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

In the matter of	)	
	)	
Mobile Satellite Ventures Subsidiary LLC	)	
	)	
Application for Minor Modification of Space Station License for AMSC-1	)	File No. SAT-MOD-20031118-00333
	)	
Minor Amendment to Application for Authority to Launch and Operate a Next-Generation Replacement MSS Satellite	)	File No. SAT-AMD-20031118-00332
	)	
Application for Minor Modification of Blanket License for Authority to Operate Mobile Earth Terminals with MSAT-1	)	File No. SES-MOD-20031118-01879

ORDER AND AUTHORIZATION

Adopted: November 8, 2004 **Released: November 8, 2004**

By the Chief, International Bureau:

I. INTRODUCTION

1. In this Order, we grant authority for Mobile Satellite Ventures Subsidiary LLC ("MSV"), which provides Mobile Satellite Service ("MSS") in the United States via geostationary-orbit satellites, to operate Ancillary Terrestrial Component ("ATC") facilities providing voice and data communication for users equipped with dual-mode MSS-ATC handsets, using L-band frequencies for ATC operation that MSV is already authorized to use for MSS transmission.[1] This authorization – the first ever granted for ATC operation – will enable MSV to offer high-quality, affordable mobile services to users inside buildings and in urban areas, in addition to providing MSS in rural areas. We also grant conditional waivers of several rule provisions pertaining to ATC operation to afford MSV flexibility to operate more efficiently without causing additional interference.

[1] "L Band" is a general designation for the entire frequency range from one to two Gigahertz. In this Order, however, the term "L Band" more specifically denotes the so-called "upper L Band" (1545-1559 MHz and 1646.5-1660.5 MHz) and "lower L Band" (1525-1544 MHz and 1626.5-1645.5 MHz), which are internationally allocated for MSS. The FCC has allocated the 1525-1559 MHz band for downlink transmission from MSS satellites to mobile earth stations in the United States and the 1626.5-1660.5 MHz band for uplink transmission from mobile earth stations to MSS satellites. The 1660-1660.5 MHz band is also allocated for radio astronomy observation on a co-primary basis. 47 C.F.R. § 2.106. Both the uplink and downlink bands are also allocated for ATC transmission, except for two one-megahertz segments at 1544-1545 MHz and 1645.5-1646.5 MHz, which are allocated exclusively for safety services. *Id.*, Footnotes 5.356, 5.375, and US380.

II. BACKGROUND

A. The Commission's ATC Policy and Licensing Procedure

2. In the *ATC Report and Order* released last year, the Commission adopted rules under which MSS operators can obtain authority to integrate ATCs into their MSS networks. This would enable the operators to provide high-capacity mobile services by re-using spectrum already assigned to them.[2] The Commission concluded that implementation of ATC, pursuant to these rules, would increase network capacity and efficiency of spectrum use, extend coverage for handset operation in places where MSS operators have previously been unable to offer reliable service, make possible substantial economies of scale, improve emergency communications, and enhance competition.[3]

3. In the interest of minimizing cost and delay and affording flexibility for dynamic, market-driven adjustments, the Commission established a "blanket" authorization process for ATC base stations, with limited exceptions.[4] An FCC-licensed MSS operator may request blanket authority for operation of ATC base stations in the United States by filing an application for modification of its space-station license.[5] Similarly, blanket authority for operation of ATC base stations in the United States in connection with provision of MSS in the United States via a foreign-licensed satellite may be requested in an application for modification of an FCC reservation of spectrum or blanket license for U.S. operation of mobile earth stations.[6]

4. MSV and several other parties filed petitions for reconsideration of various aspects

[2] Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands, *Report and Order and Notice of Proposed Rulemaking*, IB Docket Nos. 01-185 and 02-364, 18 FCC Rcd 1962 (2003), petitions for reconsideration pending ("*ATC Report and Order*"), modified *sua sponte* by *Order on Reconsideration*, 18 FCC Rcd 13590 (2003).

[3] *ATC Report and Order* at ¶¶ 2, 20-45, and 210-11.

[4] *ATC Report and Order* at ¶¶ 239-41.

[5] *Id.* at ¶240.

[6] *Id.* at ¶245. An individual, site-specific license must be obtained for a proposed ATC base station that presents an aviation-hazard issue or for which an Environmental Assessment must be prepared. *Id.* at ¶239; also see 47 C.F.R. §§ 1.1307, 17.4, and 17.7. Equipment authorization must be obtained for ATC user terminals pursuant to the test-based certification procedure specified in Part 2, Subpart J of the Commission's rules before such devices are marketed in the United States or imported for sale or lease in the United States. 47 C.F.R. § 25.149(c)(1) and (2). Also see 47 C.F.R. §§ 2.803, 2.901 *et seq.*, and 2.1204. Dual-mode MSS/ATC terminals are also subject to blanket licensing for the earth-station component. *ATC Report and Order* at ¶248.

of the *ATC Report and Order*. The petitions for reconsideration remain pending before the Commission.[7]

B. MSV's MSS Operations

5. MSV provides land, maritime, and aeronautical MSS in the United States via two geostationary satellites: AMSC-1, located at 101° W.L., which was launched in 1995, and MSAT-1, located at 106.5° W.L., launched in 1996. MSV operates AMSC-1 pursuant to a space-station license issued by the FCC that authorizes use of up to 20 MHz of internationally-coordinated L-Band spectrum for MSS transmission in both directions between AMSC-1 and mobile earth stations in the United States.[8] MSAT-1 is operated by a separately-owned company, MSV Canada, under a space-station license issued by Industry Canada, the Canadian regulatory agency. MSV provides service via MSAT-1 under authority of an FCC blanket license for operation of mobile earth stations in the United States in L-Band spectrum internationally coordinated by Canada for the MSAT-1 system. MSV acquired these authorizations for provision of MSS in the United States through assignment with the Commission's approval pursuant to a merger of the former licensees.[9]

6. MSV has applied for authority to launch and operate a next-generation L-Band MSS satellite, "MSV-1", at 101° W.L. which would supercede AMSC-1.[10] The application has been accepted for filing and is currently under consideration. As proposed, MSV-1 would have a larger service-link antenna than AMSC-1 and would transmit with higher power, hence reducing the power requirements for mobile earth-station terminals accessing the second-generation system, which would enable use of smaller, lighter terminals. MSV-1 would also have more feeder-link spectrum and deploy more spot beams than AMSC-1, which would

[7] The other petitioners are Inmarsat Ventures Ltd, the U.S. GPS Industry Council, the Cellular Telecommunications and Internet Association, Cingular Wireless LLC, The Boeing Company, and the Society of Broadcast Engineers, Inc.

[8] Coordination of use of upper and lower L-Band frequencies for provision of MSS in North America via geostationary satellite systems operated by Inmarsat or by other parties licensed by the governments of the United States, Canada, Russia, or Mexico is accomplished pursuant to a multilateral Memorandum of Understanding. The MOU provides for dynamic assignment of specific channels pursuant to recurrent temporary operating agreements to be negotiated by the system operators. The operators signed a one-year operating agreement, to be revised on an annual basis. The agreement assigned each system an amount of spectrum based on its current and projected near-term traffic requirements. The MOU requires that the precise frequency assignments for each system be kept confidential. The parties to the MOU last revised the spectrum assignments in 1999 and, pending further negotiations, continue to operate with those assignments today. Memorandum of Understanding for the Intersystem Coordination of Certain Geostationary Mobile Satellite Systems Operating in the Bands 1525-1544/1545-1559 MHz and 1626.5-1646.5/1646.5-1660.5 MHz, Mexico City, Mexico, 18 June 1996 ("Mexico City MOU").

[9] Motient Services Inc. and TMI Communications and Company, LP, Assignors, and Mobile Satellite Ventures Subsidiary LLC, Assignee, *Order and Authorization*, 16 FCC Rcd 20469 (Int'l Bur. 2001).

[10] File No. SAT-LOA-19980702-00066.

enable greater re-use of service-link spectrum. The second-generation satellite would also be designed to enable use of different air interface protocols in different geographic areas to satisfy varying customer needs and preferences. MSV reports that MSV Canada likewise plans to upgrade its MSS system and has applied to Industry Canada for authority to launch and operate a second-generation L-Band satellite at 107.3° W.L. that would supercede MSAT-1.

C. ATC Application

7. On November 18, 2003, MSV filed its current application for ATC authority in conjunction with its provision of MSS in United States via AMSC-1 and MSAT-1 and via the proposed next-generation satellites.[11] MSV requested waiver of many of the Commission's technical rules for L-Band ATC operation, arguing that the flexibility afforded by such waivers would permit it to operate more efficiently without impairing its own MSS operations or causing harmful interference to other MSS systems.[12] MSV contended that grant of the application and the associated waiver requests would enable it, for the first time, to offer a ubiquitous, high-quality, integrated mobile service throughout the United States.[13]

8. At MSV's request, the ATC application proceeding was designated "permit but disclose" for purposes of the Commission's *ex parte* rules.[14] MSV filed supplemental information in response to inquiries from International Bureau staff and amended the application to specify greater suppression of emissions in the 1606-1610 MHz band.[15] On February 9, 2004, the Bureau issued a public notice announcing that the ATC applications had been found acceptable for filing and specifying a schedule for filing comments, petitions to deny, and reply pleadings.[16]

[11] In accordance with instructions in the *ATC Report and Order*, MSV filed three applications for ATC authority on November 18, 2003. It filed an application for modification of its license for AMSC-1 and an amendment to its space-station application for MSV-1 requesting blanket authority for ATC operation in connection with its MSS operation via those satellites. MSV also filed an application for modification of its blanket license for mobile earth stations accessing MSAT-1 to request authority for ATC operation in connection with its provision of MSS in the United States via the Canadian-licensed satellite. *See* policy statements regarding application procedures in the *ATC Report and Order* at ¶¶ 240 and 245, summarized in ¶3, *supra*.

[12] Application for Minor Modification and Amendment filed Nov. 18, 2003 ("MSV ATC Application"), at 2.

[13] *Id.*

[14] Approval by grant-stamp (Dec. 2, 2003).

[15] Letters with attachments from Bruce D. Jacobs, counsel for MSV, to the FCC Secretary dated Dec. 30, 2003 and Feb. 4, 2004; letter with attachment from David S. Konczal, counsel for MSV, to the FCC Secretary filed March 25, 2004; letters with attachments from Lon C. Levin to the FCC Secretary dated Feb. 27, Aug. 31, and Sept. 22, 2004.

[16] Public Notice, Report No. SPB-200 (Feb. 9, 2004).

9. Inmarsat Ventures Limited ("Inmarsat") filed comments in opposition to MSV's ATC application.[17] Inmarsat raised concerns about the potential interference that the proposed ATC operation could cause to Inmarsat's current and next-generation MSS network. Inmarsat argued that the application should be dismissed for failure to include showings required by the rules pertaining to the peak power of ATC mobile terminals, reservation of link margin for structural attenuation inside buildings, and mobile-terminal duty-cycle regulation.[18] Inmarsat also argued that MSV had failed to show sufficient justification for its waiver requests and that most of the requested waivers would allow MSV to operate in a way that would cause harmful interference with Inmarsat's MSS system.[19] Furthermore, Inmarsat contended that MSV's ATC applications, viewed as a whole, effectively proposed operation of a primarily terrestrial network, contrary to the Commission's stated intention that ATC should be ancillary to MSS operation.[20]

10. The National Telecommunication and Information Administration ("NTIA") submitted written comments on the ATC applications, expressing concern about the potential impact on satellite radionavigation, Aeronautical Mobile Satellite En-Route Service ("AMS(R)S"), and the Global Maritime Distress and Safety System ("GMDSS").[21] For protection of AMS(R)S and GMDSS, the NTIA recommended that MSV's waiver requests pertaining to power limits for ATC base stations be granted only in part, subject to restrictions on operation in the vicinity of navigable waterways and limits on out-of-channel emissions. In addition, the NTIA recommended use of a certain measurement technique in compliance testing to ensure that out-of-band emissions from MSV's ATC mobile terminals will not interfere with reception of satellite radionavigation signals in the 1559-1610 MHz band.[22]

11. Other interested parties filed comments that expressed no opinion on the merits of MSV's waiver requests but urged the Commission to grant the ATC application or promptly

[17] Opposition of Inmarsat Ventures Ltd, filed March 25, 2004 ("Inmarsat Opposition").

[18] *Id.* at ii.

[19] *Id.* at ii-iv and 34-35.

[20] *Id.* at v.

[21] Letter (with attachment) from Frederick R. Wentland, Associate Administrator, NTIA Office of Spectrum Management, to Edmond J. Thomas, Chief, FCC Office of Engineering and Technology, dated April 21, 2004 ("NTIA Letter").

[22] *See* 47 C.F.R. § 25.253(g)(3).

take action on it.[23]

12. MSV filed comments in which it contended that Inmarsat had advanced no valid argument for denying the ATC application or the waiver requests, and Inmarsat filed a reply to these rebuttal comments.[24] Both MSV and Inmarsat filed additional written comments on a variety of issues that were originally submitted as *ex parte* presentations.

13. On August 2, 2004, MSV filed a request for expedited action.[25] MSV acknowledged in this filing that some of the issues raised by its waiver requests are closely intertwined with issues raised in its petition for reconsideration of the *ATC Report and Order*. Nevertheless, MSV asked the Bureau to grant "core elements" of its ATC application in advance of the Commission's disposition of the petitions for reconsideration in the ATC rulemaking. MSV maintained that issuance of such an expedited decision would facilitate early deployment of its proposed ATC network. Inmarsat has not filed comments in response to this request.

III. DISCUSSION

14. In this Order, we grant MSV ATC license authority subject to certain limitations and conditions. We also rule on a number of MSV's waiver requests, without prejudice to disposition of requests for related rule amendments in MSV's petition for reconsideration of the *ATC Report and Order*. The Commission may waive its rules "for good cause shown."[26] Good cause for waiver is generally found in cases where allowing deviation from a rule requirement would not disserve the rule's underlying purpose and would better serve the public interest than requiring strict compliance.[27] We grant waivers, in this decision, where we are certain that relaxation of the rule restriction will not significantly increase interference or otherwise disserve the Commission's policy objectives and will promote the public interest by facilitating more-efficient spectrum use and enhanced competition. We generally decline, however, to rule on the merits of contested waiver requests that turn on resolution of issues that are also raised before the Commission in the ATC rulemaking proceeding and require a re-balancing of competing interests or deviation from an established Commission policy. Resolution of such issues is best

[23] *See* letter from Raul R. Rodriguez, counsel for the U.S. GPS Industry Council, to the FCC Secretary dated March 24, 2004 (advocating grant); letter from Eric Epley, Executive Director, Southwest Texas Regional Advisory Council For Trauma, to FCC Secretary dated April 14, 2004 (advocating expeditious action); letter from Karl-Heinz Ziwica, Vice President for US Engineering, BMW of North America LLC, to FCC Secretary dated April 23, 2004 (advocating grant); letter from Kenneth B. Taylor, Director, North Carolina Department of Crime Control and Public Safety, Division of Emergency Management, to FCC Secretary dated April 20, 2004 (advocating expeditious action); letter from Conrad Burns, U.S. Senator, to Michael Powell, FCC Chairman, dated May 21, 2004 (advocating expeditious action); letter from Tom Davis, U.S. Representative, to Michael Powell, FCC Chairman, dated June 3, 2004 (advocating expeditious action); letter from Howard McConnell, Chairperson, Yurok Tribe, to FCC Secretary dated June 14, 2004 (advocating grant).

[24] Response of Mobile Satellite Ventures Subsidiary LLC to Opposition of Inmarsat Ventures Ltd. filed Apr. 14, 2004 ("Response to Inmarsat"); Reply of Inmarsat Ventures Ltd filed April 26, 2004.

[25] Letter from Lon C. Levin, Vice President, MSV, to the FCC Secretary dated Aug. 2, 2004, filed as attachment to letter from Henry Goldberg, Attorney for Motient, Inc., to the FCC Secretary, also dated Aug. 2, 2004. Also see letter from Lon C. Levin to the FCC Secretary dated Oct. 4, 2004 (modifying request for expedited action).

[26] 47 C.F.R. § 1.3.

[27] *See Northeast Cellular Telephone Co., LP v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990) and *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969).

left to the Commission based on the record developed in the rulemaking proceeding.

A. Foreign Ownership

15. Section 310(b)(4) of the Communications Act[28] provides that no common carrier radio-station license shall be granted to a corporation controlled by another corporation of which more than one-fourth of the capital stock is owned or voted by aliens or by any corporation organized under the laws of a foreign country, if the Commission finds that denial of the license application would serve the public interest. MSV requests authority to provide ATC as a common carrier. MSV is a U.S. limited liability company that is wholly-owned by Mobile Satellite Ventures LP ("MSV LP"), a U.S. limited-liability partnership. Thirty-eight percent of MSV LP's ownership equity is held by TMI Communications and Company, LP, a Canadian limited-liability partnership that, in turn, is wholly owned by BCE, Inc., a Canadian corporation.[29]

16. In 2001, the International Bureau reviewed MSV's foreign ownership when considering applications for assignment to MSV of the licenses that it now holds for provision of MSS via the AMSC-1 and MSAT-1 satellites.[30] The Bureau concluded that the indirect ownership of MSV by Canadian companies (namely, TMI and BCE) did not raise any material concern about adverse impact on competition in the U.S. market but ruled that prior approval would have to be obtained for any increase of foreign ownership beyond certain specified levels.[31]

17. As noted, TMI and BCE currently have a thirty-eight percent indirect equity share of MSV, which is within the level found permissible in the *MSS Assignment Order*. As no application has since been filed for permission to increase other foreign ownership interests in MSV, we presume that such interests remain within the levels previously found permissible. Therefore, in light of the Commission's favorable competitive-impact analysis in the *ATC Report and Order*[32] and the Bureau's favorable determination in the *MSS Assignment Order*, we conclude pursuant to Section 310(b)(4) that it would not serve the public interest to deny MSV's ATC application because of the current levels of indirect foreign ownership.[33]

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[28] 47 U.S.C. § 310(b)(4).

[29] MSV ATC Application, Form 312, Attachment 2.

[30] Motient Services Inc. and TMI Communications and Company, LP, Assignors, and Mobile Satellite Ventures Subsidiary, LLC, Assignee, *Order and Authorization*, 16 FCC Rcd 20469 (Int'l Bur. 2001) ("*MSS Assignment Order*").

[31] *Id.* at ¶¶ 19, 21, and 22.

[32] 18 FCC Rcd at ¶¶ 37-42.

[33] There is no need to explicitly condition the ATC authorization on compliance with the foreign-ownership reporting and further-approval requirements in MSV's MSS license. As previously noted, a valid MSS license is a prerequisite for lawful ATC operation. Therefore, if MSV's MSS license were to be cancelled or revoked for violation of reporting requirements or because of increased foreign ownership its authority to provide ATC would immediately terminate.

B. Non-Technical ATC Requirements

18. The Commission's decision to permit implementation of MSS ATC was based on the premise that ATC must be "ancillary" to MSS operation. To that end, the Commission established "gating" requirements for ATC authorization and operation to ensure that ATC will augment, rather than supplant, MSS. In order to satisfy the gating requirements, which are set forth in Section 25.149 of the Commission's rules,[34] an MSS-ATC licensee must, among other things, maintain spare satellites and replace failed satellites within a reasonable period of time[35] and must integrate its offering of ATC services with its offering of MSS.[36] We discuss MSV's compliance with these particular gating requirements below.

1. Integration with MSS: Dual-Mode Terminals

19. An ATC applicant must demonstrate that it will integrate provision of ATC service with provision of MSS, either by certifying that the handsets that will be used to access its ATC network will be dual-mode devices that can also be used to access its MSS network or by submitting other evidence that its ATC service offerings will be integrated with its MSS offerings.[37]

20. MSV asserts that the handsets that will be used to access its ATC network will be dual-mode devices that can also be used for MSS communication.[38] The protocols enabling ATC and MSS modes of operation will reside in a single baseband chipset in the handsets, and a common set of internal amplifiers and a single integral antenna will serve both modes. MSV acknowledges, however, that the handsets' internal amplifiers and integral antenna will not produce enough radiated signal power or afford enough receiver signal/noise margin to support communication via the first-generation MSS satellites currently operated by MSV and MSV Canada. In order to enable customers to use the devices for MSS communication pending commencement of operation with its proposed second-generation satellite, MSV plans to make available a "link margin booster" that can be plugged into the handsets. The booster will consist of a circularly-polarized patch antenna with approximately 3 dBi of gain coupled with a 3 dBW power amplifier and a rechargeable battery, enclosed within a saucer-shaped container approximately 1.5 inches high and 3.5 inches in diameter, with a flexible coaxial cable several feet long for connection with the handset. When MSV's proposed next-generation satellite is

[34] 47 C.F.R. § 25.149(a) and (b).

[35] 47 C.F.R. § 25.149(b)(2).

[36] 47 C.F.R. § 25.149(b)(4).

[37] 47 C.F.R. § 25.149(b)(4). Also see *ATC Report and Order* at ¶¶ 87 and 88.

[38] MSV ATC Application at 10 and Appendix A.

placed in service customers would be able to use the handsets for MSS communication via the new satellite without the booster.[39]

21. We find that MSV's proposal to deploy dual-mode handsets that will initially require use of a plug-in booster for MSS communication is a reasonable temporary solution that will enhance economic efficiency by making it possible to use the same lightweight handset for dual-mode operation with both first- and second-generation satellites. We conclude that the proposal is consistent with the Commission's integration requirement, provided that: i) handsets requiring a plug-in booster for MSS communication are not offered for sale without the booster before MSV commences commercial operation with a satellite that handset users can access without aid of an external booster and ii) MSV does not activate any additional handsets requiring a plug-in booster for MSS communication after an administratively-final denial of the license application for MSV-1 or administratively-final cancellation, revocation, or nullification of FCC license authority for that proposed satellite. The ATC authorization granted by this order is conditioned accordingly.

2. Substantial Satellite Service: Ground Spare

22. One of the basic tenets of the Commission's ATC policy is that MSS-ATC licensees that offer ATC service must provide "substantial" satellite service to the public. This means, among other things, that MSS-ATC licensees must repair or replace defective space stations within a reasonable period of time.[40] More specifically, Section 25.149(b)(2) of the Commission's rules requires an ATC applicant with a geostationary-satellite-orbit MSS system to certify that it will have a spare MSS satellite available on the ground within one year after commencing ATC operation and that it will launch the spare satellite in the first commercially reasonable launch window following failure of an operational satellite.[41] The Commission adopted this rule provision to ensure coverage continuity in the event of launch failures or satellite malfunctions.

23. MSV requests a complete waiver of the ground-spare rule. In support of this waiver request, MSV states that it has relied on an agreement with MSV Canada that provides for each party's first-generation MSS satellite to serve as an in-orbit backup for the other's in the event the other satellite malfunctions.[42] MSV asserts that it plans to enter into a similar agreement with MSV Canada with respect to second-generation satellites, so that a second-generation MSV Canada satellite would afford in-orbit backup capacity for MSV's proposed second-generation MSS satellite, and *vice versa*. Moreover, MSV asserts that once the first-generation satellites have been replaced they will provide additional in-orbit backup capacity for the second-generation satellites. MSV contends that such in-orbit backup arrangements are better than relying on ground spares because it takes much less time to shift traffic to a functional satellite that is already in orbit than to launch a ground spare, position it, and make it ready for

[39] *Id.*

[40] *ATC Report and Order* at ¶72.

[41] 47 C.F.R. § 25.149(b)(2).

[42] MSV ATC Application at 8-9.

operation.[43]

24. Viewing MSV's request for waiver of the ground-spare rule in light of the waiver criteria described above, we note that MSV has not said that it will limit the loading of AMSC-1 or its proposed second-generation satellite to the extent necessary to reserve sufficient unused capacity for full backup of the current or a second-generation MSV Canada satellite. Nor has MSV offered any guarantee that MSV Canada will similarly limit the loading of its own first-generation or second-generation satellite. Rather, MSV merely certifies that, if its own satellite fails, it will preempt up to half of the capacity of MSV Canada's satellite and transfer up to half of the traffic formerly handled by the failed satellite.[44] Further, neither MSAT-1 nor AMSC-1, nor both together, would fully suffice to back up the proposed second-generation MSV satellite. The first-generation satellites are incapable of relaying transmissions to or from handsets operated without boosters. According to MSV's business plan, handset communications would comprise a substantial portion of the traffic burden handled by its second-generation satellite. Thus, there would be no suitable in-orbit backup for MSV's second-generation satellite before MSV Canada places a second-generation MSS satellite of its own into service – and we have no way of knowing at this point when (if ever) that will occur. Therefore, we are not convinced that the proposed in-orbit back-up arrangements would fully serve the purpose for which the Commission adopted the ground-spare rule. Hence, we cannot conclude that the requested waiver to relieve MSV from any obligation to maintain a ground spare can be granted without undermining the purpose of the rule. We therefore deny the request for complete waiver of the ground-spare requirement.

25. At the same time, we do not believe that it would serve the public interest to force MSV to delay implementation of ATC to avoid violating the one-year rule in Section 25.149(b)(2) if it acquires a suitable ground spare as soon as reasonably possible. We do not think that it would be reasonable to expect or require MSV to construct a duplicate of its aging first-generation satellite for this purpose. It may well be infeasible[45] and would, in any event, be economically wasteful, for MSV to construct a spare satellite replicating the obsolete design of AMSC-1, which would not afford a suitable backup capability for MSV's planned second-generation MSS system. We assume, though, that parallel construction of a duplicate of MSV's second-generation satellite for use as a ground spare could be completed within six months after launch of the second-generation satellite.[46] Therefore, in the event that MSV completes preparations for commencing commercial ATC operation sooner than six months prior to the

[43] For example, MSV says that MSV Canada shifted traffic to AMSC-1 in less than seven hours in May 2003 after MSAT-1 failed temporarily, after only one hour of service outage. *Id.*

[44] Letter from Lon C. Levin to FCC Secretary dated Oct. 4, 2004. The statement does not explicitly indicate whether the backup agreement with MSV Canada pertains to the current satellites, the second-generation satellites, or both. Nor has MSV disclosed what, if any, reciprocal backup obligation it would have in the event of a failure of MSV Canada's satellite.

[45] It would be prohibitively expensive to build a spare satellite replicating the design of AMSC-1 unless the necessary parts can still be procured without remanufacturing, which seems unlikely in view of the fact that the design for AMSC-1 was finalized more than ten years ago.

[46] Although it might be possible to complete construction of both the second-generation satellite and a duplicate for use as a ground spare in no more time than would be required for building only one such satellite, we recognize that when duplicate satellites are under construction it commonly proves expedient to "cannibalize" one of them for replacement components, consequently retarding its completion, in order to keep construction of the other on schedule.

milestone deadline for launching its second-generation MSS satellite, we would entertain a request for a limited waiver extending the one-year deadline for obtaining a ground spare, supported by evidence that a suitable spare satellite is under construction with a scheduled delivery date no later than six months after the launch deadline.[47]

3. Other Non-Technical Requirements

26. Section 25.149 establishes other gating requirements pertaining to service coverage and spectrum use. For example, a licensee's L-Band ATC operations must be limited to the frequency assignments authorized and internationally coordinated for its L-Band MSS system, and an ATC licensee may not provide ATC service outside the geographic coverage area of its MSS network.[48] Also, an L-Band ATC applicant must show that it can provide full-time MSS in all fifty states, Puerto Rico, and the U.S. Virgin Islands except to the extent such coverage is impossible from its the assigned orbital position(s) of its satellite(s).[49] Section 25.149 also provides that ATC mobile terminals must be type-certified and meet radio-frequency radiation exposure limits and requires ATC base stations to meet previously-adopted rules pertaining to antenna construction, environmental impact, and protection of radio-astronomy observation.[50] No question has been raised pertaining to MSV's showing in these respects, which we find to be sufficient.

C. Technical Requirements for ATC Operation

27. The Commission adopted band-specific technical rules to ensure that ATC operation will not cause harmful interference. The technical requirements pertaining to L-Band ATC operation are set forth in Section 25.253 of the Commission's rules. The Commission derived the requirements in Section 25.253 from analysis of the potential for interference with operation of an ATC licensee's own MSS system and operation of other L-Band MSS systems, particularly Inmarsat's, and the potential for interference with radio-astronomy observation and satellite radionavigation in adjacent frequency bands.[51]

1. Link Margin for Structural Attenuation

28. Section 25.253(a)(8) requires an applicant for L-Band ATC authorization to demonstrate that its ATC network will reserve a minimum of 18 dB of link margin for overcoming structural attenuation between base stations and mobile terminals when the terminals are operated inside buildings.[52] Alternatively, Section 25.253(a)(8) states that, if less

[47] MSV has informed the Bureau that it expects to construct and launch MSV-1 within four years, in any event. *See* "Exhibit A", submitted with letter from Bruce D. Jacobs, counsel to MSV, to the FCC Secretary dated Dec. 30, 2003.

[48] 47 C.F.R. § 25.149(a)(2)(ii) and (a)(3).

[49] 47 C.F.R. § 25.149(b)(1). MSV certifies that it fully meets this coverage requirement.

[50] 47 C.F.R. § 25.149(a)(4), (a)(5), (c), and (d).

[51] *ATC Report and Order* at ¶¶ 130-188.

[52] *See id.* at ¶140 and Appendix C2 § 1.3.1. "Structural attenuation" is defined in 47 C.F.R. § 25.201 as "signal attenuation caused by transmitting to and from mobile terminals which are located in buildings or other man-made structures that attenuate the transmission of radiofrequency radiation."

than 18 dB of link margin is reserved for overcoming structural attenuation, the number of U.S. base stations operating on any channel must be reduced to offset the potential interference impact, or a showing must be made that the reservation of less link margin would not result in increased interference to other MSS systems.

29. MSV has submitted an ATC network link budget that shows an 18 dB structural attenuation margin.[53] MSV represents that the link budget takes into account the radius within which mobile terminals can communicate with a base station with a specified statistical reliability, subject to specified propagation impairments including structural attenuation that may result in up to 18 dB of signal loss. MSV asserts that when a mobile terminal's line-of-sight propagation path to a base station is unobstructed, its signal power will be reduced by a closed-loop power-control algorithm, implemented in the base station and mobile terminal, to an average level 18 dB lower than its maximum power.[54] MSV further asserts that an active mobile terminal moving from one base station's service area to another's will likewise operate with its signal level reduced by 18 dB when its transmissions are unimpaired by structural attenuation.[55]

30. MSV describes methods for configuring base stations at the periphery of an ATC service area to control the power of mobile terminals operating near the edge of the service area. To this end, MSV says that it will disable the transmitters of base station sectors facing away from the ATC service footprint, thus configuring them as receive-only sectors. A user terminal moving away from the ATC service footprint could transmit to a base station via the main reception lobe of such a receive-only sector, while receiving transmissions from the side lobes of one of the base station's transmit-enabled sectors. In this situation, MSV maintains, the forward link from the base station to the user terminal will be much weaker than the return link from the mobile terminal. Consequently, the communication will terminate due to forward-link breakage well before the terminal reaches a distance from the base station that would require it to radiate at maximum power. MSV asserts that an antenna front-to-back ratio of 26 dB resulting in a forward link disadvantage of approximately 25 dB is effectively mandated by the Commission's rules. The base station service radius in the direction of a receive-only sector would therefore shrink to less than two-tenths of the normal radius. Therefore, according to MSV, a user terminal that is within a receive-only sector and is not affected by structural attenuation would radiate at power levels at least 25 dB below the levels that it would generate if it were operating at the edge of a normally-engineered sector.[56]

31. Inmarsat maintains that Section 25.253(a)(8) required MSV to demonstrate that the peak EIRP of any ATC mobile terminals will not exceed -18 dBW when the terminal is operated outdoors or demonstrate that equivalent measures will be taken to limit uplink interference to Inmarsat from ATC mobile-terminal operation.[57] Inmarsat contends that MSV

[53] MSV ATC Application at p.15 and Exhibit E and letter with attachment from Lon C. Levin, MSV Vice President, to the FCC Secretary dated Aug. 31, 2004.

[54] *See*, *e.g.*, 47 C.F.R. § 25.253(g)(1) (prescribing 0 dBW limit on peak EIRP of mobile terminals).

[55] MSV ATC Application, Appendix E.

[56] *Id*.

[57] Inmarsat Opposition at p.36. EIRP – *i.e.*, equivalent isotropic radiated power – is defined in the Commission's rules as the product of the power supplied to an antenna and the antenna gain in a given direction relative to an isotropic antenna. 47 C.F.R. § 2.1. An isotropic antenna is one that radiates equally in all directions.

has not demonstrated that its ATC mobile terminals generate no more than -18 dBW EIRP when operating outdoors. To the contrary, according to Inmarsat, MSV indicates that its mobile terminals *will* sometimes transmit at EIRP levels higher than -18 dBW while operating outdoors. Inmarsat contends that MSV implies this by saying that, if necessary, it will show that uplink interference will be reduced to an equivalent extent by reducing the number of base stations or by some other alternative means.[58] Inmarsat maintains that MSV should have explained in the application where and to what extent its network will allow mobile terminals operating outdoors to radiate more than -18 dBW EIRP and to what extent it would reduce the number of base stations or how such a reduction would be calculated.[59] For these reasons, Inmarsat argues that MSV's showing fails to comply with Section 25.253(a)(8).

32. We do not agree that Section 25.253(a)(8) requires an applicant to demonstrate that the EIRP generated by mobile terminals will never exceed -18 dBW when they are operated outdoors. Rather, the Commission indicated in the *ATC Report and Order* that the underlying intention was to bar licensees from extending a base station's coverage area to such an extent that a mobile terminal at the edge of the area would have to transmit at EIRP higher than -18 dBW merely to overcome free-space path loss.[60] MSV has explained how it intends to meet this requirement.

33. Nor do we agree with Inmarsat that MSV is presently proposing to allocate less than 18 dB for structural attenuation in some areas. Rather, MSV merely said it would provide the alternative showing required by Section 25.253(a)(8), if necessary, to justify any base-station arrangement that would not comport with the proposed allocation of 18 dB for indoor structural attenuation. To require MSV to specify in its initial application precisely where and to what extent such deviation will occur would be unreasonable. We recognize that it would be very difficult to ascertain now whether 18 dB can be reserved for structural attenuation in all cases, and, if not, where and to what extent deviation will be necessary. This Order does not grant authority for any base station arrangement that would allocate less than 18 dB of link margin for structural attenuation. To obtain authority for any such deviation from the 18 dB link-margin requirement, MSV would have to specifically describe and identify the proposed deviations and demonstrate with technical analysis that equivalent interference suppression will be achieved by reducing the total number of base stations or by some other means. We find, however, that the pertinent information in MSV's application and its submission of a link budget allocating 18 dB for structural attenuation is a sufficient initial showing for purposes of Section 25.253(a)(8).

2. Protection for Radionavigation Satellite Service

34. The Commission decided in the *ATC Report and Order* that, in order to minimize

[58] Reply of Inmarsat Ventures Ltd filed Apr. 26, 2004 ("Inmarsat Reply") at 27, citing MSV ATC Application at 15-16.

[59] *Id.* at 28.

[60] *ATC Report and Order* at ¶142 and Appendix C2 § 1.3.1. It seems clear from context that "-10 dBW" in the last sentence of ¶142 is a typographical error and that the Commission meant "-18 dBW" instead.

interference with reception of Radionavigation Satellite Service ("RNSS") signals, ATC mobile terminals and base stations should operate in compliance with the limits on emissions in the 1559-1610 MHz band that the Commission had previously prescribed for mobile earth stations in the *GMPCS* rulemaking, which are set forth in Section 25.216.[61] Accordingly, Section 25.253(a)(6) requires an L-Band ATC applicant to show that its base stations and mobile terminals accessing its ATC network will operate in compliance with "the … GMPCS system requirements to protect … RNSS operations in the allocation above 1559 MHz." In other words, the applicant must show that ATC base stations and mobile terminals will operate within the emission limits for L-Band mobile earth stations, which are set forth in Section 25.216. Although this provision in 25.253(a)(6) would have sufficed to accomplish the stated intention of establishing equivalent RNSS-protection requirements for ATC transmitters, the Commission also adopted provisions in Paragraphs (d)(7) and (g)(3) of Section 25.253 that require applicants to show that emissions will not exceed certain EIRP limits in the 1559-1610 MHz RNSS band.[62]

35. In its ATC application, as amended, MSV certifies that the EIRP density of emissions in the 1559-1605 MHz band from mobile terminals that access its ATC network will not exceed -90 dBW/MHz, that the EIRP of discrete emissions from the mobile terminals of less than 700 Hz bandwidth will not exceed -100 dBW in that band, that the EIRP density of the mobile terminals' emissions will not exceed -66 dBW/MHz at 1610 MHz, and that the EIRP of their discrete emissions of less than 700 Hz bandwidth will not exceed -76 dBW at 1610 MHz. Further, MSV certifies that mobile terminals placed in service five years or more after it commences ATC operation will suppress emissions to an even greater extent in the 1605-1610 MHz band.[63] MSV also certifies that the EIRP density of emissions from its ATC base stations will not exceed -100 dBW/MHz anywhere in the 1559-1610 MHz RNSS band and that the EIRP of discrete ATC base-station emissions of less than 700 Hz bandwidth will not exceed -110 dBW in that band.[64] MSV certifies that it will use two-millisecond measurement intervals when testing transmitter performance to ensure compliance with the RNSS emission limits specified in its application.[65]

36. Because MSV's emission specifications are more strict than necessary for compliance with the applicable RNSS-band emission limits in the Commission's rules, its

[61] *ATC Report and Order* at ¶¶ 197-200. *See* Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite (GMPCS) Memorandum of Understanding and Arrangements [and] Petition of the National Telecommunications and Information Administration to Amend Part 25 of the Commission's Rules to Establish Emission Limits for Mobile and Portable Earth Stations Operating in the 1610-1660.5 MHz Band *Report and Order and Further Notice of Proposed Rulemaking*, IB Docket No. 99-67, 17 FCC Rcd 12941 (2002).

[62] The limits specified in Paragaphs (d)(7) and (g)(3) were identical, when adopted, to the limits for L-Band mobile earth stations in Section 25.216. The limits in Section 25.216 have since been revised in some respect, however, and to date there has been no conforming amendment of Paragraphs (d)(7) and (g)(3) of Section 25.253. Consequently, there are minor discrepancies between the limits in those paragraphs and the RNSS-band emission limits currently specified in Section 25.216 and cross-referenced in Section 25.253(a)(6). The discrepancies are immaterial in this case, however, because operation in accordance with MSV's proposed RNSS-band emission specifications would comport with all of these rule provisions.

[63] *See* MSV ATC Application at 25-26 and letter with attachment from Lon C. Levin to the FCC Secretary dated February 27, 2004.

[64] MSV ATC Application at 22.

[65] Letter with attachments from Lon C, Levin to the FCC Secretary dated Sept. 22, 2004.

showing satisfies the requirements of Paragraphs (a)(6), (d)(7), and (g)(3) of Section 25.253. The terms of the authorization we grant here require test data to be submitted in equipment-authorization applications to demonstrate compliance with the stricter specifications.

3. Priority and Preemptive Access: GSM Operation

37. Section 25.253(a)(5) requires an applicant for L-Band ATC authority to explain how it would afford priority and preemptive access for aeronautical mobile-satellite en-route service ("AMS(R)S") and global maritime distress and safety system ("GMDSS) communications, as required by Footnotes US308 and US315 to the Table of Frequency Allocations in Section 2.106 of the Commission's rules. MSV explains in detail how its ATC system would meet these requirements through use of inherent features of GSM operation.[66] The Commission has previously determined that an identical proposal for implementing priority and preemptive access for GSM-protocol ATC operation that MSV filed in the ATC rulemaking was consistent with the requirements of Footnotes US308 and US315.[67] Accordingly, we conclude that MSV's reiteration of that proposal in its current ATC application satisfies the requirement of Section 25.253(a)(5) insofar as it pertains to GSM operation.

4. Vocoder Rates

38. A vocoder is a device that encodes digitized speech signals into a compressed digital data stream and decodes the compressed data stream back into digitized speech signals. On the encoding side, the vocoder is preceded by a microphone and analog-to-digital converter for converting sound waves to digitized speech signals. On the decoding side, the vocoder is followed by a digital-to-analog converter, amplifier, and earphone or loudspeaker for converting the digitized speech signals back to sound waves.

39. A GSM channel is divided in the time domain into a series of consecutive frames of specified uniform duration, each of which is sub-divided into eight time-slots. A GSM mobile terminal must operate at a full-rate duty cycle – that is, it must transmit a "burst" in one assigned time-slot in every frame – in order to transmit data at the standard GSM vocoder data-output rate of 13 kbps. A GSM terminal can operate at a half-rate duty cycle, however, if the vocoder data-output rate is sufficiently reduced. When operating in half-rate duty-cycle mode, a GSM terminal will transmit one burst in every two frames, skipping every other frame. Frame-skipping reduces the time-averaged EIRP of the terminal's transmissions.[68]

40. Section 25.253(a)(2) of the Commission's rules, adopted in the *ATC Report and Order*, requires the duty cycle of an ATC mobile terminal using a standard GSM protocol to be reduced to half-rate and the vocoder output rate to be reduced accordingly when the terminal's amplifier output power exceeds -7.4 dBW and requires further vocoder-rate/duty-cycle reductions at amplifier power levels above -4.4 dBW. The Commission estimated that such vocoder/duty-cycle regulation would reduce the effective (*i.e.*, time-averaged) EIRP of active

[66] *See* MSV ATC Application, Appendix D.

[67] *See ATC Report and Order*, Appendix C2 § 3.1, and Comments of TMI, Motient, and MSV filed on Oct. 22, 2001 in Docket No. 01-185, at 7-11.

[68] *See ATC Report and Order*, Appendix C2 § 1.10.

mobile terminals by 3.5 dB, on average, assuming a typical user distribution.[69]

41. MSV requests a waiver to allow use of a different vocoder-rate/duty-cyle schedule than the one prescribed in Section 25.253(a)(2). Instead of shifting to half-rate duty cycle and vocoder operation when amplifier output power exceeds -7.4 dBW and to quarter-rate or less when the power exceeds -4.4 dBW, as the rule requires, MSV mobile terminals using a GSM protocol would shift to half-rate duty cycle and reduce the vocoder rate (from 13 kbps to 4.75 kbps) only when amplifier output power rises above -3.5 dBW and would not reduce either the duty cycle or the vocoder rate to any further extent at higher amplifier-output levels. The shift to half-rate duty cycle will reduce effective peak EIRP by 3 dB. MSV maintains that the concurrent reduction of the vocoder data transmission rate will further reduce the effective peak EIRP by another 0.5 dB, for a total reduction of 3.5 dB.[70] MSV requests waiver of Section 25.253(a)(2) as necessary to permit operation in this manner.[71]

42. Inmarsat contends that the vocoder-rate/duty-cycle schedule proposed in MSV's application would not reduce effective mobile-terminal EIRP to the same extent as the schedule prescribed in Section 25.253(a)(2). On the contrary, Inmarsat maintains that, with the user distribution assumed in the Commission's analysis, MSV's proposed vocoder-rate/duty-cycle operation would yield an average power reduction of only 0.97-1.87 dB, rather than the 3.5 dB average reduction that would result from adherence to the rule.[72] MSV replies that its proposed regulation of the vocoder data rate and the GSM duty cycle will ensure that each mobile terminal's effective EIRP will never exceed -3.5 dBW. MSV stresses that this effective maximum power level is 3.5 dB below the peak EIRP permitted by Section 25.253(g)(1), and contends that this will suffice to meet the Commission's objective of limiting uplink interference.[73] According to MSV, user distribution – the percentage of active terminals transmitting at the full vocoder rate and duty cycle and the percentage(s) transmitting with reduced vocoder rates and duty cycles – is irrelevant to uplink interference analysis.[74]

43. MSV has not persuaded us that a further 0.5 dB power reduction would result from reducing the data transmission rate, in addition to the 3 dB reduction from half-rate duty cycle operation. MSV bases the assertion that an additional 0.5 dB reduction will be achieved on an implicit assumption that forward error correction will remain constant when the data transmission rate changes. MSV has provided no support for that assumption, however. We

[69] The calculation assumes that 30% of active mobile terminals are operating outdoors with full-rate duty-cycles, 30% are operating in vehicles at quarter-rate duty cycle, and 40% are operating in buildings with an average 18% duty cycle. *ATC Report and Order*, Appendix C2 § 1.10.

[70] Since the carrier to noise density ratio required to send digital data through a radio communication link is directly proportional to the rate at which the data is sent (assuming the same modulation and forward error correction techniques are used), the required EIRP carrier power of a mobile terminal's ATC transmission can be reduced by reducing the vocoder data rate. Although toll-quality telephony requires a relatively high vocoder data rate, acceptable signal quality may be obtained at a lower vocoder rate, perhaps as low as 2.0 kbps.

[71] MSV ATC Application at pp. 13-14 and Appendix C. *See also* letter with attachment from Bruce D. Jacobs and David S. Konczal to the FCC Secretary dated Feb. 4, 2004.

[72] Inmarsat Opposition at 39-40.

[73] MSV Response, Appendix A at 4, cross-referencing Reply of Mobile Satellite Ventures Subsidiary LLC filed Sept. 2, 2003 in IB Docket No. 01-185.

[74] MSV ATC Application, Appendix C at 2.

agree with Inmarsat that MSV's proposal to switch to half-rate vocoder operation at amplifier output levels above -3.5 dBW would not reduce the *average* effective EIRP of active GSM mobile terminals to the same extent as vocoder-rate regulation in conformance with the schedule in Section 25.253(a)(2). Assuming a 3 dB reduction in the effective EIRP of mobile terminals with amplifier output above –3.5 dBW, the variable-rate vocoder operation that MSV proposes would achieve only a 0.97 dB overall-average reduction in the effective EIRP of active mobile terminals, rather than the 3.5 dB average reduction estimated in the *ATC Report and Order*.[75] We nevertheless grant MSV's request for waiver of section 25.253(a)(2) to permit use of the vocoder/duty-cycle schedule described in its application, because, as explained below, the deficit in average-EIRP reduction due to MSV's proposed vocoder/duty-cycle operation is more than offset by its demonstration that its mobile terminals' average antenna gain in the direction of co-channel satellites will be 4 dB lower than the Commission assumed in its uplink interference analysis.[76]

5. Channel Re-use Limit

44. Section 25.253(c), adopted in the *ATC Report and Order*, states that no more than 1725 ATC base stations may operate in the U.S. on any one 200 kHz L-Band channel. This rule effectively limits the number of mobile terminals that can simultaneously communicate on one GSM channel through U.S. base stations to 1725. The Commission imposed this restriction for two reasons: to limit self-interference with the operation of MSV's own satellite system and to prevent harmful interference with the operation of other L-Band MSS systems. The Commission said, however, that it would entertain requests to deploy more than 1725 base stations in the U.S. based on a showing that there would be no consequent increase in interference either to MSV's own MSS system or to other MSS systems.[77]

45. MSV argues that Section 25.253(c) should be waived to allow it to operate substantially more than 1725 base stations per channel in the U.S., based on the following contentions: (i) the channel re-use limit should be recalculated to allow MSV's ATC network to increase the noise received by Inmarsat's satellites by as much as 6%; (ii) the limit should be adjusted upward to an additional extent because MSV will deploy only 20% as many base

[75] *See ATC Report and Order*, Appendix C2 §1.10. The estimated average reduction from half-rate duty-cycle operation at nominal amplifier power levels above -3.5 dBW, as proposed in MSV's application, is derived from the following table, using the distribution assumed in the Commission's analysis:

Location	Percentage Population	Percentage Population at >-3.5 dBW	Duty Cycle	Weighted Vocoder Factor
Outdoor	30%	0%	100%	0.3 * 1 = 0.3
Vehicle	30%	0%	100%	0.3 * 1 = 0.3
Indoor	40%	100%	50%	0.4 * 0.5 = 0.2
Sum	0.3 + 0.3 + 0.2 = 0.8 **average vocoder power reduction (dB): 10log(0.8) = 0.97**			

[76] *See* discussion of mobile-terminal antenna gain in ¶¶ 52-55, *infra.*

[77] *ATC Report and Order* at ¶¶ 142, 145, 147, 167, and Appendix C2 § 1.13.

stations outside of the U.S. as it deploys within the U.S.; (iii) the limit should be further increased because the spatially-averaged antenna gain of MSV mobile terminals, when operating in ATC mode, will not exceed -4 dBi; and (iv) it is not necessary to impose the channel re-use limit to minimize self-interference because MSV will accomplish that objective through use of an interference-cancellation technique. Additionally, MSV argues that there should be no limit on re-use of channels that are not used by satellites visible in North America (aside from those licensed to MSV and MSV Canada). We address each of these contentions in turn.

46. ***Intersystem Interference Allowance*** The Commission determined that limiting the number of active U.S. base stations to 1725 per channel would ensure that MSV's ATC operation would raise the noise floor of current Inmarsat satellites by no more than 0.1% and that of next-generation Inmarsat-4 satellites by no more than 1.4% (0.7% from MSV operations within the US and no more than 0.7% from non-US operations), which the Commission deemed to be acceptable.[78] MSV argues that the 1.4% intersystem interference allowance reflected in the 1725-base-stations-per-channel limit is overly strict.[79] According to MSV, it would suffice to limit intersystem uplink interference from its ATC operation to 6% ΔT/T, which would reduce the link margin for co-channel Inmarsat-4 receivers by only 0.25 dB.[80] MSV also contends that a 6% ΔT/T interference allowance would be more consistent with the common practice, acknowledged in the *ATC Report and Order*, of designating 6% ΔT/T as a threshold for international satellite coordination.[81] For these reasons, MSV requests a waiver that would allow an amount of channel re-use that would result in up to 6% increased noise into the Inmarsat-4 satellites (which would effectively increase the channel re-use limit for MSV's system by a factor of 4.3). Inmarsat opposes this request, arguing that such a waiver would allow MSV to increase the noise floor of Inmarsat's satellites to an unacceptable extent and would effectively confer co-primary status on a non-conforming use of the band, contrary to an ITU regulation.[82]

47. In its pending petition for reconsideration of the ATC Report and Order, MSV similarly urges the Commission to amend Section 25.253(c) to adjust the limit on the number of U.S. base stations per channel upward to a level that would allow up to up to 6% ΔT/T intersystem uplink interference impact. MSV's argument for amending Section 25.253(c), which would potentially increase interference into other MSS systems, is essentially the same as the argument in its ATC application for granting equivalent relief through waiver.

48. The Commission prescribed limits on the number of ATC base stations in order to limit MSV's self-interference to 6% ΔT/T (or 0.25 dB), a level that MSV indicated it would adhere to in its system design, and also to limit interference to Inmarsat to 1.4% ΔT/T.[83] The Commission did not determine how much interference to Inmarsat would be the maximum

[78] *Id.*, Appendix C2 § 2.1.1.

[79] MSV ATC Application at 18 and Appendix I.

[80] "ΔT/T" is a shorthand expression meaning percentage of noise increase over the system thermal noise level.

[81] *ATC Report and Order* at ¶164.

[82] Inmarsat Opposition at 29-32. Also see *ATC Report and Order* at ¶214 and n.563, citing ITU Radio Regulations § 4.4.

[83] *ATC Report and Order* at Appendix C2 § 2.1.1.

acceptable. It concluded, however, that operation in accordance with the rules adopted, which were consistent with MSV's original proposal, would not hinder Inmarsat's operations. The Commission said in the *ATC Report and Order* that its adoption of rules to prevent harmful interference was not intended to preclude acceptance of less-restrictive limitations based on negotiated agreements between L-Band MSS operators. In fact, the Commission explicitly encouraged L-Band MSS operators to engage in private negotiations to resolve interference concerns and stated that it would consider waiver requests of these rules based on such agreements.[84]

49. In view of the fact that essentially the same issue is before the Commission in the rulemaking proceeding and the Commission intended to allow parties to negotiate technical solutions to interference issues, where possible, we will defer consideration of MSV's waiver request in this regard pending the Commission's resolution of the corresponding issue in MSV's petition for reconsideration. Should the parties reach a negotiated agreement on this issue, the Commission, at that time, will consider such agreement to determine what further action, if any, would be necessary.[85]

50. ***Base Station Distribution*** The Commission's estimate of the amount of uplink interference that Inmarsat would receive from ATC operation in L-Band spectrum assigned to MSV was based on an assumption that no more than 1725 base ATC stations would simultaneously operate on a single MSV-ATC channel in locations *outside* the United States.[86] MSV asserts in its application, however, that only 20% of its network's base stations will be deployed outside the U.S. Hence, MSV maintains that it could operate 1.6 times as many co-channel base stations in the United States as Section 25.253(c) currently permits – 2760 instead of 1725 – without increasing system-wide uplink interference beyond the level contemplated in the *ATC Report and Order*. MSV therefore requests a waiver that would increase the permissible number of co-channel U.S. base stations by a factor of 1.6.[87] As with the request for increased channel re-use predicated on a 6% $\Delta T/T$ intersystem interference allowance, this waiver request mirrors a request for equivalent relief through rule amendment in MSV's petition for reconsideration of the *ATC Report and Order*. In opposition, Inmarsat argues that the Commission should place no reliance on MSV's assurance concerning the number of base stations that will be deployed outside the U.S. because the Commission has no authority to enforce a limit on base-station deployment in foreign countries.[88]

51. This waiver request presents a verification issue that we cannot resolve based on the information currently before us. The waiver request presupposes that the Commission will be

[84] *ATC Report and Order* at ¶ 143.

[85] Moreover, in the event MSV is in a position to deploy and operate more than the number of co-frequency U.S. base stations permitted by this Order before the Commission issues a decision on MSV's petition for reconsideration of the ATC Report and Order, we would be willing to entertain a request for Special Temporary Authority allowing operation of additional co-frequency base stations subject to subsequent compliance with any restrictions imposed by, or necessary for conformance with, the Commission's reconsideration decision and/or subsequent coordination agreements between interested parties.

[86] *ATC Report and Order* at Appendix C2 § 2.1.1.

[87] MSV ATC Application at 16-17 and Response to Inmarsat, Appendix A at 1.

[88] Inmarsat Opposition at 24-26.

able to ascertain how many ATC base stations are operating outside the United States in spectrum assigned to MSV under the Mexico City MOU. It is not clear, however, that the rules under which ATC will be implemented outside the United States will ensure that MSV will know how many ATC base stations are operating outside the United States on particular frequency bands within its assigned L-Band spectrum. Because it is unclear from the information before us whether MSV would know how many such foreign base stations are in operation, it is equally unclear whether the Commission could verify the accuracy of MSV's assurance that no more than 20% of all ATC base stations operating in its assigned MSS spectrum will be located outside the United States. We therefore deny this waiver request without prejudice to the Commission's consideration of this issue as raised in MSV's pending petition for reconsideration of the *ATC Report and Order*.

52. ***Mobile Terminal Antenna Gain*** The Commission assumed for purposes of the interference analysis from which it derived the channel re-use limit that an L-Band ATC handset would not radiate EIRP of more than 0 dBW in the direction of an Inmarsat satellite, which necessarily implies that it could radiate no more than 0 dBW in any direction, since the orientation of a handset's antenna relative to an Inmarsat satellite will not be fixed.[89] Accordingly, the Commission adopted a rule provision, Section 25.253(g)(1), that states that an applicant for L-Band ATC authority must demonstrate that peak mobile-terminal EIRP will not exceed 0 dBW. MSV contends in its application, however, that the potential interference impact from operation of mobile-terminal handsets accessing its ATC network should be assessed on the basis of their "spatially-averaged" antenna gain and EIRP in the direction of co-channel satellites, taking into account all possible handset orientations relative to a satellite's position. MSV maintains that this is the most appropriate method for gauging interference impact because the directional gain of the cellular/PCS-type antennas that will be incorporated in its dual-mode handsets is highly irregular and because a large number of handsets with diverse orientations will contribute to the aggregate interference impact on satellite uplink reception.[90] Based on an included analysis with measured antenna-gain data obtained from an equipment manufacturer, MSV certifies that its ATC terminals' spatially-averaged antenna gain will not exceed -4 dBi toward any co-channel satellite (including MSV's own satellite) and consequently that the spatially-averaged EIRP toward any such satellite from mobile terminals operating at full power will not exceed -4 dBW.[91] Hence MSV contends that the aggregate interference impact from operation of a given number of its ATC mobile terminals will be 250% less than the Commission assumed when calculating the channel re-use limit. MSV therefore requests a waiver of Section 25.253(c) that would allow it to increase the number of co-channel U.S. base stations by a factor of 2.5 (in addition to the requested increases predicated on a 6% $\Delta T/T$ interference allowance and 80% domestic base-station deployment).[92]

53. Inmarsat argues that MSV's showing regarding spatially-averaged mobile-terminal antenna gain does not justify a waiver because MSV is not proposing any change from the mobile-terminal design specifications in its original ATC application, which the Commission

[89] *ATC Report and Order*, Appendix C2, Table 2.1.1.C. As explained previously, a mobile terminal's maximum *time-averaged* EIRP would be limited by vocoder-rate reduction to less than the maximum instantaneous EIRP.

[90] MSV ATC Application, Appendix H at 1.

[91] *Id.*; MSV Response at 16 and n.18. MSV promises to provide prototype test data that will verify these assurances.

[92] MSV ATC Application at 18.

took into account when calculating the channel re-use limit.[93] Inmarsat also questions the validity of diagrams in MSV's application that plot the gain of an external stubby antenna in two elevation planes, asserting that the plots suggest extremely high isolation values that are unlikely to be realized in practice.[94] Furthermore, Inmarsat argues that MSV's application should be dismissed for failure to demonstrate that the peak EIRP of each ATC mobile terminal will be limited to 0 dBW, as required by Section 25.253(g)(1).[95] Inmarsat asserts in this regard that the antenna gain patterns included in MSV's application indicate that an MSV mobile terminal would generate an EIRP of up to +2 dBW in the direction of maximum antenna gain.

54. The NTIA agrees that spatial averaging should be used when estimating uplink interference from mobile-terminal operation but argues that no increase in channel re-use is warranted to correct for this because the Commission erred in the other direction by adjusting for estimated average reduction in effective mobile-terminal EIRP due to vocoder-rate/duty-cycle regulation.[96] We find no merit in this contention, which is based on the incorrect premise that the Commission's uplink interference analysis assumes that all active mobile terminals will be transmitting with EIRP reduced by 20 dB through power control. Rather, the Commission estimated that the effective radiated power *that would be seen by satellites* would be reduced, on average, by 20 dB by the combined effect of power control and structural attenuation of transmissions from mobile terminals operating inside buildings and motor vehicles.[97] Vocoder-rate/duty-cycle regulation would reduce the average effective radiated power to an additional extent, as the Commission acknowledged.

55. We agree with MSV that using spatial averaging to estimate the aggregate interference impact of mobile-terminal operation is appropriate, for the reasons that MSV has stated. We therefore agree, as well, that MSV's certification that the spatially-averaged EIRP of mobile terminals operating at full power will not exceed -4 dBW in the direction of co-channel satellites, supported by the data and analysis in Appendix H of its application and MSV's commitment to provide verifying prototype test data, has a material bearing on the extent to which base-station channel re-use must be limited in order to achieve the Commission's objectives of limiting uplink interference into second-generation MSV and Inmarsat satellites to 6% and 1.4% $\Delta T/T$, respectively. As demonstrated and guaranteed, the maximum spatially-averaged EIRP of MSV's mobile terminals will be at least 4 dB less than the maximum EIRP in the direction of co-channel satellites that the Commission assumed when calculating the channel re-use limit. After adjusting for the previously-noted differential between average power

[93] Inmarsat Opposition at 27.

[94] *Id.* at n.81, referring to MSV ATC Application, Exhibit H, Figure 4.

[95] Inmarsat Opposition at 14.

[96] *See* Enclosure submitted with NTIA Letter at 14.

[97] *See ATC Report and Order*, Appendix C2 §§ 1.3-1.3.5 and Table 1.14.A.

reduction that would result from MSV's proposed vocoder/duty-cycle operation and the average reduction that would result from operation in strict compliance with Section 25.253(a)(2), there is still a net power reduction of 1.47 dB more than the Commission assumed. This warrants a 40% increase in channel re-use. We therefore grant a partial waiver to allow MSV to simultaneously operate up to 2415 co-frequency ATC base stations in the United States. To provide an adequate transition, however, MSV shall not operate more than 1208 base stations on the same channel during the first eighteen months following activation for testing of the first ATC base station.[98]

56. We do not agree with Inmarsat that MSV's ATC application should be dismissed for failure to demonstrate that mobile-terminal EIRP will not exceed 0 dBW in the direction of maximum gain. As explained above, MSV has provided a well-supported showing that its mobile terminals' spatially-averaged EIRP in any relevant direction – *i.e.*, in the direction of any L-Band satellite – will be limited to levels substantially below 0 dBW. This showing fully satisfies the underlying purpose of the demonstration requirement in Section 25.253(g)(1). For this reason, we conclude that MSV's application is not materially incomplete due to the absence of a showing regarding peak EIRP in the direction of maximum gain. Dismissal – which would simply delay resolution of important licensing issues by forcing MSV to re-file subject to another public-notice cycle – is therefore unwarranted.

57. ***Self Interference*** As noted previously, the Commission adopted the channel re-use limit not only to protect other satellite systems from harmful interference but also to limit interference into MSV's own MSS satellite to 0.25 dB.[99] MSV asserts that it will employ an adaptive interference cancellation technique that will limit self-interference to 0.25 dB or less, even if its ATC network operates with a much-higher channel re-use factor than Section 25.253(c) specifies.[100] Simply described, MSV is proposing to use signal processors in its gateway stations to cancel the portion of each MSS downlink signal that has leaked from adjacent beam coverage areas, which would include any interference from ATC mobile terminals. MSV contends that its use of this technique to cancel self-interference obviates any reason for concern that waiving the channel re-use limit to the full extent requested would result in a higher level of self-interference than the Commission deemed acceptable in the *ATC Report and Order*.[101]

58. Inmarsat contends that MSV's plan to use adaptive interference cancellation is impractical. Inmarsat asserts that in order to implement the plan with its next-generation MSS system, MSV would have to increase the number of channels in its next-generation satellite by a factor of seven and would need seven times as much feeder-link spectrum. The impact to MSV's current MSS system would be even worse, according to Inmarsat, because MSV would have to reserve all but one-seventh of its current satellite's capacity for interference monitoring. Inmarsat stresses, moreover, that MSV's use of adaptive interference cancellation would not

[98] *Cf.* 47 C.F.R. § 25.253(c).

[99] *ATC Report and Order* at ¶145 and Appendix C2 §1.14.

[100] MSV ATC Application, Appendix F at 1.

[101] MSV ATC Application, Appendix I at 3.

protect Inmarsat from interference.[102]

59. In reply, MSV denies that implementation of the interference cancellation technique will entail any reduction of its MSS traffic capacity, assignment of additional spectrum, or substantial additional cost.[103] MSV asserts that it will increase re-use of feeder-link spectrum as needed for interference monitoring by deploying additional gateway earth stations for its second-generation MSS system, rather than requesting additional bandwidth for this purpose. The interference cancellation processors will be embedded in the baseband portion of the gateway receivers and will be small and inexpensive, according to MSV. MSV also denies that there will be any adverse impact on first-generation MSS operation. To the contrary, MSV states that it does not intend to implement interference cancellation for its first-generation MSS system, which is relatively insensitive to interference due to the low receive-antenna gain of the first-generation satellites.

60. Nothing in the Commission's rules precludes MSV from implementing adaptive interference cancellation in its MSS-ATC network, although the technology is new and the degree of effectiveness remains to be seen. As Inmarsat points out, even if the use of interference cancellation eliminates all of the interference from MSV's ATC operation into its own satellite network, it will not reduce interference to Inmarsat. We need not determine in this order how effective the technique will prove to be, however, because the authorization we are granting here does not allow MSV to operate in a way that would generate more uplink interference than the Commission deemed acceptable in the *ATC Report and Order*.[104]

61. ***Non-Co-Channel Frequencies*** MSV asks the Commission for a further waiver of Section 25.253(c) to permit unlimited re-use of "non-co-channel" frequencies – *i.e.*, uplink frequencies assigned to MSV pursuant to the Mexico City MOU that are not received by any other satellite with an above-horizon line of sight to any point in North America where MSV could provide ATC service.[105] Inmarsat asserts that this request should be denied because the Commission considered and rejected a similar request from MSV in the ATC rulemaking.[106] The NTIA states that it has no objection to MSV's request for waiver of the re-use limit in this respect, however, except that MSV should not be excused from complying with applicable rule restrictions when using frequencies that are currently "non-co-channel" in the event of their subsequent use by a satellite visible in North America in conformance with international coordination requirements.[107]

62. As Inmarsat correctly points out, the Commission did, in fact, consider a similar contention from MSV in the context of the ATC rulemaking; specifically, MSV contended that there was no need to restrict use of L-Band frequencies for ATC that are not shared with another

[102] Inmarsat Opposition at 32-35.

[103] MSV Response at 17-18.

[104] This issue will be addressed in IB Docket No. 01-185 in response to MSV's petition for reconsideration.

[105] MSV ATC Application at 16-17. According to an analysis included in MSV's application, a satellite would have to be west of 7.6º E.L. and east of 158.6º E.L. to have a line-of-sight path to an MSV mobile terminal operating in ATC mode. *Id.*, Appendix G.

[106] Inmarsat Opposition at 42.

[107] NTIA Letter at 2.

MSS system.[108] The Commission declined to exempt non-shared frequencies from the channel re-use limit, however, because it could not reconcile creation of such an exception with the objective of limiting self-interference to 0.25 dB.[109] Moreover, the Commission declined "to adopt rules that would relax interference protections to other MSS licensees based on MSV's assumption that the number of co- and adjacent-channel operations in the L Band is limited" because it was unclear how those channels would be assigned in the future, due to the dynamic nature of frequency assignment under the Mexico City MOU.[110] To be sure, the Commission clearly implied that waiver of the channel re-use limit could be obtained based on a convincing showing that increased interference would not result, but MSV has not made such a showing to support its request for a waiver allowing unlimited re-use of "non-co-channel" frequencies. MSV has not demonstrated, to date, that self-interference with its own MSS uplink reception of such "non-co-channel" frequencies would not exceed 0.25 dB if there were no limit on re-use of those frequencies for ATC. Nor has MSV addressed the extent to which its unlimited re-use of non-co-channel frequencies for ATC would increase interference in adjacent channels used by other MSS systems.

63. Moreover, MSV has not clearly identified which, if any, of its assigned MSS uplink frequencies will be non-co-channel, in the sense defined in its application, when it commences ATC operation. MSV did not consider prospective satellites for which an Advanced Publication Information has been filed with the ITU that has not yet been followed by a request for coordination. Several new coordination special sections have been published recently by the ITU, however, leading us to believe that additional requests for coordination may be forthcoming. MSV also ignored prospective satellites that would be in line-of-sight with its coverage area and for which international coordination *has* been formally requested, on the assumption that they would not operate on any of MSV's assigned MSS frequencies because MSV has received no requests to coordinate with them. This assumption is unjustified, as the satellite operators have several more years in which to effect coordination agreements.

64. For these reasons, we deny the request for a waiver that would permit unlimited ATC re-use of non-co-channel frequencies.

6. Peak Traffic Limit

65. The Commission said in the *ATC Report and Order* that, because its assessment of potential adjacent-channel interference into MSV's own satellite and other MSS satellites from operation of an all-GSM L-Band ATC system was based on an assumption that up to 90,000 GSM mobile terminals could transmit at the same time to MSV's ATC base stations, it would require L-Band ATC operators to report peak traffic annually and limit peak ATC traffic to

[108] *ATC Report and Order* at ¶145.

[109] *Id.*

[110] *Id.* at ¶¶ 146-47.

90,000 simultaneously-operating terminals.[111] This limit is not included in the Commission's ATC rules, however.

66. MSV points out in its application that the Commission found that the aggregate out-of-channel emissions from 90,000 fully-loaded standard-GSM ATC carriers operating at the out-of-channel emission limit prescribed in Section 25.253(g)(1) of the Commission's rules would increase uplink noise in Inmarsat's current and next-generation satellites by only 0.001%.[112] MSV stresses that it follows from this finding that even if there were as many as 9 million fully-loaded ATC carriers the resultant out-of-band emissions would increase Inmarsat's noise level by only 0.1%. MSV therefore requests waiver of the limit on peak traffic. Alternatively, MSV requests a clarifying ruling that the limit allows up to 90,000 simultaneous ATC voice conversations in each GSM time slot and allows "equivalent" amounts of peak traffic for non-GSM ATC services.[113]

67. It is clear from relevant discussion in Appendix C2 of the *ATC Report and Order*[114] that the limit on "simultaneously transmitting MTs" refers to the number of mobile terminals in the United States transmitting simultaneously in a single time-slot, assuming that standard GSM protocols are used throughout the ATC network. This limit effectively permits 720,000 simultaneous conversations on MSV's network. Assuming a five percent activity factor, this limit would effectively permit more than 14 million subscribers. It is unlikely that this limit will constrain MSV's operations. Thus, we grant MSV's alternative request for clarification in this regard. The associated request for clarification regarding peak CDMA traffic is effectively granted by our specification, below, of numerical limits on simultaneously transmitting mobile terminals operating with cdma2000 or W-CDMA protocols.[115]

68. Regarding the request for waiver of the 90,000-terminal limit, we note that MSV has not shown in its application or associated pleadings that there is any real likelihood that more than 90,000 GSM-protocol terminals would ever simultaneously transmit to its ATC base stations in a single time-slot in any event. We also note that Inmarsat has requested in a petition for reconsideration of the *ATC Report and Order* that the Commission incorporate the 90,000-terminal limit in the ATC rules and rule that the limit applies in the aggregate to all L-band ATC licensees.[116] If the latter request were granted, the maximum permissible number of active ATC terminals in MSV's network would be reduced if another MSS licensee were authorized to provide ATC service in the United States. Since a grant of MSV's waiver request is not needed

[111] *ATC Report and Order* at ¶188. The assumption that up to 90,000 GSM terminals might transmit simultaneously originated with MSV itself. *Id.*, Appendix C2, Section 1.14. As the Commission acknowledged, the rule limiting the number of co-channel GSM base stations indirectly limits the number of simultaneously-transmitting GSM terminals in the U.S., to an extent that depends on the amount of internationally-coordinated L-Band spectrum assigned to MSV. *Id.* In contrast, the 90,000-terminal limit applies regardless of the amount of spectrum available for MSV's ATC operation.

[112] MSV ATC Application at 25, citing *ATC Report and Order* Appendix C2 Table 2.1.1.A.

[113] Letter from Lon C. Levin to FCC Secretary dated Oct. 4, 2004.

[114] *See ATC Report and Order*, Appendix C2 § 1.14.

[115] *See* Section III.C.10, *infra.*

[116] *See* Petition for Reconsideration and Clarification of Inmarsat Ventures PLC filed in IB Docket No. 01-185 on July 7, 2003 at 13.

at this time, and since another party has argued for a different interpretation of the limit in the ATC rulemaking proceeding, we decline to grant the waiver request here.

7. Overhead Gain

69. In order to protect operation of airborne Inmarsat AMS(R)S terminals, the Commission adopted Section 25.253(e), which requires an L-Band ATC applicant to demonstrate that the transmit-antenna gain of its ATC base stations will be suppressed by different specified amounts at various vertical angles.[117] MSV requests a waiver that would relax its overhead-gain suppression requirements by 8 dB over the range of angles in the vertical plane from the direction of maximum gain from 30° to 55° and by 10 dB for angles from 55° to 145°.[118] On the basis of an analysis included in the application, MSV contends that the requested relaxation of overhead-gain suppression would result in a mere 0.03 dB increase in potential interference to airborne earth-station terminals.[119] MSV asserts that granting this waiver request would reduce its costs significantly without any appreciable resultant increase in interference.

70. Inmarsat asserts that if the waiver were granted Inmarsat AMS(R)S receivers in aircraft within a horizontal distance of one kilometer from an MSV base station would be overloaded at altitudes up to 750-1000 meters, while adherence to the current requirements of 25.253(e) would preclude overload at altitudes above 500 meters. Inmarsat therefore maintains that the proposed modification of overhead gain suppression would impair the safety of aircraft just after take off and just before landing.[120] The NTIA has concluded, however, based on its own assessment of the impact of the proposed relaxation of overhead gain suppression requirements, that the waiver request can be granted without increasing the potential for interference to AMS(R)S receivers.[121]

71. We agree that relaxation of overhead gain suppression to the extent MSV proposes would not significantly increase interference to airborne Inmarsat terminals, as the effect on the noise level of Inmarsat receivers would be negligible. Inmarsat's unexplained contention that aircraft safety would be compromised by overload of AMS(R)S receivers at altitudes below 1000 meters is outweighed by the comments in favor of the waiver request from the NTIA, which represents the Federal Aviation Administration and other Federal executive-branch agencies that make extensive use of airborne Inmarsat terminals. We also agree with MSV that there is a significant public interest benefit to granting this waiver, as it will enable deployment of ATC base stations sooner and at less expense. We therefore waive section 25.253(e), in part, to permit base-station antenna gain of up to 27 dB below the maximum directional gain in

[117] *See ATC Report and Order.*, ¶¶ 158-161 and Appendix C2 §§ 1.12 and 2.2.3.

[118] MSV ATC Application at 23.

[119] *Id.*, Appendix L.

[120] Inmarsat Opposition at 57-60. Receiver overload occurs when a high-amplitude signal at the input of a receiver's amplifier causes the amplifier to attempt to exceed its maximum possible output level, consequently distorting the output signal. If a strong signal from a nearby ATC base station overloads the amplifier in an Inmarsat terminal receiver, the amplifier will distort the waveforms of both the ATC signal and a concurrently-received Inmarsat satellite signal. The amplifier's distortion of the satellite-signal waveform will cause demodulation errors and resultant errors in the receiver's output.

[121] NTIA Letter at 10.

vertical angles from 30° to 55° and up to 30 dB below the maximum directional gain in vertical angles from 55° to 145°, as requested.

8. Airport and Waterway Distance and PFD Limits

72. Section 25.253(d) of the Commission's rules states that an L-Band ATC applicant must show that it will not install a base station within 470 meters of an airport runway or aircraft stand area and that the PFD from its base stations will not exceed -73.0 dBW/m^2/200 kHz at the edges of such runways or stand areas. Section 25.253(d) also requires an ATC applicant to demonstrate either that its base stations will be situated more than 1.5 km from navigable waterways or else that the PFD from the base stations will not exceed -64.6 dBW/m^2/200 kHz at the shores of such waterways. The purpose of these restrictions is to prevent harmful interference with operation of aeronautical and maritime Inmarsat terminals.[122]

73. MSV contends in its ATC application that the Commission's PFD limits for runways and waterways are 15 dB too low, due to calculation error and erroneous estimation of the overload threshold of Inmarsat terminals. MSV also contends that it should be allowed a choice between meeting either the runway siting restriction or a corresponding PFD limit, rather than having to comply with both. MSV therefore requests waivers that would allow it to either comply with the base-station siting restrictions prescribed in Section 25.253(d) or meet PFD limits of -49.6 dBW/m^2 per carrier at the edges of runways and aircraft stands and -54.4 dBW/m^2 per carrier at the shores of navigable waterways.[123]

74. Inmarsat opposes these waiver requests.[124] Inmarsat contends that the Commission underestimated the overload sensitivity of Inmarsat terminals and therefore that the airport and waterway PFD limits should not be relaxed but should, instead, be more strict. Inmarsat also maintains that MSV should be subject to both a siting restriction with respect to runways and aircraft stands and a corresponding PFD limit because neither type of restriction standing alone would suffice to prevent interference with operation of Inmarsat aeronautical terminals. In its August 2, 2004 letter, however, MSV modified these waiver requests by asking for an 8 dB increase in the PFD limits rather than a 15 dB increase.

75. We are conducting tests to resolve the controversy concerning terminal overload thresholds. The testing might support MSV's argument for relaxing the PFD limits or might show, instead, that the current limits should be retained or that additional or stricter constraints are necessary. For example, the test results might reveal that intermodulation products or other interference-like effects militate against increasing the permitted PFD levels. To delay the release of this Order pending completion of the testing and evaluation of the results would effectively preclude granting MSV's request for expedited action on its application. We therefore deny MSV's requests for waiver of PFD limits without prejudice. As indicated in the *ATC Report and Order,* however, we would consider requests for waiver of the PFD limits based on negotiated agreements.[125]

[122] *ATC Report and Order* at ¶154.

[123] MSV ATC Application at p.21 and Appendix K.

[124] Inmarsat Opposition at 53-57.

[125] *ATC Report and Order* at ¶143.

9. Base Station EIRP

76. Section 25.253(d)(1) of the Commission's rules prohibits ATC base stations from radiating more than 19.1 dBW EIRP per 200 kHz carrier or transmitting more than three carriers per antenna sector.[126] These restrictions effectively limit aggregate EIRP per sector to 23.9 dBW. Further, Section 25.253(d)(2) prohibits ATC base stations from radiating more than 14.1 dBW EIRP toward the physical horizon (excluding man-made structures) per 200 kHz carrier, which effectively limits aggregate per-sector EIRP toward the physical horizon to 16.9 dBW. The Commission imposed these limits based on MSV's proposals in IB Docket No. 01-185, without determining whether these were the maximum levels consistent with providing adequate protection to Inmarsat. These power limits, along with other technical requirements, were deemed adequate to protect Inmarsat mobile earth-station terminals (METs) from interference.[127] In its ATC license application, MSV requests waiver of these restrictions to allow its base stations to radiate an aggregate EIRP per sector of up to 33.9 dBW toward the physical horizon and 38.9 dBW in other directions, with no limit on the number of carriers per sector, provided that the aggregate EIRP of all base stations within a 50-mile radius does not exceed 58.3 dBW in any direction. MSV bases these waiver requests on test data that demonstrate, according to MSV, that the receiver overload threshold of Inmarsat MSS terminals is 15 dB higher than the Commission assumed in the calculations from which it derived the base-station EIRP limits in Section 25.253(d).

77. In its Opposition to MSV's ATC application, Inmarsat says that it would not object to waiver of the limit on the number of carriers per sector but maintains that there is no justification for allowing MSV's base stations to radiate more than 23.9 dBW aggregate EIRP per sector.[128] To the contrary, Inmarsat contends that the aggregate per-sector EIRP of MSV's base stations should be limited to a lower level than the rules currently require.[129] Inmarsat also contends that MSV ignores the potential for intermodulation interference, which could occur at much lower levels than receiver overload.[130] On the other hand, the NTIA recommends that we allow MSV's base stations to radiate aggregate EIRP per sector of up to 35.9 dBW and up to 30.9 dBW toward the horizon, provided that base stations are not located within 2.5 km of navigable waterways or PFD at waterway boundaries does not exceed -54.6 dBW/m^2/sector.[131] The NTIA also recommends that if we waive the limit on the number of carriers per sector we should require out-of-channel emissions from each carrier to be reduced by a factor of

[126] Base station coverage areas are generally divided into a small number (on the order of 3-6) of angular sectors, each served by a separate antenna. This permits the use of high-gain antennas and increased frequency re-use for better network performance.

[127] *ATC Report and Order* at ¶¶ 148-161 and Appendix C2 § 2.2.

[128] A 23.9 dBW limit on aggregate EIRP per sector is implied by the current rule provisions that limit per-carrier EIRP to 19.1 dBW and limit the number of carriers per sector to three.

[129] Inmarsat Opposition at 46-53.

[130] Intermodulation occurs when integer multiples of sums and differences of two or more signals are combined in a receiver. Intermodulation products are calculated by: $IM=n*f_1 \pm m*f_2$, where f1 and f2 are the interfering frequencies.

[131] The NTIA initially recommended a sector PFD limit of -62.6 dBW/m^2 but subsequently revised the recommended limit to -54.6 dBW/m2 to reflect an 8dB polarization mismatch factor. Email with attachment from Edward Drocella to Ronald Repasi sent Oct. 27, 2004 at 7:39 AM.

10Log(number of carriers) relative to -53 dBW/MHz when more than three carriers are transmitted in one sector.[132]

78. In the letter submitted for the purpose of "narrow[ing] the breadth of certain core elements of its application in order to shorten the time to process its license application,"[133] MSV proposes, *inter alia*, that we initially grant a partial waiver that would allow an 8 dB increase in peak aggregate EIRP per base-station sector (rather than the 15 dB increase requested in the application) with no limit on the number of carriers per sector. We have received no comments or objections from Inmarsat or any other party in response to this modified waiver request.

79. We agree with MSV that there is no need to limit the number of carriers per sector if appropriate limits are imposed with respect to aggregate radiated power in each sector and with respect to out-of-channel emissions. Indeed, by spreading the power among more carriers, the potential for interference on a single carrier frequency is reduced. Therefore, we grant the request for waiver of the limit on the number of carriers per sector, subject to the limits on peak sector EIRP specified herein, provided that, as recommended by the NTIA, out-of-channel emissions from each carrier are reduced by a factor of 10 Log (number of carriers) relative to -53 dBW/MHz when more than three carriers are transmitted in one sector. This waiver will serve the public interest by affording MSV more flexibility to operate with the number of carriers necessary in each base station sector to satisfy peak ATC network demands without adverse impact on MSS operation.

80. The limits on base station power levels necessitate installation of more base stations to provide adequate coverage and make it more difficult to provide consistently adequate signal levels to mobile terminals in urban environments where signals levels are likely to vary dramatically. Hence, an 8 dB increase in permissible peak power per sector would enable MSV to provide adequate coverage and signal levels with fewer base stations. We will permit MSV to operate at 8 dB above the current power limits, provided it meets several conditions, enumerated below, to prevent harmful interference to Inmarsat or other L-Band MSS operators. The *ATC Report and Order* identified four potential situations in which MSV's ATC base stations could cause interference to Inmarsat MET receivers: (1) overload of land-based MET receivers when they are near an ATC base station; (2) out-of-band interference to land-based MET receivers from ATC base stations; (3) aggregate out-of-band interference to an airborne MET receiver from a relatively large number of MSV base stations visible from an aircraft; and (4) overload of an airborne MET receiver from an ATC base station. Most of these situations can be easily addressed. The out-of-band interference situations (ATC base station to terrestrial MET receiver, ATC base station to maritime MET receiver, and ATC base station to airborne MET receiver) are not impacted by a base station power change because the out-of-band emissions limit for MSV's base stations is a fixed value that won't increase if the base station power is increased.[134] The overload interference situations for maritime and airborne MET receivers are governed by both PFD limits (at the boundary of navigable waterways or at all airport runways, taxiways, landing paths and stand areas) and distance separation limits. As

[132] NTIA Letter at p.1.

[133] Letter from Lon C. Levin to the FCC Secretary dated August 2, 2004, at 1.

[134] *See* §§ 25.253(b) and 25.253(d)(7).

mentioned previously, we are not waiving the existing PFD limits at this time and we are increasing the distance separation limits to compensate for the higher base station power. In these situations, there would be no change in interference potential. Regarding the overload of an airborne MET receiver, the *ATC Report and Order* showed the existing rules provide a 10.4 dB margin against overload;[135] therefore, an 8 dB increase in power still wouldn't exceed the overload threshold and therefore interference should not occur.

81. One situation where there is a potential increase in interference is the overload of terrestrial MET receivers near an ATC base station. The *ATC Report and Order* indicated that at a 100-meter distance from an ATC base station, the ATC signal would be 1.8 dB below the Inmarsat MES receiver overload threshold.[136] If we permit an 8 dB increase in power, then the overload threshold, under the very conservative studies done in the *ATC Report and Order*, could be exceeded within 204 meters of the ATC base station. This is still quite a small area, and it is unlikely that receiver overload would actually occur as a result of such a peak-power increase. Since most ATC base stations are likely to be in urban areas in order to boost MSV's weak satellite signals, the Inmarsat signal at these areas is also likely to be quite weak. Furthermore, Inmarsat's satellite positions are lower in elevation than MSV's, so it is very likely that Inmarsat's satellite signal will be even weaker than MSV's satellite signal. This means that Inmarsat probably would not have usable satellite signals near many of the ATC base stations (even in the absence of an ATC base station). However, in an abundance of caution, we require MSV to notify Inmarsat, and any other authorized L-Band MSS operator, of any ATC base stations that would operate at peak sector power levels above the peak levels allowed under the current rules. A notified party would then have an opportunity to object within 30 days if: 1) it can prove that its system provides a usable MSS satellite signal within 204 meters of the proposed ATC base station's location, and 2) it can show that there is a reasonable likelihood that METs will attempt to access its MSS network from a location within 204 meters of the base station. (This would presumably be unlikely if there are no streets, residences, office buildings, etc. within that distance.) However, if it is convincingly shown that a higher-power MSV ATC base station could be a problem, MSV must reduce the base station's aggregate per-sector power to a level consistent with the current rules. We believe that these measures will ensure that no harmful interference will be caused, while at the same time recognizing that MSS satellite signals and MSS users are not always available in urban areas.

82. Lastly, we agree with Inmarsat that the increase in peak base-station power could increase the potential for MET receivers being affected by intermodulation products. While we do not believe that this will a significant problem for most active Inmarsat receivers, which will be operating at large distances from ATC base stations, we believe that we should address this issue in those situations where the base station power is being increased above the current rules or where the base station will exceed the limit on carriers per antenna sector. By permitting higher base station power and the use of more than three carriers per antenna sector, the potential for intermodulation products being generated in Inmarsat's receivers increases, although we believe in general the potential is small. Typically intermodulation issues are resolved between licensees, and we believe that is the appropriate approach for dealing with the increased potential for intermodulation products as a result of base station power increases and

[135] *ATC Report and Order* at Appendix C-2, Section 2.2.3.2.

[136] *ATC Report and Order* at Appendix C-2, Table 2.2.1.1.A.

use of more than three carriers per sector. We therefore require MSV to notify any other authorized L-Band MSS operator of the location of ATC base stations that will use more than three carriers in an antenna sector or operate above the power limits in the current rules. We expect MSV and other notified parties to work together to resolve any intermodulation problems.

83. Therefore, in addition to waiving the limit on the number of carriers per sector, we also grant the request for a partial waiver to increase the maximum permissible peak EIRP per base-station sector (*i.e.*, the maximum permissible aggregate peak EIRP for all carriers in a sector) to 26.9 dBW toward the physical horizon and 31.9 dBW in other directions. We retain the per-carrier EIRP limits of 14.1 dBW toward the horizon and 19.1 dBW in other directions, however, subject to the following restrictions and conditions:

i) the aggregate PFD limits specified in §§ 25.253(d)(4) and 25.253(d)(5) will continue to apply unless amended by the Commission;

ii) as suggested by the NTIA, the separation distances specified in §§ 25.253(d)(3) and 25.253(d)(5), also discussed previously, must be increased for any MSV-ATC base station that radiates more than 18.9 dBW aggregate EIRP per sector toward the physical horizon or more than 23.9 dBW aggregate EIRP per sector in another direction; the wider separation distances must be calculated on a case-by-case basis to provide a comparable PFD level at all airport runways and aircraft stand areas, including takeoff and landing paths, and at the water's edge of any navigable waterway based on free-space propagation, and should be computed according to the following equation:

$$D = 10^{(EIRP - PFD - 11)/20}$$

where:

D is the distance in meters;

EIRP is the base-station EIRP per carrier at the horizon (dBW/200 kHz);

PFD is the power flux density limits necessary to protect AMS(R)S of -73 dBW/m^2/200 kHz and to protect GMDSS operations of -64.4 dBW/m^2/200 kHz;[137]

iii) MSV must notify Inmarsat, and any other party with authority to provide L-Band MSS in the United States, of the location and power specifications of any ATC base stations that it intends to

[137] If the PFD for a sector is to be used a factor of 10 Log (number of carriers) must be included in the equation .

operate with more than three carriers per antenna sector or with peak sector EIRP above 18.9 dBW toward the physical horizon or above 23.9 dBW in another direction; MSV must provide the requisite notification at least 30 days prior to commencing such operation and shall not operate at such higher power levels if a notified party demonstrates that such operation would increase the potential for harmful interference with operation of mobile earth stations accessing that party's MSS network;

iv) out-of-channel emissions from each carrier must be reduced by a factor of 10 Log (number of carriers) relative to -53 dBW/MHz when more than three carriers are transmitted in one sector;

v) authority to operate with higher base station power is subject to any modification necessary for conformance with future Commission decisions in IB Docket 01-185 regarding permanent power limits.

84. We note that MSV is asking the Commission to increase permissible base station power levels to a greater extent in its petition for reconsideration of the *ATC Report and Order*. The limited waiver we grant here to allow an 8 dB power increase, subject to the conditions listed above, will terminate automatically to the extent it is inconsistent with any determination by the Commission in ruling on MSV's petition for reconsideration. Finally, we understand that MSV and Inmarsat are working towards resolving technical differences in order to facilitate compatible operation of their respective systems.[138] We would be willing to consider a joint proposal for additional waivers regarding base station power limits, as well as airport/waterway PFD and separation distances.

10. Authority for Use of CDMA and Non-standard GSM Modulation

85. The technical requirements for L-Band ATC operation are based on an analysis that assumes use of a standard GSM protocol – *i.e.*, either GSM/TDMA 800 or GSM 1800. An L-Band MSS licensee may apply for authority for ATC operation with another protocol, however, based on a showing that such operation would produce no more interference than a standard GSM network operating in compliance with the requirements of Section 25.253.[139]

86. MSV requests authority to implement ATC using either a GSM protocol, a CDMA protocol (specifically, cdma2000®[140] or W-CDMA), or both GSM and CDMA protocols. MSV

[138] MSV *ex parte* letter, October 6, 2004.

[139] *See* 47 C.F.R. § 25.253, Note.

[140] cdma2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States.

contends that the proposed use of CDMA protocols would cause no more interference than the rules allow from a standard GSM system.[141]

87. MSV states that its CDMA mobile terminals would radiate a maximum EIRP of -9 dBW per single code and therefore maintains that fifty such cdma2000 carriers, or two hundred such W-CDMA carriers, would merely generate the same amount of uplink interference as one fully-loaded standard GSM carrier transmitted by a mobile terminal radiating with the maximum EIRP allowed by Section 25.253(g)(1). MSV also states that the proposed CDMA mobile terminals would employ variable-rate vocoders that would switch from full-rate to half-rate when nominal EIRP exceeds -12.5 dBW.[142] Further, MSV states that the aggregate EIRP and out-of-band emissions of ATC base stations operating with CDMA would be limited to the same extent required for base-station operation with GSM and that the base-station antenna patterns would be the same regardless of the multiple-access protocol. MSV therefore contends that the potential interference from the base stations will remain the same regardless of whether a GSM or CDMA protocol is used.

88. Inmarsat argues that MSV has failed to demonstrate that the proposed CDMA operation would cause no more interference than rule-compliant operation with standard GSM protocols. In particular, Inmarsat notes that MSV has not explained how the proposed CDMA operation could comply with the requirement in Section 25.253(a)(3) to preclude other ATC mobile terminals from using open time slots. Inmarsat asserts that, in fact, it is not possible to reduce potential interference from CDMA transmission by requiring time slots to be left vacant, since CDMA carriers are transmitted simultaneously rather than in a series of time slots.[143]

89. The omission of a showing that CDMA operation would be in compliance with the requirement in Section 25.253(a)(3) is immaterial, as the Note to Section 25.253 clearly indicates that an applicant does not necessarily have to demonstrate compliance with any specific provision of Section 25.253 to receive authority for ATC operation with non-GSM protocols. Rather, it is incumbent on MSV to show that the proposed operation with CDMA protocols would produce no more interference than operation with standard GSM protocols in compliance with the specific requirements of Section 25.253.

90. We conclude that MSV's proposed operation with CDMA protocols will produce no more interference than the GSM network analyzed in the *ATC Report and Order*, provided that the total number of U.S. base stations transmitting with any protocol on any common frequency does not exceed 2415.[144] (Thus, for example, if 1000 U.S. base stations are transmitting with a

[141] MSV ATC Application at p.13 and Appendix B.

[142] *See* Response to Inmarsat at 9 and MSV ATC Application, Appendix B at 1.

[143] Inmarsat Opposition at 18-19.

[144] As Inmarsat has pointed out, MSV initially failed to explain how it would configure CDMA operation to afford priority and preemptive access for AMS(R)S and global maritime distress and safety system ("GMDSS") (continued....)

GSM protocol in a particular 200 kHz band, no more than 1415 U.S. base stations may transmit in any portion of that band with CDMA protocols.) In view of the difference in power levels between the CDMA system architectures and the GSM architecture, we prescribe limits on the number of mobile terminals that may simultaneously operate with CDMA protocols that are different from the corresponding limit for GSM terminals specified in the *ATC Report and Order*. The number of simultaneously active mobile terminals in a single 1.25-megahertz cdma2000 channel shall be no more than 120,750 and there shall be no more than 845,250 simultaneously active terminals network wide.[145] Similarly, there shall be no more than 483,000 simultaneously operating W-CDMA terminals per 5-megahertz channel. With these limits, we grant MSV's request for authority for ATC operation with cdma2000 and W-CDMA protocols. In addition, should MSV operate a mixed-architecture network with both GSM and CDMA protocols, as tentatively proposed in its application, the calculated EIRP density of simultaneously operating mobile terminals at any L-Band MSS satellite shall not exceed -244.2 dBW/Hz.[146]

91. MSV has proposed to use a non-standard GSM system architecture in its network, employing offset quadrature-phase-shift keying (OQPSK) modulation, rather than the standard GSM modulation technique, which is Gaussian minimum-shift keying (GMSK).[147] Because operation with this variant modulation technique will not cause any increase in interference, however, we conclude that no special showing is necessary to justify its use.

IV. CONCLUSION

92. We have reviewed MSV's MSS-ATC application and all associated amendments, comments, pleadings, and other documents of record. Based on that review, we conclude that MSV is legally, technically, and otherwise qualified to operate an MSS-ATC network and that grant of the application, subject to the limitations and conditions specified herein, will serve the public interest, convenience, and necessity.

(...continued from previous page)
communications, as required by Section 25.253(a)(5) and Footnotes US308 and US315 to the Table of Frequency Allocations in Section 2.106 of the Commission's rules. MSV later rectified the omission, however, by submitting a satisfactory supplementary explanation. *See* letter with attachments from Lon C. Levin to the FCC Secretary dated Sept. 22, 2004.

[145] Since it takes 50 cdma2000 or 200 W-CDMA signals to create the equivalent power of a single GSM carrier, the cdma2000 total mobile terminal limit is calculated from the number of allowed base stations times 50, or 2415*50=120,750. We also assumed that the same amount of spectrum was available for cdma2000 signals as was assumed for the purely GSM network discussed in Appendix C2 of the ATC R&O. This leads to the conclusion that there could be at most seven channels available for cdma2000 operations and at most 845,250 (2415*50*7=845,250) cdma2000 terminals transmitting simultaneously in the U.S. Similarly, for W-CDMA, there can only be one 5 MHz channel within the same amount of spectrum, so the maximum number of simultaneously-transmitting terminals in an all-W-CDMA system would be 2415*200*1=483,000. This limit is both per-channel and system-wide for the W-CDMA architecture.

[146] This is calculated from Appendix C2, Table 2.1.1.A by adding the total number of base station re-use to the received power at the satellite.

[147] Letter from Lon C. Levin to the FCC Secretary dated 31 August, 2004 concerning the testing of Inmarsat terminals.

V. ORDERING CLAUSES

93. Accordingly, pursuant to Section 309 of the Communications Act, 47 U.S.C. § 309, and Section 0.261 of the Commission's rules, 47 C.F.R. § 0.261, IT IS ORDERED that Application Files Nos. SAT-MOD-20031118-00333, SAT-AMD-20031118-00332, and SES-MOD-20031118-01879 ARE GRANTED and MSV is authorized to operate ATC base stations and mobile terminals in accordance with the terms, conditions, and technical specifications set forth in its application, except as otherwise provided herein, and in compliance with the Commission's rules, except insofar as expressly waived herein.[148]

94. IT IS FURTHER ORDERED that Paragraphs (a)(2), (c), (d)(1), (e), and (g)(1) of Section 25.253 of the Commission's rules, 47 C.F.R. § 25.253, ARE WAIVED to the extent indicated herein.

95. IT IS FURTHER ORDERED that this authorization is subject to the following conditions.

(a) This authorization is subject to any restriction necessary for conformance with a Commission decision disposing of petitions for reconsideration of the *ATC Report and Order*.

(b) The grant herein of the authority requested in Application No. SAT-AMD-20031118-00332 is contingent upon grant of the pending license application for MSV-1 and is without prejudice to disposition of that application.

(c) MSV shall ensure that the EIRP density of emissions from its ATC base stations do not exceed -100 dBW/MHz EIRP in the 1559-1610 MHz band, averaged over any two-millisecond interval, and that the EIRP of discrete ATC base-station emissions of less than 700 Hz bandwidth do not exceed -110 dBW in that band, averaged over any two-millisecond interval. These EIRP limits apply to ATC base stations that employ either Time Division Multiple Access (TDMA) or Code Division Multiple Access (CDMA) and apply to the total EIRP within any ATC base-station sector. MSV shall also ensure that all mobile terminals accessing its ATC network restrict the EIRP density of emissions in the 1559-1605 MHz band to -90 dBW/MHz or less averaged over two-millisecond interval, restrict the EIRP of discrete emissions of less than 700 Hz bandwidth to -100 dBW in that band averaged over any two-millisecond interval, restrict the EIRP density of emissions in the 1605-1610 MHz band to a level determined by linear

[148] *See, e.g.,* 47 C.F.R. § 25.253(f) (requirements for coordination of ATC base stations with SARSAT earth stations and MAT receive sites), and § 25.253(g)(2) (requiring all practicable steps to be taken to avoid causing interference with radio astronomy observation in the 1660-1660.5 MHz band).

interpolation from -90 dBW/MHz at 1605 MHz to -66 dBW/MHz at 1610 MHz, averaged over any two-millisecond interval, and restrict the EIRP of discrete emissions of less than 700 Hz bandwidth in the 1605-1610 MHz band to a level determined by linear interpolation, from -100 dBW at 1605 MHz to -76 dBW at 1610 MHz, averaged over any two-millisecond interval. Further, MSV shall ensure that all new mobile terminals placed in service more than five years after it commences ATC operation restrict the EIRP density of emissions in the 1605-1610 MHz band to a level determined by linear interpolation from -95 dBW/MHz at 1605 MHz to -71 dBW/MHz at 1610 MHz, averaged over any two-millisecond interval, and restrict the EIRP of discrete emissions of less than 700 Hz bandwidth to a level determined by linear interpolation from -105 dBW at 1605 MHz to -81 dBW at 1610 MHz, averaged over any two-millisecond interval.

(d) MSV shall ensure that test results demonstrating compliance with the foregoing limits on emissions in the 1559-1610 MHz band are included in any application for equipment authorization pursuant to 47 C.F.R. Part 2 and § 25.149(c) for mobile terminals that would be used to communicate via MSV's ATC network.

(e) The total number of MSV's U.S. ATC base stations transmitting simultaneously with any protocol on the same frequency shall not exceed 2415, and no more than 1208 MSV base stations may simultaneously transmit on the same frequency during the first eighteen months following activation for testing of the first ATC base station.

(f) MSV shall submit test data at least 60 days before commencing ATC operation proving that the spatially-averaged EIRP of mobile terminals accessing its ATC network (unadjusted for the time-averaged effect of vocoder-rate/duty-cycle regulation) will not exceed -4dBW in the direction of co-channel satellites.

(g) MSV shall ensure that dual-mode MSS/ATC handsets capable of accessing its ATC network that require plug-in boosters for MSS operation are not offered for sale, sold, or distributed without such boosters before MSV commences commercial operation with an MSS satellite capable of providing service to users operating such handsets without such attachments.

(h) In the event that the pending license application for MSV-1 is denied, MSV shall not activate any additional MSS/ATC

handsets requiring a plug-in booster for MSS communication thereafter unless and until the denial is set aside on reconsideration, review, or appeal and the application is ultimately granted. In the event that a license is granted for launch and operation of MSV-1 but is subsequently surrendered for cancellation, declared void, or revoked, MSV shall not activate any additional MSS/ATC handsets requiring a plug-in booster for MSS communication after surrendering such authorization or after such nullification or revocation becomes administratively final.[149]

(i) No more than 90,000 mobile terminals operating with GSM protocols may simultaneously transmit to MSV's ATC base stations in the United States in a single time-slot. No more than 120,750 mobile terminals operating with cdma2000 may simultaneously transmit to MSV's U.S. ATC base stations in a single 1.25-megahertz channel, and the total number of such terminals simultaneously transmitting to MSV's U.S. base stations shall not exceed 845,250. No more than 483,000 mobile terminals operating with W-CDMA may simultaneously transmit to MSV's U.S. base stations in any five-megahertz channel. If MSV implements a mixed-architecture MSS-ATC network with both GSM and CDMA protocols, the calculated EIRP density of mobile terminals accessing the network shall not exceed -244.2 dBW/Hz in the vicinity of any L-band MSS satellite licensed by another administration consistently with international coordination requirements.

(j) MSV must notify Inmarsat, and any other party with authority from the FCC for provision of L-Band MSS in the United States, of the location and power specifications of any ATC base stations that it intends to operate with more than three carriers per antenna sector or with aggregate EIRP in any sector above 18.9 dBW toward the physical horizon or above 23.9 dBW in another direction at least 30 days prior to commencing such operations and must cease or desist from operation at such higher power levels if such operation would unduly increase the potential for harmful interference.

(k) No MSV base station radiating more than 18.9 dBW aggregate EIRP in any sector toward the physical horizon or more than 23.9 dBW aggregate sector EIRP in another

[149] An action is "administratively final" when it is no longer subject to reconsideration or review under 47 C.F.R. §§ 1.106, 1.115, or 1.117 or judicial review pursuant to 47 U.S.C. § 402.

direction may be sited within a minimum separation distance from any airport runway or aircraft stand area, including takeoff and landing paths, or from the edge of any navigable waterway computed according to the following formula:

$$D = 10^{(EIRP - PFD - 11)/20}$$

where D is the distance in meters, EIRP is the base station's EIRP per carrier toward the horizon (dBW/200 kHz), and PFD is -73 dBW/m^2/200 kHz for calculating minimum separation distance from runways and aircraft stand areas and -64.4dBW/m^2/200 kHz for calculating minimum separation distance from the edges of navigable waterways.

(l) Out-of-channel emissions from each base-station carrier shall be reduced by a factor of 10 Log (number of carriers) relative to -53 dBW/MHz when more than three carriers are transmitted in one sector.

96. IT IS FURTHER ORDERED that this authorization will expire concurrently with the space-station license for MSV-1, if granted, and shall otherwise expire concurrently with the license for AMSC-1.

97. This Order is effective upon release. Petitions for reconsideration under Section 1.106 or applications for review under Section 1.115 of the Commission's rules, 47 C.F.R. §§ 1.106, 1.115, may be filed within thirty days of the date of the release of this Order (see 47 C.F.R. § 1.4(b)(2)).

FEDERAL COMMUNICATIONS COMMISSION

Donald Abelson
Chief
International Bureau