analog transmission equipment for ITFS licensees seeking to return to traditional downstream analog transmissions. In addition, as requested by CTN, this required lease provision applies to dedicated or common equipment used for educational purposes. By specifying that this obligation can be fulfilled by providing the right to purchase comparable equipment, we hope to ensure that service over the system is not disrupted when the wireless cable operator's relationship with one licensee transmitting over shared equipment terminates, but the relationships with the other licensees

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[328] *See, e.g.*, Petitioners Reply Comments; Region IV Reply Comments.

[329] *See* SWM Comments.

[330] *See* Foundation Comments.

[331] *See Turner Independent School District*, 8 FCC Rcd 3153, 3155 (1993).

[332] 12 FCC Rcd at 22212.

[333] CTN Comments.

[334] *See Turner*, 8 FCC Rcd at 3155.

sharing the equipment do not.[335] Nonetheless, as further indicated by CTN, negotiations between the parties to the lease still will be required to spell out the appropriate specific equipment that must be made available. Because provision for ITFS licensee access to purchase equipment upon termination of an excess capacity lease is a longstanding requirement, we do not believe that our adaptation of the requirement here should conflict with our decision to grandfather certain excess capacity leases.[336]

d. Commission Role

126. In the *NPRM*, the Commission invited comment on the degree of oversight that it should maintain in regulating the wireless cable industry and ITFS. The Commission described how in the past, it has adopted rules and procedures to accommodate and protect what has been viewed as the special needs of educational institutions and organizations, out of a belief that these entities should be treated differently in many situations due to limited financial and staff resources, governmental constraints, and similar factors. One of these protections has been required review by the staff of ITFS excess capacity lease agreements, for overly restrictive provisions affecting the licensee's rights and obligations and for compliance with the Commission's leasing policies.[337] The Commission requested comment on whether parties should continue to be required to file written agreements governing the ITFS licensee's lease of excess capacity on its channels.[338] Petitioners "strenuously take issue" with the belief that ITFS licensees are incapable of protecting their own interests without Commission micro-management. They assert that many ITFS licensees are major universities, state-wide organizations, non-commercial broadcast licensees, or other organizations with resources that dwarf those of their wireless cable lessees. Petitioners believe that the Commission's well-meaning efforts to protect ITFS licensees too often have had the unintended consequence of denying ITFS licensees flexibility to craft contractual arrangements that best serve local educational needs, and that, as a matter of principle, the Commission thus should refrain from dictating the provisions of ITFS excess capacity leases to the greatest extent possible.[339] Some commenters, however, such as the Public Broadcasting Commenters, ask that the Commission remain cognizant that ITFS licensees frequently find themselves in precarious financial positions due to their being nonprofit entities.[340]

127. We have considered carefully the opposing viewpoints that have been presented to us: on the one hand, that many ITFS licensees are well-funded and have "come of age"; on the other hand, that many still have very limited resources, and often those that they have to devote to ITFS are obtained completely through their excess capacity leases with wireless cable operators. Because we believe that many examples supporting both viewpoints exist, we find it still appropriate for us to maintain some degree of oversight regarding the

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[335] We also believe that this comparable equipment allowance should allay the concerns of commenters who argue that providing access to purchase shared equipment is unworkable. *See* BellSouth Reply Comments and Petitioners Comments.

[336] *See* ¶ 130, *infra*.

[337] *NPRM*, 12 FCC Rcd at 22211.

[338] *Id*. at 22212-13.

[339] *See* Petitioners Comments.

[340] *See* Public Broadcasting Commenters Comments.

relations between the wireless cable industry and ITFS, albeit a limited role which allows for maximum possible flexibility of the parties in establishing excess capacity lease provisions, while at the same time ensuring educational use of ITFS and a licensee's ability to continue uninterrupted in that use should its relationship with the wireless cable operator terminate. In this regard, we will heed the prescriptions of the numerous commenters who request that we continue to review excess capacity leases for provisions overly restrictive of ITFS licensees and in order to police established safeguards, and require amendment of noncompliant leases.[341] However, consistent with many of our decisions here regarding the substance of such leases, we intend this review to be on a lesser scale than previously, and to be more deferential to the burdens and benefits which constitute the agreement between the parties to the leases, and to allowing of flexibility in implementation of two-way services.

128. In the *NPRM*, the Commission also sought comment on a proposal, advanced by the Foundation, that the Commission require that two-way digital applications and interference consents be reviewed by legal and engineering counsel that do not represent commercial interests, and that these independent advisors certify that in their professional opinion the submission will not harm future instructional service. The Commission noted that past attempts to require all leasing parties to hire separate counsel have been declined by the Commission, having found it an unnecessary safeguard and relying instead on the staff's review and monitoring of leases.[342] Seeing no reason to change position on this issue, the Commission tentatively rejected the Foundation's proposal in the *NPRM*.[343] The Foundation continues to advocate this proposal in its comments. The Foundation argues that with the advent of two-way services, interference studies will grow far more complex, and the motives for operators to "gull" ITFS licensees will expand even further than today, when operators act on such impulses with some degree of frequency. The Foundation further asserts that the matter of interference consents is distinguishable from that of leases, because in contrast with leases, the Commission has no formal mechanism for evaluating interference consents, and there are no rules governing what interference can be accepted by licensees and what cannot. The Foundation concludes that adoption of its proposal is necessary "if the Commission's goal of protecting ITFS service is to be achieved."[344]

129. Petitioners reiterate their arguments in opposition that were recounted in the *NPRM*: namely, that the proposal is inappropriate, and unworkable in that no one can predict the impact of an application or consent on "future instructional service"; and that it is the licensee educators, not lawyers or consulting engineers, who are in the best position to determine the educational needs of their community.[345] Region IV contributes that "if the Commission were to begin dictating to ITFS entities which lawyers and engineers they must use, the boundary of legitimate FCC oversight and supervision would have been obliterated."[346] While we believe it wise for ITFS licensees to seek impartial review of applications and consents where resources

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[341] *See, e.g.*, Bay Area Consortium Comments; Mississippi ETV Comments, and Maryland Comments.

[342] *See Second Report and Order in MM Docket No. 83-523*, 101 FCC 2d at 91.

[343] 12 FCC Rcd at 22212.

[344] Foundation Comments and Reply Comments.

[345] Petitioners Comments; *see NPRM*, 12 FCC Rcd at 22212.

[346] Region IV Reply Comments. *See also* Spike Reply Comments at 10-11 (discussing a wireless cable operator's incentive to monitor interference to ITFS lessors).

allow for such review, we agree with Petitioners and Region IV that ITFS licensees are best suited to decide how to allocate their resources in this regard. In addition, as stated above, we will continue to review excess capacity leases with an eye towards provisions which are overly restrictive of the role of the ITFS licensee. Therefore, we continue to find the Foundation's proposal unnecessary, and we will not adopt it.

e. Grandfathering of Excess Capacity Lease Provisions

130. The *Joint Statement* recommends that excess capacity lease agreements that provide for digital usage and were entered into prior to release of this Order be "grandfathered for their duration."[347] Although some commenters consider this proviso "critical,"[348] others, such as CTN, maintain that because many ITFS excess capacity leases were negotiated before the parties understood the nature of digital service or had considered the availability of two-way services, the Commission should adopt a policy that requires such agreements "to be consistent with current rules rather than the rules in effect when the lease took effect."[349] We will adopt a slightly modified version of the approach recommended by the *Joint Statement*, in recognition of the fact, as described by Petitioners, that since no ITFS facility can be modified without the licensee executing an application form, "every ITFS licensee will have an opportunity to consider its contractual rights and obligations before technical changes are implemented, and can insist upon an amendment if necessary."[350] In addition, because we are not changing our minimum educational usage requirements, grandfathering lease agreements does not present a lost opportunity cost with respect to an immediate increase in educational usage by ITFS licensees.

131. We seek to ensure a transition as smooth as possible to two-way operations, and we believe that effectively requiring amendment of numerous existing leases could prove unduly burdensome to ITFS licensees and wireless cable operators who did not anticipate such changes. In this regard, we are persuaded by commenters who describe how having to go back and renegotiate excess capacity agreements will require ITFS licensees to make other concessions that may seriously undermine their expectations and damage their ability to provide educational services.[351] However, since the March 31, 1997 release of our Public Notice announcing the filing of the petition for rulemaking which initiated this proceeding,[352] no party can be heard to argue that it did not have notice that ITFS/MDS two-way operations were anticipated in the not-too-distant

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[347] *Joint Statement* at ¶ VIII.

[348] *See* Petitioners Comments; Higher Education Alliance Comments.

[349] *See* CTN Comments.

[350] Petitioners Comments.

[351] *See, e.g.*, Higher Education Alliance Comments; Region IV Comments.

[352] "Pleading Cycle Established for Comments on Petition for Rulemaking to Amend Parts 21 and 74 of the Commission's Rules to Enhance the Ability of Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions," *Public Notice* RM-9060, DA 97-637 (rel. March 31, 1997.)

future.[353] Thus, any excess capacity lease entered into, renewed, or extended after March 31, 1997 is expected to be brought into compliance immediately with all of the rule changes and policies that are adopted here,[354] as is each new such lease, renewal, or term extension from here onward. Finally, we emphasize that we will not adjudicate whether the provisions of any specific lease contemplated digital operations as a general matter. In the absence of resolution between the parties to the lease, we believe this issue to be a matter of contract law properly heard before a state tribunal.

132. In framing our policies towards grandfathering of certain excess capacity leases, we have considered, and rejected, SWM's proposal that in order to protect the rights of incumbent ITFS licensees, the Commission require that leases approved or submitted under the previous rules "be amended to make clear that the wireless cable lessee and the ITFS licensee have together considered the rule changes adopted and made any appropriate changes to lease terms, prior to the commencement of commercial operations on the frequencies using cellularization, sectorization or differing channelization plans."[355] We also decline to adopt any rules in response to HITN's comment that unless "expressly provided for" in the lease agreement, wireless cable operators should be required to renegotiate agreements with ITFS licensees in order to obtain additional capacity in a digital environment or to provide services other than downstream wireless cable video.[356] As HITN itself states, and we reiterate, the "construction of existing agreements is a matter of contract law."[357]

f. Length of Leases

133. In the *NPRM*, the Commission solicited comment on whether to retain several present requirements for excess capacity leases, including, *inter alia*, those dealing with length of lease.[358] The *Joint Statement* urges that the Commission allow excess capacity leases of up to 15 years duration, provided that any lease extending beyond the term of a licensee's authorization provides for termination of the lease in the event the Commission denies the subject station's application for renewal.[359] Virtually all of the commenters who address this proposal support it, and we are adopting it, permitting such lease terms subject to negotiation by the parties. In extending permissible excess capacity lease term limits to 10 years a few years ago, the

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[353] Similarly, the Foundation contends that grandfathering privileges only should extend to excess capacity leases entered into prior to January 8, 1998, the date that initial comments were due in this proceeding and one day following the ratification of the *Joint Statement* by its signatories. The Foundation further believes that leases should comply with current Commission standards upon their renewal, or as of their original expiration date if their terms are extended. Foundation Reply Comments.

[354] Any lease falling into this category and needing to be brought into immediate compliance with the rules and policies adopted here must be done so within 75 days of the publication of this order in the *Federal Register*.

[355] *NPRM*, 12 FCC Rcd at 22212. SWM reiterated this proposal in its comments on the *NPRM*; *see* SWM Comments.

[356] HITN Comments.

[357] HITN Reply Comments.

[358] 12 FCC Rcd at 22212-13.

[359] *Joint Statement* at ¶ VII.

Commission recognized that "the wireless cable industry requires substantial equity investment in order to become a viable competitor. . . . We also realize that a potential financier is likely to exercise caution . . . where there is uncertain long-term availability of the ITFS channels that provide the basic capacity for that system."[360] As several commenters have persuaded us, the conversion to digital operations, whether two-way or merely downstream, will entail a substantial increase in operational and infrastructure costs, and the investment community will require even far greater comfort regarding the long-term availability of excess capacity on ITFS channels.[361] In addition, we agree with the commenters who have suggested that a 15 year lease term limit will help to place wireless cable on a more equal footing with its competitors. Higher Education Alliance, for instance, argues that 15 years is the customary period for traditional cable franchises, so that extending the term limits here hopefully would enable wireless cable operators to access capital markets that traditionally support wired cable.[362] Furthermore, as other commenters have described, a 15 year lease term limit also will help provide greater certainty to ITFS licensees, which, for instance, may appreciate the assurance of long-term, stable maintenance and operational support offered by a longer lease term.[363]

134. Because we find that these policies apply equally regardless of service offering, we reject the Foundation's suggestion of maintaining the 10 year lease limit for downstream-only digital and analog systems, while allowing a 15 year limit for two-way systems.[364] ITFS licensees concerned by lease limits longer than 10 years are free to negotiate for lease limits of 10 years or less. Finally, as the Commission stated in the *ITFS Window Filing Order*, the existence of a lease "in no way affects the duration of that license or the licensee's use of the frequency, but it nevertheless allows the benefits discussed above."[365] Thus, we emphasize, as reflected in the *Joint Statement*'s proviso on this issue, that any lease extending beyond the term of a licensee's authorization must specify that such an extension is subject to the renewal of the ITFS license.[366]

g. Other Lease Requirements

135. Petitioners urge[367] that the Commission reverse two policies which, Petitioners assert, were not formed in rulemaking proceedings: 1) Barring lease provisions that require an ITFS licensee to assign its

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[360] *Amendment of Part 74 of the Commission's Rules With Regard to the Instructional Television Fixed Service, Report and Order*, 10 FCC Rcd 2907, 2914 (1995) (hereinafter *ITFS Window Filing Order*).

[361] *See, e.g.*, Petitioners Comments; NIA Comments; Bay Area Consortium Comments; BellSouth Comments. While BellSouth prefers that we abolish lease term limits altogether,r we do not believe that proposal to be justified.

[362] Higher Education Alliance Comments. *See also* Petitioners Comments (explaining how a 15 year term limit will help wireless cable compete against other wireless services).

[363] Bay Area Consortium Comments. *See also* Petitioners Comments.

[364] Foundation Reply Comments.

[365] 10 FCC Rcd at 2914.

[366] *See ITFS Window Filing Order*, 10 FCC Rcd at 2914.

[367] Petitioners Comments and BellSouth Reply Comments.

remaining obligations under an excess capacity lease if it chooses to assign its underlying license;[368] and 2) Rejecting lease provisions which require that an ITFS licensee, seeking to cease operating its facility during the excess capacity lease term, provide the wireless cable operator a reasonable opportunity to secure an eligible ITFS assignee before the license is returned to the Commission for cancellation.[369] Petitioners contend that these policies have played a role in deterring investment in wireless cable, by diluting investor confidence in the duration of availability of leased channels.[370] HITN's opposition to such provisions, on the basis of undermining the autonomy of ITFS licensees,[371] is consistent with the justification that traditionally has been provided for banning the second aforementioned set of provisions; namely, that allowing them "intrudes in an area that has been the sole province of the licensee."[372]

136. We believe that it is appropriate to continue our ban of provisions that would require an ITFS licensee to assign its remaining obligations under an excess capacity lease, while henceforth allowing provisions that would permit a wireless cable operator to find a qualified ITFS assignee to assume the license prior to its cancellation. The first policy has previously been justified out of the belief that such provisions place an unreasonable impediment on the assignment or transfer of the ITFS facility.[373] We still believe that this rationale applies, because banning such provisions enhances the ITFS licensee's flexibility in finding a buyer *should it decide to seek a buyer*. Thus, we will continue to bar lease provisions that require an ITFS licensee to assign its remaining obligations under an excess capacity lease if it chooses to assign its underlying license. However, with respect to the second policy, allowing such provisions should keep the ITFS channels, *which have been designated by the licensee for cancellation*, from lying fallow, because the wireless cable operator will have incentive to find a buyer quickly. This results in a win-win situation, because the wireless cable operator may maintain commercial use of some of the channels; educational service is available again in a much quicker manner than if the Commission were to make the station available to competing applicants as a new station; and the educational institution that merely was going to turn in its license instead also may receive some remuneration for its license, without expending many, if any, efforts towards its sale.

137. Thus, henceforth we will allow, but not require, provisions which require that an ITFS licensee, seeking to cease operating its facility during the excess capacity lease term, provide the wireless cable operator a reasonable opportunity to secure an eligible ITFS assignee before the license is cancelled by the Commission. Under such provisions, the ITFS licensee would give the cable operator six months notice that it intends to relinquish its license. The wireless cable operator will then have a period of six months both to continue utilizing the same amount of spectrum permitted under the lease, and to find an assignee for the station. If an assignee was found within the appropriate time period, the incumbent ITFS licensee would make

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[368] *See, e.g., Central Cass Public School District*, 10 FCC Rcd 3167, 3168 (1995).

[369] *See, e.g., Harlem Consolidated School District #122*, 9 FCC Rcd 7927, 7928 (1994); *Walker County Board of Education*, 12 FCC Rcd 13837, 13839-40 (Mass Med. Bur. 1997).

[370] Petitioners Comments; *see* Wireless One Reply Comments.

[371] HITN Reply Comments.

[372] *Harlem Consolidated School District #122*, 9 FCC Rcd at 7928; *see Second Report and Order in MM Docket No. 83-523,* 101 FCC 2d at 90.

[373] *See Central Cass Public School District*, 10 FCC Rcd at 3168.

its best efforts to cooperate with the transfer of the license to the new licensee. If no assignee was found within the appropriate time, the cancellation of the license would become final, the wireless cable operator would be forced to cease transmissions over the spectrum at issue, and the station then would be eligible for licensing by the Commission according to then current procedures for disposition of new stations. During the period that the wireless cable operator is attempting to find a new licensee for the ITFS station, the ITFS licensee is obligated to continue meeting its educational programming requirements. This requirement serves the public interest by maintaining the availability of the educational programming until a new licensee can assume the duties of providing such programming. Of course, we will prohibit lease provisions which *require* a licensee to refrain from submitting its license from cancellation should it desire to do so.

138. The *Joint Statement* contains provisions which call for all excess capacity leases to state that the ITFS licensee "shall have the right to use any Internet services offered over the system at no greater than the lowest prevailing commercial rate and shall have reasonable access, at rates to be negotiated between the parties, to other services offered over the system (such as addressability and two-way capability)."[374] We decline to implement these provisions of the *Joint Statement*. We do not wish to get involved in arbitrating rate complaints in MDS/ITFS, and we believe that these are best private contractual matters between the parties. While we will not mandate either of these proposals, we particularly expect that reasonable access will be a vital component to any healthy two-way system.

4. ITFS Call Sign Transmission

139. In the *NPRM*, the Commission presented Petitioners' arguments that continued enforcement of the ITFS call sign transmission requirement[375] in a two-way environment will impose substantial costs on ITFS licensees. Petitioners concluded that because it is proposed that the Commission's records will reflect who is transmitting on what channels at all times, the burdens of the call sign transmission requirement far outweigh the benefits.[376] Nevertheless, the Commission recognized the complexity of the interference environment that would result from implementation of the two-way scheme, and the difficulty that it may pose in determining sources of harmful interference. Thus, the Commission sought comment on the proposed elimination of Section 74.982, and solicited alternative solutions for maintaining the accountability of ITFS licensees.[377]

140. The few commenters which addressed this proposal unanimously favored eliminating the call sign transmission requirement where digital transmissions are utilized. The Foundation, for instance, argues that the two-way use of ITFS spectrum renders station identification requirements inapplicable, and that the "superannuation of the current rules" is reinforced by complexities related to subchannelization and superchannelization.[378] We believe that the complexity of the engineering environment that will ensue as a result of adoption and implementation of the rules in this proceeding presents arguments both for retaining and

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[374] *Joint Statement* at ¶ XII.

[375] 47 C.F.R. § 74.982. Under our existing rules, ITFS stations generally are required to transmit their call signs when beginning and ending operation and, during operation, on the hour.

[376] Petitioners reiterate these arguments in their comments on the *NPRM*. *See* Petitioners Comments.

[377] *NPRM*, 12 FCC Rcd at 22213.

[378] Foundation Comments.

eliminating call sign transmission requirements. On the one hand, the greater interference risk of two-way operations justifies retention of the rules to help identify interferers. On the other hand, redefining the requirement becomes a daunting and perhaps fruitless task where subchannelization and superchannelization are involved in a system, and the costs of enabling each upstream transmitter to transmit a call sign, and perhaps even assigning each a separate call sign, could be staggering.

141. As the Commission stated in the *Digital Declaratory Ruling* and replicated in the *NPRM*, "the burdens of requiring ITFS licensees to transmit call signs may outweigh the benefits, especially where the channels are leased to a wireless cable operator, whose identity is readily discernible and whose licensing status is readily ascertainable."[379] In a two-way environment, alleviation of interference problems primarily will be left to the wireless cable operator, because of all the coordination it must do to make a two-way system function properly. In recognition of this and the greater efficiency of digital transmissions, we believe that the burdens embedded in Section 74.982, such as costs, outweigh the benefits of applying the rule to any ITFS station utilizing any digital transmissions. Thus, any ITFS station utilizing digital modulation, whether or not in a lease agreement with a wireless cable operator and whether or not in a two-way system, will be exempt from the requirements of Section 74.982. However, because these costs would not be prohibitive to ITFS stations utilizing only analog transmissions, and because the benefits of interference identification can still be realized economically where transmissions are in analog, we will retain Section 74.982 and apply it to ITFS stations which transmit only in analog.

IV. PROCEDURAL MATTERS

142. Accordingly, IT IS ORDERED that, pursuant to the authority contained in Sections 4(i) and (j), 301, 303(f), 303(g), 303(h), 303(j), 303(r), and 308(b) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 154(j), 301, 303(f), 303(g), 303(h), 303(j), 303(r), and 308(b), this *Report and Order* IS ADOPTED, and Parts 1, 21, and 74 of the Commission's Rules, 47 C.F.R. §§ 1, 21, and 74, ARE AMENDED as set forth in the attached Appendix C.

143. IT IS FURTHER ORDERED that the rule amendments set forth in Appendix C WILL BECOME EFFECTIVE 60 days after their publication in the Federal Register.

144. IT IS FURTHER ORDERED that the Petition of Wireless Cable Ass'n Int'l for Reconsideration and Clarification, MM Docket No. 93-106 (filed August 12, 1994), and Petition of Alliance for Higher Education, *et al.*, MM Docket No. 93-106 (filed August 5, 1994), are granted to the extent described above in note 230.

145. The action contained herein has been analyzed with respect to the Paperwork Reduction Act of 1995 and found to impose new or modified reporting and recordkeeping requirements or burdens on the public. Implementation of these new or modified reporting and recordkeeping requirements will be subject to approval by the Office of Management and Budget as prescribed by the Act. The new or modified paperwork requirements contained in this Report and Order (which are subject to approval by the Office of Management and Budget) will go into effect upon OMB approval.

146. As required by the Regulatory Flexibility Act, *see* 5 U.S.C. Section 604, the Commission has prepared a Regulatory Flexibility Analysis of the possible impact on small entities of the rules adopted in this document. *See* Appendix B. IT IS FURTHER ORDERED that the Office of Public Affairs Reference

[379] *Digital Declaratory Ruling*, 11 FCC Rcd at 18868; *see Notice*, 12 FCC Rcd at 22213.

Operations Division SHALL SEND a copy of this *Report and Order*, including the Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Román Salas
Secretary

APPENDIX A
LIST OF PETITIONERS AND COMMENTING PARTIES

PETITIONERS

ADC Telecommunications Corp.
Aims Community College
Alamosa Public Schools
Alda Wireless Holdings, Inc.
American Communications Services, Inc.
American Foundation for Instructional TV
American Telecasting, Inc.
Aquinas and St. Mary's Catholic Schools
Augustina College
Barnesville Public School
Broadband Networks, Inc.
Broadcast Cable, Inc.
Bruning Public School

C.D.V. Incorporated
CAI Wireless Systems, Inc.
California Amplifier
California Human Development Corporation

California State University, Stanislaus
Center for Economic & Social Justice

Central Community College Foundation
Central Oregon Community College
CFW Cable, Inc.
Clarendon Foundation
Communications & Energy Corp., Inc.
Community School of Naples
Comwave
Concord Community Schools
Concordia College

Conifer Corporation
Cooperative Educational Services Agency #7
Cornerstone Christian School System, Inc.

Cross Country Wireless, Inc.
CS Wireless Systems, Inc.

George Mason University
Instructional
Foundation, Inc.
Humanities Instructional Television
Hybrid Networks, Inc.
Indiana Higher Education
Telecommunication

Indio Wireless Partnership
Instructional Media Center,
California State

Chico
ITS Corporation
Ivy Tech State College

Kessler and Gehman Associates,
Inc.
Lance Industries
Lucas County Educational Service

Center
Magellan University

Malcolm Public Schools
McConnell Communications, Inc.
Microwave Filter Company, Inc.
Milwaukee Regional Medical ITS,
Inc.
Missouri Baptist College, ITFS
Montrose School District
Multimedia Development
Corporation

National Digital Network,
Inc.
National Wireless Holdings, Inc.

Northern Arizona University
Oklahoma City University

DeLawder Communications, Inc.

Delta-Montrose Area Vocational Technical Center
Denver Public Schools
Digital & Wireless Television
DiviCom Inc.
Durand Community Unit School District #322
EMCEE Broadcast Products
First Assembly of God, Kahului, Maui, Inc.
Choice TV Corp.
Pikes Peak Community College
Polk Community College
Portland Community College
Preferred Entertainment, Inc.
Pueblo Community College
Pueblo School District 60
Purdue University
Raymond Central School
School District of Oakfield
South Florida Television, Inc.
Specchio Developers Ltd.
Springfield Board of Education
St. Norbert College
Stanford Telecommunications, Inc.
Suncoast Wireless Communications Corporation
Superchannels of Las Vegas, Inc.
Tennessee Wireless
Teton Wireless Television
The Knowledge Network of Greater Omaha
University of Colorado at Colorado Springs
University of Northern Colorado, Academic Technology Services
University of South Dakota
University of Southern Colorado/KTSC-TV
University of South Florida
Valley Lutheran High School
Views on Learning, Inc.
Virginia Communications, Inc.
W.A.T.C.H. TV Company
Weld County School District RE-1
Winnebago Community Unit District 323
Wireless Cable Association International, Inc.
Wireless Cable Digital Alliance
Wireless Cable of Indianapolis
Wireless Holdings, Inc. (Videotron USA)

Oklahoma Educational Television Authority
Omni Microwave
Oregon Public Broadcasting
Pacific Monolithics, Inc.
Pacific Telesis Group
PCTV Gold, Inc.
Pecatonica Community School People's

Wireless One, Inc.
Wireless One of North Carolina, LLC
Yellowstone Education Center
Yuba Community College
Zenith Digital Media Group

COMMENTERS

ADC Telecommunications Corp. et al. ("Petitioners")
Alliance for Higher Education et al.
The Alliance of MDS Licensees
BellSouth Corporation
Catholic Television Network
Cellular Phone Taskforce
Corporation for Public Broadcasting et al.
Dallas County Community College District et al.
EDX Engineering, Inc.
Gulf Coast MDS Service Company
Hispanic Information and Telecommunications Network
Instructional Telecommunications Foundation, Inc.
The National ITFS Association
The National Telephone Cooperative Association
Nextlevel Systems, Inc.
Public Television 19, Inc.
Region IV Educational Service Center et al.
The San Francisco-San Jose Educator/Operator Consortium
Schwartz, Woods & Miller
Spike Technologies, Inc.
University of Maryland System
Webcel Communications, Inc.
Wireless One of North Carolina, L.L.C.

REPLY COMMENTERS

ADC Telecomunications Corp. et al. ("Petitioners")
Archdiocese of Los Angeles Education and Welfare Corporation
Asheville-Buncombe Technical Community College et al.
BellSouth Corporation
Catholic Television Network
Community Telecommunications Network
Gulf Coast MDS Service Company
Hispanic Information and Telecommunications Network
Instructional Telecommunications Foundation, Inc.
Mississippi Ednet Institute, Inc.
The National ITFS Association
Region IV Educational Service Center et al.
The San Francisco-San Jose Educator/Operator Consortium
Spike Technologies, Inc.
Wireless One of North Carolina, L.L.C.

APPENDIX B

FINAL REGULATORY FLEXIBILITY ANALYSIS (FRFA)

Report and Order

As required by the Regulatory Flexibility Act (RFA),[1] an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Notice of Proposed Rulemaking* (*NPRM*)[2] in this proceeding. The Commission sought written public comments on the proposals in the *NPRM*, including on the IRFA. The Commission's Final Regulatory Flexibility Analysis (FRFA) in this *Report and Order* (*R&O*) conforms to the RFA, as amended by the Contract With America Advancement Act of 1996.[3]

I. Need For and Objectives of Action:

In the *R&O*, we amend Parts 21 and 74 of our rules to enhance the ability of Multipoint Distribution Service ("MDS") and Instructional Television Fixed Service ("ITFS") licensees to provide two-way communication services. These services will be enhanced through the use of two-way audio, video and data communications from "response" stations, the use of booster stations with program origination capability in a cellular configuration designed to create spectrum flexibility through frequency reuse, and the use of variable bandwidth ("subchanneling" and "superchanneling") to create additional flexibility. We believe the final rule amendments will facilitate two-way transmission and other improvements to the MDS and ITFS services.

II. Significant Issues Raised by the Public in Response to the Initial Analysis:

No comments were received specifically in response to the IRFA contained in the *NPRM*. However, some commenters did raise arguments concerning the effect that certain of our proposals may have on small entities.

As to whether we should increase educational usage requirements when ITFS licensees employ digital transmissions, Region IV argued that greater educational usage requirements would particularly burden small ITFS entities, by indirectly imposing financial and administrative burdens before these licensees are in a posture to assume such responsibilities.[4]

With respect to whether we should adopt a rolling one-day filing window for the submission of two-way MDS and ITFS applications, the Alliance of MDS Licensees argued that such a system would place an unbearable burden on the limited resources of incumbents, resulting in large operators having an advantage over small operators.[5]

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[1] 5 U.S.C. § 603.

[2] *Notice of Proposed Rulemaking in the Matter of Amendment of Parts 1, 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions*, 12 FCC Rcd 22174 (1997).

[3] Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA); *see generally* 5 U.S.C. §§ 601 *et seq*. Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

[4] Comments of Region IV.

[5] Comments of Alliance of MDS Licensees.

III. Description and Number of Small Entities Involved:

The RFA generally defines "small entity" as having the same meaning as the terms "small business," "small organization," and "small business concern."[6] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[7] A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[8]

MDS: The Commission has defined "small entity" for the auction of MDS as an entity that, together with its affiliates, has average gross annual revenues that are not more than $40 million for the preceding three calendar years.[9] This definition of a small entity in the context of MDS auctions has been approved by the SBA.[10] The Commission completed its MDS auction in March 1996 for authorizations in 493 basic trading areas (BTAs). Of 67 winning bidders, 61 qualified as small entities.[11]

MDS is also heavily encumbered with licensees of stations authorized prior to the auction. The SBA has developed a definition of small entities for pay television services, which includes all such companies generating $11 million or less in annual receipts.[12] This definition includes multipoint distribution systems, and thus applies to MDS licensees and wireless cable operators which did not participate in the MDS auction. Information available to us indicates that there are 832 of these licensees and operators that do not generate revenue in excess of $11 million annually. Therefore, for purposes of this FRFA, we find there are approximately 892 small MDS providers as defined by the SBA and the Commission's auction rules, and some of these providers may take advantage of our amended rules to provide two-way MDS.

ITFS: There are presently 2032 ITFS licensees. All but 100 of these licenses are held by educational institutions (these 100 fall in the MDS category, above). Educational institutions may be included in the

[6] 5 U.S.C. § 601(6).

[7] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of small business applies unless an agency after consultation with the Office of Advocacy of the Small Business Administration and after an opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes definitions in the Federal Register.

[8] Small Business Act, 15 U.S.C. § 632.

[9] 47 C.F.R. § 21.961(b)(1).

[10] *See Amendment of Parts 21 and 74 of the Commission's Rules With Regard to Filing Procedures in the Multipoint Distribution Service and in the Instructional Television Fixed Service and Implementation of Section 309(j) of the Communications Act - Competitive Bidding,* MM Docket No. 94-31 and PP Docket No. 93-253, Report and Order, 10 FCC Rcd 9589 (1995).

[11] One of these small entities, O'ahu Wireless Cable, Inc., was subsequently acquired by GTE Media Ventures, Inc., which did not qualify as a small entity for purposes of the MDS auction.

[12] 13 C.F.R. § 121.201.

definition of a small entity.[13] ITFS is a non-pay, non-commercial broadcast service that, depending on SBA categorization, has, as small entities, entities generating either $10.5 million or less, or $11.0 million or less, in annual receipts.[14] However, we do not collect, nor are we aware of other collections of, annual revenue data for ITFS licensees. Thus, we find that up to 1932 of these educational institutions are small entities that may take advantage of our amended rules to provide two-way ITFS.

IV. Summary of Projected Reporting, Recordkeeping and Other Compliance Requirements:

The *R&O* adopts the following proposals that include reporting, recordkeeping, and compliance requirements:

We required MDS and ITFS licensees employing two-way technology to attach labels to every subscriber transceiver in a conspicuous fashion. In addition, MDS and ITFS licensees employing two-way technology will be required to include a full explanation of the labels that appear on their transceivers, as well as reference to the applicable Commission guidelines in the instruction manuals and other information accompanying their subscriber transceivers.

We required a hub station licensee to formally notify an ITFS licensee when a response station is being located in the vicinity of any of the ITFS licensee's receive sites. Specifically, we created a notification zone with a radius of 1960 feet around each ITFS receive site and we required that, at least 20 days prior to the activation of any response station within such a zone, the hub station licensee notify, by certified mail, the appropriate ITFS licensee.

In addition to required information contained on FCC Forms 304 and 330, we required applicants to submit additional data in a specified formats and on diskettes accompanying the application forms.

While we do not ordinarily require applicants for minor changes to ITFS facilities to prepare interference showings or serve them on potentially affected parties, we required the preparation and service of interference analyses by ITFS licensees who seek to use their associated I channels for downstream transmission.

We will accept applications for MDS and ITFS response stations hubs or boosters via a rolling, one-day filing window. Each applicant will have to provide interference protection to all facilities existing or proposed prior to the filing of its application, but its application will take precedence over all subsequently filed applications. Applicants will be required to file their applications with all of their interference analyses, in both hard copy and on disk.

Applicants for two-way facilities will be required to certify that they have met all requirements regarding interference protection to existing and prior proposed facilities. The applicant will also be required to certify that it has served all potentially affected parties with copies of its application and with its engineering analysis supporting its interference compliance claim.

[13] *See* 5 U.S.C. §§ 601 (3)-(5).

[14] *See* 13 C.F.R. § 121.210 (SIC 4833, 4841, and 4899).

V. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered:

The following steps were taken in the *R&O* to minimize the significant economic impact on small entities:

The rule changes adopted in the *R&O* to allow two-way operations for MDS and ITFS will simply our licensing system and provide greater flexibility in the use of the allotted spectrum to licensees. It is expected that such changes will further eliminate market entry barriers for small entities.

By allowing for subchannelization, small entity licensees will be able to respond to the demands of the market and create unlimited number of channels to carry their current and future communications needs. Allowing superchannelization will permit small entity licensees to combine their spectrum with other small entity licensees and create larger systems to meet their particular operations and to operate at greater speeds.

To permit small entity ITFS licensees with limited resources adequate time to evaluate a two-way applicant's proposed service plan, we adopted a certification procedure whereby applicants are required to certify that they have met all requirements regarding interference protection to existing and prior proposed facilities. The applicant will also be required to certify that it has served all potentially affected parties with copies of its application and with its engineering analysis supporting its interference compliance claim.

In an effort to minimize the impact of our new rules on educational ITFS, many of whom are small entities, we determined that restricting ITFS eligible use to the downstream video/audio paradigm would preclude flexibility in service offerings for an ITFS licensee which leases excess channel capacity. We provided educational entities with additional flexibility to define what ITFS usage they regard as educational in an effort to permit such entities to further their educational mission. We did not expand our minimum educational usage requirement for digital ITFS transmissions and we added a requirement that 5 percent of an ITFS station's capacity be set aside for instructional purposes only.

The following significant alternatives were considered in the *R&O*:

We declined to adopt Catholic Television Network's (CTN) suggestion that greater suppression of spurious emissions is needed on the order of -60 dB for response stations operating at +48 dBm, up to -75 dB for response stations operating at +63 dBm.[15] We found that modifications made to the spectral mask for response stations would completely eliminate the requirements that were proposed for such emissions.

We did not adopt NextLevel's suggestion that a maximum suppression limit be placed on digital emitters which would effectively remove the out-of-band attenuation requirements for power levels below a certain minimum.[16] We found that such a relaxation of out-of-band limits, in the context of a cellularized CDMA system, could result in an adverse impact on the interference environment because, unlike other services, hundreds or thousands of low power emitters may be transmitting simultaneously and the combined effects of their out-of-band emissions could be significant.

In the *R&O*, we adopted a Methodology for calculating the interference potential of response stations.

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[15] Comments of CTN.

[16] Comments of NextLevel.

We rejected CTN's request to protect hub receivers only to a distance of 35 miles and make them secondary beyond that distance.[17] We concluded that such a step would render hubs extremely susceptible to interference and seriously degrade the communications capabilities and reliabilities within the hub's RSA. We did not adopt EDX Engineering's alternative to Petitioners' response station interference Methodology because, for many two-way system configurations, EDX's interference calculations will inevitably give erroneous results, a shortcoming that was conceded by EDX itself.[18] We also did not permit applicants to choose any methodology they wish for making interference calculations, as we found that this would drastically slow the evaluation of applications and almost certainly result in many Petitions to Deny, as licensees and applicants struggled to understand the differing and potentially incompatible assumptions and calculations incorporated into the various methodologies.

We also decline to adopt Spike Technologies Inc.'s (Spike) recommendation that hub stations be redefined to include transmitting capability.[19] We found that this was not necessary because booster and primary stations may be co-located with hub stations to provide transmission capability, and permitting hubs to also transmit would simply add redundancy and unnecessary complexity to the interference protection requirements of the rules.

We denied CTN's request that guardbands be established separating upstream (response station) transmissions from downstream ITFS transmissions.[20] We determined that CTN's first proposal, involving the creation of 24 MHz-wide guardbands, could result in partially or completely eliminating many MHz of potentially useful upstream spectrum on the speculative assumption that such action was necessary to protect ITFS receive sites from interference. We also found that CTN's second and third proposals, involving 6 MHz guardbands, would have effected less spectrum on the same assumption, and would have also involved the establishment of notification and testing procedures for response stations in proximity to ITFS receive sites. As for CTN's fourth guardband proposal, requiring 6 MHz guardbands within a 35 mile radius of ITFS primary transmitters, we determined that it was not the case that the proposed response station interference Methodology is "unduly complex" and will be ineffective in determining interference when the potential victim ITFS receive site is within a hub station's RSA.

We did not adopt CTN's request for mandatory response station testing, as we found that it would impose an unnecessary burden on 2-way licensees.[21]

We denied CTN's request to reallocate all of the 125 kHz channels to ITFS and to use them solely for response transmissions.[22] We found that reallocation and the complications associated with that is not necessary and that allowing the I channels to be used for point-to-multipoint transmissions promotes greater options for two-way system design and more efficient use of the spectrum. For the same reasons we declined CTN's suggestion that we render low power boosters secondary, we also declined to adopt Maryland's request

[17] Comments of CTN.

[18] Comments of EDX.

[19] Comments of Spike.

[20] Comments of CTN.

[21] *Id.*

[22] *Id.*

that we mandate that any non-ITFS use of I channels licensed to an ITFS entity be secondary to ITFS use.

We rejected the automatic grant proposal made by the Petitioners for granting without review any unopposed two-way license application after a 60-day comment period. We also did not adopt the proposal specified in the *NPRM* to set up a system whereby the staff would fully review the filed applications and issue a grant or denial. Instead, we adopted a certification procedure whereby applicants certify that they have met the requirements regarding interference protection to existing and prior proposed facilities and has served copies of its application on all affected parties. We determined that this approach was needed to facilitate two-way service to the public and that without it two-way service by MDS operators and/or ITFS licensees may not become a reality. The certification requirement would also protect the interests of ITFS licensees many of whom do not have the time or resources to evaluate a two-way applicants proposed service plan.

In the *R&O*, we determined that parties will have 60 days from the date of the public notice to file petitions to deny against two-way applications. We decided that, due to the complex nature of the engineering to be filed, a 60 day petition to deny period is more reasonable that the usual 30 day period.

We did not adopt HITN's suggestion that we eliminate our rule that limits eligible ITFS educational service providers to accredited institutions.[23] We found that the primary purpose of ITFS is, and always has been to meet the needs of students enrolled in courses of formal instruction. Furthermore, we found that accredited schools have been the intended users of ITFS since the origin of the service.

We decided to subject ITFS high power booster stations to educational usage requirements, separate from those to which main ITFS stations are subject. We determined, however, to not specify educational usage requirements for ITFS low power booster stations because they are authorized only to retransmit the signals of the main ITFS station, which itself is subject to educational usage requirements. In addition, we determined not to subject ITFS response stations or response station hubs to educational usage requirements, because the ITFS licensee has no control over which upstream transmissions would qualify to satisfy the requirements.

We declined to adopt time-of-day requirements for measuring educational usage in order to provide ITFS licensees with the maximum flexibility to determine which uses of their spectrum enhance their formal educational mission.

In the *R&O*, we retained two different but complementary requirements of ITFS spectral usage: a minimum of 20 hours per channel per week for educational usage, and a minimum reservation of 5% of a licensee's capacity that it may not lease. We determined that both would be difficult to measure in light of the varied forms that such usage can take. We decided that the best course would be to rely on the good faith efforts of ITFS licensees to meet these requirements and we did not institute any new, formal, proof of compliance reporting submissions in this area.

VI. Report to Congress:

The Commission will send a copy of the *Report and Order*, including this FRFA, in a report to be sent to Congress pursuant to the Small Business Regulatory Enforcement Fairness Act of 1996. *See* 5 U.S.C. § 801(a)(1)(A). In addition, the Commission will send a copy of the *Report and Order*, including the FRFA,

[23] Comments of HITN.

to the Chief Counsel for Advocacy of the Small Business Administration. A copy of the *Report and Order* and FRFA (or summaries thereof) will also be published in the Federal Register. *See* 5 U.S.C. § 604(b).

APPENDIX C

Parts 1, 21 and 74 of Title 47 of the Code of Federal Regulations are amended as follows:

PART 1 - PRACTICE AND PROCEDURE

1. In Section 1.1307, paragraph (b)(1), Table 1, right column is amended by adding the following language directly following the existing references to Multipoint Distribution Service stations:

§1.1307 Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.

* * * * *

MDS licensees are required to attach a label to subscriber transceiver or transverter antennas that (1) provides adequate notice regarding potential radio frequency safety hazards, *e.g.*, information regarding the safe minimum separation distance required between users and transceiver antennas; and (2) references the applicable FCC-adopted limits for radio frequency exposure specified in §1.1310 of this chapter.

* * * * *

1a. In Section 1.1307, paragraph (b)(1), Table 1, right column likewise is amended by adding the following language directly following the reference to Part 74, Subpart I stations:

§1.1307 Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.

* * * * *

ITFS licensees are required to attach a label to subscriber transceiver or transverter antennas that (1) provides adequate notice regarding potential radio frequency safety hazards, *e.g.*, information regarding the safe minimum separation distance required between users and transceiver antennas; and (2) references the applicable FCC-adopted limits for radio frequency exposure specified in §1.1310 of this chapter.

* * * * *

PART 21 - DOMESTIC PUBLIC FIXED RADIO SERVICES

2. Section 21.2 is amended by revising the definitions of "Multichannel Multipoint Distribution Service," "Multipoint Distribution Service," "Multipoint Distribution Service response station" and "signal booster station," and by adding definitions for "booster service area," "channel," "response station hub," "response station hub license" and "sectorization," to read as follows:

§21.2 Definitions.

* * * * *

Booster service area. A geographic area to be designated by an applicant for a booster station, within which the booster station shall be entitled to protection against interference as set forth in this Part. The booster service area must be specified by the applicant so as to not overlap the booster service area of any other booster authorized to or proposed by the applicant. However, a booster station may provide service to receive sites outside of its booster service area, at the licensee's risk of interference.

* * * * *

Channel. Unless otherwise specified, a channel under this Part shall refer to a 6 MHz frequency block assigned pursuant to §§21.901(b) or 74.902(a).

* * * * *

Multichannel Multipoint Distribution Service (MMDS). Those Multipoint Distribution Service Channels that use the frequency band 2596 MHz to 2644 MHz and associated 125 kHz channels.

Multipoint Distribution Service (MDS)' A domestic public radio service rendered on microwave frequencies from one or more fixed stations transmitting to multiple receiving facilities located at fixed points. MDS also may encompass transmissions from response stations to response station hubs or associated fixed stations.

Multipoint Distribution Service response station. A fixed station operated by an MDS licensee, the lessee of MDS channel capacity or a subscriber of either to communicate with a response station hub or associated MDS station. A response station under this Part may share facilities with other MDS response stations and/or one or more Instructional Television Fixed Service (ITFS) response stations authorized pursuant to §74.939 or §74.940.

* * * * *

Response station hub. A fixed facility licensed to an MDS licensee, and operated by an MDS licensee or the lessee of an MDS facility, for the reception of information transmitted by one or more MDS response stations that utilize digital modulation with uniform power spectral density. A response station hub licensed under this part may share facilities with other MDS response station hubs, ITFS response station hubs authorized pursuant to §74.939, MDS signal booster stations, ITFS signal booster stations, MDS stations, and/or ITFS stations.

Response station hub license. A blanket license authorizing the operation of a single response station hub at a specific location and the operation of a specified number of associated digital response stations of one or more classes at unspecified locations within one or more regions of the response service area.

Sectorization. The use of an antenna system at an MDS station, booster station and/or response station hub that is capable of simultaneously transmitting multiple signals over the same frequencies to different portions of the service area and/or simultaneously receiving multiple signals over the same frequencies from different portions of the service area.

Signal Booster Station. An MDS station licensed for use in accordance with §21.913 that operates on one or more MDS channels. Signal booster stations are intended to augment service as part of a distributed transmission system where signal booster stations retransmit the signals of one or more MDS stations and/or originate transmissions on MDS channels. A signal booster station licensed under this part may share facilities with other MDS signal booster stations, ITFS signal booster stations authorized pursuant to §74.985, MDS response station hubs and/or ITFS response station hubs.

* * * * *

3. In Section §21.11, the caption and subsections (a) and (d) are revised, subsection (e) is deleted, subsection (f) is revised and redesignated as subsection (e), and subsection (g) is redesignated as subsection (f), to read as follows:

§21.11 Miscellaneous forms.

(a) *Licensee qualifications*. FCC Form 430 ("Licensee Qualification Report") must be filed annually, no later than March 31 for the end of the preceding calendar year, unless the licensee operates solely on a common carrier basis and service was not offered at any time during the preceding year. Each annual filing must include all changes of information required by FCC Form 430 that occurred during the preceding year. In those cases in which there has been no change in any of the required information, the applicant or licensee, in lieu of submitting a new form, may so notify the Commission by letter.

* * * * *

(d) *Assignment of license.* FCC Form 702 ("Application for Consent to Assignment of Radio Station Construction Authorization or License (for Stations in Services Other than Broadcast)") must be submitted to assign voluntarily (as by, for example, contract or other agreement) or involuntarily (as by, for example, death, bankruptcy, or legal disability) the station license or conditional license. In the case of involuntary assignment, the application must be filed within 30 days of the event causing the assignment. FCC Form 702 also must be used for nonsubstantial (*pro forma*) assignments. In addition, FCC Form 430 must be submitted by the proposed assignee unless such assignee has a current and substantially accurate report on file with the Commission. Whenever a group of station licenses or conditional licenses in the same radio service is to be assigned to a single assignee, a single "blanket" application may be filed to cover the entire group, if the application identifies each station by call sign and station location and if two copies are provided for each station affected. The assignment must be completed within 45 days from the date of authorization. Upon consummation of an approved assignment, the Commission must be notified by letter of the date of consummation within 10 days of its occurrence.

(e) *Transfer of control of corporation holding a conditional license or license.* FCC Form 704 ("Application for Consent to Transfer of Control") must be submitted in order to voluntarily or involuntarily transfer control (*de jure* or *de facto*) of a corporation holding any conditional licenses or licenses. In the case of involuntary transfer of control, the application must be filed within 30 days of the event causing the transfer of control. FCC Form 704 also must be used for nonsubstantial (*pro forma*) transfers of control. In addition, FCC Form 430 must be submitted by the proposed transferee unless such transferee has a current and substantially accurate report on file with the Commission. Whenever control of a corporation holding a group of station licenses or conditional licenses in the same radio service is to be transferred to a single transferee, a single "blanket" application may be filed to cover the entire transfer, if the application identifies each station by call sign and station location and if two copies are provided for each station affected. The transfer must be completed within 45 days from the date of authorization. Upon consummation of an approved transfer, the Commission must be notified by letter of the date of consummation within 10 days of its occurrence.

* * * * *

4. Section 21.27 is revised by adding a new subsection (d), to read as follows:

§21.27 Public notice period.

* * * * *

(d) Notwithstanding any other provisions of this Part, effective as of September 17, 1998, there shall be one one-week window, at such time as the Commission shall announce by public notice, for the filing of applications for high-power signal booster station, response station hub and I channels point-to-multipoint transmissions licenses, during which all applications shall be deemed to have been filed as of the same day for purposes of §§21.909, 21.913 and 74.939(l). Following the publication of a public notice announcing the tendering for filing of applications submitted during that window, applicants shall have a period of sixty (60) days to amend their applications, provided such amendments do not result in any increase in interference to any previously-proposed or authorized station, or to facilities proposed during the window, absent consent of the applicant for or conditional licensee or licensee of the station that would receive such interference. At the conclusion of that sixty (60) day period, the Commission shall publish a public notice announcing the acceptance for filing of all applications submitted during the initial window, as amended during the sixty (60) day period. All petitions to deny such applications must be filed within sixty (60) days of such second public notice. On the sixty-first (61st) day after the publication of such second public notice, applications for new or modified response station hub, booster station and I channels point-to-multipoint transmissions licenses may be filed and will be processed in accordance with the provisions of §§21.909, 21.913 and 74.939(l). Notwithstanding §21.31, each application submitted during the initial window shall be granted on the sixty-first (61st) day after the Commission shall have given such public notice of its acceptance for filing, unless prior to such date either a party in interest timely files a formal petition to deny or for other relief pursuant to §21.30(a), or the Commission notifies the applicant that its application will not be granted. Where an application is granted pursuant to the provisions of this subsection, the conditional licensee or licensee shall maintain a copy of the

application at the transmitter site or response station hub until such time as the Commission issues a license.

5. In Section 21.30, paragraph (a)(4) is revised to read as follows:

§21.30 Opposition to applications.

(a) * * *

* * * * *

(4) Except as provided in §21.902(i)(6) regarding Instructional Television Fixed Service licensees and conditional licensees, in §21.909 regarding MDS response station hubs and in §21.913 regarding MDS booster stations, be filed within thirty (30) days after the date of public notice announcing the acceptance for filing of any such application or major amendment thereto, or identifying the tentative selectee of a random selection proceeding in the Multichannel Multipoint Distribution Service or for Multipoint Distribution Service H-channel stations (unless the Commission otherwise extends the filing deadline); and

* * * * *

6. In Section 21.31, paragraph (e)(6)(iv) is revised to read as follows:

§21.31 Mutually exclusive applications.

* * * * *

(e) * * *

* * * * *

(6) * * *

* * * * *

(iv) The change of status by an MDS applicant from common carrier to non-common carrier, from non-common carrier to common carrier, or from common carrier or non-common carrier to flexibility to alternate between common carrier and non-common carrier service.

7. In Section 21.42, paragraph (b)(3) is revised, and new paragraph (c)(8) is added, to read as follows:

§21.42 Certain modifications not requiring prior authorization.

* * * * *

(b) * * *

* * * * *

(3) The Commission is notified of changes made to facilities by the submission of a completed FCC Form 304 within thirty (30) days after the changes are made.

* * * * *

(c) * * *

* * * * *

(8) A change to a sectorized antenna system comprising an array of directional antennas, provided that such system does not change polarization or result in an increase in radiated power by more than one dB in any direction; provided, however, that notice of such change is provided to the Commission on FCC Form 331 within ten (10) days of installation.

8. In Section 21.101(a), note 2 is revised to read as follows:

§21.101 Frequency tolerance.

(a) * * *

[2]Beginning November 1, 1991, equipment authorized to be operated in the frequency bands 2150-2162 MHz, 2596-2644 MHz, 2650-2656 MHz, 2662-2668 MHz, and 2674-2680 MHz for use in the Multipoint Distribution Service shall maintain a frequency tolerance within ±1 kHz of the assigned frequency. MDS booster stations authorized pursuant to §21.913(b) shall maintain a frequency tolerance within ±1 kHz of the assigned frequencies. MDS booster stations authorized pursuant to §21.913(e) and MDS response stations authorized pursuant to §21.909 shall employ transmitters with sufficient frequency stability to ensure that the emission stays within the authorized bandwidth.

* * * * *

9. In Section 21.118, subsection (c) is revised to read as follows:

§21.118 Transmitter construction and installation.

* * * * *

(c) Each transmitter employed in these services shall be equipped with an appropriately labeled pilot lamp or meter which will provide continuous visual indication at the transmitter when its control circuits have been placed in a condition to activate the transmitter. Such requirement will not be applicable to MDS response stations or MDS booster stations authorized pursuant to

§21.913(e). In addition, facilities shall be provided at each transmitter to permit the transmitter to be turned on and off independently of any remote control circuits associated therewith.

* * * * *

10. Section 21.201, including the caption, is revised to read as follows:

§21.201 Posting of station license.

Each licensee shall post at the station, the booster station authorized pursuant to §21.913(b) or the MDS response station hub the name, address and telephone number of the custodian of the station license or other instrument of authorization if such license or instrument of authorization, or a clearly legible photocopy thereof, is not maintained at the station, booster station or response station hub. Each operator of an MDS booster station authorized pursuant to §21.913(e) shall post at the booster station the name, address and telephone number of the custodian of the notification filed pursuant to §21.913(e) if such notification is not maintained at the station.

11. Section 21.304 is revised to read as follows:

§21.304 Tariffs, reports, and other material required to be submitted to the Commission.

Sections 1.771 through 1.815 of this chapter contain summaries of certain materials and reports, including schedule of charges and accounting and financial reports, which, when applicable, must be filed with the Commission. These requirements likewise shall apply to licensees which alternate between rendering service on a common carrier and non-common carrier basis.

12. Section 21.900 is revised to read as follows:

§21.900 Eligibility.

(a) Authorizations for stations in this service will be granted to existing and proposed communications common carriers and non-common carriers. An application will be granted only in cases where it can be shown that:

(1) The applicant is legally, financially, technically, and otherwise qualified to render the proposed service; and

(2) There are frequencies available to enable the applicant to render a satisfactory service; and

(3) The public interest, convenience and necessity would be served by a grant thereof.

(b) The applicant shall state whether service will be provided on a common carrier basis, a non-common carrier basis, or alternating between a common carrier and non-common carrier basis. In addition, an applicant proposing to provide any common carrier service whatsoever shall state whether there is any affiliation or relationship to any intended or likely subscriber or program originator.

13. In Section 21.901, subsections (a), (b), and (d) and note 1 are revised, and new subsection (g) is added, to read as follows:

§21.901 Frequencies.

(a) Frequencies in the bands 2150-2162 MHz, 2596-2644 MHz, 2650-2656 MHz, 2662-2668 MHz, 2674-2680 MHz and 2686-2690 MHz are available for assignment to fixed stations in this service. Frequencies in the band 2150-2160 MHz are shared with nonbroadcast omnidirectional radio systems licensed under other parts of the Commission's Rules, and frequencies in the band 2160-2162 MHz are shared with directional radio systems authorized in other common carrier services. Frequencies in the 2596-2644 MHz band are shared with Instructional Television Fixed Service stations licensed under Part 74 of the Commission's Rules. Channels I5, I13, I6 and I14, listed in §74.939(j) of this chapter, are assigned to fixed stations in the 2596-2620 band, and are shared with Instructional Television Fixed Service Stations licensed under Part 74 of the Commission's Rules to operate in this band; grandfathered channels I21, I29, I22 and I30, listed in §74.939(j) of this chapter, are licensed under Part 21 or Part 74 of the Commission's Rules, as applicable.

(b) Applicants may be assigned a channel(s) according to one of the following frequency plans:

(1) At 2150-2156 MHz (designated as Channel 1), or

(2) At 2156-2162 MHz (designated as Channel 2), or

(3) At 2156-2160 MHz (designated as Channel 2A), or

(4) At 2596-2602 MHz, 2608-2614 MHz, 2620-2626 MHz, and 2632-2638 MHz (designated as Channels E1, E2, E3 and E4, respectively, with the four channels to be designated the E-group channels), and Channels I5 and I13 listed in §74.939(j),[1] or

(5) At 2602-2608 MHz, 2614-2620 MHz, 2626-2632 MHz and 2638-2644 MHz (designated as Channels F1, F2, F3 and F4, respectively, with the four channels to be designated the F-group channels), and Channels I6 and I14, listed in §74.939(j),[1] or

(6) At 2650-2656 MHz, 2662-2668 MHz and 2674-2680 MHz (designated as Channels H1, H2 and H3, respectively, with the three channels to be designated the H-group channels).[1]

* * * * *

(d) An MDS licensee or conditional licensee may apply to exchange evenly one or more of its assigned channels with another MDS licensee or conditional licensee in the same system, or with an ITFS licensee or conditional licensee in the same system where one or both parties utilizes digital transmissions or leases capacity to an operator which utilizes digital transmissions. The licensees or conditional licensees seeking to exchange channels shall file in tandem with the Commission separate *pro forma* assignment of license applications, each attaching an exhibit which clearly specifies that the application is filed pursuant to a channel exchange agreement.

The exchanged channel(s) shall be regulated according to the requirements applicable to the assignee.

* * * * *

(g) Frequencies in the bands 2150-2162 MHz, 2596-2644 MHz, 2650-2656 MHz, 2662-2668 MHz and 2674-2680 MHz are available for point-to-multipoint use and/or for communications between MDS response stations and response station hubs when authorized in accordance with the provisions of §21.909, provided that such frequencies may be employed for MDS response stations only when transmitting using digital modulation.

NOTES:
[1] No 125 kHz channels are provided for Channels E3, E4, F3, F4, H1, H2 and H3, except for those grandfathered for Channels E3, E4, F3 and F4. The 125 kHz channels associated with Channels E3, E4, F3, F4, H1, H2 and H3 are allocated to the Private Operational Fixed Point-to-Point Microwave Service, pursuant to §101.147(g) of this chapter.

14. In Section §21.902, the caption, paragraphs (b)(3), (4) and (5)(i), and paragraphs (f)(1) and (2) are revised, and new paragraph (b)(7) and subsection (l) are added, to read as follows:

§21.902 Interference.

* * * * *

(b) * * *

* * * * *

(3) Engineer the system to provide at least 45 dB of cochannel interference protection within the 56.33 km (35 mile) protected service area of any authorized or previously-proposed ITFS or incumbent MDS station, and at each previously-registered ITFS receive site (both stations utilizing 6 MHz bandwidths).

(4) Engineer the station to provide at least 0 dB of adjacent channel interference protection within the 56.33 km (35 mile) protected service area of any authorized or previously-proposed ITFS or incumbent MDS station, and at each previously-registered ITFS receive site (both stations utilizing 6 MHz bandwidths).

(5) (i) Engineer the station to limit the calculated free space power flux density to -73 dBW/m^2 (or the appropriate value for bandwidth other than 6 MHz) at the boundary of a 56.33 km (35 mile) protected service area, where there is an unobstructed signal path from the transmitting antenna to the boundary; or alternatively, obtain the written consent of the entity authorized for the adjoining area to exceed the -73 dBW/m^2 limiting signal strength at the common boundary.

* * * * *

(7) Notwithstanding the above, main, booster and response stations shall use the following formulas, as applicable, for determining compliance with: (1) Radiated field contour limits where bandwidths other than 6 MHz are employed at stations utilizing digital modulation with uniform power spectral density; and (2) Cochannel and adjacent channel D/U ratios where the bandwidths in use at the interfering and protected stations are unequal and both stations are utilizing digital modulation with uniform power spectral density or one station is utilizing such modulation and the other station is utilizing either 6 MHz NTSC analog modulation or 125 kHz analog modulation (I channels only).

(i) Contour limit: -73 dBW + 10 log (X/6), where X is the bandwidth in MHz of the digital channel.

(ii) Cochannel D/U: 45 dB + 10 log (X1/X2), where X1 is the bandwidth in MHz of the protected channel and X2 is the bandwidth in MHz of the interfering channel.

(iii) Adjacent channel D/U: 0 dB + 10 log (X1/X2), where X1 is the bandwidth in MHz of the protected channel and X2 is the bandwidth in MHz of the interfering channel.

* * * * *

(f) * * *

(1) Cochannel interference is defined as the ratio of the desired signal to the undesired signal present in the desired channel, at the output of a reference receiving antenna oriented to receive the maximum desired signal. Harmful interference will be considered present when a free space calculation for an unobstructed signal path determines that this ratio is less than 45 dB (both stations utilizing 6 MHz bandwidths).

(2) Adjacent channel interference is defined as the ratio of the desired signal to undesired signal present in an adjacent channel, at the output of a reference receiving antenna oriented to receive the maximum desired signal level.

(i) Harmful interference will be considered present when a free space calculation for an unobstructed signal path determines that this ratio is less than 0 dB (both stations utilizing 6 MHz bandwidths).

(ii) In the alternative, harmful interference will be considered present for an ITFS station constructed before May 26, 1983, when a free space calculation determines that this ratio is less than 10 dB (both stations utilizing 6 MHz bandwidths), unless:

(A) The individual receive site under consideration has been subsequently upgraded with up-to-date reception equipment, in which case the ratio shall be less than 0 dB. Absent information presented to the contrary, however, the Commission will assume that reception equipment installation occurred simultaneously with original station equipment; or

(B) The license for an MDS station is conditioned on the proffer to the affected ITFS station licensee of equipment capable of providing a ratio of 0 dB or more at no

expense to the ITFS station licensee, and also conditioned, if necessary, on the proffer of installation of such equipment; and there has been no showing by the affected ITFS station licensee demonstrating good cause and that the proposed equipment will not provide a ratio of 0 dB or more, or that installation of such equipment, at no expense to the ITFS station licensee, is not possible or has not been proffered.

* * * * *

(l) Specific rules relating to response station hubs, booster stations, and 125 kHz channels are set forth in §§21.909, 21.913, 21.940, 74.939, 74.940 and 74.985. To the extent those specific rules are inconsistent with any rules set forth above, those specific rules shall control.

15. In Section 21.903, subsection (a) and paragraph (b)(1) are revised, and new subsection (d) is added, to read as follows:

§21.903 Purpose and permissible service.

(a) Multipoint Distribution Service channels are available for transmissions from MDS stations and associated MDS signal booster stations to receive locations, and from MDS response stations to response station hubs. When service is provided on a common carrier basis, subscriber supplied information is transmitted to points designated by the subscriber. When service is provided on a non-common carrier basis, transmissions may include information originated by persons other than the licensee, licensee-manipulated information supplied by other persons, or information originated by the licensee. Point-to-point radio return links from a subscriber's location to a MDS operator's facilities may also be authorized in the 18,580 through 18,820 MHz and 18,920 through 19,160 MHz bands. Rules governing such operation are contained in Subpart I of Part 101 of this chapter, the Point-to-Point Microwave Radio Service.

(b) * * *

(1) Unless service is rendered on a non-common carrier basis, the common carrier controls the operation of all receiving facilities (*e.g.*, including any equipment necessary to convert the signal to a standard television channel, but excluding the television receiver); and

* * * * *

(d) An MDS licensee also may apply for authorization by the Commission to alternate, without further authorization required, between rendering service on a common carrier and non-common carrier basis, provided that the licensee notify the Commission of any service status changes at least 30 days in advance of such changes.

16. Section 21.904 is revised to read as follows:

§21.904 Transmitter power.

(a) The maximum EIRP of an MDS main or booster station shall not exceed 33 dBW (or, when digital modulation with uniform power spectral density and subchannels or superchannels, or 125

kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth), except as provided in paragraph (b) of this section.

(b) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP over a 6 MHz channel in dBW in a given direction shall be determined by the following formula:

EIRP = 33 dBW + 10 log (360/beamwidth) [where 10 log (360/beamwidth) $\leq$ 6 dB].

Beamwidth is the total horizontal plane beamwidth of the individual transmitting antenna for the station or any sector measured at the half-power points. The first term of the equation above, 33 dBW, must be adjusted appropriately based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth.

(c) An increase in station transmitter power, above currently authorized or previously-proposed values, to the maximum values provided in paragraphs (a) and (b) of this section, may be authorized, if the requested power increase would not cause harmful interference to any authorized or previously-proposed, cochannel or adjacent channel station entitled to interference protection under the Commission's rules, or if an applicant demonstrates that:

(1) A station that must be protected from interference could eliminate that interference by increasing its power; and

(2) The interfered-with station may increase its own power consistent with the rules and without causing interference to any MDS booster station or response station hub which operates as part of the same coordinated system as the interfered-with station; and

(3) The applicant requesting authorization of a power increase agrees to pay all expenses associated with the increase in power by the interfered-with station.

* * * * *

17. In Section 21.905, subsection (b) is revised, and new subsection (d) is added, to read as follows:

§21.905 Emissions and bandwidth.

* * * * *

(b) Quadrature amplitude modulation, digital vestigial sideband modulation, quadrature phase shift key modulation and code division multiple access emissions may be employed, subject to compliance with the policies set forth in the *Declaratory Ruling and Order*, 11 FCC Rcd 18839 (1996). Different types of emissions may be authorized if the applicant describes fully the modulation and bandwidth desired and demonstrates that operation of the station will not cause impermissible interference. The licensee may subchannelize its authorized bandwidth, provided that digital modulation is employed and the aggregate power does not exceed the authorized

power for the channel, and may utilize all or a portion of its authorized bandwidth for MDS response stations authorized pursuant to §21.909. The licensee may also, jointly with affected adjacent channel licensees, transmit utilizing bandwidth in excess of its authorized frequencies, provided that digital modulation is employed, all power spectral density requirements set forth in this Part are met and the out-of-band emissions restrictions set forth in §21.908 are met at and beyond the edges of the channels employed. The wider channels thus created may be redivided to create narrower channels.

* * * * *

(d) Notwithstanding the above, any digital emission which meets the uniform power spectral density requirements of the *Declaratory Ruling and Order* may be used in the following circumstances:

(1) At any MDS main or booster station transmitter which is located more than 160.94 km (100 miles) from the nearest boundary of all cochannel and adjacent channel ITFS and MDS protected service areas, including Basic Trading Areas and Partitioned Service Areas; and

(2) At all MDS response station transmitters within a response service area if all points along the response service area boundary line are more than 160.94 km (100 miles) from the nearest boundary of all cochannel and adjacent channel ITFS and MDS protected service areas, including Basic Trading Areas and Partitioned Service Areas; and

(3) At any MDS transmitter where all parties entitled by this Part to interference protection from that transmitter have mutually consented to the use at that transmitter of such emissions.

18. In Section 21.906, subsections (a) and (d) are revised to read as follows:

§21.906 Antennas.

(a) Transmitting antennas shall be omnidirectional, except that a directional antenna with a main beam sufficiently broad to provide adequate service may be used either to avoid possible interference with other users in the frequency band, or to provide coverage more consistent with distribution of potential receiving points. In lieu of an omnidirectional antenna, a station may employ an array of directional antennas in order to reuse spectrum efficiently. When an applicant proposes to employ a directional antenna, or a licensee notifies the Commission pursuant to §21.42 of the installation of a sectorized antenna system, the applicant shall provide the Commission with information regarding the orientation of the directional antenna(s), expressed in degree of azimuth, with respect to true north, and the make and model of such antenna(s).

* * * * *

(d) Directive receiving antennas shall be used at all points other than response station hubs and shall be elevated no higher than necessary to assure adequate service. Receiving antenna height shall not exceed the height criteria of Part 17 of this chapter, unless authorization for use of a specific maximum antenna height (above ground and above mean sea level) for each location has

been obtained from the Commission prior to the erection of the antenna. Requests for such authorization shall show the inclusive dates of the proposed operation. (See Part 17 of this chapter concerning the construction, marking and lighting of antenna structures.)

19. Section 21.907 is deleted in its entirety.

20. In Section 21.908, the caption is revised, current subsections (a), (c), (d) and (e) are deleted, current subsection (b) is revised and redesignated as subsection (a), and new subsections (b), (c) (d) and (e) are added, to read as follows:

§21.908 Transmitting equipment.

(a) The maximum out-of-band power of an MDS station transmitter or booster transmitting on a single 6 MHz channel with an EIRP in excess of -9 dBW employing analog modulation shall be attenuated at the channel edges by at least 38 dB relative to the peak visual carrier, then linearly sloping from that level to at least 60 dB of attenuation at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge, and attenuated at least 60 dB at all other frequencies. The maximum out-of-band power of an MDS station transmitter or booster transmitting on a single 6 MHz channel or a portion thereof with an EIRP in excess of -9 dBW (or, when subchannels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths) employing digital modulation shall be attenuated at the 6 MHz channel edges at least 25 dB relative to the licensed average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies. Notwithstanding the foregoing, in situations where an MDS station or booster station transmits, or where adjacent channel licensees jointly transmit, a single signal over more than one contiguous 6 MHz channel utilizing digital modulation with an EIRP in excess of -9 dBW (or, when subchannels or superchannels are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel bandwidth), the maximum out-of-band power shall be attenuated at the channel edges of those combined channels at least 25 dB relative to the power level of each channel, then attenuated along a linear slope from that level to at least 40 dB at 250 kHz above or below the channel edges of those combined channels, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower edges of those combined channels, and attenuated at least 60 dB at all other frequencies. However, should harmful interference occur as a result of emissions outside the assigned channel, additional attenuation may be required. A transmitter licensed prior to November 1, 1991, that remains at the station site initially licensed, and does not comply with this subsection, may continue to be used for its life if it does not cause harmful interference to the operation of any other licensee. Any non-conforming transmitter replaced after November 1, 1991, must be replaced by a transmitter meeting the requirements of this subsection.

(b) A booster transmitting on multiple contiguous or non-contiguous channels carrying separate signals (a “broadband” booster) with an EIRP in excess of -9 dBW per 6 MHz channel and employing analog, digital or a combination of these modulations shall have the following characteristics:

(1) For broadband boosters operating in the frequency range of 2.150-2.160/2 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges forming the band edges by at least 25 dB relative to the licensed analog peak visual carrier or digital average power level (or, when subchannels are used, the appropriately adjusted value based on upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the band edges, then linearly sloping from that level to at least 60 dB of attenuation at 3.0 MHz above and below the band edges, and attenuated at least 60 dB at all other frequencies.

(2) For broadband boosters operating in the frequency range of 2.500-2.690 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges forming the band edges by at least 25 dB relative to the licensed analog peak visual carrier or digital average power level (or, when subchannels are used, the appropriately adjusted value based on upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the band edges, then linearly sloping from that level to at least 50 dB of attenuation at 3.0 MHz above and below the band edges, then linearly sloping from that level to at least 60 dB of attenuation at 20 MHz above and below the band edges, and attenuated at least 60 dB at all other frequencies.

(3) Within unoccupied channels in the frequency range of 2.500-2.690 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges of an unoccupied channel by at least 25 dB relative to the licensed analog peak visual carrier power level or digital average power level of the occupied channels (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the occupied channel edges, then linearly sloping from that level to at least 50 dB of attenuation at 3.0 MHz above and below the occupied channel edges, and attenuated at least 50 dB at all other unoccupied frequencies.

(c) Boosters operating with an EIRP less than -9 dBW per 6 MHz channel shall have no particular out-of-band power attenuation requirement, except that if they cause harmful interference, their operation shall be terminated within 2 hours of notification by the Commission until the interference can be cured.

(d) The maximum out-of-band power of an MDS response station using all or part of a 6 MHz channel and employing digital modulation shall be attenuated at the 6 MHz channel edges at least 25 dB relative to the licensed average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies. Where MDS response stations with digital modulation utilize all or part of more than one contiguous 6 MHz channel to form a larger channel (*e.g.*, a channel of width 12 MHz), the above-specified attenuations shall be applied only at the upper and lower edges of the overall combined channel. Notwithstanding these provisions, should harmful interference occur as a result of emissions outside the assigned channel(s), additional attenuation may be required by the Commission.

(e) In measuring compliance with the out-of-band emissions limitations, the licensee shall employ one of two methods: (1) absolute power measurement of the average signal power with one instrument, with measurement of the spectral attenuation on a separate instrument; or (2) relative measurement of both the average power and the spectral attenuation on a single instrument. The appropriate one of the two following formulas shall be used in each instance:

For absolute power measurements:

$$Attenuation\ in\ dB\ (below\ channel\ power) = A + 10\ log\left(C_{BW} / R_{Bw}\right)$$

For relative power measurements:

$$Attenuation\ in\ dB\ (below\ flat\ top) = A + 10log\left(R_{BW1} / R_{BW2}\right)$$

Where:

A= Attenuation specified for spectral point (e.g., 25, 35, 40, 60 dB)
C_{BW} = Channel bandwidth (for absolute power measurements)
R_{BW} = Resolution bandwidth (for absolute power measurements)
R_{BW1} = Resolution bandwidth for flat top measurement (relative)
R_{BW2} = Resolution bandwidth for spectral point measurement (relative)

The formula for absolute power measurements is to be used when the average signal power is found using a separate instrument, such as a power meter; the formula gives the amount by which the measured power value is to be attenuated to find the absolute power value to be used on the spectrum analyzer or equivalent instrument at the spectral point of concern. The formula for relative power measurements is to be used when the average signal power is found using the same instrument as used to measure the attenuation at the specified spectral points, and allows different resolution bandwidths to be applied to the two parts of the measurement; the formula gives the required amplitude separation (in dB) between the flat top of the (digital) signal and the point of concern.

21. Section 21.909 is revised in its entirety, to read as follows:

§21.909 MDS response stations.

(a) An MDS response station is authorized to provide communication by voice, video and/or data signals with its associated MDS response station hub or MDS station. An MDS response station may be operated only by the licensee of an MDS station, by any lessee of the MDS station or response station hub, or by a subscriber of either. The authorized channel may be divided to provide distinct subchannels for each of more than one response station, provided that digital modulation is employed and the aggregate power does not exceed the authorized power for the channel. An MDS response station may also, jointly with other licensees, transmit utilizing bandwidth in excess of that authorized to the station, provided that digital modulation is employed, all power spectral density requirements set forth in this Part are met, and the out-of-band emissions restrictions set forth in §21.908(b) or §21.909(j) are complied with. When a 125 kHz channel is employed for response communications, the specific channel which may be used by the response station is determined in accordance with §§21.901 and 74.939(j).

(b) MDS response stations that utilize the 2150-2162 MHz band, the 2500-2686 MHz band, and/or the 125 kHz channels may be installed and operated without an individual license, to communicate with a response station hub authorized under a response station hub license, provided that the conditions set forth in §21.909(g) are complied with and that MDS response stations operating in the 2150-2162 MHz and/or 2500-2686 MHz band(s) employ only digital modulation with uniform power spectral density in accordance with the Commission's *Declaratory Ruling and Order*, 11 FCC Rcd 18839 (1996).

(c) An applicant for a response station hub license shall:

(1) File FCC Form 331 with Mellon Bank, and certify on that form that it has complied with the requirements of §21.909(c)(2) and (d). Failure to certify compliance and to comply completely with the requirements of §21.909(c)(2) and (d) shall result in dismissal of the application or revocation of the response station hub license, and may result in imposition of a monetary forfeiture; and

(2) Submit to International Transcription Services, Inc. ("ITS"), 1231 20th Street, N.W., Washington, DC 20036, both in hard copy, and on a 3.5" computer diskette in ASCII, the following:

(i) Duplicates of the Form 331 filed with Mellon Bank; and

(ii) The data required by Appendix D to the *Report and Order* in MM Docket No. 97-217, FCC 98-231, "Methods for Predicting Interference from Response Station Transmitters and to Response Station Hubs and for Supplying Data on Response Station Systems"; and

(iii) The information, showings and certifications required by §21.909(d); and

(3) Submit to the Commission, only upon Commission staff request, duplicates of the submissions required by §21.909(c)(2).

(d) An applicant for a response station hub license shall, pursuant to §21.909(c)(2)(iii), submit to ITS the following:

(1) The geographic coordinates, street address, and the height of the center line of the reception antenna(s) above mean sea level for the proposed response station hub; and

(2) A specification of:

(i) the response service area in which the applicant or its lessee proposes to install MDS response stations to communicate with the response station hub, any regions into which the response service area will be subdivided for purposes of interference analysis, and any regional classes of response station characteristics which will be used to define the operating parameters of groups of response stations within each region for purposes of interference analysis, including:

(A) the maximum height above ground level of the transmission antenna that will be employed by any response station in the regional class and that will be used in interference analyses; and

(B) the maximum equivalent isotropic radiated power (EIRP) that will be employed by any response station in the regional class and that will be used in interference analyses; and

(C) any sectorization that will be employed, including the polarization to be employed by response stations in each sector and the geographic orientation of the sector boundaries, and that will be used in interference analyses; and

(D) the combined worst-case outer envelope plot of the patterns of all models of response station transmission antennas that will be employed by any response station in the regional class to be used in interference analyses; and

(E) the maximum number of response stations that will be operated simultaneously in each region using the characteristics of each regional class applicable to each region.

(ii) the channel plan (including any guardbands at the edges of the channel) to be used by MDS response stations in communicating with each response station hub, including a statement as to whether the applicant will employ the same frequencies on which response stations will transmit to also transmit on a point-to-multipoint basis from an MDS station or MDS booster station; and

(3) A demonstration that:

(i) The proposed response station hub is within a protected service area, as defined in §21.902(d) or §21.933, to which the applicant is entitled either (A) by virtue of its being the licensee of an incumbent MDS station whose channels are being converted for MDS response station use; or (B) by virtue of its holding a Basic Trading Area or Partitioned Service Area authorization. In the case of an application for response stations to utilize one or more of the 125 kHz response channels, such demonstration shall establish that the response station hub is within the protected service area of the station authorized to utilize the associated E-Group or F-Group channel(s); and

(ii) The entire proposed response service area is within a protected service area to which the applicant is entitled either (A) by virtue of its being the licensee of an incumbent MDS station whose channels are being converted for MDS response station use; or (B) by virtue of its holding a Basic Trading Area or Partitioned Service Area authorization. In the alternative, the applicant may demonstrate that the licensee entitled to any cochannel protected service area which is overlapped by the proposed response service area has consented to such overlap. In the case of an application for response stations to utilize one or more of the 125 kHz response channels, such demonstration shall establish that the response service area is entirely within the protected service area of the station authorized to utilize the associated E-Group or F-Group

channel(s), or, in the alternative, that the licensee entitled to any cochannel protected service area which is overlapped by the proposed response service area has consented to such overlap; and

(iii) The combined signals of all simultaneously operating MDS response stations within all response service areas and oriented to transmit towards their respective response station hubs, and all cochannel MDS stations and booster stations licensed to or applied for by the applicant will not generate a power flux density in excess of -73 dBW/m² (or the pro rata power spectral density equivalent based on the bandwidth actually employed in those cases where less than a 6 MHz channel is to be employed) outside the boundaries of the applicant's protected service area, as measured at locations for which there is an unobstructed signal path, except to the extent that consent of affected licensees has been obtained or consents have been granted pursuant to §21.909(d)(3)(ii) to an extension of the response service area beyond the boundaries of the protected service area; and

(iv) The combined signals of all simultaneously operating MDS response stations within all response service areas and oriented to transmit towards their respective response station hubs, and all cochannel MDS stations and booster stations licensed to or applied for by the applicant, will result in a desired to undesired signal ratio of at least 45 dB (or the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths): (A) within the protected service area of any authorized or previously-proposed cochannel incumbent MDS or ITFS station with a 56.33 km (35 miles) protected service area with center coordinates located within 160.94 km (100 miles) of the proposed response station hub; and (B) within the booster service area of any cochannel booster station entitled to such protection pursuant to §§21.913(f) or 74.985(f) and located within 160.94 km (100 miles) of the proposed response station hub; and (C) at any registered receive site of any authorized or previously-proposed cochannel ITFS station or booster station located within 160.94 km (100 miles) of the proposed response station hub, or, in the alternative, that the licensee of or applicant for such cochannel station or hub consents to the application; and

(v) The combined signals of all simultaneously operating MDS response stations within all response service areas and oriented to transmit towards their respective response station hubs, and all cochannel MDS stations and booster stations licensed to or applied for by the applicant, will result in a desired to undesired signal ratio of at least 0 dB (or the appropriately adjusted value based upon the ratio of the channel to subchannel bandwidths): (A) within the protected service area of any authorized or previously-proposed adjacent channel incumbent MDS or ITFS station with a 56.33 km (35 miles) protected service area with center coordinates located within 160.94 km (100 miles) of the proposed response station hub; and (B) within the booster service area of any adjacent channel booster station entitled to such protection pursuant to §§21.913(f) or 74.985(f) and located within 160.94 km (100 miles) of the proposed response station hub; and (C) at any registered receive site of any authorized or previously-proposed adjacent channel ITFS station or booster station located within 160.94 km (100 miles) of the proposed response station hub, or, in the alternative, that the licensee of or applicant for such adjacent channel station or hub consents to the application; and

(vi) The combined signals of all simultaneously operating MDS response stations within all response service areas and oriented to transmit towards their respective response station

hubs and all cochannel MDS stations and booster stations licensed to or applied for by the applicant will comply with the requirements of §§21.909(i) and 74.939(i).

(4) A certification that the application has been served upon

(i) the holder of any cochannel or adjacent channel authorization with a protected service area which is overlapped by the proposed response service area;

(ii) the holder of any cochannel or adjacent channel authorization with a protected service area that adjoins the applicant's protected service area;

(iii) the holder of a cochannel or adjacent channel authorization for any BTA or PSA inside whose boundaries are locations for which there is an unobstructed signal path for combined signals from within the response station hub applicant's protected service area; and

(iv) every licensee of, or applicant for, any cochannel or adjacent channel, authorized or previously-proposed, incumbent MDS station with a 56.33 km (35 mile) protected service area with center coordinates located within 160.94 km (100 miles) of the proposed response station hub; and

(v) every licensee of, or applicant for, any cochannel or adjacent channel, authorized or previously-proposed ITFS station (including any booster station or response station hub) located within 160.94 km (100 miles) of the proposed response station hub.

(e) Except as set forth in §21.27(d), applications for response station hub licenses may be filed at any time. Notwithstanding any other provision of Part 21 (including §21.31), applications for response station hub licenses meeting the requirements of §21.909(c) shall cut-off applications that are filed on a subsequent day for facilities that would cause harmful electromagnetic interference to the proposed response station hubs. A response station hub shall not be entitled to protection from interference caused by facilities proposed on or prior to the day the application for the response station hub license is filed. Response stations shall not be required to protect from interference facilities proposed on or after the day the application for the response station hub license is filed.

(f) Notwithstanding the provisions of §21.30(b)(4) and except as set forth in §21.27(d), any petition to deny an application for a response station hub license shall be filed no later than the sixtieth (60th) day after the date of public notice announcing the filing of such application or major amendment thereto. Notwithstanding §21.31 and except as provided in §21.27(d), an application for a response station hub license that meets the requirements of this section shall be granted on the sixty-first (61st) day after the Commission shall have given public notice of the acceptance for filing of it, or of a major amendment to it if such major amendment has been filed, unless prior to such date either a party in interest timely files a formal petition to deny or for other relief pursuant to §21.30(a), or the Commission notifies the applicant that its application will not be granted. Where an application is granted pursuant to the provisions of this subsection, the conditional licensee or licensee shall maintain a copy of the application at the response station hub until such time as the Commission issues a response station hub license.

(g) An MDS response station hub license shall be conditioned upon compliance with the following:

(1) No MDS response station shall be located beyond the response service area of the response station hub with which it communicates; and

(2) No MDS response station shall operate with a transmitter output power in excess of 2 watts; and

(3) No MDS response station shall operate with an EIRP in excess of that specified in the application for the response station hub pursuant to §21.909(d)(2)(i)(B) for the particular regional class of characteristics with which the response station is associated, and such response station shall not operate at an excess of 33 dBW EIRP (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth); and

(4) Each MDS response station shall employ a transmission antenna oriented towards the response station hub with which the MDS response station communicates, and such antenna shall be no less directional than the worst case outer envelope pattern specified in the application for the response station hub pursuant to §21.909(d)(2)(i)(D) for the regional class of characteristics with which the response station is associated; and

(5) The combined out-of-band emissions of all response stations using all or part of one or multiple contiguous 6 MHz channels and employing digital modulation shall comply with §21.908(d). The combined out-of-band emissions of all response stations using all or part of one or multiple contiguous 125 kHz channels shall comply with §21.909(j). However, should harmful interference occur as a result of emissions outside the assigned channel, additional attenuation may be required; and

(6) The response stations transmitting simultaneously at any time within any given region of the response service area utilized for purposes of analyzing the potential for interference by response stations shall conform to the numerical limits for each class of response station proposed in the application for the response station hub license. Notwithstanding the foregoing, the licensee of a response station hub license may alter the number of response stations of any class operated simultaneously in a given region, without prior Commission authorization, provided that the licensee:

(i) First notifies the Commission of the altered number of response stations of such class(es) to be operated simultaneously in such region, and certifies in that notification that it has complied with the requirements of §21.909(g)(6)(ii) and (iii); and

(ii) Provides ITS with a copy of such notification and with an analysis establishing that such alteration will not result in any increase in interference to the protected service area or protected receive sites of any existing or previously-proposed, cochannel or adjacent channel MDS or ITFS station or booster station, to the protected service area of any MDS Basic Trading Area or Partitioned Service Area licensee entitled to protection pursuant to §21.909(d)(3), or to any existing or previously-proposed, cochannel or adjacent channel response

station hub, or response station under §21.940 or §74.940; or that the applicant for or licensee of such facility has consented to such interference; and

(iii) Serves a copy of such notification and analysis upon each party entitled to be served pursuant to §21.909(d)(4); and

(iv) Submits to the Commission, only upon Commission staff request, duplicates of the submissions required by §21.909(g)(6)(ii); and

(7) Where an application is granted under this section, if a facility operated pursuant to that grant causes harmful, unauthorized interference to any cochannel or adjacent channel facility, it must promptly remedy the interference or immediately cease operations of the interfering facility, regardless of whether any petitions to deny or for other relief were filed against the application during the application process. The burden of proving that a facility operated under this section is not causing harmful, unauthorized interference lies on the licensee of the alleged interfering facility, following the filing of a documented complaint of interference by an affected party; and

(8) In the event any MDS or ITFS receive site suffers interference due to block downconverter overload, the licensee of each response station hub with a response service area within five miles of such receive site shall cooperate in good faith to expeditiously identify the source of the interference. Each licensee of a response station hub with an associated response station contributing to such interference shall bear the joint and several obligation to promptly remedy all interference resulting from block downconverter overload at any ITFS receive site registered prior to the submission of the application for the response station hub license or at any receive site within an MDS or ITFS protected service area applied for prior to the submission of the application for the response station hub license, regardless of whether the receive site suffering the interference was constructed prior to or after the construction of the response station(s) causing the downconverter overload; provided, however, that the licensee of the registered ITFS receive site or the MDS or ITFS protected service area must cooperate fully and in good faith with efforts by the response station hub licensee to prevent interference before constructing response stations and/or to remedy interference that may occur. In the event that more than one response station hub licensee contributes to block downconverter interference at a MDS or ITFS receive site, the licensees of the contributing response stations hubs shall cooperate in good faith to remedy promptly the interference.

(h) Applicants must comply with Part 17 of this chapter concerning notification to the Federal Aviation Administration of proposed antenna construction or alteration.

(i) Response station hubs shall be protected from cochannel and adjacent channel interference in accordance with the following criteria:

(1) An applicant for any new or modified MDS or ITFS station (including any high-power booster station or response station hub) shall be required to demonstrate interference protection to a response station hub within 160.94 km (100 miles) of the proposed facilities. In lieu of the interference protection requirements set forth in §§21.902(b)(3) - (5), 21.938(b)(1) and (2) and (c), and 74.903, such demonstration shall establish that the proposed facility will not increase the

effective power flux density of the undesired signals generated by the proposed facility and any associated main stations, booster stations or response stations at the response station hub antenna for any sector. In lieu of the foregoing, an applicant for a new MDS or ITFS main station license or for a new or modified response station hub or booster license may demonstrate that the facility will not increase the noise floor at a reception antenna of the response station hub by more than 1 dB for cochannel signals and 45 dB for adjacent channel signals, provided that:

(i) the entity submitting the application may only invoke this alternative once per response station hub reception sector; or

(ii) the licensee of the affected response station hub may consent to receive a certain amount of interference at its hub.

(2) Commencing upon the filing of an application for an MDS response station hub license and until such time as the application is dismissed or denied or, if the application is granted, a certification of completion of construction is filed, the MDS station whose channels are being utilized shall be entitled both to interference protection pursuant to §§21.902(b)(3) - (5), 21.938(b)(1) and (2) and (c), and 74.903, and to protection of the response station hub pursuant to the preceding subparagraph. Unless the application for the response station hub license specifies that the same frequencies also will be employed for digital and/or analog point-to-multipoint transmissions by MDS stations and/or MDS booster stations, upon the filing of a certification of completion of construction of an MDS response station hub where the channels of an MDS station are being utilized as response station transmit frequencies, the MDS station whose channels are being utilized for response station transmissions shall no longer be entitled to interference protection pursuant to §§21.902(b)(3) - (5), 21.938(b)(1) and (2) and (c), and 74.903 within the response service area with regard to any portion of any 6 MHz channel employed solely for response station communications. Upon the certification of completion of construction of an MDS response station hub where the channels of an MDS station are being utilized for response station transmissions and the application for the response station hub license specifies that the same frequencies will be employed for point-to-multipoint transmissions, the MDS station whose channels are being utilized shall be entitled both to interference protection pursuant to §§21.902(b)(3) - (5), 21.938(b)(1) and (2) and (c), and 74.903, and to protection of the response station hub pursuant to the preceding provisions of this subsection.

(j) 125 kHz wide response channels shall be subject to the following requirements: The 125 kHz wide channel shall be centered at the assigned frequency. If amplitude modulation is used, the carrier shall not be modulated in excess of 100%. If frequency modulation is used, the deviation shall not exceed ± 25 kHz. Any emissions outside the channel shall be attenuated at the channel edges at least 35 dB below peak output power when analog modulation is employed or 35 dB below licensed average output power when digital modulation is employed (or, when subchannels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths). Any emissions more than 125 kHz from either channel edge, including harmonics, shall be attenuated at least 60 dB below peak output power when analog modulation is employed, or at least 60 dB below licensed average output power when digital modulation is employed (or, when subchannels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths). Notwithstanding the foregoing, in situations where adjacent channel licensees jointly transmit over more than one contiguous channel utilizing digital

modulation, the maximum out-of-band power shall be attenuated at the edges of those combined channels at least 35 dB relative to the licensed average power level of each channel. Emissions more than 125 kHz from either edge of the combined channels, including harmonics, shall be attenuated at least 60 dB below peak analog power or average digital power of each channel, as appropriate.

(k) A response station may be operated unattended. The overall performance of the response station transmitter shall be checked by the hub licensee as often as necessary to ensure that it is functioning in accordance with the requirements of the Commission's rules. The licensee of a response station hub is responsible for the proper operation of all associated response stations and must have reasonable and timely access to all associated response station transmitters. Response stations shall be installed and maintained by the licensee of the associated hub station, or the licensee's employees or agents, and protected in such manner as to prevent tampering or operation by unauthorized persons. No response hub may lawfully communicate with any response station which has not been installed by an authorized person, and each response station hub licensee is responsible for maintaining, and making available to the Commission upon request, a list containing the customer name and site location (street address and latitude/longitude to the nearest second) of each associated response station, plus the technical parameters (*e.g.*, EIRP, emission, bandwidth, and antenna pattern, height, orientation and polarization) pertinent to each specific response station.

(l) The transmitting apparatus employed at MDS response stations shall have received type certification.

(m) An MDS response station shall be operated only when engaged in communication with its associated MDS response station hub or MDS station, or for necessary equipment or system tests and adjustments. Radiation of an unmodulated carrier and other unnecessary transmissions are forbidden.

(n) At least 20 days prior to the activation of a response station transmitter located within a radius of 1960 feet of a registered or previously-applied-for ITFS receive site, the response station hub licensee must notify, by certified mail, the licensee of the ITFS site of the intention to activate the response station. The notification must contain the street address and geographic coordinates (to the nearest second) of the response station, a specification of the station's EIRP, antenna pattern/orientation/height AMSL, channel(s) to be used, as well as the name and telephone number of a contact person who will be responsible for coordinating the resolution of any interference problems.

(o) Interference calculations shall be performed in accordance with Appendix D to the *Report and Order* in MM Docket No. 97-217, FCC 98-231, "Methods For Predicting Interference From Response Station Transmitters and To Response Station Hubs and For Supplying Data on Response Station Systems." Compliance with the out-of-band emissions limitations shall be established in accordance with §21.908(e).

22. In Section 21.910, the caption, introductory text, subsection (a), and paragraph (b) are revised, and new subsection (d) is added, to read as follows:

§21.910 Special procedures for discontinuance, reduction or impairment of service by common carrier licensees.

Any licensee who has elected common carrier status and who seeks to discontinue service on a common carrier basis and instead provide service on a non-common carrier basis, or who otherwise intends to reduce or impair service, shall be subject to the following procedures:

(a) The carrier shall notify all affected customers of the planned discontinuance, reduction or impairment. Notice shall be in writing to each affected customer unless the Commission authorizes in advance, for good cause shown, another form of notice. Notice shall include the following:

(1) Name and address of carrier; and

(2) Date of planned service discontinuance, reduction or impairment; and

(3) Points or geographic areas of service affected; and

(4) How many and which channels are affected; and

(5) The following statement:

> The FCC normally will authorize this proposed discontinuance of service (or reduction or impairment) unless it is shown that end-users will be affected adversely thereby. Affected customers wishing to object should file objections within 45 days after receipt of this notification, and address them to the Video Services Division, Federal Communications Commission, Washington, DC 20554, referencing the §21.910 Application of (carrier's name). Comments should include specific information about the impact of this proposed discontinuance (or reduction or impairment) upon end-users, including any inability by the customer to acquire reasonable substitute service from another provider. The affected customer must state that it has provided a copy of the objection to the carrier seeking discontinuance.

(b) The carrier shall file with this Commission, on or after the date on which notice has been given to all affected customers, an application which shall contain the following:

* * * * *

(d) The provisions of this section shall not apply to licensees authorized by the Commission to alternate, without further authorization required, between rendering service on a common carrier and non-common carrier basis.

23. Section 21.913 is revised in its entirety, to read as follows:

§21.913 Signal booster stations.

(a) An MDS booster station may reuse channels to repeat the signals of MDS stations or to originate signals on MDS channels. The aggregate power flux density generated by an MDS station and all associated signal booster stations and all simultaneously operating cochannel response stations may not exceed -73 dBW/m² (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel or 125 kHz bandwidths) at or beyond the boundary of the protected service area, as defined in §§21.902(d) and 21.933, of the main MDS station whose channels are being reused, as measured at locations for which there is an unobstructed signal path, unless the consent of the affected cochannel licensee is obtained.

(b) An MDS licensee or conditional licensee who is a response station hub licensee, conditional licensee or applicant may secure a license for an MDS signal booster station that has a maximum power level in excess of -9 dBW EIRP (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth) and that employs only digital modulation with uniform power spectral density in accordance with the Commission's *Declaratory Ruling and Order*, 11 FCC Rcd 18839 (1996) (a "high-power MDS signal booster station"). The applicant for a high-power MDS signal booster station shall file FCC Form 331 with Mellon Bank, and certify on that form that the applicant has complied with the additional requirements of §21.913(b). Failure to certify compliance and to comply completely with the following requirements of §21.913(b) shall result in dismissal of the application or revocation of the high-power MDS signal booster station license, and may result in imposition of a monetary forfeiture. The applicant for a high-power MDS signal booster station additionally is required to submit to International Transcription Services, Inc., 1231 20th Street, N.W., Washington, DC 20036, both in hard copy, and on a 3.5" computer diskette in ASCII, and likewise to submit to the Commission, only upon Commission staff request, duplicates of the Form 331 filed with Mellon Bank, and the following information:

(1) A demonstration that the proposed signal booster station site is within the protected service area, as defined in §§21.902(d) and 21.933, of the MDS station whose channels are to be reused; and

(2) A study which demonstrates that the aggregate power flux density of the MDS station and all associated booster stations and simultaneously operating cochannel response stations licensed to or applied for by the applicant, measured at or beyond the boundary of the protected service area of the MDS station whose channels are to be reused, does not exceed -73 dBW/m² (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel or 125 kHz bandwidths) at locations for which there is an unobstructed signal path, unless the consent of the affected licensees has been obtained; and

(3) In lieu of the requirements of §§21.902(c) and (i), a study which demonstrates that the proposed booster station will cause no harmful interference (as defined in §21.902(f)) to cochannel and adjacent channel, authorized or previously-proposed ITFS and MDS stations with protected service area center coordinates as specified in §21.902(d), to any authorized or previously-proposed response station hubs, booster stations or I channel stations associated with

such ITFS and MDS stations, or to any previously-registered ITFS receive sites, within 160.94 kilometers (100 miles) of the proposed booster station's transmitter site. Such study shall consider the undesired signal levels generated by the proposed signal booster station, the main station, all other licensed or previously-proposed associated booster stations, and all simultaneously operating cochannel response stations licensed to or applied for by the applicant. In the alternative, a statement from the affected MDS or ITFS licensee or conditional licensee stating that it does not object to operation of the high-power MDS signal booster station may be submitted; and

(4) A description of the booster service area; and

(5) A demonstration either

(i) That the booster service area is entirely within the protected service area to which the licensee of a station whose channels are being reused is entitled by virtue of its being the licensee of an incumbent MDS station, or by virtue of its holding a Basic Trading Area or Partitioned Service Area authorization; or

(ii) That the licensee entitled to any cochannel protected service area which is overlapped by the proposed booster service area has consented to such overlap; and

(6) A demonstration that the proposed booster service area can be served by the proposed booster without interference; and

(7) A certification that copies of the materials set forth in §21.913(b) have been served upon the licensee or conditional licensee of each station (including each response station hub and booster station) required to be studied pursuant to §21.913(b)(3), and upon any affected holder of a Basic Trading Area or Partitioned Service Area authorization pursuant to §21.913(b)(2).

(c) Except as provided in §21.27(d), applications for high-power MDS signal booster station licenses may be filed at any time. Notwithstanding any other provision of Part 21 (including §21.31), applications for high-power MDS signal booster station licenses meeting the requirements of §21.913(b) shall cut-off applications that are filed on a subsequent day for facilities that would cause harmful electromagnetic interference to the proposed booster stations.

(d) Notwithstanding the provisions of §21.30(a)(4) and except as provided in §21.27(d), any petition to deny an application for a high-power MDS signal booster station license shall be filed no later than the sixtieth (60th) day after the date of public notice announcing the filing of such application or major amendment thereto. Notwithstanding §21.31 and except as provided in §21.27(d), an application for a high-power MDS signal booster station license that meets the requirements of §21.913(b) shall be granted on the sixty-first (61st) day after the Commission shall have given public notice of the acceptance for filing of it, or of a major amendment to it if such major amendment has been filed, unless prior to such date either a party in interest timely files a formal petition to deny or for other relief pursuant to §21.30(a), or the Commission notifies the applicant that its application will not be granted. Where an application is granted pursuant to the provisions of this subsection, the conditional licensee or licensee shall maintain

a copy of the application at the MDS booster station until such time as the Commission issues a high-power MDS signal booster station license.

(e) Eligibility for a license for an MDS signal booster station that has a maximum power level of -9 dBW EIRP (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth) (a "low-power MDS signal booster station") shall be restricted to an MDS licensee or conditional licensee. A low-power MDS signal booster station may operate only on one or more MDS channels that are licensed to the licensee of the MDS booster station, but may be operated by a third party with a fully-executed lease or consent agreement with the MDS conditional licensee or licensee. An MDS licensee or conditional licensee may install and commence operation of a low-power MDS signal booster station for the purpose of retransmitting the signals of the MDS station or for originating signals. Such installation and operation shall be subject to the condition that for sixty (60) days after installation and commencement of operation, no objection or petition to deny is filed by an authorized cochannel or adjacent channel ITFS or MDS station with a transmitter within 8.0 kilometers (5 miles) of the coordinates of the low-power MDS signal booster station. An MDS licensee or conditional licensee seeking to install a low-power MDS signal booster station under this rule must, within 48 hours after installation, submit FCC Form 331 to the Commission in Washington, DC, and submit to International Transcription Services, Inc., 1231 20th Street, N.W., Washington, DC 20036, both in hard copy, and on a 3.5" computer diskette in ASCII, duplicates of the Form 331 filed with the Commission, and the following (which also shall be submitted to the Commission only upon Commission staff request at any time):

(1) A description of the signal booster technical specifications (including an antenna envelope plot or, if the envelope plot is on file with the Commission, the make and model of the antenna, antenna gain and azimuth), the coordinates of the booster, the height of the center of radiation above mean sea level, the street address of the signal booster and a description of the booster service area; and

(2) A demonstration either

(i) That the booster service area is entirely within the protected service area to which each licensee of a station whose channels are being reused is entitled by virtue of its being the licensee of an incumbent MDS station, or by virtue of its holding a Basic Trading Area or Partitioned Service Area authorization; or

(ii) That the licensee entitled to any cochannel protected service area which is overlapped by the proposed booster service area has consented to such overlap; and

(3) A demonstration that the proposed booster service area can be served by the proposed booster without interference; and

(4) A certification that no Federal Aviation Administration determination of No Hazard to Air Navigation is required under Part 17 of this chapter or, if such determination is required, either:

(i) A statement of the FCC Antenna Structure Registration Number; or

(ii) If an FCC Antenna Structure Registration Number has not been assigned for the antenna structure, the filer must indicate the date the application by the antenna structure owner to register the antenna structure was filed with the FCC in accordance with Part 17 of this chapter; and

(5) A certification that:

(i) The maximum power level of the signal booster transmitter does not exceed -9 dBW EIRP (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth); and

(ii) Where the booster is operating on channel D4, E1, F1, E2, F2, E3, F3, E4, F4 and/or G1, no registered receiver of an ITFS E or F channel station, constructed prior to May 26, 1983, is located within a 1.61 km (1 mile) radius of the coordinates of the booster, or in the alternative, that a consent statement has been obtained from the affected ITFS licensee; and

(iii) The applicant has complied with §1.1307 of this chapter; and

(iv) Each MDS and/or ITFS station licensee (including the licensees of booster stations and response station hubs) with protected service areas and/or registered receivers within a 8 km (5 mile) radius of the coordinates of the booster has been given notice of its installation; and

(v) The signal booster site is within the protected service area of the MDS station whose channels are to be reused; and

(vi) The aggregate power flux density of the MDS station and all associated booster stations and simultaneously operating cochannel response stations licensed to or applied for by the applicant, measured at or beyond the boundary of the protected service areas of the MDS stations whose channels are to be reused, does not exceed -73 dBW/m^2 (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel or 125 kHz bandwidths) at locations for which there is an unobstructed signal path, unless the consent of the affected licensees has been obtained; and

(vii) The antenna structure will extend less than 6.10 meters (20 feet) above the ground or natural formation or less than 6.10 meters (20 feet) above an existing manmade structure (other than an antenna structure); and

(viii) The MDS conditional licensee or licensee understands and agrees that, in the event harmful interference is claimed by the filing of an objection or petition to deny, the conditional licensee or licensee must terminate operation within two (2) hours of notification by the Commission, and must not recommence operation until receipt of written authorization to do so by the Commission.

(f) Commencing upon the filing of an application for a high-power MDS signal booster station license and until such time as the application is dismissed or denied or, if the application is granted, a certification of completion of construction is filed, an applicant for any new or modified MDS or ITFS station (including a response station hub, high-power booster station, or I Channels station) shall demonstrate compliance with the interference protection requirements set forth in §§21.902(b)(3) - (5), 21.938(b)(1) and (2) and (c), or 74.903 with respect to any previously-proposed or authorized booster service area both using the transmission parameters of the high-power MDS signal booster station (*e.g.*, EIRP, polarization(s) and antenna height) and the transmission parameters of the MDS station whose channels are to be reused by the high-power MDS signal booster station. Upon the filing of a certification of completion of construction of an MDS booster station applied for pursuant to §21.913(b), or upon the submission of an MDS booster station notification pursuant to §21.913(e), the MDS station whose channels are being reused by the MDS signal booster shall no longer be entitled to interference protection pursuant to §§21.902(b)(3) - (5), 21.938(b)(1) and (2) and (c), and 74.903 within the booster service area based on the transmission parameters of the MDS station whose channels are being reused. A booster station shall not be entitled to protection from interference caused by facilities proposed on or prior to the day the application or notification for the booster station is filed. A booster station shall not be required to protect from interference facilities proposed on or after the day the application or notification for the booster station is filed.

(g) Where an application is granted under §21.913(d), if a facility operated pursuant to that grant causes harmful, unauthorized interference to any cochannel or adjacent channel facility, it must promptly remedy the interference or immediately cease operations of the interfering facility, regardless of whether any petitions to deny or for other relief were filed against the application during the application process. The burden of proving that a high-power MDS signal booster station is not causing harmful, unauthorized interference lies on the licensee of the alleged interfering facility, following the filing of a documented complaint of interference by an affected party.

(h) In the event any MDS or ITFS receive site suffers interference due to block downconverter overload, the licensee of each signal booster station within five miles of such receive site shall cooperate in good faith to expeditiously identify the source of the interference. Each licensee of a signal booster station contributing to such interference shall bear the joint and several obligation to promptly remedy all interference resulting from block downconverter overload at any ITFS receive site registered prior to the submission of the application or notification for the signal booster station or at any receive site within an MDS or ITFS protected service area applied for prior to the submission of the application or notification for the signal booster station, regardless of whether the receive site suffering the interference was constructed prior to or after the construction of the signal booster station(s) causing the downconverter overload; provided, however, that the licensee of the registered ITFS receive site or the MDS or ITFS protected service area must cooperate fully and in good faith with efforts by the signal booster station licensee to prevent interference before constructing the signal booster station and/or to remedy interference that may occur. In the event that more than one signal booster station licensee contributes to block downconverter interference at a MDS or ITFS receive site, the licensees of the contributing signal booster stations shall cooperate in good faith to remedy promptly the interference.

24. In Section 21.925, subsection (b) is revised to read as follows:

§21.925 Applications for BTA authorizations and MDS station licenses.

* * * * *

(b) Separate long-form applications must be filed for each individual MDS station license sought within the protected service area of a BTA or PSA, including:

(1) An application for each E-channel group, F-channel group, and single H, 1, and 2A channel station license sought;

(2) An application for each site where one or more MDS response station hub license(s) is/are sought, provided that the technical parameters of each MDS response station hub are the same;

(3) An application for each site where one or more MDS booster station(s) will operate with an EIRP in excess of -9 dBW (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth);

(4) An application for authority to operate at an MDS station in the area vacated by an MDS station incumbent that has forfeited its station license; and

(5) An application for each ITFS-channel group station license sought in accordance with §§74.990 and 74.991.

* * * * *

25. In Section 21.938, paragraphs (b) and (c)(4), and subsections (e) and (f), are revised to read as follows:

§21.938 BTA and PSA technical and interference provisions.

* * * * *

(b) Unless the affected parties have executed a written interference agreement in accordance with §21.937, and subject to the provisions of §§21.909, 21.913, 21.940, 74.939, 74.940 and 74.985 regarding the protection of response station hubs, booster service areas and 125 kHz channels from harmful electromagnetic interference, stations licensed to a BTA or PSA authorization holder must not cause harmful electromagnetic interference to the following:

* * * * *

(c) * * *

* * * * *

(4) An ITFS station authorized before September 15, 1995 may be modified, provided the power flux density of that station does not exceed -73 dBW/m^2 (or the appropriate value for bandwidth other than 6 MHz) at locations along the 56.33 km (35 mile) circle centered on the then-existing transmitting antenna site or service area of a collocated incumbent MDS station, as applicable.

* * * * *

(e) Unless specifically excepted, BTA or PSA authorization holders are governed by the interference protection and other technical provisions applicable to MDS.

(f) The calculated free space power flux density from an MDS station, other than an incumbent MDS station, may not exceed -73 dBW/m^2 (or the appropriate value for bandwidth other than 6 MHz) at locations on BTA or PSA boundaries for which there is an unobstructed signal path from the transmitting antenna to the boundary, unless the applicant has obtained the written consent of the authorization holder for the affected BTA or PSA.

26. New Section 21.940 is added, to read as follows:

§21.940 Individually licensed 125 kHz channel MDS response stations.

(a) The provisions of §21.909(a), (e), (h), (j), (l) and (m), and §74.939(j), also shall apply with respect to authorization of a 125 kHz channel(s) MDS response station not under a response station hub license. The applicant shall comply with the requirements of §21.902, and §21.938 where appropriate, including the provisions of §§21.909, 21.913, 74.939 and 74.985 regarding the protection of response station hubs and booster service areas from harmful electromagnetic interference, using the appropriately adjusted interference protection values based upon the ratio of the bandwidths in use, where the authorized or previously-proposed cochannel or adjacent channel station is operated or to be operated in a system with one or more response station hub(s).

(b) An application for a license to operate a new or modified 125 kHz channel(s) MDS response station not under a response station hub license shall be filed with Mellon Bank on FCC Form 304. The applicant shall supply the following information on that form for each response station:

(1) The geographic coordinates and street address of the MDS response station transmitting antenna; and

(2) The manufacturer's name, type number, operating frequency, and power output of the proposed MDS response station transmitter; and

(3) The type of transmitting antenna, power gain, azimuthal orientation and polarization of the major lobe of radiation in degrees measured clockwise from True North; and

(4) A sketch giving pertinent details of the MDS response station transmitting antenna installation including ground elevation of the transmitter site above mean sea level; overall height above ground, including appurtenances, of any ground-mounted tower or mast on which the

transmitting antenna will be mounted or, if the tower or mast is or will be located on an existing building or other manmade structure, the separate heights above ground of the building and the tower or mast including appurtenances; the location of the tower or mast on the building; the location of the transmitting antenna on the tower or mast; and the overall height of the transmitting antenna above ground.

(c) Each MDS response station licensed under this section shall comply with the following:

(1) No MDS response station shall be located beyond the protected service area of the MDS station with which it communicates; and

(2) No MDS response station shall operate with a transmitter output power in excess of 2 watts; and

(3) No MDS response station shall operate at an excess of 16 dBW EIRP.

(d) During breaks in communications, the unmodulated carrier frequency shall be maintained within 35 kHz of the assigned frequency at all times. Adequate means shall be provided to insure compliance with this rule.

(e) Each MDS response station shall employ a directive transmitting antenna oriented towards the transmitter site of the associated MDS station or towards the response station hub with which the MDS response station communicates. The beamwidth between half power points shall not exceed 15^{o} and radiation in any minor lobe of the antenna radiation pattern shall be at least 20 dB below the power in the main lobe of radiation.

(f) A response station may be operated unattended. The overall performance of the response station transmitter shall be checked by the licensee of the station or hub receiving the response signal, or by the licensee's employees or agents, as often as necessary to ensure that the transmitter is functioning in accordance with the requirements of the Commission's rules. The licensee of the station or hub receiving the response signal is responsible for the proper operation of the response station and must have reasonable and timely access to the response station transmitter. The response station shall be installed and maintained by the licensee of the associated station or hub, or the licensee's employees or agents, and protected in such manner as to prevent tampering or operation by unauthorized persons. No response station which has not been installed by an authorized person may lawfully communicate with any station or hub.

PART 74 - EXPERIMENTAL RADIO, AUXILIARY, SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTIONAL SERVICES

27. Section 74.901 is amended by revising the definitions of "instructional television fixed station" and "ITFS response station," and by adding definitions for "booster service area," "channel," "response station hub," "response station hub license," "sectorization" and "signal booster station," to read as follows:

§74.901 Definitions.

* * * * *

Booster service area. A geographic area to be designated by an applicant for a booster station, within which the booster station shall be entitled to protection against interference as set forth in this Part. The booster service area must be specified by the applicant so as to not overlap the booster service area of any other booster authorized to or proposed by the applicant. However, a booster station may provide service to receive sites outside of its booster service area, at the licensee's risk of interference. The booster station must be capable of providing substantial service within the designated booster service area.

Channel. Unless otherwise specified, a channel under this Part shall refer to a 6 MHz frequency block assigned pursuant to §§21.901(b) or 74.902(a).

* * * * *

Instructional television fixed station. A fixed station licensed to an educational organization and intended primarily for video, data, or voice transmissions of instructional, cultural, and other types of educational material to one or more fixed receiving locations.

ITFS response station. A fixed station operated by an ITFS licensee, the lessee of ITFS channel capacity or a subscriber of either to communicate with a response station hub or associated ITFS station. A response station under this Part may share facilities with other ITFS response stations and/or one or more Multipoint Distribution Service (MDS) response stations authorized pursuant to §21.909 or §21.940.

* * * * *

Response station hub. A fixed facility licensed to an ITFS licensee, and operated by an ITFS licensee or the lessee of an ITFS channel, for the reception of information transmitted by one or more ITFS response stations that utilize digital modulation with uniform power spectral density. A response station hub licensed under this part may share facilities with other ITFS response station hubs, MDS response station hubs authorized pursuant to §21.909, MDS signal booster stations, ITFS signal booster stations, MDS stations, and/or ITFS stations.

Response station hub license. A blanket license authorizing the operation of a single response station hub at a specific location and the operation of a specified number of associated digital response stations of one or more classes at unspecified locations within one or more regions of the response service area.

Sectorization. The use of an antenna system at an ITFS station, booster station and/or response station hub that is capable of simultaneously transmitting multiple signals over the same frequencies to different portions of the service area and/or simultaneously receiving multiple signals over the same frequencies from different portions of the service area.

Signal booster station. An ITFS station licensed for use in accordance with §74.985 that operates on one or more ITFS channels. Signal booster stations are intended to augment service as part of a distributed transmission system where signal booster stations retransmit the signal of an ITFS station and/or originate information. A signal booster station licensed under this part may share facilities with other ITFS signal booster stations, MDS signal booster stations authorized pursuant to §21.913, MDS response stations and/or ITFS response stations.

* * * * *

28. In Section 74.902, subsections (c) and (d) are revised, subsection (e) is deleted, subsections (f), (g), (h), (i) and (j) are redesignated respectively as subsections (g), (h), (i), (j) and (k), and new subsections (e) and (f) and a new note 1 are added, to read as follows:

§74.902 Frequency assignments.

* * * * *

(c) Channels 2596-2602, 2602-2608, 2608-2614, 2614-2620, 2620-2626, 2626-2632, 2632-2638, and 2638-2644 MHz and the corresponding 125 kHz channels listed in §74.939(j) are shared with the Multipoint Distribution Service.[1] No new Instructional Television Fixed Service applications for these channels filed after May 25, 1983 will be accepted, except in accordance with §74.902(f). In those areas where Multipoint Distribution Service use of these channels is allowed, Instructional Television Fixed Service users of these channels will continue to be afforded protection from harmful cochannel and adjacent channel interference from Multipoint Distribution Service stations, pursuant to §21.902.

(d) Frequencies will be assigned as follows:

(1) A licensee is limited to the assignment of no more than four 6 MHz and four 125 kHz channels for use in a single area of operation, all of which 6 MHz channels initially should be selected from the same Group listed in paragraph (a) of this section, but which later may come from different Groups as a result of authorized channel swaps pursuant to §74.902(f). An area of operation is defined as the area 35 miles or less from the ITFS main station transmitter. Applicants shall not apply for more channels than they intend to construct within a reasonable time, simply for the purpose of reserving additional channels. The number of channels authorized to an applicant will be based on the demonstration of need for the number of channels requested. The Commission will take into consideration such factors as the amount of use of any currently assigned channels and the amount of proposed use of each channel requested, the amount of, and justification for, any repetition in the schedules, and the overall demand and availability of ITFS channels in the community. For those applicant organizations formed for the purpose of serving accredited institutional or governmental organizations, evaluation of the need will only consider service to those specified receive sites which submitted supporting documentation pursuant to §74.932(a)(4).

(2) An applicant leasing excess capacity and proposing a schedule which complies in all respects with the requirements of §74.931(c) or (d) will have presumptively demonstrated need, in accordance with paragraph (d)(1) of this section, for no more than four channels. This

presumption is rebuttable by demonstrating that the application does not propose to comport with our educational usage requirements, that is, to transmit some formal educational usage, as defined in §74.931(a), and to transmit the requisite minimum educational usage of §74.931(c) or (d) for genuinely educational purposes.

(e) Frequencies in the bands 2500-2650 MHz, 2656-2662 MHz, 2668-2674 MHz, and 2680-2686 MHz are available for point-to-multipoint use and/or for communications between ITFS response stations and response station hubs when authorized in accordance with the provisions of §74.939, provided that such frequencies may be employed for ITFS response stations only when transmitting using digital modulation.

(f) An ITFS licensee or conditional licensee may apply to exchange evenly one or more of its assigned channels with another ITFS licensee or conditional licensee in the same system, or with an MDS licensee or conditional licensee in the same system where one or both parties utilizes digital transmissions or leases capacity to an operator which utilizes digital transmissions, except that an ITFS licensee or conditional licensee may not exchange one of its assigned channels for MDS channel 2A. The licensees or conditional licensees seeking to exchange channels shall file in tandem with the Commission separate *pro forma* assignment of license applications, each attaching an exhibit which clearly specifies that the application is filed pursuant to a channel exchange agreement. The exchanged channel(s) shall be regulated according to the requirements applicable to the assignee; provided, however, that an ITFS licensee or conditional licensee which receives one or more E or F Group channels through a channel exchange with an MDS licensee or conditional licensee shall not be subject to the restrictions on ITFS licensees who were authorized to operate on the E or F Group channels prior to May 26, 1983.

* * * * *

NOTES:
[1] No 125 kHz channels are provided for Channels E3, E4, F3 and F4, except for those grandfathered. The 125 kHz channels associated with Channels E3, E4, F3 and F4 are allocated to the Private Operational Fixed Point-to-Point Microwave Service, pursuant to §101.147(g) of this chapter.

29. In Section 74.903, paragraphs (a)(1), (2) and (3), (b), (b)(1), (2) and (4), (c) and (d) are revised, paragraph (b)(5) and subsections (e) and (f) are deleted, and new paragraphs (a)(6) and (b)(5) are added, to read as follows:

§74.903 Interference.

(a) * * *

(1) Cochannel interference is defined as the ratio of the desired signal to the undesired signal, at the output of a reference receiving antenna oriented to receive the maximum desired signal level. Harmful interference will be considered present when a free space calculation determines that this ratio is less than 45 dB (both stations utilizing 6 MHz bandwidths).

(2) Adjacent channel interference is defined as the ratio of the desired signal to undesired signal present in an adjacent channel, at the output of a reference receiving antenna oriented to receive the maximum desired signal level.

(i) Harmful interference will be considered present when a free space calculation determines that this ratio is less than 0 dB (both stations utilizing 6 MHz bandwidths).

(ii) In the alternative, harmful interference will be considered present for an ITFS station constructed before May 26, 1983, when a free space calculation determines that this ratio is less than 10 dB (both stations utilizing 6 MHz bandwidths), unless:

(A) The individual receive site under consideration has been subsequently upgraded with up-to-date reception equipment, in which case the ratio shall be less than 0 dB. Absent information presented to the contrary, however, the Commission will assume that reception equipment installation occurred simultaneously with original station equipment; or

(B) The license for an ITFS station is conditioned on the proffer to the affected ITFS station licensee of equipment capable of providing a ratio of 0 dB or more at no expense to the ITFS station licensee, and also conditioned, if necessary, on the proffer of installation of such equipment; and there has been no showing by the affected ITFS station licensee demonstrating good cause and that the proposed equipment will not provide a ratio of 0 dB or more, or that installation of such equipment, at no expense to the ITFS station licensee, is not possible or has not been proffered.

(3) For purposes of this section and except as set forth in §74.939 regarding the protection of response station hubs, all interference calculations involving receive antenna performance shall use the reference antenna characteristics shown in Figure I, §74.937(a) or, in the alternative, utilize the actual pattern characteristics of the antenna in use at the receive site under study. If the actual receive antenna pattern is utilized, the applicant must submit complete details including manufacturer, model number(s), co-polar and cross-polar gain patterns, and other pertinent data.

* * * * *

(6) Notwithstanding the above, main, booster and response stations shall use the following formulas, as applicable, for determining compliance with: (1) Radiated field contour limits where bandwidths other than 6 MHz are employed at stations utilizing digital modulation with uniform power spectral density; and (2) Cochannel and adjacent channel D/U ratios where the bandwidths in use at the interfering and protected stations are unequal and both stations are utilizing digital modulation with uniform power spectral density or one station is utilizing such modulation and the other station is utilizing either 6 MHz NTSC analog modulation or 125 kHz analog modulation (I channels only).

(i) Contour limit: -73 dBW + 10 log (X/6), where X is the bandwidth in MHz of the digital channel.

(ii) Cochannel D/U: 45 dB + 10 log (X1/X2), where X1 is the bandwidth in MHz of the protected channel and X2 is the bandwidth in MHz of the interfering channel.

(iii) Adjacent channel D/U: 0 dB + 10 log (X1/X2), where X1 is the bandwidth in MHz of the protected channel and X2 is the bandwidth in MHz of the interfering channel.

(b) All applicants for instructional television fixed stations are expected to take full advantage of such directive antenna techniques to prevent interference to the reception of any existing or previously-proposed operational fixed, multipoint distribution, international control or instructional television fixed station at authorized receiving locations. Therefore, all applications for new or major changes must include an analysis of potential interference to all existing and previously-proposed stations in accordance with §74.903(a). An applicant for a new instructional television fixed station or for changes in an existing ITFS facility or conditional license must include the following technical information with the application:

(1) An analysis of the potential for harmful interference with the receive sites registered as of September 17, 1998, and with the protected service area, of any authorized or previously-proposed cochannel station if:

(i) The proposed transmitting antenna has an unobstructed electrical path to receive site(s) and/or the protected service area of any other station that utilizes, or would utilize, the same frequency; or

(ii) The proposed transmitter is within 80.5 km (50 miles) of the coordinates of any such station.

(2) An analysis of the potential for harmful adjacent channel interference with the receive sites registered as of September 17, 1998, and with the protected service area, of any authorized or previously-proposed station if the proposed transmitter is within 80.5 km (50 miles) of the coordinates of any station that utilizes, or would utilize, an adjacent channel frequency.

* * * * *

(4) In lieu of the interference analyses required by paragraphs (b)(1) and (2) of this section, an applicant may submit (a) statement(s) from the affected cochannel or adjacent channel licensee(s) or conditional licensee(s) that any resulting interference is acceptable.

(5) Specific rules relating to response station hubs, booster stations, and 125 kHz channels are set forth in §§21.909, 21.913, 21.940, 74.939, 74.940 and 74.985. To the extent those specific rules are inconsistent with any rules set forth above, those specific rules shall control.

(c) Existing licensees, conditional licensees and prospective applicants, including those who lease or propose to lease excess capacity pursuant to §74.931(c) or (d), are expected to cooperate fully and in good faith in attempting to resolve problems of potential interference before bringing the matter to the attention of the Commission.

(d) Each authorized or previously-proposed applicant, conditional licensee, or licensee must be protected from harmful electrical interference at each of its receive sites registered previously as of September 17, 1998, and within a protected service area as defined at §21.902(d)(1) of this chapter and in accordance with the reference receive antenna characteristics specified at §21.902(f) of this chapter. An ITFS entity which did not receive protected service area protection prior to September 17, 1998 shall be accorded such protection by a cochannel or adjacent channel applicant for a new station or station modification, including a booster station, response station or response station hub, where the applicant is required to prepare an analysis, study or demonstration of the potential for harmful interference.

30. In Section 74.911, paragraph (a)(1) is revised, and a new subsection (e) is added, to read as follows:

§74.911 Processing of ITFS station applications.

(a) * * *

(1) In the first group are applications for new stations or major changes in the facilities of authorized stations. These applications are subject to the provisions of paragraph (c) of this section. A major change for an ITFS station will be any proposal to add new channels, change from one channel (or channel group) to another except as provided for in §74.902(f), change polarization, increase the EIRP in any direction by more than 1.5 dB, increase the transmitting antenna height by 25 feet or more, or relocate a facility's transmitter site by 10 miles or more. Applications submitted pursuant to §§74.939 and 74.985 shall not be considered major change applications. However, the Commission may, within 15 days after the acceptance of an application, or 15 days after the acceptance of any other application for modification of facilities, advise the applicant that such application is considered to be one for a major change, and subject to the provisions of paragraph (c) of this section.

* * * * *

(e) Notwithstanding any other provisions of this Part, effective as of September 17, 1998, there shall be one one-week window, at such time as the Commission shall announce by public notice, for the filing of applications for high-power signal booster station, response station hub, and I channels point-to-multipoint transmissions licenses, during which all applications shall be deemed to have been filed as of the same day for purposes of §§74.939 and 74.985. Following the publication of a public notice announcing the tendering for filing of applications submitted during that window, applicants shall have a period of sixty (60) days to amend their applications, provided such amendments do not result in any increase in interference to any previously-proposed or authorized station, or to facilities proposed during the window, absent consent of the applicant for or conditional licensee or licensee of the station that would receive such additional interference. At the conclusion of that sixty (60) day period, the Commission shall publish a public notice announcing the acceptance for filing of all applications submitted during the initial window, as amended during the sixty (60) day period. All petitions to deny such applications must be filed within sixty (60) days of such second public notice. On the sixty-first (61st) day after the publication of such second public notice, applications for new or modified response station hub and booster station licenses may be filed and will be processed in accordance with

the provisions of §§74.939 and 74.985. Notwithstanding §74.911(d), each application submitted during the initial window shall be granted on the sixty-first (61st) day after the Commission shall have given such public notice of its acceptance for filing, unless prior to such date either a party in interest timely files a formal petition to deny or for other relief pursuant to §74.912, or the Commission notifies the applicant that its application will not be granted. Where an application is granted pursuant to the provisions of this subsection, the conditional licensee or licensee shall maintain a copy of the application at the transmitter site or response station hub until such time as the Commission issues a license.

31. In Section 74.912, subsection (a) is revised to read as follows:

§74.912 Petitions to deny.

(a) Any party in interest may file with the Commission a petition to deny any application for new facilities or major changes in the facilities of authorized stations, provided such petitions are filed by the date established pursuant to the cut-off provisions of §74.911(c). In the case of all other applications, except those excluded under Section 309(c) of the Communications Act of 1934, as amended, and except as provided in §§74.939 and 74.985, petitions to deny must be filed not later than 30 days after issuance of a public notice of the acceptance for filing of the applications. In the case of applications for renewal of license, petitions to deny may be filed after the issuance of a public notice of acceptance for filing of the applications and up until the first day of the last full calendar month of the expiring license term. Any party in interest may file with the Commission a petition to deny any notification regarding ITFS booster stations within the 60 day period provided for in §74.985(e).

* * * * *

32. In Section 74.931, subsection (a) is revised, subsections (b) and (c) are deleted, subsections (d) and (e) are revised and redesignated respectively as subsections (b) and (c), new subsection (d) is added, and subsections (f), (g), (h), (i), (j) and (k) are redesignated respectively as subsections (e), (f), (g), (h), (i) and (j), to read as follows:

§74.931 Purpose and permissible service.

(a)(1) Instructional television fixed stations are intended primarily through video, data, or voice transmissions to further the educational mission of accredited public and private schools, colleges and universities providing a formal educational and cultural development to enrolled students. Authorized instructional television fixed station channels must be used to further the educational mission of accredited schools offering formal educational courses to enrolled students, with limited exceptions as set forth in paragraphs (c)(3) and (d)(2) of this section and §§74.990 through 74.992 of this Part.

(2) In furtherance of the educational mission of accredited schools, instructional television fixed station channels may be used for:

(i) In-service training and instruction in special skills and safety programs, extension of professional training, informing persons and groups engaged in professional and technical activities of current developments in their particular fields, and other similar endeavors.

(ii) Transmission of material directly related to the administrative activities of the licensee, such as the holding of conferences with personnel, distribution of reports and assignments, exchange of data and statistics, and other similar uses.

(iii) Response channels transmitting information associated with formal educational courses offered to enrolled students, including uses described in paragraphs (a)(2)(i) and (ii) of this section, from ITFS response stations to response station hubs.

(b) Stations, including high-power ITFS signal booster stations, may be licensed in this service as originating or relay stations to interconnect instructional television fixed stations in adjacent areas, to deliver instructional and cultural material to, and obtain such material from, commercial and noncommercial educational television broadcast stations for use on the instructional television fixed system, and to deliver instructional and cultural material to, and obtain such material from, nearby terminals or connection points of closed circuit educational television systems employing wired distribution systems or radio facilities authorized under other parts of this Chapter, or to deliver instructional and cultural material to any CATV system serving a receiving site or sites which would be eligible for direct reception of ITFS signals under the provisions of subsection (a) of this section.

(c) A licensee solely utilizing analog transmissions may use excess capacity on each channel to transmit material other than the ITFS subject matter specified in subsections (a) and (b) of this section, subject to the following conditions:

(1) Before leasing excess capacity on any one channel, the licensee must provide at least 20 hours per week of ITFS educational usage on that channel, except as provided in paragraph (c)(2) of this section. An additional 20 hours per week per channel must be strictly reserved for ITFS use and not used for non-ITFS purposes, or reserved for recapture by the ITFS licensee for its ITFS educational usage, subject to one year's advance, written notification by the ITFS licensee to its lessee and accounting for all recapture already exercised, with no economic or operational detriment to the licensee. These hours of recapture are not restricted as to time of day or day of the week, but may be established by negotiations between the ITFS licensee and the lessee. This 20 hours per channel per week ITFS educational usage requirement and this recapture and/or reservation requirement of an additional 20 hours per channel per week shall apply spectrally over the licensee's whole protected service area.

(2) For the first two years of operation, an ITFS entity may lease excess capacity if it provides ITFS educational usage for at least 12 hours per channel per week, provided that the entity does not employ channel loading technology.

(3) The licensee may shift its requisite ITFS educational usage onto fewer than its authorized number of channels, via channel mapping or channel loading technology, so that it can lease full-time channel capacity on its ITFS station, associated ITFS booster stations, and/or ITFS response stations and associated response station hubs, subject to the condition that it

provide a total average of at least 20 hours per channel per week of ITFS educational usage on its authorized channels. The use of channel mapping or channel loading consistent with the Rules shall not be considered adversely to the ITFS licensee in seeking a license renewal. The licensee also retains the unabridgeable right to recapture, subject to six months' advance written notification by the ITFS licensee to its lessee, an average of an additional 20 hours per channel per week, accounting for all recapture already exercised. The licensee may agree to the transmission of this recapture time on channels not authorized to it, but which are included in the wireless system of which it is a part.

(4) An ITFS applicant, conditional licensee, or licensee may specify an omnidirectional antenna for point-to-multipoint transmissions to facilitate the leasing of excess capacity.

(5) Leasing activity may not cause unacceptable interference to cochannel or adjacent channel operations.

(6) When an ITFS licensee makes capacity available on a common carrier basis, it will be subject to common carrier regulation.

(i) A licensee operating as a common carrier is required to apply for the appropriate authorization and to comply with all policies and rules applicable to that service. Responsibility for making the initial determination of whether a particular activity is common carriage rests with the ITFS licensee. Initial determinations by the licensees are subject to Commission examination and may be reviewed at the Commission's discretion.

(ii) An ITFS licensee also may apply for authorization by the Commission to alternate, without further authorization required, between rendering service on a common carrier and non-common carrier basis, provided that the licensee notify the Commission of any service status changes at least 30 days in advance of such changes.

(iii) Licensees under §74.931(c)(6) additionally shall comply with the provisions of §§21.304, 21.900(b), 21.903(b)(1) and (2), and 21.910 of this chapter.

(d) A licensee utilizing digital transmissions on any of its licensed channels may use excess capacity on each channel to transmit material other than the ITFS subject matter specified in subsections (a) and (b) of this section, subject to the following conditions:

(1) The licensee must reserve a minimum of 5% of the capacity of its channels for instructional purposes only, and may not lease this reserved capacity. In addition, before leasing excess capacity, the licensee must provide at least 20 hours per licensed channel per week of ITFS educational usage. This 5% reservation and this 20 hours per licensed channel per week ITFS educational usage requirement shall apply spectrally over the licensee's whole protected service area.

(2) The licensee may shift its requisite ITFS educational usage onto fewer than its authorized number of channels, via channel mapping or channel loading technology, and may shift its requisite ITFS educational usage onto channels not authorized to it, but which are included in the wireless system of which it is a part ("channel shifting"), so that it can lease full-

time channel capacity on its ITFS station, associated ITFS booster stations, and/or ITFS response stations and associated response station hubs, subject to the condition that it provide a total average of at least 20 hours per licensed channel per week of ITFS educational usage. The use of channel mapping, channel loading, and/or channel shifting consistent with the Rules shall not be considered adversely to the ITFS licensee in seeking a license renewal.

(3) An ITFS applicant, conditional licensee, or licensee may specify an omnidirectional antenna for point-to-multipoint transmissions to facilitate the leasing of excess capacity.

(4) Leasing activity may not cause unacceptable interference to cochannel or adjacent channel operations.

(5) A licensee leasing any of its licensed channels to be used as response channels shall be required to maintain at least 25% of the capacity of its channels for point-to-multipoint transmissions during the term of the lease and following termination of the leasing arrangement. This 25% preservation may be over the licensee's own authorized channels or over channels not authorized to it, but which are included in the wireless system of which it is a part.

(6) When an ITFS licensee makes capacity available on a common carrier basis, it will be subject to common carrier regulation.

(i) A licensee operating as a common carrier is required to apply for the appropriate authorization and to comply with all policies and rules applicable to that service. Responsibility for making the initial determination of whether a particular activity is common carriage rests with the ITFS licensee. Initial determinations by the licensees are subject to Commission examination and may be reviewed at the Commission's discretion.

(ii) An ITFS licensee also may apply for authorization by the Commission to alternate, without further authorization required, between rendering service on a common carrier and non-common carrier basis, provided that the licensee notify the Commission of any service status changes at least 30 days in advance of such changes.

(iii) Licensees under §74.931(d)(6) additionally shall comply with the provisions of §§21.304, 21.900(b), 21.903(b)(1) and (2), and 21.910 of this chapter.

* * * * *

33. In Section 74.935, subsections (a) and (b) are revised to read as follows:

§74.935 Power limitations.

(a) The maximum EIRP of an ITFS main or booster station shall not exceed 33 dBW (or, when digital modulation with uniform power spectral density and subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth), except as provided in paragraph (b) of this section.

(b) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP over a 6 MHz channel in dBW in a given direction shall be determined by the following formula:

EIRP = 33 dBW + 10 log (360/beamwidth) [where 10 log (360/beamwidth) $\leq$ 6 dB]

Beamwidth is the total horizontal plane beamwidth of the individual transmitting antenna for the station or any sector measured at the half-power points. The first term of the equation above, 33 dBW, must be adjusted appropriately based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth.

* * * * *

34. Section 74.936 is revised in its entirety, to read as follows:

§74.936 Emissions and bandwidth.

(a) An ITFS station may employ amplitude modulation (C3F) for the transmission of the visual signal and frequency modulation (F3E) or (G3E) for the transmission of the aural signal when transmitting a standard analog television signal. Quadrature amplitude modulation, digital vestigial modulation, quadrature phase shift key modulation and code division multiple access emissions may be employed, subject to compliance with the policies set forth in the *Declaratory Ruling and Order*, 11 FCC Rcd 18839 (1996). The licensee may subchannelize its authorized bandwidth, provided that digital modulation is employed and the aggregate power does not exceed the authorized power for the channel, and may utilize all or a portion of its authorized bandwidth for ITFS response stations authorized pursuant to §74.939. The licensee may also, jointly with affected adjacent channel licensees, transmit utilizing bandwidth in excess of its authorized frequencies, provided that digital modulation is employed, all power spectral density requirements set forth in this Part are met and the out-of-band emissions restrictions set forth in 74.936 are met at the edges of the channels employed. The wider channels thus created may be redivided to create narrower channels.

(b) Notwithstanding the above, any digital emission which meets the uniform power spectral density requirements of the *Declaratory Ruling and Order* may be used in the following circumstances:

(1) At any ITFS main or booster station transmitter which is located more than 160.94 km (100 miles) from the nearest boundary of all cochannel and adjacent channel ITFS and MDS protected service areas, including Basic Trading Areas and Partitioned Service Areas; and

(2) At all ITFS response station transmitters within a response service area if all points along the response service area boundary line are more than 160.94 km (100 miles) from the nearest boundary of all cochannel and adjacent channel ITFS and MDS protected service areas, including Basic Trading Areas and Partitioned Service Areas; and

(3) At any ITFS transmitter where all parties entitled by this Part to interference protection from that transmitter have mutually consented to the use at that transmitter of such emissions.

(c) The maximum out-of-band power of an ITFS station transmitter or booster transmitting on a single 6 MHz channel with an EIRP in excess of -9 dBW employing analog modulation shall be attenuated at the channel edges by at least 38 dB relative to the peak visual carrier, then linearly sloping from that level to at least 60 dB of attenuation at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge, and attenuated at least 60 dB at all other frequencies. The maximum out-of-band power of an ITFS station transmitter or booster transmitting on a single 6 MHz channel or a portion thereof with an EIRP in excess of -9 dBW (or, when subchannels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths) employing digital modulation shall be attenuated at the 6 MHz channel edges at least 25 dB relative to the licensed average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies. Notwithstanding the foregoing, in situations where an ITFS station or booster station transmits, or where adjacent channel licensees jointly transmit, a single signal over more than one contiguous 6 MHz channel utilizing digital modulation with an EIRP in excess of -9 dBW (or, when subchannels or superchannels are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel bandwidth), the maximum out-of-band power shall be attenuated at the channel edges of those combined channels at least 25 dB relative to the power level of each channel, then attenuated along a linear slope from that level to at least 40 dB at 250 kHz above or below the channel edges of those combined channels, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower edges of those combined channels, and attenuated at least 60 dB at all other frequencies. However, should harmful interference occur as a result of emissions outside the assigned channel, additional attenuation may be required. A transmitter licensed prior to November 1, 1991, that remains at the station site initially licensed, and does not comply with this subsection, may continue to be used for its life if it does not cause harmful interference to the operation of any other licensee. Any non-conforming transmitter replaced after November 1, 1991, must be replaced by a transmitter meeting the requirements of this subsection.

(d) A booster transmitting on multiple contiguous or non-contiguous channels carrying separate signals (a “broadband” booster) with an EIRP in excess of -9 dBW per 6 MHz channel and employing analog, digital or a combination of these modulations shall have the following characteristics:

(1) For broadband boosters operating in the frequency range of 2.150-2.160/2 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges forming the band edges by at least 25 dB relative to the licensed analog peak visual carrier or digital average power level (or, when subchannels are used, the appropriately adjusted value based on upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the band edges, then linearly sloping from that level to at least 60 dB of attenuation at 3.0 MHz above and below the band edges, and attenuated at least 60 dB at all other frequencies.

(2) For broadband boosters operating in the frequency range of 2.500-2.690 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges forming the band edges by at least 25 dB relative to the licensed analog peak visual carrier or digital average power level (or, when subchannels are used, the appropriately adjusted value based on upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the band edges, then linearly sloping from that level to at least 50 dB of attenuation at 3.0 MHz above and below the band edges, then linearly sloping from that level to at least 60 dB of attenuation at 20 MHz above and below the band edges, and attenuated at least 60 dB at all other frequencies.

(3) Within unoccupied channels in the frequency range of 2.500-2.690 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges of an unoccupied channel by at least 25 dB relative to the licensed analog peak visual carrier power level or digital average power level of the occupied channels (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the occupied channel edges, then linearly sloping from that level to at least 50 dB of attenuation at 3.0 MHz above and below the occupied channel edges, and attenuated at least 50 dB at all other unoccupied frequencies.

(e) Boosters operating with an EIRP less than -9 dBW per 6 MHz channel shall have no particular out-of-band power attenuation requirement, except that if they cause harmful interference, their operation shall be terminated within 2 hours of notification by the Commission until the interference can be cured.

(f) The maximum out-of-band power of an ITFS response station using all or part of a 6 MHz channel and employing digital modulation shall be attenuated at the 6 MHz channel edges at least 25 dB relative to the licensed average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies. Where ITFS response stations with digital modulation utilize all or part of more than one contiguous 6 MHz channel to form a larger channel (*e.g.*, a channel of width 12 MHz), the above-specified attenuations shall be applied only at the upper and lower edges of the overall combined channel. Notwithstanding these provisions, should harmful interference occur as a result of emissions outside the assigned channel(s), additional attenuation may be required by the Commission.

(g) The requirements of §73.687(c)(2) will be considered to be satisfied insofar as measurements of operating power are concerned if the transmitter is equipped with instruments for determining the combined visual and aural operating power. However, licensees are expected to maintain the operating powers within the limits specified in §74.935. Measurements of the separate visual and aural operating powers must be made at sufficiently frequent intervals to insure compliance with the rules, and in no event less than once a month. However, the provisions of §73.687(c)(2) and of this subsection shall not be applicable to ITFS response stations or to low power ITFS booster stations authorized pursuant to §74.985(e).

(h) Compliance with the out-of-band emissions limitations shall be established in accordance with Rule Section 21.908(e).

35. In Section 74.937, subsections (a) and (b) are revised to read as follows:

§74.937 Antennas.

(a) In order to minimize the hazard of harmful cochannel and adjacent channel interference from other stations, directive receiving antennas should be used at all receiving locations other than response station hubs. The choice of receiving antennas is left to the discretion of the licensee. However, for the purpose of interference calculations, except as set forth in §74.939, the general characteristics of the reference receiving antenna shown in Figure I of this section (i.e., a 0.6 meter (2 foot) parabolic reflector antenna) are assumed to be used in accordance with the provisions of §74.903(a)(3) unless pertinent data is submitted of the actual antenna in use at the receive site. Licensees may install receiving antennas with general characteristics superior to those of the reference receive antenna. Nevertheless, should interference occur and it can be demonstrated by an applicant that the existing antenna at the receive site is inappropriate, a more suitable yet practical receiving antenna should be installed. In such cases, the modification of the receive site will be in the discretion, and will be the responsibility, of the licensee serving the site.

(b) Except as set forth in §74.931(c)(4) and (d)(3), directive transmitting antennas shall be used whenever feasible so as to minimize interference to other licensees. The radiation pattern shall be designed to minimize radiation in directions where no reception is intended. When an ITFS station is used for point-to-point service, an appropriate directional antenna must be used.

* * * * *

36. Section 74.938 is revised to read as follows:

§74.938 Transmission Standards.

The width of an ITFS channel is 6 MHz. However, the licensee may subchannelize its authorized bandwidth, provided that digital modulation is employed and the aggregate power does not exceed the authorized power for the channel, and may utilize all or a portion of its authorized bandwidth for ITFS response stations authorized pursuant to §74.939. The licensee may also, jointly with other licensees, transmit utilizing bandwidth in excess of its authorized bandwidth, provided that digital modulation is employed, all power spectral density requirements set forth in this Part are met and the out-of-band emissions restrictions set forth in §74.936 are met at the edges of the channels employed.

37. Section 74.939 is revised in its entirety, including revision of the caption, to read as follows:

§74.939 ITFS response stations.

(a) An ITFS response station is authorized to provide communication by voice, video and/or data signals with its associated ITFS response station hub or associated ITFS station. An ITFS

response station may be operated only by the licensee of the ITFS station, by any person or entity authorized by the ITFS licensee to receive point-to-multipoint transmissions over its channels, by any lessee of excess capacity, or by a subscriber of any lessee of excess capacity. The authorized channel may be divided to provide distinct subchannels for each of more than one response station, provided that digital modulation is employed and the aggregate power does not exceed the authorized power for the channel. An ITFS response station may also, jointly with other licensees, transmit utilizing bandwidth in excess of that authorized to the station, provided that digital modulation is employed, all power spectral density requirements set forth in this Part are met, and the out-of-band emission restrictions set forth in §74.936 or §74.939(k) are complied with.

(b) ITFS response stations that utilize the 2150-2162 MHz band pursuant to §74.902(f), the 2500-2686 MHz band, and/or the 125 kHz channels identified in §74.939(j) may be installed and operated without an individual license, to communicate with a response station hub authorized under a response station hub license, provided that the conditions set forth in §74.939(g) are complied with and that ITFS response stations operating in the 2150-2162 MHz and/or 2500-2686 MHz band(s) employ only digital modulation with uniform power spectral density in accordance with the Commission's *Declaratory Ruling and Order*, 11 FCC Rcd 18839 (1996).

(c) An applicant for a response station hub license shall:

(1) File FCC Form 331 with the Commission in Washington, DC, and certify on that form that it has complied with the requirements of §74.939(c)(2) and (d). Failure to certify compliance and to comply completely with the requirements of §74.939(c)(2) and (d) shall result in dismissal of the application or revocation of the response station hub license, and may result in imposition of a monetary forfeiture; and

(2) Submit to International Transcription Services, Inc. ("ITS"), 1231 20th Street, N.W., Washington, DC 20036, both in hard copy, and on a 3.5" computer diskette in ASCII, the following:

(i) Duplicates of the Form 331 filed with the Commission; and

(ii) The data required by Appendix D to the *Report and Order* in MM Docket No. 97-217, FCC 98-231, "Methods for Predicting Interference from Response Station Transmitters and to Response Station Hubs and for Supplying Data on Response Station Systems"; and

(iii) The information, showings and certifications required by §74.939(d); and

(3) Submit to the Commission, only upon Commission staff request, duplicates of the submissions required by §74.939(c)(2).

(d) An applicant for a response station hub license shall, pursuant to §74.939(c)(2)(iii), submit to ITS the following:

(1) The geographic coordinates, street address, and the height of the center line of the reception antenna(s) above mean sea level for the response station hub; and

(2) A specification of:

(i) The response service area in which the applicant or its lessee proposes to install ITFS response stations to communicate with the response station hub, any regions into which the response service area will be subdivided for purposes of interference analysis, and any regional classes of response station characteristics which will be used to define the operating parameters of groups of response stations within each region for purposes of interference analysis, including:

(A) the maximum height above ground level of the transmission antenna that will be employed by any response station in the regional class and that will be used in interference analyses; and

(B) the maximum equivalent isotropic radiated power (EIRP) that will be employed by any response station in the regional class and that will be used in interference analyses; and

(C) any sectorization that will be employed, including the polarization to be employed by response stations in each sector and the geographic orientation of the sector boundaries, and that will be used in interference analyses; and

(D) the combined worst-case outer envelope plot of the patterns of all models of response station transmission antennas that will be employed by any response station in the regional class to be used in interference analyses; and

(E) the maximum number of response stations that will be operated simultaneously in each region using the characteristics of each regional class applicable to each region.

(ii) The channel plan (including any guardbands at the edges of the channel) to be used by ITFS response stations in communicating with the response station hub, including a statement as to whether the applicant will employ the same frequencies on which response stations will transmit to also transmit on a point-to-multipoint basis from an MDS station or MDS booster station; and

(3) A demonstration that:

(i) The proposed response station hub is within the protected service area, as defined in §21.902(d)(1) of this chapter, of the ITFS station(s) whose channels will be used for communications to the response station hub or, in the case of an application for response stations to utilize one or more of the 125 kHz response channels, the response station hub is within the protected service area of the station authorized to utilize the associated channel(s); and

(ii) The entire proposed response service area is within the protected service area of the ITFS station(s) whose channels will be used for communications to the response station hub or, in the alternative, the applicant may demonstrate that the licensee of any cochannel protected service area which is overlapped by the proposed response service area has consented

to such overlap. In the case of an application for response stations to utilize one or more of the 125 kHz response channels, such demonstration shall establish that the response service area is entirely within the protected service area of the station authorized to utilize the associated channel(s), or, in the alternative, that the licensee entitled to any cochannel protected service area which is overlapped by the proposed response service area has consented to such overlap; and

(iii) The combined signals of all simultaneously operating ITFS response stations within all response service areas and oriented to transmit towards their respective response station hubs and all cochannel ITFS stations and booster stations licensed to or applied for by the applicant will not generate a power flux density in excess of -73 dBW/m² (or the pro rata power spectral density equivalent based on the bandwidth actually employed in those cases where less than a 6 MHz channel is to be employed) outside the boundaries of the applicant's protected service area, as measured at locations for which there is an unobstructed signal path, except to the extent that consent of affected licensees has been obtained or consents have been granted pursuant to §74.939(d)(3)(ii) to an extension of the response service area beyond the boundaries of the protected service area; and

(iv) The combined signals of all simultaneously operating ITFS response stations within all response service areas and oriented to transmit towards their respective response station hubs, and all cochannel ITFS stations and booster stations licensed to or applied for by the applicant, will result in a desired to undesired signal ratio of at least 45 dB (or the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths): (A) within the protected service area of any authorized or previously-proposed cochannel MDS or ITFS station with center coordinates located within 160.94 km (100 miles) of the proposed response station hub; and (B) within the booster service area of any cochannel booster station entitled to such protection pursuant to §§21.913(f) or 74.985(f) and located within 160.94 km (100 miles) of the proposed response station hub; and (C) at any registered receive site of any authorized or previously-proposed cochannel ITFS station or booster station located within 160.94 km (100 miles) of the proposed response station hub, or, in the alternative, that the licensee or applicant for such cochannel station or hub consents to the application; and

(v) The combined signals of all simultaneously operating ITFS response stations within all response service areas and oriented to transmit towards their respective response station hubs, and all cochannel ITFS stations and booster stations licensed to or applied for by the applicant, will result in a desired to undesired signal ratio of at least 0 dB (or the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths): (A) within the protected service area of any authorized or previously-proposed adjacent channel MDS or ITFS station with center coordinates located within 160.94 km (100 miles) of the proposed response station hub; and (B) within the booster service area of any adjacent channel booster station entitled to such protection pursuant to §§21.913(f) or 74.985(f) and located within 160.94 km (100 miles) of the proposed response station hub; and (C) at any registered receive site of any authorized or previously- proposed adjacent channel ITFS station or booster station located within 160.94 km (100 miles) of the proposed response station hub, or, in the alternative, that the licensee of or applicant for such adjacent channel station or hub consents to such application; and

(vi) The combined signals of all simultaneously operating ITFS response stations within all response service areas and oriented to transmit towards their respective response station

hub and all cochannel ITFS stations and booster stations licensed to or applied for by the applicant will comply with the requirements of §§21.909(i) and 74.939(i).

(4) A certification that the application has been served upon

(i) the holder of any cochannel or adjacent channel authorization with a protected service area which is overlapped by the proposed response service area;

(ii) the holder of any cochannel or adjacent channel authorization with a protected service area that adjoins the applicant's protected service area;

(iii) the holder of a cochannel or adjacent channel authorization for any BTA or PSA inside whose boundaries are locations for which there is an unobstructed signal path for combined signals from within the response station hub applicant's protected service area; and

(iv) every licensee of, or applicant for, any cochannel or adjacent channel, authorized or previously-proposed, incumbent MDS station with a 56.33 km (35 mile) protected service area with center coordinates located within 160.94 km (100 miles) of the proposed response station hub; and

(v) every licensee of, or applicant for, any cochannel or adjacent channel, authorized or previously-proposed ITFS station (including any booster station or response station hub) located within 160.94 km (100 miles) of the proposed response station hub.

(e) Applications for response station hub licenses shall be deemed minor change applications and, except as provided in §74.911(e), may be filed at any time. Notwithstanding any other provision of Part 74, applications for response station hub licenses meeting the requirements of §74.939(c) shall cut-off applications that are filed on a subsequent day for facilities that would cause harmful electromagnetic interference to the proposed response station hubs. A response station hub shall not be entitled to protection from interference caused by facilities proposed on or prior to the day the application for the response station hub license is filed. Response stations shall not be required to protect from interference facilities proposed on or after the day the application for the response station hub license is filed.

(f) Notwithstanding the provisions of §74.912 and except as provided by §74.911(e), any petition to deny an application for a response station hub license shall be filed no later than the sixtieth (60th) day after the date of public notice announcing the filing of such application or major amendment thereto. Notwithstanding §74.911(d) and except as provided in §74.911(e), an application for a response station hub license that meets the requirements of this section shall be granted on the sixty-first (61st) day after the Commission shall have given public notice of the acceptance for filing of it, or of a major amendment to it if such major amendment has been filed, unless prior to such date either a party in interest timely files a formal petition to deny or for other relief pursuant to §74.912, or the Commission notifies the applicant that its application will not be granted. Where an application is granted pursuant to the provisions of this subsection, the conditional licensee or licensee shall maintain a copy of the application at the response station hub until such time as the Commission issues a response station hub license.

(g) An ITFS response station hub license establishing a response service area shall be conditioned upon compliance with the following:

(1) No ITFS response station shall be located beyond the response service area of the response station hub with which it communicates; and

(2) No ITFS response station shall operate with a transmitter output power in excess of 2 watts; and

(3) No ITFS response station shall operate with an EIRP in excess of that specified in the application for the response station hub pursuant to §74.939(d)(2)(i)(B) for the particular regional class of characteristics with which the response station is associated, and such response station shall not operate at an excess of 33 dBW EIRP (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth); and

(4) Each ITFS response station shall employ a transmission antenna oriented towards the response station hub with which the ITFS response station communicates, and such antenna shall be no less directional than the worst case outer envelope pattern specified in the application for the response station hub pursuant to §74.939(d)(2)(i)(D) for the regional class of characteristics with which the response station is associated; and

(5) The combined out-of-band emissions of all response stations using all or part of one or multiple contiguous 6 MHz channels and employing digital modulation shall comply with §74.936(e). The combined out-of-band emissions of all response stations using all or part of one or multiple contiguous 125 kHz channels shall comply with §74.939(k). However, should harmful interference occur as a result of emissions outside the assigned channel, additional attenuation may be required; and

(6) The response stations transmitting simultaneously at any time within any given region of the response service area utilized for purposes of analyzing the potential for interference by response stations shall conform to the numerical limits for each class of response station proposed in the application for the response station hub license. Notwithstanding the foregoing, the licensee of a response station hub license may alter the number of response stations of any class operating simultaneously in a given region, without prior Commission authorization, provided that the licensee:

(i) First notifies the Commission of the altered number of response stations of such class(es) to be operated simultaneously in such region, and certifies in that notification that it has complied with the requirements of §74.939(g)(6)(ii) and (iii); and

(ii) Provides ITS with a copy of such notification and with an analysis establishing that such alteration will not result in any increase in interference to the protected service area or protected receive sites of any existing or previously-proposed, cochannel or adjacent channel MDS or ITFS station or booster station, to the protected service area of any MDS Basic Trading Area or Partitioned Service Area licensee entitled to protection pursuant to §74.939(d)(3), or to any existing or previously-proposed, cochannel or adjacent channel response

station hub, or response station under §21.940 or §74.940; or that the applicant for or licensee of such facility has consented to such interference; and

(iii) Serves a copy of such notification and analysis upon each party entitled to be served pursuant to §74.939(d)(4); and

(iv) Submits to the Commission, only upon Commission staff request, duplicates of the submissions required by §74.939(g)(6)(ii); and

(7) Where an application is granted under this section, if a facility operated pursuant to that grant causes harmful, unauthorized interference to any cochannel or adjacent channel facility, it must promptly remedy the interference or immediately cease operations of the interfering facility, regardless of whether any petitions to deny or for other relief were filed against the application during the application process. The burden of proving that a facility operated under this section is not causing harmful, unauthorized interference lies on the licensee of the alleged interfering facility, following the filing of a documented complaint of interference by an affected party; and

(8) In the event any MDS or ITFS receive site suffers interference due to block downconverter overload, the licensee of each response station hub with a response service area within five miles of such receive site shall cooperate in good faith to expeditiously identify the source of the interference. Each licensee of a response station hub with an associated response station contributing to such interference shall bear the joint and several obligation to promptly remedy all interference resulting from block downconverter overload at any ITFS receive site registered prior to the submission of the application for the response station hub license or at any receive site within an MDS or ITFS protected service area applied for prior to the submission of the application for the response station hub license, regardless of whether the receive site suffering the interference was constructed prior to or after the construction of the response station(s) causing the downconverter overload; provided, however, that the licensee of the registered ITFS receive site or the MDS or ITFS protected service area must cooperate fully and in good faith with efforts by the response station hub licensee to prevent interference before constructing response stations and/or to remedy interference that may occur. In the event that more than one response station hub licensee contributes to block downconverter interference at a MDS or ITFS receive site, the licensees of the contributing response station hubs shall cooperate in good faith to remedy promptly the interference.

(h) Applicants must comply with Part 17 of this chapter concerning notification to the Federal Aviation Administration of proposed antenna construction or alteration. The provisions of §§74.967 and 74.981(a)(5) of this Subpart, concerning antenna painting and lighting requirements, apply to ITFS response stations and response station hubs, as well as to main and booster stations.

(i) Response station hubs shall be protected from cochannel and adjacent channel interference in accordance with the following criteria:

(1) An applicant for any new or modified MDS or ITFS station (including any high-power booster station or response station hub) shall be required to demonstrate interference protection

to a response station hub within 160.94 km (100 miles) of the proposed facilities. In lieu of the interference protection requirements set forth in §§21.902(i), 21.938(b)(3) and 74.903, such demonstration shall establish that the proposed facility will not increase the effective power flux density of the undesired signals generated by the proposed facility and any associated main stations, booster stations or response stations at the response station hub antenna for any sector. In lieu of the foregoing, an applicant for a new MDS or ITFS main station license or for a new or modified response station hub or booster license may demonstrate that the facility will not increase the noise floor at a reception antenna of the response station hub by more than 1 dB for cochannel signals and 45 dB for adjacent channel signals, provided that:

(i) the entity submitting the application may only invoke this alternative once per response station hub reception sector; or

(ii) the licensee of the affected response station hub may consent to receive a certain amount of interference at its hub.

(2) Commencing upon the filing of an application for an ITFS response station hub license and until such time as the application is dismissed or denied or, if the application is granted, a letter informing the Commission of completion of construction is submitted, the ITFS station whose channels are being utilized shall be entitled both to interference protection pursuant to §§21.902(i), 21.938(b)(3) and 74.903, and to protection of the response station hub pursuant to the preceding subparagraph. Unless the application for the response station hub license specifies that the same frequencies also will be employed for digital and/or analog point-to-multipoint transmissions by ITFS stations and/or ITFS booster stations, upon the submission of a letter informing the Commission of completion of construction of an ITFS response station hub where the channels of an ITFS station are being utilized as response station transmit frequencies, the ITFS station whose channels are being utilized for response station transmissions shall no longer be entitled to interference protection pursuant to §§21.902(i), 21.938(b)(3) and 74.903 within the response service area with regard to any portion of any 6 MHz channel employed solely for response station communications. Upon the submission of a letter informing the Commission of completion of construction of an ITFS response station hub where the channels of an ITFS station are being utilized for response station transmissions and the application for the response station hub license specifies that the same frequencies will be employed for point-to-multipoint transmissions, the ITFS station whose channels are being utilized shall be entitled both to interference protection pursuant to §§21.902(i), 21.938(b)(3) and 74.903, and to protection of the response station hub pursuant to the preceding provisions of this subsection.

(j) ITFS response stations may operate on either all or part of a 6 MHz channel assigned a licensee, on any 125 kHz channel assigned a licensee, or on adjacent frequencies authorized to multiple licensees where such stations are operated jointly. The 125 kHz channels listed in the following table shall be assigned to the licensees of MDS and ITFS stations for use at response stations, or for licensing for point-to-multipoint transmissions pursuant to §74.939(l), in accordance with the table. The specified 125 kHz frequency channel may be subdivided to provide a distinct operating frequency for each of more than one station, or may be combined with adjacent channels, provided that digital modulation is employed in accordance with §74.939(a). The specified 125 kHz frequency channels also may be exchanged with the licensee

of another MDS or ITFS station for use of another 125 kHz channel assigned to the other licensee.

Frequency (MHz)	Main Channel Designation	125 kHz Channel Designation
2686.0625	A1	I1
2686.1875	B1	I2
2686.3125	C1	I3
2686.4375	D1	I4
2686.5625	E1	I5
2686.6875	F1	I6
2686.8125	G1	I7
2686.9375	H1	I8
2687.0625	A2	I9
2687.1875	B2	I10
2687.3125	C2	I11
2687.4375	D2	I12
2687.5625	E2	I13
2687.6875	F2	I14
2687.8125	G2	I15
2687.9375	H2	I16
2688.0625	A3	I17
2688.1875	B3	I18
2688.3125	C3	I19
2688.4375	D3	I20
2688.5625	E3	I21
2688.6875	F3	I22
2688.8125	G3	I23
2688.9375	H3	I24
2689.0625	A4	I25
2689.1875	B4	I26
2689.3125	C4	I27
2689.4375	D4	I28
2689.5625	E4	I29
2689.6875	F4	I30
2689.8125	G4	I31

(k) 125 kHz wide response channels shall be subject to the following requirements: The 125 kHz wide channel shall be centered at the assigned frequency. If amplitude modulation is used, the carrier shall not be modulated in excess of 100%. If frequency modulation is used, the deviation shall not exceed ± 25 kHz. Any emissions outside the channel shall be attenuated at the channel edges at least 35 dB below peak output power when analog modulation is employed or 35 dB below licensed average output power when digital modulation is employed (or, when subchannels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths). Any emissions more than 125 kHz from either channel edge, including harmonics, shall be attenuated at least 60 dB below peak output power when analog modulation is employed, or at least 60 dB below licensed average output power when digital modulation is employed (or, when subchannels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths). Notwithstanding the foregoing, in situations where adjacent channel licensees jointly transmit over more than one channel utilizing digital modulation, the maximum out-of-band power shall be attenuated at the edges of those combined channels at least 35 dB relative to the licensed average power level of each channel. Emissions more than 125

kHz from either edge of the combined channels, including harmonics, shall be attenuated at least 60 dB below peak analog power or licensed average digital power of each channel, as appropriate. Different types of emissions may be authorized for use on 125 kHz wide channels if the applicant describes fully the modulation and bandwidth desired, and demonstrates that the modulation selected will cause no more interference than is permitted under this subsection. Greater attenuation may be required if interference is caused by out-of-channel emissions.

(l) Any MDS or ITFS conditional licensee or licensee who wishes to use one or more of its associated I channels for point-to-multipoint transmissions in a system with one or more authorized, or previously- or simultaneously-proposed, response station hub(s) shall:

(1) File FCC Form 331 with the Commission, filing with Mellon Bank for I channels associated with an MDS station, and filing with the Commission in Washington, DC for I channels associated with an ITFS station. The application shall specify which of the associated I channels is/are intended for point-to-multipoint transmissions. The applicant also shall certify on the appropriate form that it has complied with the requirements of §74.939(l)(2). Failure to certify compliance and to comply completely with the requirements of §74.939(l)(2) shall result in dismissal of the application or revocation of the authorization for point-to-multipoint transmissions on the relevant I channels, and may result in imposition of a monetary forfeiture. Modification applications to convert I channels associated with ITFS stations to point-to-multipoint transmissions shall be considered minor changes for purposes of §74.911. These applications shall be subject to the procedures set forth in §21.27(d) or §74.911(e), as appropriate; and

(2) Submit to International Transcription Services, Inc., 1231 20th Street, N.W., Washington, DC 20036, both in hard copy, and on a 3.5" computer diskette in ASCII, and likewise submit to the Commission, only upon Commission staff request:

(i) Duplicates of the Form 331 filed with Mellon Bank or with the Commission, as appropriate; and

(ii) The interference analyses required to be performed under §21.902, and §21.938 where appropriate, including the provisions of §§21.909, 21.913, 74.939 and 74.985 regarding the protection of response station hubs and booster service areas from harmful electromagnetic interference, and including protection of stations authorized pursuant to §§21.940 and 74.940 from harmful electromagnetic interference, using the appropriately adjusted interference protection values based upon the ratio of the bandwidths in use; and

(3) Except as provided in §21.27(d) or §74.911(e), as appropriate, be permitted to file applications to convert associated I channels to point-to-multipoint transmissions at any time. I channels used for point-to-multipoint transmissions shall be afforded interference protection in the same manner as other point-to-multipoint MDS and ITFS facilities, with appropriate adjustment of the interference protection values for bandwidth. Notwithstanding any other provision of Parts 21 and 74, applications to convert associated I channels to point-to-multipoint transmissions, meeting the requirements of §74.939(l)(1) and (2), shall cut-off applications that are filed on a subsequent day for facilities that would cause harmful electromagnetic interference to the proposed point-to-multipoint operations; and

(4) Notwithstanding the provisions of §§21.30(a)(4) and 74.912, and except as provided in §21.27(d) or §74.911(e), as appropriate, be subject to a petition to deny an application to convert associated I channels to point-to-multipoint transmissions that is filed no later than the sixtieth (60th) day after the date of public notice announcing the filing of such application or major amendment thereto. Notwithstanding §§21.31 and 74.911(d), and except as provided in §21.27(d) or §74.911(e), as appropriate, an application to convert associated I channels to point-to-multipoint transmissions that meets the requirements of this subsection shall be granted on the sixty-first (61st) day after the Commission shall have given public notice of the acceptance for filing of it, or of a major amendment to it if such major amendment has been filed, unless prior to such date either a party in interest timely files a formal petition to deny or for other relief pursuant to §21.30(a) or §74.912, or the Commission notifies the applicant that its application will not be granted. Where an application is granted pursuant to the provisions of this subsection, the conditional licensee or licensee shall maintain a copy of the application at the I channels station until such time as the Commission issues an I channels station license for point-to-multipoint transmissions; and

(5) Where an application is granted under this subsection, and a facility operated pursuant to that grant causes harmful, unauthorized interference to any cochannel or adjacent channel facility, promptly remedy the interference or immediately cease operations of the interfering facility, regardless of whether any petitions to deny or for other relief were filed against the application during the application process. The burden of proving that a facility operated under this subsection is not causing harmful, unauthorized interference lies on the licensee of the alleged interfering facility, following the filing of a documented complaint of interference by an affected party.

(m) A response station may be operated unattended. The overall performance of the response station transmitter shall be checked by the hub licensee as often as necessary to ensure that it is functioning in accordance with the requirements of the Commission's rules. The licensee of a response station hub is responsible for the proper operation of all associated response stations and must have reasonable and timely access to all station transmitters. Response stations shall be installed and maintained by the licensee of the associated hub station, or the licensee's employees or agents, and protected in such manner as to prevent tampering or operation by unauthorized persons. No response hub may lawfully communicate with any response station which has not been installed by an authorized person, and each response station hub licensee is responsible for maintaining, and making available to the Commission upon request, a list containing the customer name and site location (street address and latitude/longitude to the nearest second) of each associated response station, plus the technical parameters (*e.g.*, EIRP, emission, bandwidth, and antenna pattern, height, orientation and polarization) pertinent to each specific response station.

(n) The transmitting apparatus employed at ITFS response stations shall have received type certification.

(o) An ITFS response station shall be operated only when engaged in communication with its associated ITFS response station hub or ITFS station, or for necessary equipment or system tests and adjustments. Radiation of an unmodulated carrier and other unnecessary transmissions are forbidden.

(p) At least 20 days prior to the activation of a response station transmitter located within a radius of 1960 feet of a registered or previously-applied-for ITFS receive site, the response station hub licensee must notify, by certified mail, the licensee of the ITFS site of the intention to activate the response station. The notification must contain the street address and geographic coordinates (to the nearest second) of the response station, a specification of the station's EIRP, antenna pattern/orientation/height AMSL, channel(s) to be used, as well as the name and telephone number of a contact person who will be responsible for coordinating the resolution of any interference problems.

(q) Interference calculations shall be performed in accordance with Appendix D to the *Report and Order* in MM Docket No. 97-217, FCC 98-231, "Methods For Predicting Interference From Response Station Transmitters and To Response Station Hubs and For Supplying Data on Response Station Systems." Compliance with the out-of-band emission limitations shall be established in accordance with §21.908(e)

38. New Section 74.940 is added, to read as follows:

§74.940 Individually licensed 125 kHz channel ITFS response stations.

(a) The provisions of §74.939(a), (e), (h), (j), (k), (n) and (o), also shall apply with respect to authorization of a 125 kHz channel(s) ITFS response station not under a response station hub license. The applicant shall comply with the requirements of §21.902, and §21.938 where appropriate, including the provisions of §§21.909, 21.913, 74.939 and 74.985 regarding the protection of response station hubs and booster service areas from harmful electromagnetic interference, using the appropriately adjusted interference protection values based upon the ratio of the bandwidths in use, where the authorized or previously-proposed cochannel or adjacent channel station is operated or to be operated in a system with one or more response station hub(s).

(b) An application for a license to operate a new or modified 125 kHz channel(s) ITFS response station not under a response station hub license shall be filed with the Commission in Washington, DC, on FCC Form 330. The applicant shall supply the following information on that form for each response station:

(1) The geographic coordinates and street address of the ITFS response station transmitting antenna; and

(2) The manufacturer's name, type number, operating frequency, and power output of the proposed ITFS response station transmitter; and

(3) The type of transmitting antenna, power gain, azimuthal orientation and polarization of the major lobe of radiation in degrees measured clockwise from True North; and

(4) A sketch giving pertinent details of the ITFS response station transmitting antenna installation including ground elevation of the transmitter site above mean sea level; overall height above ground, including appurtenances, of any ground-mounted tower or mast on which the transmitting antenna will be mounted or, if the tower or mast is or will be located on an existing

building or other manmade structure, the separate heights above ground of the building and the tower or mast including appurtenances; the location of the tower or mast on the building; the location of the transmitting antenna on the tower or mast; and the overall height of the transmitting antenna above ground.

(c) Each ITFS response station licensed under this section shall comply with the following:

(1) No ITFS response station shall be located beyond the protected service area of the ITFS station with which it communicates; and

(2) No ITFS response station shall operate with a transmitter output power in excess of 2 watts; and

(3) No ITFS response station shall operate at an excess of 16 dBW EIRP.

(d) During breaks in communications, the unmodulated carrier frequency shall be maintained within 35 kHz of the assigned frequency at all times. Adequate means shall be provided to insure compliance with this rule.

(e) Each ITFS response station shall employ a directive transmitting antenna oriented towards the transmitter site of the associated ITFS station or towards the response station hub with which the ITFS response station communicates. The beamwidth between half power points shall not exceed 15º and radiation in any minor lobe of the antenna radiation pattern shall be at least 20 dB below the power in the main lobe of radiation.

(f) A response station may be operated unattended. The overall performance of the response station transmitter shall be checked by the licensee of the station or hub receiving the response signal, or by the licensee's employees or agents, as often as necessary to ensure that the transmitter is functioning in accordance with the requirements of the Commission's rules. The licensee of the station or hub receiving the response signal is responsible for the proper operation of the response station and must have reasonable and timely access to the response station transmitter. The response station shall be installed and maintained by the licensee of the associated station or hub, or the licensee's employees or agents, and protected in such manner as to prevent tampering or operation by unauthorized persons. No response station which has not been installed by an authorized person may lawfully communicate with any station or hub.

39. Section 74.950 is deleted in its entirety.

40. In Section 74.951, subsection (b) is revised to read as follows:

§74.951 Modification of transmission systems.

* * * * *

(b) Any change in the antenna system affecting the direction of radiation, directive radiation pattern, antenna gain, or radiated power; provided, however, that a licensee may install a sectorized antenna system without prior consent if such system does not change polarization or

result in an increase in radiated power by more than one dB in any direction, and notice of such installation is provided to the Commission on FCC Form 331 within ten (10) days of installation.

* * * * *

41. Section 74.952 is revised to read as follows:

§74.952 Acceptability of equipment for licensing.

ITFS transmitters must be type certified by the Commission for the particular signals that will be employed in actual operation. Either the manufacturer or the licensee must obtain transmitter certification for the transmitter by filing an application for certification with appropriate information concerning the signal waveforms and measurements.

42. In Section 74.961, subsection (a) is revised to read as follows:

§74.961 Frequency tolerance.

(a) The frequency of any ITFS station, or of any ITFS booster station authorized pursuant to §74.985(b), shall be maintained within ±1 kHz of the assigned frequency at all times when the station is in operation. ITFS booster stations authorized pursuant to §74.985(e) and ITFS response stations authorized pursuant to §74.939 shall employ transmitters with sufficient frequency stability to ensure that the emission stays within the authorized bandwidth. A transmitter licensed prior to November 1, 1991, that remains at the station site initially licensed and does not comply with this paragraph may continue to be used for its life if it does not cause harmful interference to the operation of any other licensee. Any non-conforming transmitter replaced after November 1, 1991, must be replaced by a transmitter meeting the requirements of this paragraph.

* * * * *

43. Section 74.965 is revised to read as follows.

§74.965 Posting of station license.

(a) The instrument of authorization, a clearly legible photocopy thereof, or the name, address and telephone number of the custodian of the instrument of authorization shall be available at each station, booster station authorized pursuant to §74.985(b) and ITFS response station hub. Each operator of an ITFS booster station shall post at the booster station the name, address and telephone number of the custodian of the notification filed pursuant to §74.985(e) if such notification is not maintained at the booster station.

(b) If an ITFS station, an ITFS booster station or an ITFS response station hub is operated unattended, the call sign and name of the licensee shall be displayed such that it may be read within the vicinity of the transmitter enclosure or antenna structure.

44. In Section 74.982, subsection (b) is revised, and new subsection (g) is added, to read as follows:

§74.982 Station identification.

* * * * *

(b) Except as otherwise provided in paragraphs (c) and (d) of this section, each instructional television fixed station solely utilizing analog transmissions shall transmit its call sign at the beginning and end of each period of operation and, during operation, on the hour. Visual or aural transmissions shall be employed.

* * * * *

(g) The provisions of §74.982(b) - (e) shall not apply to any ITFS licensee's station or transmissions where digital transmissions are utilized by the ITFS licensee on any of its licensed or shifted channels.

45. Section 74.985 is revised in its entirety, to read as follows:

§74.985 Signal booster stations.

(a) An ITFS booster station may reuse channels to repeat the signals of ITFS stations or to originate signals on ITFS channels. The aggregate power flux density generated by an ITFS station and all associated signal booster stations and all simultaneously operating cochannel response stations licensed to or applied for by the applicant may not exceed -73 dBW/m² (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel or 125 kHz bandwidths) at or beyond the boundary of the protected service area, as defined by §21.902(d)(1) of this chapter, of the main ITFS station whose channels are being reused, as measured at locations for which there is an unobstructed signal path, unless the consent of the cochannel licensee is obtained.

(b) An ITFS licensee or conditional licensee who is a response station hub licensee, conditional licensee or applicant may secure a license for an ITFS signal booster station that has a maximum power level in excess of -9 dBW EIRP (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth) and that employs only digital modulation with uniform power spectral density in accordance with the Commission's *Declaratory Ruling and Order*, 11 FCC Rcd 18839 (1996) (a "high-power ITFS signal booster station"). The applicant for a high-power ITFS signal booster station shall file FCC Form 331 with the Commission in Washington, DC, and certify on that form that the applicant has complied with the additional requirements of §74.985(b). Failure to certify compliance and to comply completely with the following requirements of §74.985(b) shall result in dismissal of the application or revocation of the high-power ITFS signal booster station license, and may result in imposition of a monetary forfeiture. The applicant for a high-power ITFS signal booster station additionally is required to submit to International Transcription Services, Inc., 1231 20th Street, N.W., Washington, DC 20036, both in hard copy, and on a 3.5" computer diskette in

ASCII, and likewise to submit to the Commission, only upon Commission staff request, duplicates of the Form 331 filed with the Commission, and the following information:

(1) A demonstration that the proposed signal booster station site is within the protected service area, as defined in §§21.902(d)(1) of this chapter, of the main ITFS station whose channels are to be reused; and

(2) A demonstration that the booster service area is entirely within the protected service area of the ITFS station whose channels are being reused, or in the alternative, that the licensee entitled to any cochannel protected service area which is overlapped by the proposed booster service area has consented to such overlap; and

(3) A demonstration that the proposed booster service area can be served by the proposed booster without interference; and

(4) A study which demonstrates that the aggregate power flux density of the ITFS station and all associated booster stations and simultaneously operating cochannel response stations licensed to or applied for by the applicant does not exceed -73 dBW/m^2 (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel or 125 kHz bandwidths) at or beyond the boundary of the protected service area of the main ITFS station whose channels are to be reused, as measured at locations for which there is an unobstructed signal path, unless the consent of affected licensees has been obtained; and

(5) In lieu of the requirements of §74.903, a study which demonstrates that the proposed signal booster station will cause no harmful interference (as defined in §74.903(a)(1) and (2)) to cochannel and adjacent channel, authorized or previously-proposed ITFS and MDS stations with protected service area center coordinates as specified in §21.902(d), to any authorized or previously-proposed response station hubs, booster service areas, or I channel stations associated with such ITFS and MDS stations, or to any previously-registered ITFS receive sites, within 160.94 kilometers (100 miles) of the proposed booster station's transmitter site. Such study shall consider the undesired signal levels generated by the proposed signal booster station, the main station, all other licensed or previously-proposed associated booster stations, and all simultaneously operating cochannel response stations licensed to or applied for by the applicant. In the alternative, a statement from the affected MDS or ITFS licensee or conditional licensee stating that it does not object to operation of the high-power ITFS signal booster station may be submitted; and

(6) A description of the booster service area; and

(7) A certification that copies of the materials set forth in §74.985(b) have been served upon the licensee or conditional licensee of each station (including each response station hub and booster station) required to be studied pursuant to §74.985(b)(5), and upon any affected holder of a BTA or PSA authorization pursuant to §74.985(b)(4).

(c) Applications for high-power ITFS signal booster station licenses shall be deemed minor change applications and, except as provided in §74.911(e), may be filed at any time.

Notwithstanding any other provision of Part 74, applications for high-power ITFS signal booster station licenses meeting the requirements of §74.985(b) shall cut-off applications that are filed on a subsequent day for facilities that would cause harmful electromagnetic interference to the proposed booster stations.

(d) Notwithstanding the provisions of §74.912 and except as provided in §74.911(e), any petition to deny an application for a high-power ITFS signal booster station license shall be filed no later than the sixtieth (60th) day after the date of public notice announcing the filing of such application or major amendment thereto. Notwithstanding §74.911(d) and except as provided in §74.911(e), an application for a high-power ITFS signal booster station license that meets the requirements of §74.985(b) shall be granted on the sixty-first (61st) day after the Commission shall have given public notice of the acceptance for filing of it, or of a major amendment to it if such major amendment has been filed, unless prior to such date either a party in interest timely files a formal petition to deny or for other relief pursuant to §74.912, or the Commission notifies the applicant that its application will not be granted. Where an application is granted pursuant to the provisions of this subsection, the conditional licensee or licensee shall maintain a copy of the application at the ITFS booster station until such time as the Commission issues a high-power ITFS signal booster station license.

(e) Eligibility for a license for an ITFS signal booster station that has a maximum power level of -9 dBW EIRP (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth) (a "low-power ITFS signal booster station") shall be restricted to an ITFS licensee or conditional licensee. A low-power ITFS signal booster station may operate only on one or more ITFS channels that are licensed to the licensee of the ITFS booster station, but may be operated by a third party with a fully-executed lease or consent agreement with the ITFS conditional licensee or licensee. An ITFS licensee or conditional licensee may install and commence operation of a low-power ITFS signal booster station for the purpose of retransmitting the signals of the ITFS station or for originating signals. Such installation and operation shall be subject to the condition that for sixty (60) days after installation and commencement of operation, no objection or petition to deny is filed by an authorized cochannel or adjacent channel ITFS or MDS station with a transmitter within 8.0 kilometers (5 miles) of the coordinates of the low-power ITFS signal booster station. An ITFS licensee or conditional licensee seeking to install a low-power ITFS signal booster station under this rule must, within 48 hours after installation, submit FCC Form 331 to the Commission in Washington, DC, and submit to International Transcription Services, Inc., 1231 20th Street, N.W., Washington, DC 20036, both in hard copy, and on a 3.5" computer diskette in ASCII, duplicates of the Form 331 filed with the Commission, and the following (which also shall be submitted to the Commission only upon Commission staff request at any time):

(1) A description of the signal booster technical specifications (including an antenna envelope plot or, if the envelope plot is on file with the Commission, the make and model of the antenna, antenna gain and azimuth), the coordinates of the booster, the height of the center of radiation above mean sea level, the street address of the signal booster, and a description of the booster service area; and

(2) A demonstration that the booster service area is entirely within the protected service area of the station whose channels are being reused, or, in the alternative, that the licensee entitled to any protected service area which is overlapped by the proposed booster service area has consented to such overlap; and

(3) A demonstration that the proposed booster service area can be served by the proposed booster without interference; and

(4) A certification that no Federal Aviation Administration determination of No Hazard to Air Navigation is required under Part 17 of this chapter or, if such determination is required, either

(i) a statement of the FCC Antenna Structure Registration Number; or

(ii) if an FCC Antenna Structure Registration Number has not been assigned for the antenna structure, the filer must indicate the date the application by the antenna structure owner to register the antenna structure was filed with the FCC in accordance with Part 17 of this chapter; and

(5) A certification that

(i) The maximum power level of the signal booster transmitter does not exceed -9 dBW EIRP (or, when subchannels or superchannels, or 125 kHz channels, are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel, or 125 kHz, bandwidth); and

(ii) Where the booster is operating on channel D4, E1, F1, E2, F2, E3, F3, E4, F4 and/or G1, no registered receiver of an ITFS E or F channel station, constructed prior to May 26, 1983, is located within a 1 mile (1.61 km) radius of the coordinates of the booster, or in the alternative, that a consent statement has been obtained from the affected ITFS licensee; and

(iii) The applicant has complied with §1.1307 of this chapter; and

(iv) Each MDS and/or ITFS station licensee (including the licensees of booster stations and response station hubs) with protected service areas and/or registered receivers within a 8 km (5 mile) radius of the coordinates of the booster has been given notice of its installation; and

(v) The signal booster site is within the protected service area of the ITFS station whose channels are to be reused; and

(vi) The aggregate power flux density of the ITFS station and all associated booster stations and simultaneously operating cochannel response stations licensed to or applied for by the applicant does not exceed -73 dBW/m^2 (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel or 125 kHz bandwidths) at or beyond the boundary of the protected service area of the main ITFS

station whose channels are to be reused, as measured at locations for which there is an unobstructed signal path, unless the consent of affected licensees has been obtained; and

(vii) The antenna structure will extend less than 6.10 meters (20 feet) above the ground or natural formation or less than 6.10 meters (20 feet) above an existing manmade structure (other than an antenna structure); and

(viii) The ITFS conditional licensee or licensee understands and agrees that in the event harmful interference is claimed by the filing of an objection or petition to deny, the conditional licensee or licensee must terminate operation within two (2) hours of notification by the Commission, and must not recommence operation until receipt of written authorization to do so by the Commission.

(f) Commencing upon the filing of an application for a high-power ITFS signal booster station license and until such time as the application is dismissed or denied or, if the application is granted, a letter informing the Commission of completion of construction is submitted, an applicant for any new or modified MDS or ITFS station (including any response station hub, high-power booster station, or I channels station) shall demonstrate compliance with the interference protection requirements set forth in §§21.902(i), 21.938(b)(3) or 74.903 with respect to any previously-proposed or authorized booster service area both using the transmission parameters of the high-power ITFS signal booster station (*e.g.*, EIRP, polarization(s) and antenna height) and the transmission parameters of the ITFS station whose channels are to be reused by the high-power ITFS signal booster station. Upon the submission of a letter informing the Commission of completion of construction of an ITFS booster station applied for pursuant to §74.985(b), or upon the submission of an ITFS booster station notification pursuant to §74.985(e), the ITFS station whose channels are being reused by the ITFS signal booster shall no longer be entitled to interference protection pursuant to §§21.902(i), 21.938(b)(3) and 74.903 within the booster service area based on the transmission parameters of the ITFS station whose channels are being reused. A booster station shall not be entitled to protection from interference caused by facilities proposed on or prior to the day the application or notification for the booster station is filed. A booster station shall not be required to protect from interference facilities proposed on or after the day the application or notification for the booster station is filed.

(g) Where an application is granted under §74.985(d), if a facility operated pursuant to that grant causes harmful, unauthorized interference to any cochannel or adjacent channel facility, it must promptly remedy the interference or immediately cease operations of the interfering facility, regardless of whether any petitions to deny or for other relief were filed against the application during the application process. The burden of proving that a high-power ITFS signal booster station is not causing harmful, unauthorized interference lies on the licensee of the alleged interfering facility, following the filing of a documented complaint of interference by an affected party.

(h) In the event any MDS or ITFS receive site suffers interference due to block downconverter overload, the licensee of each signal booster station within five miles of such receive site shall cooperate in good faith to expeditiously identify the source of the interference. Each licensee of a signal booster station contributing to such interference shall bear the joint and several obligation to promptly remedy all interference resulting from block downconverter overload at

any ITFS receive site registered prior to the submission of the application or notification for the signal booster station or at any receive site within an MDS or ITFS protected service area applied for prior to the submission of the application or notification for the signal booster station, regardless of whether the receive site suffering the interference was constructed prior to or after the construction of the signal booster station(s) causing the downconverter overload; provided, however, that the licensee of the registered ITFS receive site or the MDS or ITFS protected service area must cooperate fully and in good faith with efforts by the signal booster station licensee to prevent interference before constructing the signal booster station and/or to remedy interference that may occur. In the event that more than one signal booster station licensee contributes to block downconverter interference at a MDS or ITFS receive site, the licensees of the contributing signal booster stations shall cooperate in good faith to remedy promptly the interference.

46. In Section 74.986, paragraph (a) is revised, and new paragraph (a)(8) is added, to read as follows:

§74.986 Involuntary ITFS station modifications.

(a) Parties specified in paragraph (b) of this section may, subject to Commission approval, involuntarily modify the facilities of an existing ITFS licensee in the following situations:

* * * * *

(8) There are no response station hubs licensed to or previously-proposed by any of the parties specified in paragraph (b) of this section, in the same system as the existing ITFS licensee of whose facilities involuntary modification is sought; however, in no event shall the Commission approve an involuntary retuning of an existing ITFS licensee's station to other frequencies, except as provided in §74.902(i) - (k).

* * * * *

METHODS FOR PREDICTING INTERFERENCE FROM RESPONSE STATION TRANSMITTERS AND TO RESPONSE STATION HUBS AND FOR SUPPLYING DATA ON RESPONSE STATION SYSTEMS.

This document sets out the methodology to be used in carrying out three requirements with respect to response stations used as part of two-way cellularized MDS and ITFS systems. It details the methods for conducting interference studies from response stations to other systems; it details the methods for calculating interference protection for response station hubs; and it defines a file format to be used in submitting data in response station hub applications. It also describes the propagation analysis techniques to be used in these studies.

Four Major Steps for Response Station Interference Analysis

In carrying out the studies of interference from response station transmitters, the aggregate power of the interfering signals to be expected from the response station transmitters shall be determined using a process comprising four major steps, as described below. First, a grid of points shall be defined that is statistically representative of the distribution of transmitters to be expected within the response service area, and the elevations to be associated with each of them shall be determined. Second, any regions and any classes of response stations to be used shall be defined. Third, the appropriate transmitter configuration to be used in each interference study shall be determined. Fourth, the equivalent power of each of the representative transmitters shall be determined and used in the various required interference studies. The parameters used in the studies shall be provided in a prescribed electronic form as described later in this document.

Defining Grid of Points for Analysis

Since it is impossible to know *a priori* where response stations will be located, a grid of points is used to represent statistically, in a relatively small number of locations, the potentially much larger number of response stations that are likely to be installed in the areas surrounding each of the points. Once defined, the same grid of points shall be used by all parties conducting interference analyses involving the subject response station system.

Defining the representative grid of points to use in all the interference studies required in Rule Sections 21.909 and 74.939 begins by geographically defining the response service area (RSA) of the response station hub (RSH). This may be done using either a list of coordinates or a radius from the response station hub location. When coordinates are used, straight lines shall interconnect one location with the next in the order given in the list, and the last location described shall be connected to the first location by a straight line. When a radius from the response station hub location is used, the value shall be expressed in miles, with any fractional part expressed as a decimal value to three places. The boundaries described are administrative and serve to circumscribe the area in which response station transmitters may be located.

The characteristics of any sectors in the RSH receiving antenna also must be described in two ways: geographically, so as to limit the locations from which response stations will transmit to each sector, and electrically, by providing data on the electrical field response of the antenna pattern in each sector. Sectors may overlap one another geographically. The geographic boundaries of a sector shall be defined using either a list of coordinates or a list of bearings. Electrical field response data shall be relative to the direction of maximum response of the sector antenna and shall be provided every one (1) degree completely around the antenna. Both azimuth and elevation field patterns shall be supplied for each polarization to be used with a given antenna type. The geographic orientation of each sector to the nearest degree and the polarization in each sector also shall be specified. When response stations share channels or sub-channels by transmitting simultaneously on them, the maximum number of response stations that will be permitted to transmit simultaneously within each sector must be specified.

The RSA may be subdivided into regions to allow different characteristics to be used for response stations in different portions of the RSA. (For details on regions and their use, see the section below on Defining Regions and Classes for Analysis.) Any regions to be used when analyzing interference must also be described in a manner similar to that used to describe the RSA itself. Analysis of the regions involves use of one or more classes of response station characteristics. For each such class, a combination must be specified of the maximum antenna height, the maximum equivalent isotropic radiated power (EIRP), and the worst case antenna pattern that will be used in practice in installations of response stations associated with that class within the respective regions. (For details on classes and their use, see the section below on Defining Regions and Classes for Analysis.) When response stations share channels or sub-channels by transmitting simultaneously on them, the maximum number of response stations associated with each class that will be permitted to transmit simultaneously within each region and each sector must be specified.

To define the grid of points, a line is first established surrounding the RSA, following the shape of the RSA boundary, ½ mile outside the RSA, and never more than ½ mile from the RSA boundary at any point. This is termed the “analysis line” and will be used in determining that an adequate number of grid points representing transmitters is being used in the interference analyses. A starting point is defined on the analysis line due north (true) of the response station hub. A series of analysis points is then spaced along the analysis line with the starting point being one of those points. The analysis points must occur with a spacing no greater than every ½ mile along the analysis line or every 5 degrees (as seen from the response station hub), whichever yields the largest number of analysis points. When an RSA has a non-circular shape, the choice of distance along the analysis line or angle from the response station hub must be made for each portion of the line so as to maximize the number of analysis points in that portion. The analysis points are to be described by their geographic coordinates. (The results of this method are that, for a circular RSA, a minimum of 72 analysis points will be used, and that, for portions of the analysis line of any RSA more than 5.73 miles from the response station hub, the distance method will be used.)

Next, the grid of points is defined within the RSA to statistically represent the response stations. The grid uses uniform, square spacing of the points, as measured in integer seconds of latitude and longitude, with the first square surrounding the RSH and with its points equidistant from it. The lines connecting the points on one side of any grid square point true north, east, south, or west. The grid is defined so as to include all points within or on the boundary of the RSA, with the exceptions

noted below. The result is that the grid can be defined by only two values — the coordinates of the hub and the separation between adjacent grid points in seconds — combined with the description of the RSA boundary.

Any points falling at locations at which it would be physically impossible to install a response station (such as in the middle of a lake, but not the middle of a forest) are removed from the grid. The points of the grid so removed are to be described by their geographic coordinates.

The grid of points is then divided into two groups. The division is to be done using a checkerboard pattern so that alternating points along the east-west and north-south axes belong to opposite groups and points along any diagonal line belong to the same group.

The combination of the grid of points within the RSA and the points on the analysis line is next used to determine that the number of grid points is truly representative of a uniform distribution of response station transmitters within the RSA. This is done by conducting a power flux density analysis from each grid point within the RSA to each point on the analysis line. For this analysis, a single response station should be assumed to be located at each grid point, that response station having the combined worst case antenna pattern without regard to polarization of all response station classes assigned to that grid point and the maximum EIRP of any response station class assigned to that grid point. (For details on the method for determining the combined worst case antenna pattern, see the section below on Defining Regions and Classes for Analysis.) The response station antennas all should be oriented toward the response station hub.

The analysis of grid point adequacy should be done using free space path loss over flat earth only and should not include the effects of terrain in the calculation of received signal levels. At each point on the analysis line, the power flux density from all grid points in each group of the checkerboard pattern should be aggregated. This is done by converting power received from each assumed transmitter from dBW/m^2 to W/m^2, summing the power in W/m^2 from all transmitters in each group, and then converting the sum back to dBW/m^2.

After the aggregated power flux density from each of the two groups has been calculated, the received power flux densities from the two groups are compared at each of the points on the analysis line. The power flux densities from the two groups must be within 3 dB of one another at each of the points on the analysis line. In addition, there must be no closer spacing of grid points that allows a difference of greater than 3 dB between the groups. If the power flux densities of both groups are within 3 dB at every analysis point, a sufficient number of grid points is included for use in further analyses. If they are not within 3 dB at every analysis point, a larger number of grid points (i.e., closer spacing of grid points) must be used so that the 3 dB criterion is met.

In cases in which sectorized response station hubs are used, a further test is required to assure that an adequate number of grid points is used. In addition to meeting the requirements of the preceding paragraph, each sector must contain a number of grid points equal to or greater than the distance from the hub to the furthest point in the sector, expressed in miles, divided by two, with a minimum of five grid points per sector. Should an insufficient number of grid points fall within any sector after meeting the 3 dB criterion, the point spacing for the entire RSA must be decreased until this additional requirement is satisfied.

Once the geographic locations of the grid points are determined, the elevations to be attributed to each must be decided. This is done by creating a geographic square uniformly spaced around each grid point having a width and a height equal to the spacing between grid points and oriented in the same directions as the lines between grid points used to lay out the grid structure. Each such square is then examined with respect to all of the data points of the U.S. Geological Survey (USGS) 3-second database falling within the square to find the elevation of the highest such data point, expressed in feet. That elevation is ascribed to the associated grid point and shall be used for the elevation of that grid point in all further and future analyses of the response station system.

Defining Regions and Classes for Analysis

To provide flexibility in system design, regions may optionally be created within response service areas. Regions may be of arbitrary size, shape, and location. The territory within a region must be contiguous. Regions within a single RSA may not overlap one another. Within regions, response stations are apt to be randomly distributed and for analysis purposes are to be assumed to be uniformly distributed. Regions are to be defined by their boundaries in the same manner as are response service areas. (For details on describing boundaries, see the section above on Defining Grid of Points for Analysis.)

Within each region, at least one class of response station with defined characteristics must be specified to match the interference predicted to be caused with the types of installations to be made. The classes are to be used in interference analyses and to provide limitations on the installations that may be made in the related region. The characteristics of each such class of response stations shall include the maximum height above ground level (AGL) for antennas, the maximum equivalent isotropic radiated power (EIRP), and the combined worst-case antenna radiation pattern – for each polarization when both are used – for all response stations of that class to be installed. When response stations share a channel by transmitting simultaneously (see section below on Determining Transmitter Configuration), for each class of response stations within each region, the maximum number of such response stations that may transmit simultaneously on any channel or sub-channel shall be specified.

The combined worst-case antenna azimuth radiation pattern is required to be specified collectively for all of the classes of response stations located at each grid point (in the procedure above, in the section on Defining Grid of Points for Analysis, for confirming that the required number of grid points is specified) and individually for each of the classes defined for each region of the RSA. In the case of the collective pattern used to determine adequacy of the number of grid points, if both polarizations are used in the system, the horizontally- and vertically-polarized azimuth patterns of each antenna should be treated as deriving from separate antennas and should be combined with one another and with the patterns from all the other antennas at that grid point. In the cases of the individual patterns for each class used for interference analyses, if both polarizations are used in the system, the horizontally- and vertically-polarized combined worst-case azimuth patterns should be determined separately for all classes defined. Similarly, the cross-polarized worst-case patterns should be determined for each polarization.

These combined worst-case patterns are derived by setting the maximum forward signal power of all antenna types to be used within the class or classes to the same value and then using the highest level of radiation in each direction from any of the antennas as the value in that direction for the

combined antenna pattern. The same method is used to determine both plane- and cross-polarized patterns, which are used separately in interference analyses. The combined worst-case plane- and cross-polarized patterns for each class will be used in all of the interference studies and are not to be exceeded in actual installations of response stations within a class to which the pattern applies.

Determining System Configuration

Several factors in the configuration of a system determine whether or not transmitters located at specific grid points could cause interference to particular neighboring systems. In order to simplify the study of interference to those neighbors, the system configuration is taken into account so as to reduce the number of calculations required by eliminating the study of interference from specific grid points when possible. The main factor that determines whether to eliminate certain grid points from consideration is terrain blockage.

When grid points are completely blocked from line-of-sight to any part of a neighboring system, they can be eliminated from the aggregation of power used in calculating interference to that system. To determine whether to eliminate a grid point for this reason, a shadow study can be conducted from each grid point in the direction of the neighboring system. Separate studies can be conducted for classes of response stations that have different maximum elevations above ground. If there is no area within the protected service area or at any of the registered receiving locations of the neighboring system to which a particular class of station at a grid point has line-of-sight, it can be eliminated from the calculations that determine the power of interfering signals at the neighbor's location. Alternatively, lack of line-of-sight can be evaluated from each class at each grid point to each location analyzed within the neighboring system (see section below on Calculating Aggregated Power from Transmitters), and grid points can be eliminated on a location-by-location basis, if that process is more easily implemented.

There are two ways in which a large number of response stations can share channels: They can take turns using the channels so that only one transmitter will be turned on at any particular instant on each channel or sub-channel being received by a separate receiver in the system, or they can transmit at the same time and use special filtering techniques at the receiver to separate the signals they are sending simultaneously to that receiver. These two cases will result in different levels of power being radiated into neighboring systems, and therefore they must be analyzed slightly differently.

In the case of response stations that take turns using a channel or sub-channel, the grid point and class of station that produces the worst case of interference to each analyzed location in the neighboring system must be determined for each group of response stations that share a channel (e.g., within a response station hub receiving antenna sector). In this case, the interfering signal source can be treated as a single transmitter occupying the full bandwidth of the channel or sub-channels used from that location and having a power level equal to the aggregate of the power transmitted on all of the sub-channels, if sub-channels are used.

In the case of response stations that simultaneously share a channel or sub-channel, the grid point and class of station that produces the worst case of interference to each analyzed location in the neighboring system must be determined for each group of response stations that share a channel (e.g., within a response station hub receiving antenna sector). In this case, the interfering signal source can be treated as a single grid point at which are located all of the simultaneously operating transmitters, occupying the full bandwidth of the channel or sub-channels used from that location,

and having a power level equal to the aggregate of the power transmitted by all of the response stations operating simultaneously on all of the sub-channels, if sub-channels are used.

In cases of shared-channel operation in which the number of simultaneously operating response stations of a class is limited by a region that crosses sector boundaries, the number of such response stations considered within some sectors may be limited so that the total included in the analysis in all sectors does not exceed the total permitted for the region. The objective in analyzing these cases is to find the worst case situation with regard to the maximum number of simultaneously operating transmitters, assigning them collectively to the locations at which they cause the most interference to each location analyzed within neighboring systems, while respecting the limits imposed on the number of such transmitters by sector and by region. A statement describing in detail the process or algorithm followed in selecting the number and classes of response stations analyzed at each grid point shall be appended to the application and distributed as a standard ASCII text file along with the data file described below in the section on the File Format.

An example of the case just described of shared-channel operation with the number of simultaneously operating transmitters limited both by region and by sector is one in which a region comprises an annular ring that stretches from half the radius to the full radius of a circular RSA. The region has a limit of 200 simultaneously operating transmitters of a particular class, and each of 20 sectors is limited to 20 simultaneously operating transmitters. If the worst case interference from each sector were caused by the subject class and all were used in analyzing interference to a neighboring system, the result would be the use of 400 such response stations (20 x 20) in the analysis, while the region is limited to 200. Consequently, the 10 regions (10 x 20 meets the limit of 200) causing the most interference to the neighbor would be selected, and, in the other 10 sectors, the classes of station causing the second largest amount of interference to the neighbor would be selected for use in the analysis. In choosing the secondary interfering response station classes, the same type of limitations would have to be observed. The process for making these selections based on the appropriate limitations would have to be followed for each analyzed point in the neighboring system.

Calculating Aggregated Power from Transmitters

The final major step in calculating interference from response station transmitters is the calculation of the equivalent isotropic radiated power (EIRP) to be attributed to each of the selected grid points in the various interference studies so as to be representative of the number of response stations that are expected to be in operation simultaneously within the RSA. When analyzing systems in which the response stations take turns using a channel or sub-channels, this means, for each location analyzed in the system to be protected, selecting the grid point and class of station within each sector that radiates the strongest signal to that location and aggregating the power from all such selected grid points and classes, using the maximum EIRP (for all sub-channels taken together), the maximum antenna height, and the worst case antenna pattern for a single station of that class at each selected grid point. For systems in which response stations simultaneously share the channel or sub-channels to each receiver at each hub, substantially the same analysis is performed. The difference is that the maximum number of simultaneously operating response stations within each sector is placed at each selected grid point, in turn. The maximum EIRP (for all sub-channels taken together) for each regional class at each grid point or additional point, expressed in dBW, is converted to Watts. The power is then multiplied by the number of simultaneously operating transmitters in the

regional class assigned to that grid point or additional point, and the resulting power in Watts is converted back to dBW. When the number of simultaneously operating transmitters within a sector in the class and at the grid point that causes the most signal to be propagated to a location in the neighboring system does not equal the number of simultaneously operating transmitters permitted in that sector, the grid point and class of station that cause the next largest amount of signal to be so propagated shall be used to account for the remaining number of simultaneously operating transmitters permitted in the sector, and so on as necessary. At each location analyzed within the neighboring system, the power received from the selected grid points within each sector is aggregated through conversion from dBW to Watts, addition of power levels, and conversion back to dBW. In each case, the values so calculated are the aggregated powers of all the simultaneously operating response station transmitters sharing the same channel(s) or sub-channel(s), from all sectors, for use as the undesired signal levels in interference analyses .In a system using both polarizations, the response stations represented by each grid point are to be assumed to use the polarization of the response station hub antenna sector in which they are located. The appropriate horizontal or vertical combined worst-case antenna pattern is to be used in interference studies depending upon the polarization of the sector in which each grid point is located. In a system using only one polarization, the effect of antenna sectors can be ignored and the choice between horizontal and vertical polarization patterns made identically for all grid points.

Finally, the aggregate power of each active regional class at each active grid point is used in conducting the required interference studies described in the relevant Rules. For example, to determine that the -73 dBW/m^2 limitation is met, a field strength contour is calculated by first calculating a matrix of field strengths from each regional class at each grid point in the RSA into the region of the PSA or other boundary to be protected using the terrain-based propagation analysis tool specified below (i.e., free space path loss plus reflection and multiple diffractions — see section below on Propagation Analysis Tool). The matrix represents an array of locations on a square grid separated by a short distance (no more than 1 mile). Once the protected area matrix is calculated from signals originating at each regional class at each grid point or additional point, the matrices are summed by first converting from dBW/m^2 to W/m^2, adding the field strength values from all regional classes at all grid points at each matrix point, and converting from W/m^2 back to dBW/m^2. The summed matrix is then used to route a protection contour by interpolating between matrix points. The contour so determined should not cross the boundary under consideration. When response stations partially or completely share channels, subchannels or superchannels with booster and/or primary stations within the same system, the interference contributions of these stations must be added to those of the response stations in order to determine the overall interference impact of the system and its conformance with applicable interference protection criteria.

Similar methods should be used in conducting the other interference studies required in this section. These include the desired-to-undesired (D/U) signal ratio studies for co-channel and adjacent channel interference. In all of these studies, the analysis should use the aggregate power of each regional class at each grid point or additional point, the worst case plane- or cross-polarized antenna pattern, as appropriate, for each regional class, with the antennas at each grid point aimed toward the response station hub, and the maximum antenna height above ground specified for each regional class at each grid point or additional point.

Protection to Response Station Hubs

Protection to response station hubs is required from two types of neighboring systems: those applied for or licensed prior to the licensing of the subject response station hub and those applied for or licensed subsequent to the licensing of the subject response station hub. In cases in which the neighboring system was licensed first, the protection to be provided to the response station hub after any modifications of the neighboring system shall be no less than that provided prior to the modifications. In cases in which the neighboring system is licensed later, the protection to be provided to the response station hub after construction of the neighboring system shall be such as not to degrade the noise floor of hub receivers by more that 1 dB for co-channel signals and 45 dB for adjacent channel signals. The methods to be used to determine the amount of protection provided or the amount of degradation follow.

For purposes of interference protection calculations, an applicant for a response station hub shall specify the geographic coordinates of the hub location and, for each sector, (1) the height of the antenna above ground (AGL) and above mean sea level (AMSL), (2) the hub receiving antenna pattern (both in azimuth and elevation, both co- and cross-polarized in the main vertical lobe), (3) the hub receiving antenna gain in the main lobe (in dBi), (4) the azimuth of the main lobe, (5) any mechanical tilt to be utilitized, and (6) the polarization of the receiving antenna.

The level of interference caused to a response station hub by either an existing or a new MDS or ITFS station shall be independently determined for each sector. In making such a determination, the power from all sources (main, booster, and response stations) related to a particular primary license of an individual licensee shall be aggregated to yield an effective power flux density of the interfering signal(s). The resulting summation can then be used for comparisons between old and new values when existing stations are modified or for comparison against the specified receiver degradation threshold for new stations that are proposed.

In calculating the effective power flux density value, the effective isotropic radiated power (EIRP) radiated in the direction of the response station hub from each main, booster, and/or response station (as represented by the selected grid points described earlier in the section Four Major Steps for Response Station Interference Analysis) of the neighboring system shall first be determined. The power arriving at the response station hub shall be analyzed using the propagation analysis tool described in the following section on that subject. The aggregation of power from all related sources shall take account of the angular displacement of each particular source from the peak of the main lobe of the receiving antenna and the relative polarization of each interfering signal source.

To determine the effective power flux density, the following formula shall be used:

$$PFD_{EFF} = 10\log_{10} \sum_{1}^{n} 10^{\frac{ISi + G_{REL}i}{10}} \qquad (1)$$

Where: PFD_{EFF} = *Effective Power Flux Density (dBW/m^2)*
n = *Number of Interfering Signal Sources (units)*

ISi = *Interfering Signal Power Flux Density of ith Source (dBW/m^2)*
$G_{REL}i$ = *Relative Gain of Hub Sector in Direction of ith Source (dB) (includes antenna discrimination & polarization effects)*

For neighboring systems licensed first, it is necessary to ascertain that the value of the effective power flux density after a modification, as predicted for each response station hub antenna sector, does not exceed the value predicted for the same sector prior to the modification. For new neighboring systems, an additional step is required to ascertain that the predicted value of the effective power flux density does not exceed the allowed threshold values for both co-channel and adjacent channel signals.

To calculate the relationship of the effective power flux density to the threshold values for co-channel and adjacent channel signals, the level of the noise floor of the hub receiver first must be figured. It is given by the formula:

$$P_{THERMAL} = 10\log\left[k\{{}^{5}/_{9}(T-32)+273\}BW\right] \quad (2)$$

Where: $P_{THERMAL}$ = *Noise Power from Thermal Sources (dBW)*
k = *Boltzmann's Constant* (1.380662 x 10^{-23})
T = *Noise Temperature* (*degrees Fahrenheit*)
BW = *Bandwidth* (*Hz*)

With a typical noise temperature of 63 deg. F and a bandwidth of 6 MHz, Equation 2 yields a thermal noise power of -136.2 dBW. The equivalent total power flux density of the thermal noise power plus the effective power flux density of the interfering signal(s) is given by:

$$PFD_{EQUIV} = 10\log_{10}\left(10^{\frac{PFD_{EFF}}{10}} + 10^{\frac{P_{THERMAL}-L_c+NF+G_{ANT}}{10}}\right) \quad (3)$$

Where: PFD_{EQUIV} = *Equivalent Total Power Flux Density (dBW / m^2)*
L_C = *Cable Losses (dB)*
NF = *Noise Figure of First Amplifier (dB)*
G_{ANT} = *Antenna Gain (dBi)*

Compliance with the limits for co-channel and adjacent channel interference from new stations to response station hubs can be determined by first calculating the equivalent total power flux density with the effective power flux density of the interference set to zero and then re-computing with the true effective power flux density. The two values found should not differ by more than 1 dB for co-channel interference nor by more than 45 dB for adjacent channel interference.

Propagation Model

When analyzing interference from response stations to other systems and from other systems to response station hubs, a propagation model shall be used that takes into account the effects of terrain and certain other factors. The model is derived from basic calculations described in NTIS Technical Note 101.[1] It is intended as a tool for analysis of wide area coverage of microwave transmissions, and it is available built into commercial propagation analysis software packages that are widely used by the MDS/ITFS industry for coverage and interference prediction.[2]

In the model described, two loss terms are computed — the free space path loss based solely on distance and the excess path loss (XPL) that derives from terrain obstacles and other elements in the environment. Among the inputs required for some implementations of the model are location and time variability factors. Other factors for such items as clutter and foliage losses can be considered by some software versions, but they will not be used in analyzing the systems considered herein.

The excess path loss portion of the calculation considers several conditions that impact signal propagation. These include whether the path is "line of sight" for the direct ray, whether there is 0.6 first Fresnel zone clearance, or whether the path is totally obstructed. When the path is unobstructed, a single ground reflection is added to the direct ray to determine path loss. When the first Fresnel zone is partially obstructed, an additional loss up to 6 dB is included by the model. When the path is totally obstructed, the path loss is calculated using the Epstein-Peterson method[3] that considers the diffraction losses over successive terrain obstacles. In this case, each obstacle is treated separately, with the preceding obstacle (or the transmitter, in the first instance) considered to be the transmitter and the succeeding obstacle (or the receiver, in the last instance) considered to be the receiver.

Some software implementations of the methods described herein may provide for setting parameters for both location and time variability in terms of the percentage of the locations or of the time that signals meet or exceed studied levels. For purposes of analyzing the interference from response stations and to response station hubs, both the location and the time variability factors shall be set to 50 percent in all cases. When available as a parameter, the confidence level shall be set to 50 percent.

In conducting analyses of interference from response stations, the minimum acceptable signal threshold shall be set to the noise floor for the bandwidth involved, as calculated per Equation 2 above. Thus for a 6 MHz channel, the minimum signal level considered would be -136.2 dBW or -106.2 dBm. As a result of this setting, when the desired signal falls below this level, the D/U ratio

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"Transmission Loss Prediction for Tropospheric Communication Circuits," Technical Note 101, NTIS Access Number AD 687-820, National Technical Information Service, US Department of Commerce, Springfield, VA.

An example of such a software implementation is the Free Space + RMD™ method included in some products of EDX Engineering, Inc.

J. Epstein and D.W. Peterson. "An experimental study of wave propagation at 850 Mc.," Proc. IRE, vol. 41, no. 5, pp. 595-611, May, 1953.

from any interfering signal source will be ignored. These studies shall be conducted based exclusively upon the levels of the desired and undesired signals without the addition of thermal noise.

Propagation Model Outline

For the purposes of these Rules, the propagation model has three basic elements that affect the predicted field strength at the receiver:

1) Line-of-Sight (LOS) mode, using basic two-ray theory with constraints

2) Non-line-of-sight (NLOS) mode, using multiple wedge diffraction

3) Partial first Fresnel zone obstruction losses applicable to either mode

The LOS and NLOS modes are mutually exclusive — a given path between a transmitter and a receiver is either LOS or not. The fundamental decision as to whether a path is LOS is based on the path geometry. That decision is described in the next subsection, which also defines the LOS mode for the model.

Line-of-Sight (LOS) Mode

The determination of whether a path between a transmitter and a receiver is LOS is made by comparing the depression angle of the path between the transmitter and receiver with the depression angle to each terrain elevation point along the path. The depression angle from transmitter to receiver is computed using an equation of the form:

$$\theta_{t-r} = \frac{h_r - h_t}{d_r} - \frac{d_r}{2a} \qquad (4)$$

where:

θ_{t-r} is the depression angle relative to horizontal from the transmitter to the receiver in radians

h_t is the elevation of the transmit antenna center of radiation above mean sea level in meters

h_r is the elevation of the receive antenna center of radiation above mean sea level in meters

d_r is the great circle distance from the transmitter to the receiver in meters

a is the effective earth radius in meters taking into account atmospheric refractivity

The atmospheric refractivity is usually called the K factor. A typical value of K is 1.333, and using the actual earth radius of 6340 kilometers, a equals 8451 kilometers, or 8,451,000 meters. For the purpose of these Rules, K = 1.333 shall be used.

Using an equation of the same form, the depression angle from the transmitter to any terrain

elevation point can be found as:

$$\theta_{t-p} = \frac{h_p - h_t}{d_p} - \frac{d_p}{2a} \tag{5}$$

where:

θ_{t-p} is the depression angle relative to horizontal for the ray between the transmitter and the point on the terrain profile

h_p is the elevation of the terrain point above mean sea level in meters

d_p is the great circle path distance from the transmitter to the point on the terrain path in meters

h_t and a are as defined above following Equation (4).

The variable θ_{t-p} is calculated at every point along the path between the transmitter and the receiver and compared to θ_{t-r}. If the condition $\theta_{t-p} > \theta_{t-r}$ is true at any point, then the path is considered NLOS and the model formulations in the subsection on Non-Line-of-Sight (NLOS) Mode below are used. If $\theta_{t-p} \leq \theta_{t-r}$ is true at every point, then the transmitter-receiver path is LOS and the formulations in this subsection apply.

For LOS paths, the field strength at the receiver is calculated as the vector combination of a directly received ray and a single reflected ray. This calculation is presented next. If the geometry is such that a terrain elevation point along the path between the transmitter and receiver extends into the 0.6 first Fresnel zone, then an additional loss ranging from 0 to 6 dB is included for partial Fresnel zone obstruction. This is discussed in a subsequent subsection.

Two-Ray Field Strength at the Receiver Using a Single Ground Reflection

For an LOS path, the field at the receiver consists of the directly received ray from the transmitter and a number of other rays received from a variety of reflecting and scattering sources. For low antenna heights (on either the transmit or receive end of the path) the field at the receiver is dominated by the direct ray and a single reflected ray which intersects the ground near the transmitter or receiver, whichever is nearer to the ground. The *height-gain function* in which a field at the antenna increases as the height of the antenna above ground increases is a direct result of the direct and ground reflection rays adding vectorially so that the magnitude of the resultant manifests this effect. The height-gain function is modeled here by considering the actual ground reflected ray and the direct ray in vector addition. The magnitude of the direct ray is given by:

$$E_r = \frac{1}{d_r}\sqrt{\frac{P_t G_t \eta}{4\pi}} \tag{6}$$

where E_r is the field strength at the receive point, P_T is the transmitter power delivered to the terminals of the transmit antenna, G_T is the transmit antenna gain in the direction of the receive point (or the ray departure direction), η is the plane wave free space impedance (377 ohms), and d_r is the path distance from the transmitter to the receive point in kilometers.

Written in dB terms, this reduces to:

$$E_r = 76.92 - 20.0\log(d_r) + P_T \qquad \text{dB}\mu\text{V/m} \tag{7}$$

In Equation (7), P_T is effective radiated power (ERP_d) in dBW. The magnitude and phase of the ground-reflected ray are found by first calculating the complex reflection coefficient as follows:

$$R = R_s\, g \tag{8}$$

where R_s is the smooth surface reflection coefficient and g is the surface roughness attenuation factor (a scalar quantity).

For parallel and perpendicular polarizations, respectively, the smooth surface reflection coefficients are:

$$R_{s\parallel} = \frac{\varepsilon\sin\gamma_0 - \sqrt{\varepsilon - \cos^2\gamma_0}}{\varepsilon\sin\gamma_0 + \sqrt{\varepsilon - \cos^2\gamma_0}} \qquad \text{parallel polarization} \tag{9}$$

$$R_{s\perp} = \frac{\sin\gamma_0 - \sqrt{\varepsilon - \cos^2\gamma_0}}{\sin\gamma_0 + \sqrt{\varepsilon - \cos^2\gamma_0}} \qquad \text{perpendicular polarization} \tag{10}$$

where γ_0 is the angle of incidence and ε is the complex permittivity given by:

$$\varepsilon = \varepsilon_1 - j60\sigma_1\lambda \tag{11}$$

where ε_1 is the relative dielectric constant of the reflecting surface, σ_1 is the conductivity of the

reflecting surface in Siemens/m, and λ is the (free space) wavelength of the incident radiation. For the case of ground reflection, verical polarization is parallel polarization and horizontal polarization is perpendicular polarization.

For the model defined here, it is assumed that the local surface roughness is 0 (smooth surface) so that the term *g* in Equation (8) is one. Also, values of $\sigma_1 = 0.008$ Siemens/meter and $\varepsilon_1 = 15$ are commonly used for ground constants and shall be employed unless specific values for the location being studied are available.

Since the lengths of the reflected path and the direct path are essentially the same (differing by only a few wavelengths or less), the amplitude of the two rays due to spatial attenuation (path length) is assumed to be the same. The reflected ray, however, is multiplied by the reflection coefficient as given above and then shifted (retarded) in phase as a result of the longer path length compared to the direct ray. The vector addition of the two rays at the receiver is thus:

$$E_r = E_d \sin(\omega t) + E_d R \sin(\omega t + \Delta\varphi)$$

where:

E_d is the magnitude of the direct ray

ω is the carrier frequency in radians

R is the complex reflection coefficient given above

$\Delta\varphi$ is the phase delay of reflected ray in radians

The carrier term is usually suppressed so that the magnitude of Equation (12) becomes

$$\begin{aligned} |E_r| &= E_d \left| 1 + R\, e^{i(\varphi_r + \Delta\varphi)} \right| \\ &= E_d \sqrt{(1 + R\cos(\varphi_r + \Delta\varphi))^2 + (R\sin(\varphi_r + \Delta\varphi))^2} \end{aligned} \qquad (13)$$

where φ_r is the phase angle of the reflection coefficient. The term $\Delta\varphi$ is found from the actual path length difference in meters. For a two-ray path geometry over a curved earth, the path length difference is given by:

$$\Delta r = \frac{2h'_t\, h'_r}{d_r}$$

(14)

where:

h_t' is the height of the transmit antenna *above the reflecting plane* in meters

h_r' is the height of the receive antenna *above the reflecting plane* in meters

so that

$$\Delta\varphi = \frac{2\pi\Delta r}{\lambda} \quad (\textit{modulo } 2\pi \textit{ radians}) \tag{15}$$

The usual issue in using this approach is defining where the reflecting plane is for a complex terrain profile between transmitter and receiver. The reflection point is found by evaluating the angle of incidence and reflection at every terrain elevation point along the path. The angle of incidence at any point along the path profile (the evaluation point) is found from simple geometry as follows:

$$\gamma_t = \tan^{-1} [h_t / d_t] \tag{16}$$

for the transmitter, and

$$\gamma_r = \tan^{-1} [h_r / d_r] \tag{17}$$

for the receiver. The terms h_t, h_r, d_t, and d_r are the transmit antenna height above the evaluation point, the receive antenna height above the evaluation point, and the distances from the evaluation pointto the transmitter and receiver, respectively. The evaluation point where $\gamma_t = \gamma_r$is considered the reflection point. However, it is unlikely that these angles will ever be exactly equal. In such cases, at the two adjacent evaluation points where the angles inflect (i.e. γ_r becomes larger than γ_t), the reflection point is considered to exist along the profile segment defined by the adjacent points. The exact reflection point is then found along this profile segment using linear interpolation since the profile segment is by definition a linear slope. With the distance and elevation of the reflection point established, the reflection angle of incidence γ_0 is found using an equation of the form of Equation (16). This value of γ_0 is then used in Equation (9) or (10) to find the magnitude and phase of the reflection coefficients.

The effect of the nearby ground reflection will be to reduce the amplitude of the directly received ray because, in general, the two rays will add out of phase. The amplitude of the reflected ray will be nearly equal to the direct ray because, at low reflection angles of incidence, $|R| \cong 1.0$ for most

practical combinations of frequency, conductivity, and permittivity. For an antenna placed very near the ground, the cancellation calculated through use of these formulas will be almost perfect, so that the directly received (free space) ray will be reduced by 40 dB or more. It is unlikely, however, that such a perfect cancellation will occur in the real world. It is therefore appropriate to put some reasonable limits on the change in amplitude of the directly-received ray that can be caused by a reflection. Based on measurement and theoretical data, the limits placed on change in the free space amplitude due to reflections are -25 dB and + 6 dB.

Thus based on the preceding discussion, the path loss or attenuation term $A_{reflection}$ can be written as:

$$\begin{aligned} A_{reflection} &= -20\log\left|1+R\times e^{\,i(\varphi_r+\Delta\varphi)}\right| \\ &= -20\log\sqrt{(1+R\cos(\varphi_r+\Delta\varphi))^2+(R\sin(\varphi_r+\Delta\varphi))^2} \end{aligned} \qquad (18)$$

with the limits that $-6.0 \text{ dB} \le A_{reflection} \le 25.0 \text{ dB}$.

Attenuation Due to Partial Obstruction of the Fresnel Zone

When a path is LOS but terrain obstacles are close to obstructing the path, additional attenuation will occur which cannot be accounted for using the ray approach just discussed. The failure of the ray approach to account for attenuation due to a "near miss" of obstacles on the path can be overcome to some extent by including a loss term in the LOS formulation which is based on the extent to which an obstacle penetrates the first Fresnel zone. From diffraction theory, when the ray just grazes an obstacle, the field on the other side is reduced by 6 dB (half the wavefront is obstructed). When the clearance between the obstacle and the ray path is 0.6 of the first Fresnel zone, the change in the field strength at the receiver is 0 dB, and with additional clearance a field strength increase of 6 dB can occur owing to the in-phase contribution from the ray diffracted from the obstacle. For additional clearance, an oscillatory pattern in the field strength occurs.

In the model described, if the ray path clears intervening obstacles by at least 0.6 of the first Fresnel zone, then no adjustment to the receiver field will occur. For the case when an obstacle extends into the 0.6 first Fresnel zone, a loss factor ranging from 0 to 6 dB is applied based on a linear proportion of how much of the 0.6 First Fresnel zone is penetrated. This Fresnel zone path loss or attenuation term can be written as:

$$A_{Fresnel} = 6.0\left(1.0-\frac{C_{obs}(d_p)}{R_{FR}(d_p)}\right)\ dB \qquad (19)$$

where:

$C_{obs}(d_p)$ is the height difference in meters between the ray path and the terrain elevation at distance d_p along the path

$R_{FR}(d_p)$ is the 0.6 first Fresnel zone radius at distance d_p along the path

The values $C_{obs}(d_p)$ and $R_{FR}(d_p)$ are calculated taking into account the effective earth radius using the K factor. The 0.6 first Fresnel zone radius is given by

$$R_{FR}(d_p) = 0.6\left[549.367\sqrt{\frac{d_p(d_r - d_p)}{fd_r}}\right] \quad meters \tag{20}$$

where f is the frequency in MHz and all distances are in kilometers.

The use of the partial Fresnel zone obstruction loss from 0 dB at 0.6 clearance to 6 dB at grazing also provides a smooth transition into the NLOS mode in which knife-edge diffraction loss just below grazing will start at 6 dB and increase for steeper ray bending angles to receiving locations in the shadowed region. Note that this attenuation factor is found only for the terrain profile point that extends farthest into the 0.6 first Fresnel zone, not for every profile point which extends into the 0.6 first Fresnel zone.

Summary of Calculation of Field Strength at the Receiver Under LOS Conditions

All of the formulations for computing the field strength at the receiver under LOS conditions are now in place. They can be summarized with the following simple equation:

$$E_r = 76.92 - 20\log(d_r) + P_T - A_{reflection} - A_{Fresnel} \quad dB\mu V/m \tag{21}$$

where $A_{reflection}$ is the change due the reflection in dB from Equation (18), and $A_{Fresnel}$ is the partial Fresnel zone obstruction loss from Equation (19). The term P_T is the effective radiated power (ERP_d) in dBW in the direction of the receiver.

In terms of path loss between two antennas with gains of 0 dBi in the path direction, Equation (21) can be written as:

$$L_{LOS} = 32.45 + 20.0\log f + 20\log d_r + A_{reflection} + A_{Fresnel} \quad dB \tag{22}$$

Non-Line-of-Sight (NLOS) Mode

The mechanism for deciding when to use the LOS mode and when to use the NLOS mode is described at the beginning of the subsection on Line-of-Sight Mode above. When the model elects to use the NLOS formulations to follow, it means that one or more terrain or other features obstructs the ray path directly from the transmitter to the receiver. In this case, the free space field strength is further reduced for the attenuation caused by the obstacles. For the model defined here, the calculation of obstruction loss over an obstacle is done by assuming the obstacle is a perfect electrical conductor rounded obstacle with a height equal to the elevation of the obstruction and a

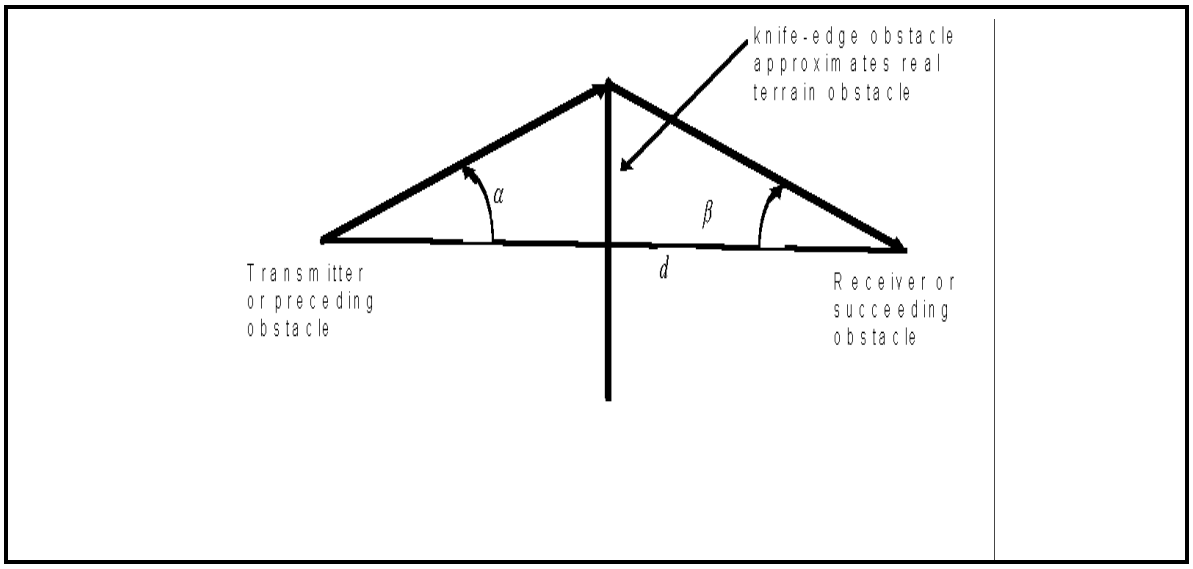

Figure 1 – Geometry for computing v

radius equal to 1 meter. Diffraction loss in this model is calculated assuming individual obstacles on the path can be modeled as isolated rounded obstacles. The losses from multiple isolated obstacles are then combined.

Diffraction Loss

The loss over an individual rounded obstacle is primarily a function of the parameter v that is related to the path clearance over the obstacle. The total diffraction loss, $A(v,\rho)$, in dB, is the sum of three parts — $A(v,0)$, $A(0,\rho)$, and $U(v,\rho)$. The equations to calculate the total and the three parts are given below:

$$A(v,\rho) = A(v,0) + A(0,\rho) + U(v,\rho) \quad (23)$$

$$A(v,0) = 6.02 + 9.0v + 1.65v^2 \quad \text{for } -0.8 \le v \le 0 \quad (24)$$

$$A(v,0) = 6.02 + 9.11v + 1.27v^2 \quad \text{for } 0 \le v \le 2.4 \quad (25)$$

$$A(v,0) = 12.593 + 20\log_{10}(v) \quad \text{for } v > 2.4 \quad (26)$$

$$A(v,0) = 6.02 + 5.556\rho + 3.148\rho^2 + 0.256\rho^3 \quad (27)$$

$$U(v,\rho) = 11.45v\rho + 2.19(v\rho)^2 - 0.206(v\rho)^3 - 6.02 \text{ for } v\rho \le 3 \quad (28)$$

$$U(v,\rho) = 13.47v\rho + 1.058(v\rho)^2 - 0.048(v\rho)^3 - 6.02 \text{ for } 3 < v\rho \le 5 \quad (29)$$

$$U(v,\rho) = 20v\rho - 18.2 \text{ for } v > 5 \quad (30)$$

where the curvature factor is

$$\rho = 0.676\, R^{0.333} f^{-0.1667} \sqrt{\frac{d}{d_1\, d_2}} \quad (31)$$

The obstacle radius *R* is in *kilometers*, and the frequency *f* is in MHz. The distance term *d* is the path length from the transmitter (or preceding obstacle) to the receiver (or next obstacle), d_1 is the distance from the transmitter (or preceding obstacle) to the obstacle, and d_2 is the distance from the obstacle to the receiver (or next obstacle). When the radius is zero, the obstacle is a knife edge, and $A(v,\rho) = A(v,0)$.

The parameter *v* in the equations above takes into account the geometry of the path and can be thought of as the bending angle of the radio path over the obstacle. It is computed as:

$$v = \sqrt{\frac{2d \tan(\alpha) \tan(\beta)}{\lambda}} \qquad (32)$$

where *d* is the path length from the transmitter (or preceding obstacle) to the receiver (or next obstacle), α is the angle relative to a line from the transmitter (or preceding obstacle) to the receiver (or next obstacle), and β is the angle relative to a line from the receiver (or next obstacle) to the transmitter (or preceding obstacle). The definitions of α and β are shown in Figure 1. For the multiple obstacle case, obstacles are treated successively as transmitter-obstacle-receiver triads to construct the path geometry and bending angle *v* over each obstacle. The value of *v* is then used to calculate the diffraction loss over each obstacle. The resulting obstacle losses are summed to arrive at the total obstacle diffraction loss for the path.

Summary of Calculation of Field Strength at the Receiver Under NLOS Conditions

The field strength at the receiver in the NLOS mode can then be written as:

$$E_r = 104.77 - 20\log(d_r) + P_T - A_{diff} \quad dB\mu V/m \tag{33}$$

where all the terms have the same definitions as given in the preceding subsection and the term A_{diff} is defined as:

$$A_{diff} = \sum_{n=1}^{n_{obs}} A_n(v,\rho) \quad dB \tag{34}$$

where $A(v,\rho)$ is defined in Equation (23) and n_{obs} is the number of obstructions in the path.

The corresponding path loss between antennas with 0 dBi gain in the path direction can be written as:

$$L_{NLOS} = 32.45 + 20.0\log f + 20\log d_r + A_{diff} \quad dB \tag{35}$$

File Format

To facilitate the exchange of data on two-way MDS and ITFS systems permissible under Parts 21 and 74, a file format is herein described for the submission of requisite technical data to be provided to the Commission's copy contractor and to all parties which must be served with notice of the applications and/or engineering studies. The media and basic formatting of that media are defined by ISO/EIC Standards 9293.5 9529-1.6 and 9529-2.7.

The remainder of this document outlines the format of technical information regarding each Response Service Area (RSA) to be submitted with each MDS/ITFS two-way application. The data shall appear in a number of sections for the purpose of grouping similar items within the file. Data

shall be coded in an ASCII-formatted,[4] comma-delimited file. Carriage return (0Dh) and line feed (0Ah) characters shall be placed at the end of each line in the file, as is normal when using standard text editors. To help in identifying data, where file sections are formatted as tables, the first entry in each row within a table shall be a sequence number indicating the position of the row within the table. To the extent possible, the sequence number shall be representative of the type of data contained on the row, such as the number of degrees of azimuth or elevation.A generic example of the required file construction appears at the end of this section and may be used as a template for the submission of data. As shown there, section titles shall appear on a separate line in square brackets "[ ]" and shall be separated from the preceding sections and from the data within their own sections by a blank line. Headers shall appear on the top line of the data contained within a section. Headers may contain data and may also help with both human and machine readability.

Units of measure that are to be utilized for all information supplied in the file are:

Latitude – Degrees, Minutes, Seconds (DD,MM,SS)

Longitude – Degrees, Minutes, Seconds (DDD,MM,SS)

Azimuth or Bearing – Degrees (to 1 decimal place)

Radius – Miles (to 2 decimal places)

Ground Elevation – Feet AMSL (to 0 decimal places)

Antenna Height – Feet AGL (to 0 decimal places)

Antenna Tilt – Degrees (to 1 decimal place)

Power (EIRP) – dBW (to 2 decimal places)

Antenna Gain – dBi (to 2 decimal places)

1. General Information

Section Title: "General Info"

Entries: File Number (Assigned by Commission)

Licensee name

City/State of hub location

Coordinates of hub location

ANSI X3.4-1986 (R1992), Coded Character Set — 7-Bit American National Standard Code for Information Interchange

Ground Elevation of hub location (feet)

Call sign/file number of station being modified (if applicable)

City/State of station being modified

2. Geographic Boundary Definitions – Circular Areas Only

Section Title: "Circular Geographic Areas

Section Header: RSA Circular (0 or 1), Regions Circular (00 or RR, where RR = total # of circular regions)

Entries:00, RSA Center Latitude, RSA Center Longitude, RSA Radius (omit entries other than leading 00 if RSA is non-circular)

01, Region 01 Center Latitude, Region 01 Center Longitude, Region 01 Radius

02, Region 02 Center Latitude, Region 02 Center Longitude, Region 02 Radius

:

:

RR, Region RR Center Latitude, Region RR Center Longitude, Region RR Radius

The geographic area of an RSA or region may be described by a circle having a defined center point location and a radius. If the RSA is circular, then RSA Circular = 1, otherwise 0.

If there are circular regions, then Regions Circular = the number of such regions, RR. Otherwise, Regions Circular = 00.

3.Geographic Boundary Definitions – Non-Circular Areas

Section Title: "Non-Circular Areas"

Section Header: RSA Non-Circular (0 or 1), Regions Non-Circular (00 or NN, where NN = total # of non-circular regions), # of points defining RSA (XXX), # of points defining region RR+1 (AAA), …, # of points defining region RR+NN (ZZZ)

Entries: RSA Latitude (001), RSA Longitude (001), Region 01 Latitude (001), Region 01 Longitude (001), …, Region NN Latitude (001), Region NN Longitude (001)

RSA Latitude (002), RSA Longitude (002), Region 01 Latitude (002), Region 01 Longitude (002), …, Region NN Latitude (002), Region NN

Longitude (002)

:

:

RSA Latitude (XXX), RSA Longitude (XXX), Region 01 Latitude (AAA), Region 01 Longitude (AAA), …, Region NN Latitude (ZZZ), Region NN Longitude (ZZZ)

The geographic descriptions of an RSA in the sections for Circular Areas Only (Section 2) and for Non-Circular Areas are mutually exclusive. One of them shall have the RSA indicator set to 1; the other shall be set to 0. Any RSA data contained in the section with the RSA indicator set to 0 shall be ignored.

Regions of both types, i.e., circular and non-circular, are permitted within a single RSA. Regions in this non-circular section shall be numbered sequentially continuing from the last region number in the circular section, i.e., from RR+1 to RR+NN, so that all regions have unique region numbers.

4.Hub Sectorization Data

Section Title: "Sectorization"

Section Header: # of sectors within RSA (SS)

Entries: "Sector 01," Hub Receive Antenna Pattern #, Gain, Azimuth of Main Lobe, Height AGL, Mechanical Beam Tilt, Polarization, Max Simultaneous Transmitters

"Sector 02," Hub Receive Antenna Pattern #, Gain, Azimuth of Main Lobe, Height AGL, Mechanical Beam Tilt, Polarization, Max Simultaneous Transmitters

:

:

"Sector (SS)," Hub Receive Antenna Pattern #, Gain, Azimuth of Main Lobe, Height AGL, Mechanical Beam Tilt, Polarization, Max Simultaneous Transmitters

Each sector is to be assigned a number beginning with the sector whose main lobe azimuth is pointing due north or the closest to due north when proceeding in a clockwise direction from true north.

The receiving antenna pattern used in each sector is defined in the Antenna Pattern Data section, and the association of each sector with a specific antenna pattern is made here. This pattern shall be used in the calculation of potential interference to a hub from surrounding stations.

The geographic definition of each sector is found in the Sector Geographic Definitions section.

Mechanical beam tilt for each hub receiving antenna is specified in this section. Tilting the antenna downward is defined using a positive number.

The polarization of each sector is defined as either horizontal or vertical.

The maximum number of transmitters that can operate simultaneously on the channel or any subchannel within each sector is specified in this section.

5.Grid Point Definitions

Section Title: "Grid Points"

Table Header: # of grid points (MMMM)

Entries: Point 0001: Latitude, Longitude, Elevation, Region # in which Located, Bearing to Hub, Polarization (H, V, or B), Number of associated Class(es) of Station(s), Class Designators

Point 0002: Latitude, Longitude, Elevation, Region # in which Located, Bearing to Hub, Polarization (H,V, or B), Number of associated Class(es) of Station(s), Class Designators

:

:

Point MMMM: Latitude, Longitude, Elevation, Region # in which Located, Bearing to Hub, Polarization (H,V, or B), Number of associated Class(es) of Station(s), Class Designators

The header specifies the total number of grid points (MMMM) defined in the Grid Point Definition Table.

The location of each grid point is defined by latitude and longitude. The bearing from the grid point to the hub is specified. The region in which the grid point is located is indicated using the region number assigned in the sections above giving geographic boundary definitions. Grid points not located in specifically defined regions shall be indicated as being in Region 00, which describes the remainder of the RSA.

Polarization for each grid point must be specified as horizontal (H), vertical (V), or both (B). In areas where sectors having opposite polarizations overlap, it may be desirable to have the flexibility to utilize both polarizations. If so, grid points in these overlapping areas must be specified as B, both polarizations.

Each grid point must be assigned at least one class of station. Assignment of multiple classes to a single grid point is also permitted.

6. Sector Geographic Definitions

Section Title: "Sector Definitions"

Table Header: # of sectors (SS), Bearings or Coordinates (B or C)
Entries: "Sector 01," Start Bearing, Stop Bearing
(Bearings) "Sector 02," Start Bearing, Stop Bearing
:
"Sector SS," Start Bearing, Stop Bearing

OR

Table Header: # of sectors (SS), Bearings or Coordinates (B or C), # of Coordinates in sector 01 (CC1), # of Coordinates in Sector 02 (CC2), …, # of Coordinates in sector SS (CCC)

Entries: Sector 01 Latitude (001), Sector 01 Longitude (001), Sector 02 Latitude (001), Sector 02 Longitude (001), …, Sector SS Latitude (001), Longitude Sector SS (001)

Sector 01 Latitude (002), Sector 01 Longitude (002), Sector 02 Latitude (002), Sector 02 Longitude (002), …, Sector SS Latitude (002), Sector SS Longitude (002)

:
:

Sector 01 Latitude (CC1), Sector 01 Longitude (CC1), Sector 02 Latitude (CC2), Sector 02 Longitude (CC2), …, Sector SS Latitude (CCC), Sector SS Longitude (CCC)

Sector geographic boundaries can be described in either of two ways: (1) as straight lines radiating out from the hub location at the specified bearings until they cross the outer boundary of the RSA, or (2) as sets of coordinates between which straight boundary lines exist that describe closed geographic areas. In either case, sectors may overlap, and, when they do, grid points in the overlap areas must be analyzed as though they were included exclusively within each sector. When sets of coordinates are used, the last coordinate pair shall be assumed to connect to the first such pair.

7.Response Station Class Data

Section Title: "Class Info"

Table Header: # of classes (CL)

Entries: "Class 1," Worst Case Ant Pattern #, Max Height, Max Power, Number of Regions in Which Used, Region(s) in Which Used, Maximum Simultaneous Number within Each Region

"Class 2," Worst Case Ant Pattern #, Max Height, Max Power, Region(s) in Which Used, Maximum Simultaneous Number within Each Region

:
:

"Class CL," Worst Case Ant Pattern #, Max Height, Max Power, Region(s) in Which Used, Maximum Simultaneous Number within Each Region

Classes are defined by the combination of the worst case antenna pattern, the maximum height above ground level (AGL) at which the antennas may be mounted, and the maximum power (EIRP) they may emit.

Associated with each class description is one or more pairs of values indicating the region numbers in which the class is used and the maximum number of transmitters that may transmit simultaneously on the channel or on each subchannel within each region. The two types of values alternate, and one pair is present for each region in which the particular class is used. The regions shall be listed in ascending numerical order.

8.Antenna Pattern Data (Hub Receive and Worst Case Response Transmit)

Section Title: "Antenna Patterns"

Table Header: # hub antenna patterns (HP), # of worst case response station transmit antenna patterns (RP)

Entries:

000, Hub (1) Plane Azimuth, Hub (1) Cross Azimuth, Hub (1) Plane Elevation, Hub 1 Cross Elevation, Hub (2) Plane Azimuth, Hub (2) Cross Azimuth, Hub (2) Plane Elevation, Hub (2) Cross Elevation, …, Hub (HP) Plane Azimuth, Hub (HP) Cross Azimuth, Hub (HP) Plane Elevation, Hub (HP) Cross Elevation, Response (1) Plane Azimuth, Response (1) Cross Azimuth, Response (2) Plane Azimuth, Response (2) Cross Azimuth, …, Response (RP) Plane Azimuth, Response (RP) Cross Azimuth

001, Hub (1) Plane Azimuth, Hub (1) Cross Azimuth, Hub (1) Plane Elevation, Hub (1) Cross Elevation, Hub (2) Plane Azimuth, Hub (2) Cross Azimuth, Hub (2) Plane Elevation, Hub (2) Cross Elevation, …, Hub (HP) Plane Azimuth, Hub (HP) Cross Azimuth, Hub (HP) Plane Elevation, Hub (HP) Cross Elevation, Response (1) Plane Azimuth, Response (1) Cross Azimuth, Response (2) Plane Azimuth, Response (2) Cross Azimuth, …, Response (RP) Plane Azimuth, Response (RP) Cross Azimuth

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359, Hub (1) Plane Azimuth, Hub (1) Cross Azimuth, Hub (1) Plane Elevation, Hub (1) Cross Elevation, Hub (2) Plane Azimuth, Hub (2) Cross Azimuth, Hub (2) Plane Elevation, Hub (2) Cross Elevation, …, Hub (HP) Plane Azimuth, Hub (HP) Cross Azimuth, Hub (HP) Plane Elevation, Hub (HP) Cross Elevation, Response (1) Plane Azimuth, Response (1) Cross Azimuth, Response (2) Plane Azimuth, Response (2) Cross Azimuth, …, Response (RP) Plane Azimuth, Response (RP) Cross Azimuth

The hub receiving antenna patterns and response station transmitting antenna patterns shall be defined in 1 degree increments beginning with 0 degrees and ending at 359. All entries shall be in dB relative to the peak response. Both azimuth and elevation patterns shall be entered from 0 to 359 degrees. In cases where elevation data is known only over a limited range, just the known points should be entered. For example, if elevation data is known from –10 degrees to +20 degrees of elevation, this data should be entered beginning at 350 and ending at 20. For angles at which data is not available, a space (20h) shall be inserted as a place holder.

Example File & Template

In the example file and template below, formatting elements and descriptive terms to be included in the submitted file exactly as shown are in `plain text`. Those items to be replaced by real data and shown here as place holders for purposes of example are shown in *`italicized text and CAPITAL LETTERS`*.

```
[General Info]

File FILE NUMBER

Licensee LICENSEE NAME

Hub Lat DDMMSS, Hub Lon DDDMMSS

Hub City CITY, ST

Elevation AMSL FEET

Call CALL SIGN

Stn City CITY, ST

[Circular Geographic Areas]

RSA 0/1, Regions 00/RR

00,DDMMSS,DDDMMSS,MI.MM

01,DDMMSS,DDDMMSS,MI.MM

02,DDMMSS,DDDMMSS,MI.MM

:: :::::: ::::::: ::::::

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RR,DDMMSS,DDDMMSS,MI.MM

[Non-Circular Areas]

RSA 0/1, Regions 00/NN

00,XXX,RR+1,AAA,RR+2,BBB,...,RR+NN,ZZZ

001,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,...,DDMMSS,DDDMMSS

002,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,...,DDMMSS,DDDMMSS

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:::,

ZZZ,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,...,DDMMSS,DDDMMSS

[Sectorization]

Sectors *SS*

Sector, Hub Pat, Gain, Az, AGL, Tilt, Pol, Max # Trans

01,*HP,dB.dB,DDD.DD,FFFF,DD.D,H/V,TTTT*

02,*HP,dB.dB,DDD.DD,FFFF,DD.D,H/V,TTTT*

03,*HP,dB.dB,DDD.DD,FFFF,DD.D,H/V,TTTT*

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SS,*HP,dB.dB,DDD.DD,FFFF,DD.D,H/V,TTTT*

[Grid Points]

Points MMMM

Pnt, Lat, Lon, Elev, Regn, Bearing, Pol, # Classes, Class Designators...

0001,*DDMMSS,DDDMMSS,FFFF,R#,DDD.DD,H/V/B,###,CC1,CC2,CC3,...CC###*

0002,*DDMMSS,DDDMMSS,FFFF,R#,DDD.DD,H/V/B,###,CC1,CC2,CC3,...CC###*

0003,*DDMMSS,DDDMMSS,FFFF,R#,DDD.DD,H/V/B,###,CC1,CC2,CC3,...CC###*

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MMMM,*DDMMSS,DDDMMSS,FFFF,R#,DDD.DD,H/V/B,###,CC1,CC2,CC3,...CC###*

[Sector Definitions]

Sectors *SS*, Type *B*

01,DD.DD,DD.DD

02,DD.DD,DD.DD

03,DD.DD,DD.DD

:: :: :: :: ::

:: :: :: :: ::

SS,DD.DD,DD.DD

OR

Sectors *SS*, Type *C,01,CC1,02,CC2,03,CC3,...SS,CCC*

001,*DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,...DDMMSS,DDDMMSS*

002,*DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,...DDMMSS,DDDMMSS*

003,*DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,...DDMMSS,DDDMMSS*

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CCC,*DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,DDMMSS,DDDMMSS,...DDMMSS,DDDMMSS*

[Class Info]

Classes *CL*

Class, Pattern, AGL, Max EIRP, # Reg, Reg, Max # Tx

01,*PAT,HHH,dB.dB,##,R1,##R1,R2,##R2,...RG,##RG*

02,*PAT,HHH,dB.dB,##,R1,##R1,R2,##R2,...RG,##RG*

03,*PAT,HHH,dB.dB,##,R1,##R1,R2,##R2,...RG,##RG*

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CL,*PAT,HHH,dB.dB,##,R1,##R1,R2,##R2,...RG,##RG*

[Antenna Patterns]

Hub *HP*, Response *RP*

Deg,*H01PA,H01CA,H01PE,H01CE,H02PA,H02CA,H02PE,H02CE,...HHPPA,HHPCA,HHPPE,HHPCE,R01PA,R01CA,R01PE,R01CE,R02PA,R02CA,R02PE,R02CE,...RRPPA,RRPCA,RRPPE,RRPCE*

000,*dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB*

001,*dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB*

002,*dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB*

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358,*dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB*

359,*dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,dB.dB,...dB.dB,dB.dB,dB.dB,dB.dB,*

.dB, dB.dB, dB.dB, dB.dB, dB.dB, dB.dB, dB.dB, dB.dB, dB.dB, . . .dB.dB, dB.dB, dB.dB, dB .dB