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

In the matter of	)	
	)	
Flexibility for Delivery of	)	
Communications by Mobile Satellite	)	IB Docket No. 01-185
Service Providers in the 2 GHz Band, the	)	
L-Band, and the 1.6/2.4 GHz Bands	)	

Memorandum Opinion and Order and
Second Order on Reconsideration

Adopted: February 10, 2005 **Released: February 25, 2005**

By the Commission: Commissioner Copps approving in part, concurring in part, and issuing a separate statement.

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I. INTRODUCTION

1. By this *Memorandum Opinion and Order and Second Order on Reconsideration*, the Commission revises the rules adopted in 2003 for flexibility in the provision of Mobile Satellite Service (MSS) communications, permitting the addition of ancillary terrestrial components (ATC) to MSS systems. We reaffirm that ATC is a part of, and ancillary to, MSS. We reconsider and substantially change certain technical standards for ATC in the L-band, in order to permit MSS/ATC licensees flexibility in designing and operating their ATC while at the same time preventing harmful interference from ATC to co-primary MSS licensees in the L-band. We also allow certain increases in ATC base station power because it has been demonstrated that these increases will not cause harmful interference. Finally, we amend the rules for authorizing MSS operators to add ATC to their networks.

II. EXECUTIVE SUMMARY

2. This *Memorandum Opinion and Order and Second Order on Reconsideration* addresses eight petitions for reconsideration of prior Commission decisions regarding ATC operations. These decisions fall into four areas: (1) gating criteria, (2) uplink interference, (3) downlink interference, and (4) licensing issues.

3. Gating criteria are conditions that an MSS operator must meet in order to receive authorization to operate ATC. This *Memorandum Opinion and Order and Second Order on Reconsideration*:

- Affirms our prior decision not to require a specific percentage of MSS system capability to be reserved for MSS operation, and

- Clarifies that all MSS/ATC equipment must be able to communicate via both MSS and ATC, and that services must be available through both MSS and ATC.

4. Uplink interference issues address the protection of other co-primary MSS operators in the L-band from harmful interference from ATC operations. This *Memorandum Opinion and Order and*

Second Order on Reconsideration changes the basis of interference protection from a list of specific technical requirements to a limit on the increase in interference an MSS/ATC network can cause to other MSS operators' satellites, leaving MSS/ATC operators free to design and operate their systems as they consider best, within the interference standards.

5. Downlink interference issues address the protection of MSS earth stations from interference from ATC. This *Memorandum Opinion and Order and Second Order on Reconsideration*:

- Raises the limits on ATC base station power, while continuing to protect other MSS operators' earth stations,
- Allows higher ATC signal strength near airports and waterways, while continuing to protect other MSS operators' earth stations, and
- Relaxes overhead gain limits for ATC base stations.

6. Licensing issues address how MSS operators will be granted ATC authority. This *Memorandum Opinion and Order and Second Order on Reconsideration*:

- Reaffirms that MSS/ATC authority is ineligible for competitive bidding,
- Reaffirms that public notice and comment will be provided in consideration of applications for ATC authority, and
- Declines to grant conditional authority, requiring instead that MSS operators be in compliance with all gating criteria before they can be authorized to provide ATC.

III. BACKGROUND

7. MSS is a radiocommunication service involving transmission between mobile earth stations and one or more space stations.[1] The Commission has allocated and assigned spectrum in several bands to MSS.[2] MSS systems can provide communications in areas where it is difficult or impossible to provide communications coverage via terrestrial base stations, such as remote or rural areas and non-coastal maritime regions.[3] A disadvantage of MSS is the fact that the satellite link is susceptible to blocking by structural attenuation, particularly in urban areas and inside buildings.[4]

8. After receiving applications from MSS operators requesting authority to re-use their assigned spectrum to provide terrestrially-based service, we began this proceeding to consider permitting MSS operators to integrate terrestrial services into their satellite networks, in order to augment coverage in areas where their satellite signals are largely unavailable due to blocking.[5] After receiving voluminous public comment on whether to permit MSS operators to operate ATCs, and under what restrictions such

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[1] *See* 47 C.F.R. § 2.1(c).

[2] MSS is allocated spectrum at 1525-1559 MHz (space-to-Earth), 1610-1660.5 MHz (Earth-to-space), 2483.5-2500 (space-to-Earth), 2000-2020 MHz (Earth-to-space), and 2180-2200 MHz (space-to-Earth). *See* 47 C.F.R. § 2.106.

[3] *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; Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile Satellite Service,* IB Docket No. 01-185, ET Docket No. 95-18, Notice of Proposed Rulemaking, FCC 01-225, 16 FCC Rcd 15,532 at ¶ 1 (2001) (*MSS Flexibility NPRM*).

[4] *See id.*

[5] *See id.*

operations should be permitted, we released a *Report and Order* that permits MSS operators to provide integrated ATC within their assigned MSS spectrum, and adopted rules pertaining to the licensing and operation of ATC systems.[6]

9. *MSS Flexibility R&O*. In deciding to permit MSS operators to integrate ATC into their MSS systems, we stated that "permitting MSS licensees to enhance spectrum efficiency through ATC represents a superior choice to continuing with the regulatory status quo."[7] Further, we found that MSS/ATC would expand the consumer market MSS is capable of serving, leading to economies of scale and lower prices for consumers.[8] Granting authority for integrated MSS/ATC would also allow MSS operators to offer the capability of receiving calls via both satellite and terrestrial radio links with a single dual-mode handset and a single telephone number, whereas current dual-capability MSS/Commercial Mobile Radio Service (CMRS) handsets require separate numbers for MSS and CMRS services.[9] Moreover, MSS/ATC would eliminate operational and transactional difficulties and costs for MSS operators in negotiating separate terrestrial roaming agreements with various terrestrial CMRS operators within the MSS operators' service areas.[10] Finally, we found that MSS/ATC would enhance the ability of the national and global telecommunications systems to protect the public by offering ubiquitous service to law enforcement, public aid agencies, and the public,[11] and would strengthen competition in the telecommunications market.[12]

10. We concluded that our decision to permit MSS operators to acquire ATC authority did not establish the requisite conditions for assigning licenses through competitive bidding under section 309(j) of the Communications Act of 1934, as amended (Communications Act).[13] We also concluded that granting ATC authority by modifying MSS operators' rights under their existing authorizations and declining to authorize separate terrestrial authorizations in MSS bands precluded the filing of mutually exclusive applications, a requirement for assigning licenses by competitive bidding.[14] Further, we found that granting ATC authority under the conditions we prescribed would not unjustly enrich MSS operators because MSS, even with ATC, is not a close substitute for terrestrial CMRS for most customers, and will not compete with CMRS directly.[15] With regard to licensing, we decided to implement geographic area licensing of ATC base stations generally, and individual licensing of ATC base stations in situations where the stations could pose threats of adverse effects to the environment, public health, scenic and historic locations, tribal lands, aviation, or related concerns.[16] We also decided that applications for ATC

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[6] *See 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*, IB Docket Nos. 01-185 and 02-364, Report and Order and Notice of Proposed Rulemaking (*MSS Flexibility R&O*), FCC 03-15, 18 FCC Rcd 1962 (2003). The Notice of Proposed Rulemaking portion of the document initiated the new IB Docket No. 02-364 regarding spectrum sharing in the Big LEO bands and is not relevant to the discussion herein.

[7] *See id.* at 1974, ¶ 22.

[8] *See id.* at 1975, ¶ 24.

[9] *See id.* at 1976, ¶ 25.

[10] *See id.* at 1977, ¶ 26.

[11] *See MSS Flexibility R&O*, 18 FCC Rcd at 1978, ¶ 28.

[12] *See id.* at 1979, ¶ 30.

[13] *See id* at 2068, ¶ 219.

[14] *See id.* at 2068-69, ¶ 221.

[15] *See id.* at 2072, ¶ 229.

[16] *See id.* at 2076-77, ¶ 239.

authority would be treated as minor modifications to the MSS operators' space station licenses.[17] Further, foreign-licensed MSS operators permitted to offer service in the United States under a Letter of Intent (LOI) would apply for ATC authority by modification of the LOI.[18] We specified that ATC construction and testing may not begin until after an ATC authorization has been issued, but may begin prior to commencement of the provision of MSS services.[19] Finally, we decided to license MSS ATC handsets by our equipment certification procedure under Part 2, Subpart J of the rules.[20]

11. To protect other users of MSS spectrum, both satellite and terrestrial, from harmful interference from ATC, we adopted a number of technical rules for ATC. These rules vary for the three MSS bands, and apply power limits for ATC base stations and MSS handsets, and require separation distances from airports or navigable waterways for ATC base stations.[21] The MSS/ATC operator is also required to resolve any harmful interference to other services caused by its ATC base stations or handsets.[22]

12. Sua Sponte Order. On July 3, 2003, we released an *Order on Reconsideration (Sua Sponte Order)*, in which we reconsidered and clarified certain aspects of the *MSS Flexibility R&O* on our own motion.[23] Because we had decided in the *MSS Flexibility R&O* that we would not grant ATC authority to any MSS operator until that MSS operator satisfied all of several preconditions for operating ATC, collectively known as gating criteria,[24] we clarified that we will allow preoperational ATC construction and testing in accordance with the technical rules, at any time after physical construction of the MSS satellites has begun. Such construction and testing is to be at the MSS operator's risk, and does not presuppose authorization to operate an ATC.[25] Further, we clarified that we would consider ATC applications before each of the gating criteria was met, provided the MSS operator applying for ATC authorization makes a substantial showing that its MSS and ATC operations will meet the gating criteria.[26] Also in our *Sua Sponte Order*, we specified that no ATC authority will be granted until we are satisfied that each of the gating criteria has been met or will be met at the same time the application is granted.[27] As a result of this decision, we also eliminated the rule requiring MSS operators to have a conditioned ATC authorization before engaging in preoperational constructing and testing, instead allowing such construction and testing at any time after an MSS operator has begun construction of satellites and has informed us of its intent to construct and test ATC facilities.[28] Finally, we required all initial applications for ATC authority to be placed on public notice, in order to allow interested parties to

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[17] *See MSS Flexibility R&O*, 18 FCC Rcd at 2077, ¶ 240.

[18] *See id.* at 2080, ¶ 245.

[19] *See id.* at 2082-83, ¶ 250.

[20] *See id.* at 2082, ¶ 248. *See also* 47 C.F.R. Part 2, Subpart J.

[21] *See* 47 C.F.R. §§ 25.147(c), 25.252-25.254.

[22] *See* 47 C.F.R. § 25.255.

[23] *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*, IB Docket No. 01-185, Order on Reconsideration (*Sua Sponte Order*), FCC 03-162, 18 FCC Rcd 13,590 (2003).

[24] Gating criteria are designed to ensure that MSS operators may not operate terrestrial services unrelated to their satellite operations. For a detailed discussion of gating criteria, see *infra.*

[25] *See Sua Sponte Order* at 13,593, ¶ 7.

[26] *See id.* at 13,594-95, ¶ 10; 47 C.F.R. § 25.149(f). This will allow us to consider granting ATC authority while the construction and testing of the MSS system is ongoing.

[27] *See Sua Sponte Order* at 13,594-95, ¶ 10.

[28] *See id.* at 13,595-96, ¶ 13.

comment on the applications. Such public notice will contain a statement that any party objecting to an application for ATC authority bears the burden of demonstrating that the applicant's proposed ATC is not consistent with the rules.[29]

13. Seven parties filed petitions for reconsideration and/or clarification of the *MSS Flexibility R&O*.[30] One party filed a petition for reconsideration of the *Sua Sponte Order*.[31] Eight parties filed oppositions to or comments on the petitions for reconsideration or clarification,[32] and six parties filed replies to oppositions or comments.[33]

14. On July 8, 2003, AT&T Wireless Services, Inc. and Cellco Partnership, doing business as Verizon Wireless, petitioned the U.S. Circuit Court of Appeals for the District of Columbia Circuit for review of the *MSS Flexibility R&O*.[34] The petitioners in that action challenge our decision to allow ATC in MSS spectrum as unreasoned decisionmaking and not in accordance with the law.[35]

15. <u>MSV's ATC License</u>. On November 18, 2003, MSV applied for authority to provide ATC in the United States in conjunction with its provision of MSS in the United States via satellites licensed by the Commission and Industry Canada.[36] MSV requested waiver of many of our 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.[37] MSV contended that grant of its ATC applications 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.[38] On February 9, 2004, the International Bureau issued a public notice that these ATC applications were accepted for filing, specifying a schedule for filing comments, petitions to deny, and reply pleadings.[39]

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[29] *See id.* at 13,596, ¶ 14.

[30] Petitions for reconsideration and/or clarification were filed by the Society of Broadcast Engineers, Inc. (SBE); the U.S. GPS Industry Council (GPSIC); Mobile Satellite Ventures Subsidiary LLC (MSV); the Cellular Telecommunications & Internet Association (CTIA), Inmarsat Ventures PLC (Inmarsat); the Boeing Co. (Boeing); and Cingular Wireless LLC (Cingular).

[31] Boeing filed a petition for reconsideration of the *Sua Sponte Order.*

[32] Oppositions to petitions were filed by Boeing; MSV; Inmarsat; Globalstar, L.P. (Globalstar); ICO Global Communications (Holdings) Limited (ICO); and AT&T Wireless Services, Inc., Cingular, and Verizon Wireless (jointly the Wireless Carriers). Comments on the petitions were filed by Aeronautical Radio, Inc. and the Air Transport Association (ARINC/ATA) and Delta Airlines, Inc. (Delta).

[33] Replies to oppositions were filed by Boeing, SBE, MSV, Cingular, and CTIA. GPSIC filed a reply to comments.

[34] *See AT&T Wireless Services, Inc. and Cellco Partnership d/b/a Verizon Wireless v. FCC*, Case No. 03-1191 (D.C.Cir. filed Jul. 8, 2003) (stayed pending exhaustion of administrative remedies).

[35] *See id.*, Petitioners' Non-Binding Statement of Issues to be Raised 2 (filed Aug. 8, 2003).

[36] In accordance with instructions in the *MSS Flexibility R&O*, MSV filed three applications for ATC authority on November 18, 2003: an application for authority to provide ATC in conjunction with MSS via MSV's currently operational satellite, AMSC-1; an amendment to MSV's pending application for license authority for a second-generation L-band MSS satellite, requesting authority to provide ATC in conjunction with provision of MSS via that satellite; and an application for modification of MSV's blanket license for provision of MSS in the United States via a Canadian-licensed L-Band MSS satellite operated by an affiliated company, MSV Canada, for authority to offer ATC in the United States in conjunction with its provision of MSS via that satellite.

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

[38] *Id.*

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

16. Inmarsat filed comments in opposition to MSV's ATC applications, raising concerns about the potential interference that the proposed ATC operation could cause to Inmarsat's current and next-generation MSS networks.[40] The National Telecommunications and Information Administration (NTIA) also submitted written comments on the ATC applications. For protection of Aeronautical Mobile Satellite (Route) Service (AMS(R)S) and Global Maritime Distress and Safety System (GMDSS) operations, 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. NTIA also 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.[41] Other interested parties filed comments that expressed no opinion on the merits of MSV's waiver requests but urged us to grant the ATC application or promptly take action on it.[42]

17. On August 2, 2004, MSV filed a request for expedited action on its application.[43] MSV acknowledged in this filing that some of the issues raised by its waiver requests were closely intertwined with issues raised in its petition for reconsideration of the *MSS Flexibility R&O*. Nevertheless, MSV asked the Bureau to grant "core elements" of its ATC application in advance of our disposition of the petitions for reconsideration in the ATC rulemaking proceeding.

18. On November 8, 2004, the International Bureau granted MSV's applications for ATC authority in part, granting some of its waiver requests, denying others, and deferring resolution of some issues that were also raised in the petitions for reconsideration in this proceeding.[44]

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

[41] *See* 47 C.F.R. § 25.253(g)(3).

[42] *See* letter from Raul R. Rodriguez, counsel for the U.S. GPS Industry Council, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Mar. 24, 2004) (advocating grant); letter from Eric Epley, Executive Director, Southwest Texas Regional Advisory Council For Trauma, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Apr. 14, 2004) (advocating expeditious action); letter from Karl-Heinz Ziwica, Vice President for US Engineering, BMW of North America LLC, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Apr. 23, 2004) (advocating grant); letter from Kenneth B. Taylor, Director, North Carolina Department of Crime Control and Public Safety, Division of Emergency Management, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Apr. 20, 2004) (advocating expeditious action); letter from Conrad Burns, U.S. Senator, to Michael Powell, Chairman, FCC, IB Docket 01-185 (dated May 21, 2004) (advocating expeditious action); letter from Tom Davis, U.S. Representative, to Michael Powell, Chairman, FCC, IB Docket 01-185 (dated Jun. 3, 2004) (advocating expeditious action); letter from Howard McConnell, Chairperson, Yurok Tribe, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Jun. 14, 2004) (advocating grant).

[43] Letter from Lon C. Levin, Vice President, MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (Aug. 2, 2004) (MSV Aug. 2 *Ex Parte* letter), filed as attachment to letter from Henry Goldberg, counsel for Motient, Inc., to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Aug. 2, 2004). Also see letter from Lon C. Levin, Vice President, MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Oct. 4, 2004) (modifying request for expedited action).

[44] *See Mobile Satellite Ventures Subsidiary LLC Application for Minor Modifications of Space Station License for AMSC-1; Minor Amendment to Application for Authority to Launch and Operate a Next-Generation Replacement MSS Satellite, Application for Minor Modification of Blanket License for Authority to Operate Mobile Earth Terminals with MSAT-1*, File Nos. SAT-MOD-20031118-00333, SAT-AMD-2003-1118-00332, SES-MOD-20031118-01879, Order and Authorization, DA 04-3553 (rel. Nov. 8, 2004) *(ATC License Order)*. On December 8, 2004, Inmarsat filed an *Application for Review* of this Order and Authorization. The *Application for Review* is currently under consideration.

IV. DISCUSSION

A. Gating Criteria

19. Background. In the *MSS Flexibility R&O*, we established several prerequisites that MSS operators would be required to meet in order to be allowed to offer ATC. These prerequisites have been collectively called "gating criteria." To ensure that ATC will be ancillary to provision of MSS, we adopted a requirement that MSS operators must provide substantial satellite service to be eligible for ATC authorization.[45] We defined substantial satellite service as the capability of providing continuous satellite service over the entire geographic area of satellite coverage required in our rules,[46] maintenance of spare satellites to replace destroyed or degraded satellites expeditiously,[47] and commercial availability of service, meaning offering MSS service to the general public for a fee, throughout the mandatory geographic coverage area.[48] We also required the offer of MSS and ATC services to be integrated. To demonstrate integrated service, MSS/ATC operators could demonstrate that all handsets offered were dual-mode (MSS and ATC), or could submit individualized substantial showings to demonstrate integrated service.[49] Finally, we required MSS operators to offer ATC only in the frequency bands in which they are authorized to provide MSS.[50] We considered and rejected proposals from commenters to require that MSS traffic be quantitatively "primary" or "predominant" in MSS/ATC systems,[51] to require that all MSS/ATC calls be routed through a satellite;[52] to require that MSS operators demonstrate a technical inability to serve proposed ATC areas by satellite as a condition of ATC;[53] and to impose additional fees for MSS operators who wish to provide ATC.[54] Three petitions filed in the instant proceeding request that we reconsider various aspects of the gating criteria for ATC and require MSS/ATC operators to dedicate a certain amount of capacity exclusively for MSS;[55] require MSS/ATC handsets to always attempt to communicate via the satellite first;[56] clarify that all MSS/ATC handsets

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[45] *See MSS Flexibility R&O* at 2001-02, ¶ 72.

[46] *See id*. at 2003-04, ¶ 75. We required MSS providers seeking to provide ATC to demonstrate coverage: for the 2 GHz MSS band, of all 50 states, Puerto Rico, and the U.S. Virgin Islands 100% of the time; for the L-band, of 50 states, Puerto Rico, and the U.S. Virgin Islands 100% of the time unless technically impossible from the orbit position(s) of the satellite(s); for the Big LEO band, of all locations between 70º North latitude and 55º South latitude for at least 75% of every 24-hour period and on a continuous basis throughout all 50 states, Puerto Rico, and the U.S. Virgin Islands. *See also* 47 C.F.R. 25.147(b)(1).

[47] *See MSS Flexibility R&O* at 2007, ¶ 83. We required operational NGSO MSS providers wishing to provide ATC to maintain at least one spare satellite in orbit, and operational GSO MSS providers wishing to provide ATC to maintain a spare satellite on the ground within one year of commencing operations and to launch the spare satellite in the first commercially reasonable launch window following satellite failure. *See also* 47 C.F.R. § 25.147(b)(2).

[48] *See MSS Flexibility R&O* at 2008, ¶ 86. *See also* 47 C.F.R. § 25.147(b)(3).

[49] *See MSS Flexibility R&O* at 2008-09, ¶¶ 87-88. *See also* 47 C.F.R. § 25.147(b)(4).

[50] *See MSS Flexibility R&O* at 2011-12, ¶ 93. In the 2 GHz MSS band, ATC is limited to the MSS provider's selected assignment. In the Big LEO band, ATC is limited to no more than 5.5 megahertz of spectrum in each direction of operation, and must conform to Big LEO MSS band-sharing arrangements. In the L-band, ATC is limited to the frequencies available for the providers of MSS operations under coordination in accordance with the Mexico City Memorandum of Understanding and successor agreements. *See also* 47 C.F.R. § 25.147(b)(5).

[51] *See MSS Flexibility R&O* at 2014-15, ¶ 99.

[52] *See id.* at 2015, ¶ 100.

[53] *See id.* at 2015, ¶ 101.

[54] *See id.* at 2015-16, ¶ 102.

[55] *See* Cingular, *Petition for Reconsideration* at 3; CTIA, *Petition for Reconsideration* at 3-4.

[56] *See* Cingular *Petition* at 10-11.

must be dual-mode to qualify for our "safe harbor" demonstration of integrated MSS/ATC service;[57] forbid ATC-only service subscriptions;[58] clarify that gating criteria must be met for each band in which an MSS operator seeks authority to provide ATC;[59] and clarify that our geographic coverage requirement applies only to the extent technically feasible.[60]

1. Substantial Satellite Service

20. We deny petitioners' requests to require that a specific percentage of an MSS/ATC operator's capacity be reserved exclusively for MSS.[61] We note that we refuted similar arguments regarding "primary" or "predominant" satellite service in the *MSS Flexibility R&O*[62] for reasons that we fully reaffirm, and that the petitions, oppositions, and replies do little more than simply rehash those arguments. We deny these requests because, as we stated in the *MSS Flexibility R&O*, we are unable to impose a quantitative criterion of MSS service in an MSS/ATC system that would not be arbitrary. First, the percentage of spectrum used by MSS and ATC will vary drastically in the different areas served by the satellites. In a rural area with a low population density and considerable terrain folding and other challenges to terrestrial system propagation, the MSS/ATC system will use most or all of its channels and time for MSS. In a densely-populated urban area with tall buildings whose structures prevent MSS service inside and block the communications path between handsets in the immediate vicinity and MSS satellites, the MSS/ATC system could use the large majority of its channels and time for ATC. Thus, we deny CTIA's proposal of allowing only 20% of the available channels in any spot beam to be used for ATC[63] because it would result in a grossly inefficient use of spectrum in many areas.

21. Similarly, we cannot predict what eventualities may cause traffic loading to increase or decrease, or how such loads will be distributed between ATC transmitters and MSS handsets. As Globalstar points out, considerations for allocating spectrum between MSS and ATC vary by time and geography.[64] Further, in a natural or other disaster, the higher efficiency of ATC may be crucial to providing telecommunications for the public. It is equally possible that such a disaster could damage or destroy the capacity of ATC, and possibly of terrestrial mobile communications as well. In such a circumstance, MSS would become critical even in an area where MSS is usually not the most efficient method of communication. Neither CTIA's recommendation of allowing a maximum of 20% of MSS capacity for ATC nor Cingular's recommendation that we require MSS/ATC operators to reserve at least 50% of their capacity for MSS service at all times[65] explains why these numbers are reasonable.

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[57] *See id.* at 11.

[58] *See* CTIA *Petition* at 6.

[59] *See* Cingular *Petition* at 15; CTIA *Petition* at 8.

[60] *See* Boeing, *Petition for Reconsideration of the Boeing Company* at 2.

[61] Cingular asserts that our rules requiring substantial satellite service are merely cosmetic and reflect unreasoned decisionmaking. *See* Cingular *Petition* at 3. Cingular and CTIA request that we adopt a specific percentage of satellite capacity that must be reserved for MSS operations. Cingular requests that we require MSS/ATC operators to reserve at least 50% of their capacity for MSS service at all times. *See id.* at 9-10. CTIA agrees that a numerical limit on ATC is needed, stating that "a reasonable criterion would be that the capacity in any satellite antenna beam is never reduced by more than 20% from what it would be in the absence of an [ATC]." CTIA *Petition* at 4. *See also* letter from Diane Cornell, CTIA, to Marlene Dortch, Secretary, FCC, IB Docket 01-185, Appx. at 5 (dated Feb. 2, 2005) (CTIA Feb. 2 *Ex Parte* letter).

[62] *See MSS Flexibility R&O* at 2013-14, ¶¶ 98-99.

[63] *See* CTIA *Petition* at 3-4.

[64] *See* Globalstar, *Consolidated Opposition of Globalstar, L.P.* at 5.

[65] *See id.* at 9-10.

22. Such imponderables as MSS usage and ATC usage in different parts of the country under different circumstances render any attempt to establish a single, fixed percentage of capacity that must be reserved for MSS highly problematic and uncertain. Further, such a requirement would substantially negate the value of dynamic frequency assignment in improving spectrum efficiency. We agree with commenters that assert that MSS/ATC operators will have an incentive to continue providing substantial satellite service.[66] Should we specify a fixed percentage of an MSS/ATC operator's spectrum that must be reserved for MSS operations, the MSS/ATC operator would probably have to permanently assign a certain number of channels in each spot beam for MSS traffic only, reducing the options available for dynamic frequency assignment. Imposition of a rigid percentage of MSS/ATC capacity that must be reserved for MSS would not be conducive to either business success or providing the best possible service to the public.

23. In addition, we find no basis in the record to conclude that MSS/ATC operators would surrender their single most valuable system feature, complete ubiquity of coverage, in order to compete with the already well developed and heavily financed terrestrial mobile systems. Rather, two factors strongly favor substantial satellite service in an MSS/ATC system. First, MSS/ATC customers will likely be drawn to MSS because of its ubiquity. Specifically, MSS, with or without ATC, will appeal most strongly to customers who expect to need communications in areas currently unserved by terrestrial mobile providers, such as rural areas, underpopulated areas, areas with significant hindrances to terrestrial radio propagation, and marine areas where terrestrial mobile base stations cannot be installed. Thus, customer demand will do much to ensure continuing substantial satellite service. Second, our rules require MSS/ATC licensees to retain capacity for providing MSS throughout their mandatory geographic coverage areas.[67] Nevertheless, we reiterate and reaffirm that the terrestrial service is to be offered on an *ancillary* basis by satellite licensees. The gating criteria we have adopted are intended to ensure compliance with this ancillary requirement. To the extent we receive specific complaints about a particular system, we will examine the totality of the services being offered to ensure that the terrestrial service is in fact ancillary to the satellite service. For these reasons, we again decline to establish a specific, additional requirement for substantial satellite service.

2. Integrated Service

24. We deny Cingular's request that we adopt a requirement that any MSS/ATC handset first attempt to place a call through the MSS component of the service and only call through the ATC if the satellite signal is unavailable or unreliable.[68] The *MSS Flexibility R&O* required that MSS/ATC providers

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[66] ICO asserts that MSS operators will have an incentive to continue to provide robust satellite service because they have invested large sums of money in satellites, agreeing with our reasoning that MSS operators are "unlikely 'to abandon satellite services merely for the opportunity to compete only in the market for terrestrial mobile services where much larger, better financed competitors already engage in "'competitive, intense [and] aggressive price competition.'" *See* ICO, *Consolidated Opposition of ICO Global Communications (Holdings) Limited* at 5-6 (quoting *MSS Flexibility R&O* at 1982-83, ¶ 35). *See also* letter from Suzanne Hutchings Malloy, ICO, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 2 (dated Feb. 3, 2005) (ICO Feb. 3 *Ex Parte* letter). Boeing concurs, stating that the business plan of MSS/ATC operators must be to provide mobile services in all locations in the United States, especially those locations unserved or underserved by terrestrial operators, and that MSS operators will invest in the additional cost of ATC transmitters only where the MSS signal is not available or in heavily populated "bottleneck" locations. *See* Boeing, *Opposition of the Boeing Company* at 5. MSV states that its system would meet a gating factor that restricts ATC from significantly decreasing satellite capacity but that such a gating criterion is unnecessary and could hinder MSS/ATC operators in seeking financing. *See* MSV, *Consolidated Opposition to and Comments on Petitions for Reconsideration* at 15-16. *See also* letter from Lon. C. Levin, Vice President MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 2-4 (dated Feb. 3, 2005).

[67] *See* 47 C.F.R. § 25.149(a)(2), (6).

[68] *See* Cingular *Petition* at 10-11.

offer a single, integrated service. We disagree with Cingular and CTIA that such a requirement is the only way to ensure integrated service.[69]

25. We addressed this issue in the *MSS Flexibility R&O*, stating that "requiring satellite-routing would defeat most of the benefits of authorizing ATC in the first instance."[70] None of the parties seeking reconsideration presented new facts or arguments to change our analysis. We agree with MSV and Globalstar that adding a requirement that the MSS/ATC handset attempt to acquire the satellite first would impair operational efficiency.[71]

26. We also agree with Boeing that all modern wireless communications networks involve continuous instructions to handsets regarding the location and type of base stations assigned, and that the efficiencies of dynamic frequency assignment would be hampered by a firm rule that handsets must try to acquire the MSS communications path first.[72] Any "satellite first-look" requirement would involve the use of extra time and power in the handset, and would complicate control signals from the MSS satellite and ATC base stations to the handsets. Such a requirement would increase the cost of providing service, hinder call completion, and ultimately reduce system efficiency. Further, any such requirement could ultimately force a weaker satellite signal on consumers in areas where a stronger ATC signal was available, but a satellite signal was also available. We find no significant public interest benefit to offset these serious disadvantages.

27. We can see no reason why an MSS/ATC operator would install ATC base stations in any area where customer demand can be adequately accommodated by the operator's satellite system. On the contrary, the MSS/ATC operators' interest in avoiding unnecessary capital expenditures would deter them from installing ATC base stations in non-urban areas where traffic is light enough to be handled by MSS alone. Thus, we believe that MSS/ATC operators will only install ATC base stations in areas where the satellite signal is substantially affected by blocking or where consumers demand more communications paths than the satellite can provide. These are the precise situations for which we authorized ATC. Therefore, we disagree with CTIA's contention that MSS/ATC handsets will always attempt to acquire ATC first, and that as a result ATC will not be ancillary to MSS.[73] On the contrary, we presume that an MSS/ATC handset will be in constant communication with the MSS/ATC network, and will choose the best communication path available to it, whether MSS or ATC. We therefore decline to add an artificial and spectrally inefficient requirement to the MSS/ATC rules.

3. Dual-Mode Devices

28. Background. In the *MSS Flexibility R&O*, we stated that a "safe harbor" method by which MSS operators could demonstrate MSS/ATC system integration without specific, detailed showings of system integration is to provide ATC services via dual-mode handsets that can also be used for communication via the provider's satellite system.[74] Cingular requests that we clarify that the integrated

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[69] *See id. See also* CTIA Feb. 2 *Ex Parte* letter at 5.

[70] *MSS Flexibility R&O* at 2015, ¶ 100.

[71] *See* MSV *Opposition* at 16. Globalstar adds that such a requirement is spectrally inefficient, and would require handsets to attempt to use the MSS communications path whenever the MSS signal was above a certain threshold, regardless of actual communications traffic, leading to denials of service when the users could use ATC to complete their calls. *See* Globalstar *Opposition* at 7.

[72] *See* Boeing *Opposition* at 8.

[73] *See* CTIA *Reply* at 5. *See also* CTIA Feb. 2 *Ex Parte* letter at 5.

[74] *See MSS Flexibility R&O* at 2008-09, ¶ 87. Applicants for MSS/ATC may prove integrated service by demonstrating "[t]he MSS/ATC operator will use a dual-mode handset that can communicate with both the MSS

(continued....)

service "safe harbor" can be satisfied only by a dual-mode handset that "actually incorporates the capability to communicate with both the satellite and the ATC base stations."[75] MSV responds to this request, asking that we clarify that "component kits" consisting of a handset with all of the hardware and software necessary for access to both ATC and MSS, and a separate antenna booster needed for communicating with MSV's current generation satellite meets the definition of a dual-mode handset.[76]

29. Discussion. We clarify that a "dual-mode handset," for the purposes of 47 C.F.R. § 25.149(b)(4)(i) shall consist of a handset which, when sold to the customer, contains all the hardware and software necessary to acquire and communicate via both the operator's MSS system's signal and its ATC system's signal, either within the casing or permanently affixed to the casing in such a fashion that no part of the equipment would ordinarily be detached from the casing unless defective and in need of replacement. Specifically, we will not ordinarily consider "component kits" as described by MSV to be dual-mode handsets. Any handset that requires a supplementary attachment to acquire and use both the MSS and the ATC signal will not be considered dual-mode.

30. We also extend this clarification to apply to personal digital assistants (PDAs), laptop computers, and other digital devices communicating via MSS/ATC. In the *MSS Flexibility R&O*, we exempted such devices from the dual-mode "safe harbor" demonstration of integrated service for MSS/ATC.[77] Cingular requests that we eliminate this exception or clarify its scope, claiming that otherwise potentially significant terrestrial services could be provided on a stand-alone basis.[78]

31. We agree with Cingular that "there is no clear definition of what constitutes a PDA at a time when handsets have begun to incorporate various computer and Internet access functions, along with voice capability."[79] By exempting such devices from our safe harbor, we would generate considerable confusion over precisely what devices would qualify for safe harbor by being dual-mode. We also agree with other parties that argue that digital devices should not necessarily be required to be dual-mode.[80] These parties, however, ignore the fact that dual-mode devices are not required under our gating criteria, they are merely required to qualify for the safe harbor demonstration of integrated service. Any MSS/ATC operator that chooses not to make its handsets or digital devices dual-mode can satisfy our integrated service gating criterion by presenting sufficient evidence demonstrating that they will offer integrated service. For example, ICO expresses its intention to offer digital voice and data through satellite air-interface repeaters that provide service links to satellites, claiming that such repeaters could be attached to a number of devices, making it unnecessary to make each individual device satellite-capable.[81]

32. We agree with Cingular and CTIA that there is no clear distinction between PDAs and

(...continued from previous page)
network and the MSS/ATC to provide the proposed ATC service," or by an alternate showing establishing that the MSS/ATC service is integrated. *See* 47 C.F.R. § 25.147(b)(4).

[75] Cingular *Petition* at 11. Cingular states that MSS/ATC proponents "sought flexibility to offer 'dual mode' phones where the capability to access the satellite was merely a component available at the point of sale." *Id.*

[76] *See* MSV *Opposition* at 17-18.

[77] *See MSS Flexibility R&O* at 2009, n.229.

[78] *See* Cingular *Petition* at 12.

[79] Cingular *Petition* at 12. CTIA also points out that there are PDAs and other digital devices available on the market in the United States today incorporating voice and data capabilities. *See* CTIA *Petition* at 7. *See also* CTIA Feb. 2 *Ex Parte* letter at 6.

[80] *See, e.g.,* Inmarsat *Opposition* at 3-4

[81] *See* ICO *Opposition* at 3-4. *See also* ICO Feb. 3 *Ex Parte* letter at 3.

handsets that is relevant to our ATC rules. For this reason, we grant Cingular's request to the extent of finding that devices providing ATC, including PDAs and other digital devices, must be dual-mode, as defined above, for purposes of the "safe harbor" method of demonstrating integrated MSS/ATC service.[82] MSS/ATC operators choosing to use handsets or digital devices that are not dual-mode will be required to demonstrate that they offer integrated service.[83]

4. ATC-Only Subscriptions

33. We clarify that "integrated service" as used in this proceeding and required by 47 C.F.R. § 25.149(b)(4) forbids MSS/ATC operators from offering ATC-only subscriptions.[84] We reiterate our intention not to allow ATC to become a stand-alone system. The purpose of ATC is to enhance MSS coverage, enabling MSS operators to extend service into areas that they were previously unable to serve, such as the interiors of buildings and high-traffic density urban areas. We will not permit MSS/ATC operators to offer ATC-only subscriptions, because ATC systems would then be terrestrial mobile systems separate from their MSS systems. We therefore clarify that "integrated service" as used in this proceeding and required by 47 C.F.R. § 25.147(b)(4) forbids MSS/ATC operators from offering ATC-only subscriptions.[85]

5. Band-Specific Gating Criteria

34. We clarify that any MSS operator wishing to incorporate an ATC component into its system must meet the gating criteria for each spectrum band in which it wishes to provide ATC. We agree with Cingular and CTIA that we did not make this requirement explicit in the rules.[86] Accordingly, we require MSS operators seeking ATC authorization to meet the gating criteria in each band in which an MSS operator intends to provide ATC. The rules specify that in each of the 2 GHz MSS band, the Big LEO band, and the L-band, MSS/ATC is limited to the frequencies authorized for MSS communication.[87]

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[82] Because MSS is the basic service to which ATC is ancillary, we see no reason why we should prohibit or restrict MSS-only devices.

[83] For example, the International Bureau authorized MSV's use of a dual-mode handset with a separate antenna booster for its current generation satellites. The Bureau found that MSV had demonstrated satisfaction of the integrated service requirement, and that its proposal to use the separate antenna booster with a dual-mode handset designed to communicate with MSV's next generation satellite without a booster to be a reasonable temporary solution that will enhance economic efficiency. *See ATC License Order* at ¶ 21.

[84] CTIA requests that we forbid MSS/ATC operators to offer "ATC-only" subscriptions to customers, stating that such a requirement would ensure that MSS/ATC operators would offer ATC only as part of an integrated system with MSS as the primary component. *See* CTIA *Petition* at 6; CTIA Feb. 2 *Ex Parte* letter at 5. No party explicitly opposes this request, but Globalstar states that a "customer should have the option of taking an ATC-only service at a high data rate" in urban areas where the customer does not expect to leave the ATC-covered area. Globalstar *Opposition* at 8-9.

[85] Because MSS is the basic service to which ATC is ancillary, we will not prohibit or restrict MSS-only service subscriptions.

[86] Cingular states that "[w]hile the Commission has made it clear that it does not intend to allow gaming of its ATC rules [footnote omitted], the failure to explicitly state that satisfaction of the gating criteria is license/band-specific and not licensee-specific presents that opportunity." Cingular *Petition* at 15. CTIA adds that it believes the Commission intended to make satisfaction of gating criteria a precondition to the grant of ATC authority for each MSS license, but that MSS operators should not be allowed to avoid their satellite obligations in one band by claiming they have met those obligations in another band. *See* CTIA *Petition* at 8; *see also* CTIA Feb. 2 *Ex Parte* letter at 7. *But see* ICO *Opposition* at 10 (arguing that Cingular's and CTIA's request is frivolous because the requirement of band-specific satisfaction of gating criteria is explicit in the rules) (citing *MSS Flexibility R&O* at 2011-12, ¶ 93; 47 C.F.R. 25.149(b)(5). *See also* Globalstar *Opposition* at 9.

[87] *See* 47 C.F.R. § 25.149(b)(5).

Further, as we have made clear, an ATC is ancillary to the MSS system it supports. These requirements have the effect of obligating MSS operators to fulfill the gating criteria in each band in which the seek to provide ATC. Therefore we clarify that our gating criteria must be met in each band in which an MSS operator seeks authorization to provide ATC.

6. Geographic Coverage

35. We clarify our geographic coverage requirement by adding the phrase "if technically feasible" to the gating criteria for the 2 GHz MSS band in the MSS/ATC service rules. We agree with Boeing that the difference between our coverage requirements as an MSS/ATC gating criterion and our general requirement for GSO 2 GHz MSS operators is critical because it is not technically possible to provide MSS to all of Alaska using a GSO satellite system.[88]

36. The meaning of the phrase "consistent with the coverage requirements for 2 GHz MSS GSO operators" in the MSS/ATC gating criteria is that the MSS/ATC "coverage requirement" gating criterion is satisfied by a showing that the coverage requirements of the 2 GHz MSS service rules, including the exemption for technical infeasibility, are met. We therefore agree with Boeing that the technical feasibility clause should be in the rules.

B. Uplink Interference in the L-Band

37. Background. In the *MSS Flexibility R&O*, we extensively discussed and analyzed proposed technical rules for MSS/ATC, with the goal of adopting a flexible set of technical rules that would prevent harmful interference while permitting the rapid and economically efficient development of ATC. We addressed issues of self-interference, *i.e.*, the interference an ATC could cause to the MSS system of which it is a part; inter-system interference, *i.e.*, the interference an ATC could cause to other MSS systems; and out-of-band interference that ATC could cause to services other than MSS.

38. In the L-band,[89] unlike other MSS bands, each MSS operator is licensed for the entire band, but must coordinate with other users of the L-band to determine which channels each MSS operator may use. Under an international agreement known as the Mexico City Memorandum of Understanding (Mexico City MoU), five L-band MSS operators are to coordinate their use of the L-band, meeting annually to re-negotiate their coordination agreement. These negotiations have not occurred since 1999, and the 1999 coordination agreement remains in effect.[90] Because the channels used by the L-band MSS operators are interleaved,[91] inter-system interference protection is a significant challenge.

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[88] *See* Boeing *Petition* at 2. Our ATC rules state that a geostationary orbit (GSO) 2 GHz MSS operator must demonstrate that its system "can provide space-segment service covering all 50 states, Puerto Rico, and the U.S. Virgin Islands one-hundred percent of the time, consistent with the coverage requirements for 2 GHz MSS GSO operators." 47 C.F.R. § 25.149(b)(1)(i). By contrast, the service rules for GSO 2 GHz MSS systems require the systems to be "capable of providing mobile satellite services on a continuous basis throughout the 50 states, Puerto Rico, and the U.S. Virgin Islands, *if technically feasible*." 47 C.F.R. § 25.143(b)(2)(iv) (emphasis supplied).

[89] The L-band consists of the bands assigned by the Commission in the United States for MSS operations: 1525-1544 MHz and 1545-1559 MHz for downlinks, and 1626.5-1645.5 MHz and 1646.5-1660.5 MHz for uplinks. *See* 47 C.F.R. § 2.106.

[90] The five operators in the L-band and their authorizing countries are MSV (United States), TMI (Canada), Inmarsat (United Kingdom), Solidaridad (Mexico), and Volna-More (Russia). *See MSS Flexibility R&O* at 1994, n.144.

[91] In the L-band, all licensees have equal rights to all channels in the band. The licensees coordinate their channel usage so that each licensee has some channels it uses exclusively, some it is not entitled to use, and some that it shares with other licensees. By contrast, in the Big LEO and 2 GHz MSS bands, each licensee has exclusive rights to a block of spectrum.

39. In the *MSS Flexibility R&O*, we based our analysis of interference potential on MSV's proposed ATC. MSV's proposal provided specific system features for us and parties to evaluate.[92]

40. We began our uplink interference analysis in the *MSS Flexibility R&O* with the level of interference that MSV claimed was appropriate for its next generation satellite to accept from its own ATC, or self-interference.[93] The analysis assumed that MSV's self-interference would increase no more than 0.25 dB with an ATC active and that, by using very general assumptions, the expected interference into an Inmarsat satellite receiver would be about the same, or less than, the interference received by MSV.94 We concluded that "the total noise increase in the Inmarsat-4 receiver would be on the order of 1.4%. The noise increase for the Inmarsat-3 satellite receiver would be on the order of 0.1%.95 Neither of these noise increases should hinder the Inmarsat operations."96 Accordingly, we adopted technical rules for L-band ATC that mandated adherence to the assumed design parameters,97 which were largely consistent with MSV's ATC design proposal at that time.98 Based on this data, we calculated MSV's satellite gain, receiver noise temperature, degradation of signals, and a number of other factors in the system design, and established a set of rules to ensure that ATC would not cause harmful interference to MSV's own satellite operations or to Inmarsat. These rules included a limitation on ATC base stations of 1725 nation-wide on any one channel,99 a requirement for power reduction from MSS/ATC handsets when they operate outside buildings (structural attenuation),100 limits on base station power and antenna

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[92] *See MSS Flexibility R&O* at 2031-32, ¶ 132. Inmarsat, which could receive harmful interference from MSV's ATC, has had the opportunity to evaluate and comment upon MSV's proposal, as has NTIA. NTIA is the agency responsible for the telecommunications of the Federal government, including defense communications, aviation communications, and the Global Positioning System (GPS), among other systems and services. The Commission therefore works with NTIA in evaluating the potential for interference to, and the need for protection of, systems operated by the Federal government.

[93] *See id.* at 2033, ¶ 136. *See also* letter from Bruce Jacobs, counsel for MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 11 (dated Mar. 28, 2002), Table *SS Link Margin Degradation to Accommodate Intra-System Effect of ATC*.

[94] *See id.* at 2033, ¶ 137.

[95] The total radio "noise," or power that can interfere with the reception of desired signals, can be expressed as a "system temperature," which includes both the noise received from all sources by the system's antennas and the noise added by the system's own operation. The system noise temperature (T) of Inmarsat's satellite receivers is 600K. $\Delta T/T$ represents the rise in that noise temperature caused by a new source of noise, such as ATC. The equation calls for dividing the increase in the system noise temperature (Δ) by the noise temperature without the new source of noise (T). Thus, $36 \div 600 = 6\%$, so 6% $\Delta T/T$ in this case would be sufficient additional noise to raise the system temperature of Inmarsat's satellite receivers by 36 degrees Kelvin.

[96] *MSS Flexibility R&O* at 2170, Appx. C2, ¶ 2.1.1. Inmarsat-3 refers to the current generation of Inmarsat satellites. Inmarsat has planned to construct and launch Inmarsat-4 satellites in the future. These satellites will feature much higher receiver sensitivity and many more antenna beams, each covering a smaller area of the Earth's surface. These different characteristics required the Commission to evaluate the impact of potential interference on both the current and the planned Inmarsat satellites.

[97] "Below, we. . . provide an individual assessment of the potential for interference from MSV's ATC operations to Inmarsat's networks. . . ." *MSS Flexibility R&O* at 2143, Appx. C2. For a description of MSV's ATC, *see Application of Motient Services Inc.*, File Nos. SAT-LOA-19980702- 00066, SAT-AMD-20001214-00171 & SAT-AMD-20010302. *See also* Public Notice, Report No. SAT-00066 at 2 (rel. Mar. 19, 2001) (MSV Application). MSV later indicated that it would seek to use the same ATC network with its current-generation MSS system. *See* Letter from Carson E. Agnew, President and Chief Operating Officer, and P. Karabinis, Chief Technical Officer, MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 (dated Dec. 16, 2002).

[98] *See* 47 C.F.R. § 25.253.

[99] *See id.* at § 25.253(c).

[100] *See id.* at § 25.253(a)(8).

gain,101 and out-of-channel emissions limits.102 Several parties petitioned for changes to these rules.

1. Interference Standard

41. Upon review of the arguments in petitions and oppositions, we change the basis of the rules for uplink interference in the L-band. As a result, an MSS/ATC operator in the L-band may increase the noise level of another co-primary MSS system by no more than 6% ΔT/T from the MSS/ATC operator's entire system, both MSS and ATC, without a specific coordination agreement being accepted by all affected parties. Three separate factors inform this decision. First, through the course of this proceeding, MSV has changed its ATC design substantially, and may do so again. In using MSV's originally-proposed ATC specifications as a basis for its technical analysis of interference, we intended to ground our analysis, and therefore its rules, in real-world considerations. It was not our intention to design our rules for MSV's proposed system, but rather to establish rules for all potential ATC systems in the L-band. Second, we agree with MSV's contention that we should not impose restrictions designed to limit self-interference. A more appropriate basis for interference limits is the interference an MSS/ATC system may cause to another MSS system in the L-band. Third, we note that Inmarsat provides both AMS(R)S and GMDSS communications.[103] In addition to our statutory mandate to prevent harmful interference,[104] we are determined to ensure that these safety and emergency communications suffer no degradation due to harmful interference.

42. We conclude that interference to other MSS systems is a better basis for our technical rules than self-interference. The International Telecommunication Union (ITU) has standards in place to protect GSO MSS systems from interference, in addition to well-defined methods to calculate the level of interference.[105] These standards permit an MSS provider to increase the noise level of another co-primary MSS provider's satellite receivers up to a level of 6% ΔT/T without coordinating.[106] An MSS provider in the L-band wishing to operate at a higher level of interference to co-primary MSS systems must coordinate and receive consent to do so from other MSS providers.[107] These standards have been effective in preventing harmful interference between L-band MSS providers.[108] Inmarsat urges us to reject the claims of an MSS licensee that it can withstand a self-interference level higher than 0.25 dB, which

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101 *See id.* at § 25.253(d)(1-2).

102 *See id.* at § 25.253(d)(7).

103 *See, e.g.,* 47 C.F.R. § 80.1187 (Inmarsat as part of GMDSS); § 87.187(q) (AMS(R)S) .

104 *See* 47 U.S.C. § 303(f).

105 *See* ITU-R RR Appendix 8 (rev. WRC-03).

106 *See* ITU-R Rec. M.1086 which stipulates that the procedures of ITU-R Appendix 29 (now Appendix S8) be used in determining the ΔT/T between two geostationary MSS satellites, and that the satellite systems coordinate operations if the calculated value of ΔT/T is greater than 6%.

107 *See* ITU-R Rec. M.1086.

108 Inmarsat states that the interference tolerance of satellites is limited and does not account for terrestrial uses such as ATC. Inmarsat designs an interference allowance of approximately 25% ΔT/T in its system, and uses 6% ΔT/T from any one other satellite system as the basis for coordination. If MSV's ATC alone were allowed to create 6% ΔT/T, Inmarsat claims that this would consume almost a quarter of its entire interference margin, which would significantly constrain its ability to provide L-band MSS. Inmarsat stresses that ATC is merely an ancillary component of MSS, and claims that the interference caused by ATC should be included in the interference allowance for MSS systems. ATC interference must be kept at a low level, as our rules currently require, in order to ensure effective coordination and spectrum efficiency in the L-band, according to Inmarsat. *See* Inmarsat, *Inmarsat Opposition to Petition for Partial Reconsideration and Clarification of Mobile Satellite Ventures Subsidiary LLC* at 8-11. *See also* letter from John P. Janka, counsel for Inmarsat, to Marlene Dortch, Secretary, FCC, IB Docket 01-185, Appx. 1 at 5 (dated Feb. 3, 2005) (Inmarsat Feb 3 *Ex Parte* letter).

equates to 6% ΔT/T. Inmarsat argues that if an MSS/ATC operator were to exceed this level, the MSS/ATC operator would be required to either limit its ATC service, contrary to its business interests, or degrade its satellite performance.[109] We agree with MSV that interference to other MSS systems, rather than self-interference, is the appropriate concern upon which to base our interference rules. We also agree with Inmarsat that we should not allow an ATC, by itself, to interfere with another MSS system to a level of 6% ΔT/T.

43. We adopt a requirement that the permitted level of interference from one L-band MSS system into the satellite receivers of another L-band MSS system shall be no greater than 6% ΔT/T without a coordination agreement among the affected parties. Because ATC is an ancillary component of an MSS system, we consider interference caused by ATC operation as part of the 6% ΔT/T level of interference allowed from an MSS system without coordination, rather than allowing an MSS system with ATC a greater capacity to cause interference without coordination than an MSS system without ATC. Therefore, on any L-band channel an MSS/ATC system is entitled to use under the current L-band coordination agreement, and where another MSS system has a satellite within the visible arc from the MSS/ATC operator's area of coverage, the MSS/ATC operator may cause no more than a 6% ΔT/T increase in the system noise of the other co-primary operator's satellite system, unless the parties to the coordination agreement have coordinated to allow a higher level of interference, in which case the coordinated level serves as the baseline for permissible aggregate interference from all of the MSS/ATC provider's operations.

44. The current coordination agreement under which Inmarsat and MSV share L-band spectrum was finalized in 1999. Ideally, the L-band MSS operators should renegotiate their coordination agreement every year. Indeed, changes to the existing coordination agreement could help avoid some of the potential interference issues that could arise from deployment of MSS/ATC.[110] At the same time, however, we acknowledge that it could take a great deal of time and effort to conduct further coordination negotiations. For this reason, in the case of any L-band frequency that is currently the subject of a coordination agreement and is shared between an MSS operator and an MSS/ATC operator, we will permit an MSS/ATC to cause a small increase in interference to another MSS operator's system above the coordinated interference level when the coordinated interference level is already greater than 6% ΔT/T. This measure accounts for the reality that MSS is currently operating in the L-band, and that it may be necessary and appropriate to allow a slightly higher level of interference than currently coordinated levels allow in order to permit ATC to begin operations. When L-band MSS operators enter into a new coordination agreement, this additional interference allowance will no longer apply, and MSS/ATC operators will be required to operate its ATC within the limits coordinated by the parties.

45. Permitting interference from MSS/ATC operations in the United States to co-primary MSS systems on shared channels at the 1% ΔT/T level will allow MSS/ATC operators to implement ATC without undue risk of harmful interference, until such time as a new coordination agreement can be reached that considers interference from both MSS and ATC. This interim allowance of an additional 1% ΔT/T is higher than the 0.7% ΔT/T limit upon which we based our interference analysis in the *MSS Flexibility R&O*. We conclude that this value is reasonable because, as MSV points out, our conclusion in the *MSS Flexibility R&O* was that an increase of 0.7% ΔT/T in interference from the United States, and

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[109] *See* Inmarsat *Petition* at 13-14.

[110] Such renegotiation could also facilitate the efficient usage and protection of new satellites that will be deployed over the next few years by both Inmarsat and MSV. While we encourage such renegotiation to occur at the earliest possible opportunity, we recognize that the existing agreement, which identifies frequencies available to each operator from specific orbital locations and antenna beams, and in some cases, interference levels coordinated between the operators, provides a basis under which current MSS operators can continue to operate as well as deploy and use new satellites and MSS/ATC.

another 0.7% $\Delta T/T$ from outside the United States, would not hinder Inmarsat's MSS operations.[111] Our analysis therefore accepted aggregate system-wide interference at a level of 1.4% $\Delta T/T$.[112] MSV points out that it plans to deploy 80% of its ATC in the United States, and only 20% in Canada.[113] This is reasonable because of the much higher population of the United States. Thus, 80% of the total of 1.4% $\Delta T/T$, or 1.12% $\Delta T/T$, can be expected to emanate from MSV's ATC in the United States. We round this figure down to 1% $\Delta T/T$ to ensure that interference from ATC does not rise to a level that would interfere with MSS operations, while still allowing ATC to be rapidly deployed.

46. In summary, we adopt three interference limits for MSS/ATC operations in the L-band, varying with the channels in question.

- In any channel that is coordinated for the exclusive use of an MSS/ATC operator, and where there is no other MSS operator's satellite within the visible arc as seen from the ATC geographic coverage area, the MSS/ATC operator is limited only by in-band and out-of-band emissions limits and the need to control self-interference sufficiently to maintain substantial satellite service.

- In any channel which is coordinated for shared use between the MSS/ATC operator and another MSS operator, the MSS/ATC operator is permitted to cause interference to the other MSS operator up to a level of 6% $\Delta T/T$ from its entire MSS/ATC network.

- In any channel which is coordinated for shared use between the MSS/ATC operator and another MSS operator, and is coordinated to permit a level of interference from the MSS/ATC operator higher than 6% $\Delta T/T$, the MSS/ATC operator's ATC may raise the interference to the other MSS operator an additional 1% $\Delta T/T$ without further coordination.[114]

47. This approach has several benefits. First, it allows MSS/ATC operators freedom to design their systems to meet a limit on uplink interference in the manner that they think best promotes the efficiency and utility of their service offering. They are in a better position to make decisions regarding the interference trade-offs between MSS and ATC that will produce the best service. Second, under this approach, L-band MSS/ATC providers will have a strong incentive to innovate, in order to get the maximum possible coverage and efficiency within their interference "budget" by using interference reduction techniques. We cannot predict what techniques may be invented or where such techniques will prove most effective, in the MSS component or the ATC of an MSS/ATC system. Finally, our revised approach supports and encourages private coordination agreements among the interested parties in the band. Private negotiations between expert parties with their business interests at heart are more likely to produce the most efficient interference levels than regulations based on largely hypothetical cases. We therefore will permit interference levels above 6% $\Delta T/T$ where the parties have reached coordination agreements. We note that the Mexico City MoU contemplated such coordination sessions on an annual basis.

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[111] *See* MSV *Petition* at 6 (citing *MSS Flexibility R&O* at 2170, Appx. C, ¶ 2.1.1).

[112] *See id.*

[113] *See id.*

[114] We note that the existing coordination agreement does not specify current $\Delta T/T$ protection levels. However, such levels can be calculated using either ITU-R Appendix 8 (Rev.WRC-03) or the methodology that was presented in our *MSS Flexibility R&O*. We would expect both parties to approach the development of a new coordination agreement in good faith and to apply good engineering judgment to determine the various factors and trade-offs that must go into the evaluation of sharing between an MSS system and an MSS/ATC system. The methodology that was presented in our *MSS Flexibility R&O* could be used as an example of the different factors that could be taken into account in determining the interference from an MSS/ATC system into an MSS system.

2. Other Issues

48. Because of the change in our interference standard, and the elimination of certain technical rules, we dismiss as moot several requests for changes to those technical rules. MSV petitioned for an increase in the number of base stations each MSS/ATC operator is permitted on two separate grounds.[115] Our overall limit on the interference an MSS/ATC operator may cause to other MSS systems obviates the need for a numerical limit on ATC base stations. MSV also requests that we amend the rules to allow the use of half-rate vocoders and channels, as opposed to quarter-rate vocoders and channels.[116] This rule is also rendered unnecessary by our new interference standard.

49. Inmarsat requests that we require MSS/ATC applicants to provide a full description of their ATC architecture.[117] Inmarsat also requests that the restriction we applied limiting the number of simultaneously-transmitting ATC handsets to 90,000 be inserted into the rules, noting that the restriction is in the text of the *MSS Flexibility R&O*, but not in the rules.[118] We are also removing these requirements from our rules, replacing them with an overall limitation on the amount of interference an MSS/ATC system can cause to another MSS system in the L-band. For this reason, we dismiss Inmarsat's requests as moot.

50. Because we are allowing MSS/ATC providers to apportion their interference budget between MSS and ATC according to their own designs and business plans, and to change those apportionments without further approval as long as the sum of the ATC and MSS interference remains below the levels required, we have little basis for limiting the number of base stations or mobile handsets, so we will eliminate these limits. The intent of these rules was to limit the total interference caused by ATC. These specific numerical limits were based on an analysis of MSV's proposed ATC. Many of the values proposed by MSV have changed. More importantly, we believe that it is important to allow MSS/ATC licensees flexibility to design their ATC in accordance with technical and market demands. We have decided that a better way to achieve this goal is to limit the total interference that an ATC may cause, rather than dictating system design features.

[115] MSV requested that we increase the limit on co-channel base stations in the United States from 1725 to 2760 based on the fact that we assumed in the *MSS Flexibility R&O* that MSV would deploy one-half of its ATC network in the United States. Therefore, according to MSV, we intended to limit co-channel base stations to 3450 network-wide, half in the United States and half outside the United States. Because it plans to deploy approximately 80% of its ATC network within the United States, MSV requested that we increase the permitted number of co-channel base stations in the United States to 80% of the network-wide total, or 2760. *See* MSV *Petition* at 5-6 (citing 47 C.F.R. § 25.253(c)). MSV also requests that we increase the number of permitted co-channel base stations to 14,785 based on its argument that ATC should be allowed to interfere with co-primary MSS systems to a level of 6% $\Delta T/T$. *See id.* at 15.

[116] A vocoder converts the caller's voice into a digital signal for transmission and converts the received digital signal back into intelligible voice. By reducing the rate of the vocoder, the transmitter can reduce the interference caused by the transmission, at the expense of voice quality. MSV states that in the *MSS Flexibility R&O*, we assumed that MSV would use a quarter-rate vocoder and channel and that this would reduce the effective isotropic radiated power of MSV's ATC handsets by 3.5 dB. MSV claims that this reduction in EIRP will be achieved with a half-rate vocoder. *See* MSV *Petition* at 14. Contrary to MSV's assertions, 47 C.F.R. § 25.253(a)(2) requires the use of a variable-rate vocoder, not a quarter-rate or half-rate vocoder.

[117] Inmarsat requests that we require such a description to include a detailed demonstration that the cell structure of the ATC includes an 18 dB link margin for structural attenuation and that this margin will be used only for service to mobile handsets indoors. *See* Inmarsat *Petition.* at 11. *See also* Inmarsat Feb 3 *Ex Parte* letter at Appx. 5.

[118] Inmarsat seeks clarification that this limit applies to all MSS/ATC operators in the L-band, not to each such operator, because it claims that the latter interpretation would have no relation to the assumptions underlying our interference analysis. *See* Inmarsat *Petition* at 13.

51. While we are eliminating many of our more detailed technical rules on uplink interference, we expect MSS/ATC providers will use, and be able to document compliance with, realistic technical parameters when calculating the increase in uplink interference (*i.e.*, ΔT/T) to other MSS systems. For example, if a party relies on an 18 dB structural attenuation link budget during coordination, it must be able to demonstrate how its system will ensure compliance with that parameter. Similar demonstrations would be needed for other key parameters, such as the vocoder/power relationship, number of mobile users, etc. We retain the authority to request the values used for these factors and the demonstrations used to justify them.[119]

C. Downlink Interference in the L-Band

52. Background. Where uplink interference protection is concerned with interference into the satellite receiver of an MSS system, downlink interference protection ensures that receivers on or near the surface of the Earth are able to receive signals without harmful interference. As we stated in the *MSS Flexibility R&O*, the potential for interference may exist in four ways: (1) overload of the land-based mobile earth terminal (MET) receiver[120] from in-band emissions when in close proximity to ATC base stations; (2) out-of-band interference to the land-based MET from ATC base stations; (3) aggregate interference to the airborne MET from multiple ATC base stations; and (4) overload of the airborne MET from an ATC base station.[121] To protect METs from overload, we established a power limit on ATC base stations of 19.1 dBW per carrier with no more than three carriers per sector,[122] and 14.1 dBW EIRP per carrier toward the horizon.[123] To protect land-based METs from out-of-band interference, we adopted an out-of-band emission limit of -57.9 dBW/megahertz for ATC base stations.[124] To protect airborne METs from out-of-band interference, we established overhead gain limits for ATC base stations dependent on the angle of maximum gain from the base station antenna.[125] We determined that airborne receiver overload was not expected to occur, and so established no technical limits on this basis.

1. ATC Base Station Power Levels

53. We grant a request from MSV to reconsider the power limits on base stations, and generally allow an 8dB increase in base station power.[126] With an added 15 dB of margin, MSV claims that we can increase the permitted EIRP of ATC base stations from 23.9 dBW to 38.9 dBW, with an aggregate peak EIRP in any direction from all base station sectors of no more than 53.9 dBW, and the EIRP toward the

[119] MSV is the only L-band MSS provider currently authorized to provide ATC. Our elimination of some technical rules here does not affect the terms of MSV's ATC authorization. MSV must conform to all the terms of its ATC authorization unless it applies for modification of its license and demonstrates that the modifications it proposes would be consistent with the limits on interference we adopt here.

[120] Overload occurs when the total input power to the receiver drives the receiver from its operational linear state to a non-linear state, which results in distortion of the desired input signal or, in the case of severe overload, the inability of the receiver to operate.

[121] *See MSS Flexibility R&O* at 2038, ¶ 148.

[122] *See MSS Flexibility R&O* at 2038, ¶ 148; 47 C.F.R. § 25.253(d)(1).

[123] *See MSS Flexibility R&O* at 2039, ¶ 152; 47 C.F.R. § 25.253(d)(2).

[124] *See MSS Flexibility R&O* at 2041, ¶ 157; 47 C.F.R. § 25.253(b).

[125] *See MSS Flexibility R&O* at 2042, ¶ 160; 47 C.F.R. § 25.253(e).

[126] MSV claims that it submitted "uncontroverted evidence" that the overload threshold for Inmarsat METs is -45 dBm, instead of the -60 dBm value we used in our calculation. MSV submits measurements it conducted of the 1 dB compression point of the receiver front-ends in Inmarsat's land-based and maritime METs produced by a variety of manufacturers. This data purports to demonstrate that "even an in-band signal level of -45 dBm does not overload an Inmarsat land-based or maritime MET." *See* MSV *Petition* at 16-17; Appx. C.

horizon from 18.9 dBW to 33.9 dBW per sector.[127] Inmarsat disputes MSV's contention, asserting that it has provided reports from two separate manufacturers of Inmarsat METs, demonstrating that a receiver overload threshold of at most -75 dBm is necessary to protect Inmarsat from out-of-band interference from ATC base stations[128]

54. We are presented with two opposing propositions from MSV and Inmarsat. MSV states that the appropriate MET receiver overload threshold upon which to base our downlink interference calculations is -45 dBm. Inmarsat claims that the appropriate threshold is -75 dBm. Both parties provide reports and measurements to support their assertions. Faced with the need to decide among these two alternatives or the -60 dBm threshold we used in our downlink interference calculations in the *MSS Flexibility R&O*, the staff conducted tests of the overload thresholds of representative METs, supplied by MSV and Inmarsat. The report of these tests is attached as Appendix A.

55. The testing indicates that most of the Inmarsat receivers tested outperform the overload limit of -60 dBm used in our analysis in the *MSS Flexibility R&*O. From the test data, we conclude that Inmarsat receivers can tolerate another 8 dB increase in power when the interfering signal is more than approximately two megahertz removed from the desired signal.[129] This tolerance is 8 dB better than the assumed tolerance of -60 dBm upon which we based our ATC base station power limits. We also note that in an *ex parte* filing, MSV requested a waiver of our rules to allow an additional 8 dB of base station power, both generally and near airports and waterways,[130] in place of the 15 dB increase MSV requested in its petition. For this reason, we grant MSV's request to change the power limits on base stations, as follows. Generally in the L-band, the EIRP of ATC base stations shall be limited to 31.9 dBW, and the EIRP toward the horizon shall be limited to 26.9 dBW per base station sector. This represents an 8 dB increase over the current power limits that apply when three carriers are used within an antenna sector.

56. The testing our staff conducted also indicates that in cases where the interfering signal is less than approximately two megahertz removed from the desired signal, our assumption of Inmarsat MET receiver tolerance of -60 dBm was correct. Generally, we do not regulate the susceptibility of receivers to interference from transmissions on nearby frequencies. Rather, we rely on the marketplace – manufacturers and service providers – to decide how much susceptibility to interference will be acceptable to consumers. In addition, we generally do not limit one party's ability to use the spectrum based on another party's choice regarding receiver susceptibility. In this situation, it is clear from our testing and our knowledge of receiver design that Inmarsat can deploy receivers in the future that can be less susceptible to interference from transmissions on nearby frequencies. We recognize, however, that it is important to provide some amount of protection to current receivers used by Inmarsat in the L-band because some of Inmarsat's operations are safety-related, though these safety-related transmissions are likely to be limited in quantity. Furthermore, it is not clear that there will be great usage of Inmarsat MSS signals near urban areas where MSS ATC L-band transmitters will be deployed. This is because: 1) MSS signals are often obstructed by buildings and the environment in general, and 2) there are other more reliable and cheaper modes of communication that are more likely to be used (e.g., VHF air traffic

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[127] *See id.* at 17-18. The peak EIRP level of 19.1 dBW per carrier, with no more than three carriers per sector, specified in 47 C.F.R. § 25.253(d)(1) equates to an aggregate EIRP per sector of 23.9 dBW. The EIRP level of 14.1 dBW toward the horizon per carrier specified in 47 C.F.R. § 25.253(d)(2) equates to an aggregate EIRP toward the horizon per sector of 18.9 dBW.

[128] Specifically, Inmarsat claims that the overload threshold of its METs is -72 dBm at a one megahertz frequency offset, and lower still at offsets of less than one megahertz. For this reason, Inmarsat requests that we recalculate the ATC base station power limits based on an overload threshold of -75 dBm, instead of the -60 dBm we used in our calculation. *See* Inmarsat *Petition* at 15-17; Inmarsat *Opposition* at 16.

[129] *See* Appx. A, § 3.

[130] *See* MSV Aug. 2 *Ex Parte* letter at 1.

control, VHF marine, CMRS communications, and landline). As such, we conclude that it is inefficient and unnecessary for us to limit MSS ATC deployment at higher power levels on all frequencies in the L-band.

57. The 1544-1545 MHz sub-band, within the MSS L-band allocation, is limited to distress and safety communications.[131] Thus, it is reasonable to provide greater protection against interference in this particular sub-band. In reviewing our receiver test results, as discussed earlier, we found that current Inmarsat receivers can generally tolerate increased ATC power levels and power flux density (PFD) levels provided they are more than approximately two megahertz away in frequency from the desired signal. After reviewing the current frequency sharing agreement governing use of the L-band in North America by MSS licensees, we conclude that distress and safety communications should have adequate protection from critical interference due to increased ATC transmitted power and increased PFD limits if we limit such increases to spectrum outside the 1541.5-1547.5 MHz band (that is, 2.5 megahertz away from the band edges of the 1544-1545 MHz sub-band). We recognize that some consumers may wish to transmit non-safety traffic through an MSS system even when located in urban areas near MSS/ATC transmitters, and that those transmissions would have to be on frequencies outside the 1544-1545 MHz sub-band. Nevertheless, it appears that Inmarsat and other MSS operators should have adequate ability to support such operations, either by providing those users with receivers that are less susceptible to interference or by directing non-safety traffic to frequencies that are adequately removed from higher-power ATC transmissions in a particular area. In this regard, we note that under the current frequency sharing agreement, MSV's operations are limited to significantly fewer frequencies than Inmarsat's operations. Furthermore, parties to coordination negotiations that will be needed in the L-band for next-generation satellite deployment and large-scale deployment of ATC can accommodate ATC operations in their negotiations. In order to protect the safety functions of Inmarsat operations, our rules, based on a receiver tolerance of interference at -60 dBm, will remain in place for the portion of the L-band at 1541.5-1547.5 MHz.[132]

58. Our testing also revealed another potential source of interference to Inmarsat METs: third-order intermodulation interference. Third-order intermodulation interference occurs when two frequencies, both removed from the frequency carrying the desired signal, interact to cause interference to the frequency carrying the desired signal.[133] Our testing indicates that Inmarsat's receivers may be vulnerable to intermodulation interference, depending upon the combined power of the two unwanted signals. Our testing showed that the four terminals tested will not experience third-order intermodulation difficulties if the combined power at the receiver from the two unwanted signals is less than -70 dBm.[134]

59. To resolve third-order intermodulation problems, we require any MSS/ATC operator to notify the affected MSS operator in any case where a single base station or multiple base stations will transmit on frequencies that can produce third-order intermodulation products that overlap a frequency assigned to the affected MSS operator in the 1525-1559 MHz band, where such transmissions will result in a signal level of -70 dBm or higher for the combined signals at the output of the affected MSS

[131] *See* 47 C.F.R. § 2.106, n.5.356.

[132] In this portion of the band, ATC base stations will be limited to a peak EIRP of 19.1 dBW per carrier and 14.1 dBW toward the physical horizon per carrier. *See* 47 C.F.R. § 25.253(d).

[133] Determining the frequencies whose interactions can cause intermodulation to the desired frequency is accomplished by applying the formula $2 f_1 - f_2 = X$, where f_1 and f_2 are the frequencies producing the intermodulation, and X is the desired frequency.

[134] *See* Appx. A, Figure 3. The single exception occurs in the tests of Terminal C with cdma2000 modulation where sensitivity to having one of the two unwanted signals near 1552 MHz occurred. This sensitivity was probably due to an image rejection problem in the receiver as discussed in Attachment A, n.19.

operator's terminal's receiving antenna.[135] The MSS/ATC operator and the affected MSS operator must work together to resolve the interference problem. We note that careful selection of base station frequencies by the MSS/ATC operator can minimize the number of situations in which this problem will arise, as could aggregating the channels used by the different MSS operators through the coordination process.

60. The rules specify the maximum permitted EIRP per carrier and limit to three the number of carriers per ATC base station sector.[136] MSV requests that we eliminate the restriction on the number of carriers per sector.[137] Because it is the total EIRP produced within an ATC base station sector that can cause receiver overload, the number of carriers used to generate that EIRP level is inconsequential. An ATC base station could be implemented with a few high power carriers or many low power carriers. As long as the EIRP resulting from the different implementations was the same, the interference potential would be the same. Therefore, we grant MSV's request and remove the limitations on the number of carriers per ATC base station sector from the rules.[138]

2. Protection of Airports and Waterways

61. Background. In the special case of ATC base stations near airport runways or waterways, we grant an 8 dB increase in PFD limits, with certain restrictions. Our testing of Inmarsat METs found that they were able to tolerate 8 dB more interference than we assumed in the *MSS Flexibility R&*O, which justifies an 8 dB increase in PFD. In the *MSS Flexibility R&*O, we determined that these areas required additional protection for METs, due to the fact that they tend to be open, with few buildings, where signal propagation from ATC base stations will be closer to "free-space" conditions than it would be in urban areas with heavy concentrations of buildings and other obstructions.[139] We decided that protection of METs from interference in these situations required a physical separation for ATC base stations of a minimum of 470 meters from any runway or aircraft stand area.[140] To further protect aircraft METs from interference, we also required ATC base stations to produce a PFD of no more than -73.0 dBW/m² per 200 kilohertz channel at the edge of airports.[141] In the case of waterways, we required that ATC base stations be separated by 1.5 kilometers (0.9 miles) if there is a clear view of the water, and that ATC base stations could produce a PFD of no more than -64.6 dBW/m² per 200 kilohertz channel at the edge of navigable waterways.[142]

62. Asserting that these protection requirements are unnecessarily stringent, MSV requests that we allow an additional 15 dB of PFD at the edges of airports and navigable waterways, based on its measurements of Inmarsat MET receiver front-end one-dB compression points that purportedly

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[135] For the purpose of determining when a signal at the output of an MSS terminal antenna is greater than -70 dBm, a calculation based on free-space propagation, and omni-directional antenna, and the actual polarizations used by the ATC base station and the MSS system may be used. Unless otherwise justified, the MSS terminal should be assumed to be at ground level.

[136] *See* 47 C.F.R. § 25.535(d)(1).

[137] *See* letter from David S. Konczal, counsel for MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185, Appx. at 18 (dated Mar. 10, 2004).

[138] We note that in implementing a multiple-carrier base station, the EIRP level of each carrier can be expressed as the total EIRP divided by the number of carriers. Alternately, expressed in decibels, the EIRP per carrier will be the peak EIRP-10*log(number of carriers). *See* Appx. B, § 25.253.

[139] *See MSS Flexibility R&O* at 2178, Appx C2, ¶ 2.2.1.3.

[140] *See id.* at 2040, ¶ 154; 47 C.F.R. § 25.253(d)(3).

[141] *See MSS Flexibility R&O* at 2040, ¶ 154; 47 C.F.R. § 25.253(d)(4).

[142] *See MSS Flexibility R&O* at 2040, ¶ 154; 47 C.F.R. § 25.253(d)(5).

demonstrates that the proper overload threshold is -45 dBm, rather than the -60 dBm we used in our calculations.[143] Further, MSV contends that our approach of requiring both separation distances and PFD limits in the case of airports and waterways deprives ATC providers of flexibility and is unnecessary to protect METs from interference.[144]

63. Discussion. Because of the results of our testing, we deny Inmarsat's request that we recalculate the PFDs and separation distances relevant to airports and waterways based on an overload threshold for Inmarsat METs of -75 dBm, rather than the -60 dBm or -50 dBm that we used in calculating these limits. The analysis of PFDs at edges of airports and waterways is contained in Appendix C2 of the *Flexibility R&O*. That analysis assumed that Inmarsat maritime METs could tolerate an unwanted signal level of -60 dBm while Inmarsat airborne METs could tolerate an unwanted signal levels of -50 dBm. Because our tests indicated that Inmarsat MET receivers are capable of tolerating an interference level of -52 dBm, a level 8 dB higher than the -60 dBm we assumed in setting PFD limits near waterways, we will permit an increase of 8 dB in the PFD permitted at the edges of waterways.

64. With respect to airports, we use the results of our tests and base PFDs on an interference level of -52 dBm. Inmarsat indicates that theoretical calculations predict that receiver overload should occur at levels around -54 dBm for its "Aero H" receivers and -60 dBm for its higher data-rate "S64" receivers.[145] We believe, however, that these calculations represent a worst-case situation that is several dB worse than would be expected in real-world receivers. While we did not test an airborne MET receiver, we have no reason to believe that airborne receivers, which must meet stringent government testing and approval standards, would perform worse with respect to receiver overload than the other MET receivers that we did test. As with our decision to increase the limits on ATC base station power generally, the PFD limits that we adopted in the *MSS Flexibility R&O* will remain in force for the sub-band at 1541.5-1547.5 MHz, except that the PFD limits for airports will be reduced by 2 dB to reflect the results of our testing. We acknowledge Inmarsat's concern that METs aboard aircraft are part of a safety service, as well as the statement of Aeronautical Radio, Inc. and the Air Transport Association of America (ARINC/ATA) that AMS(R)S communications use the Inmarsat space segment, and that these communications are time-critical, safety communications that require protection under ITU regulations.[146] However, continuance of the more stringent PFD limits in the 1541.5-1547.5 MHz sub-band adequately assures the protection of safety and emergency communications in the 1544-1545 MHz sub-band. Accordingly, we change the PFD limit for ATC base stations at the edges of airports to -56.8 dBW/m^2/200 kilohertz, summed over all carriers in a sector for the full 1525-1559 MHz band, [147] and for ATC base stations at the edges of waterways to -56.6 dBW/m^2/200 kHz, summed over all carriers in a sector, for carriers outside the sub-

[143] *See* MSV *Petition* at 19.

[144] MSV contends that ATC providers should be able to site base stations outside the separation distances without having to measure the PFD produced, and that alternately, ATC providers should be allowed to site their base stations within the separation distances if they measure the PFD at the edges of airports and waterways, and those PFDs are within the limits in the rules. *See id.* at 20-21; MSV *Reply* at 9.

[145] *See* Inmarsat Feb 3 *Ex Parte* letter at 42-49.

[146] *See* ARINC/ATA *Comments* at 2.

[147] MSV correctly pointed out that there was a numerical error in the calculation of the PFD at the edge of a airport contained in Attachment C2 of the *MSS Flexibility R&O*, although the calculation supplied by MSV was also incorrect. We base the PFD calculated here on the following parameters: an Inmarsat terminal receive gain of 0 dBi, a polarization isolation of 0 dB, a frequency of 1542 MHz (center of the band), and an interference tolerance level of -52 dBm. *See* letter from Bruce Jacobs, counsel for MSV, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 1-2 (dated Nov. 18, 2003).

band at 1541.5-1547.5 MHz.[148] For carriers within the 1541.5-1547.5 MHz sub-band, our original PFD limits for ATC base stations at the edges of waterways of -64.6 dBW/m^2/200 kHz, summed over all carriers in a sector, will remain in effect.

65. We also agree with MSV that the dual requirements of PFD limits and physical separations of ATC base stations from airports and waterways is unnecessary. The separation distance we established provides a critical additional protection for safety services, according to Inmarsat.[149] While we recognize this argument, the determinative factor in preventing interference to METs is PFD, not separation. Therefore, we will eliminate the distance requirements in the rules, and require only that ATC base stations meet the PFD limits in the rules. Compliance may be demonstrated by either actual measurement of PFD at the edge of the airport or waterway, or by calculations using free-space loss.[150] The separation distances remain a good general indicator of necessary distances for design purposes. We also note ARINC/ATA's observation that there is no need for ATC base stations within 470 meters of an airport, because airports are generally free of obstructions and MSS satellites should be in view at all times. This factor, however, is more appropriate as a system design consideration. Our PFD requirement remains the critical factor in preventing harmful interference.

3. Overhead Gain Suppression

66. We grant MSV's request that we increase the overhead gain limits by 10 dB in elevation angles from 55° to 145° and by 8 dB in elevation angles from 30° to 55°. We agree with MSV's claim that ATC base stations can operate with 10 dB more gain in elevation angles from 55° to 145° and 8 dB more gain in elevation angles from 30° to 55° without causing an increase in interference greater than 0.3 dB based upon the aggregate interference model used in the *MSS Flexibility R&O* Technical Appendix.[151]

67. We find that MSV is correct in its assertion that the increases in overhead gain limits it requests will cause only a minimal increase in interference to co-primary MSS operators. We note that Inmarsat states that the overhead gain limits in the *MSS Flexibility R&O* were based on MSV's own statement that it would use a "specially designed antenna" that would perform to the specifications in its application for ATC authority, and that Inmarsat previously commented that MSV was unlikely to achieve these specifications.[152] We find this argument unpersuasive in light of the fact that an increase in interference of 0.3 dB is negligible. In measuring interference, a difference of 0.3 dB is difficult to measure, and in any event is highly unlikely to be a significant rise in interference. We find that there is no serious threat of harmful interference in relaxing the overhead gain suppression limits as requested by MSV, and therefore grant the request.

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[148] We base this PFD calculation for waterways for the band 1541.5-1547.5 MHz on the following parameters: a n Inmarsat terminal receive gain of 7.5 dBi, a polarization isolation of 8 dB, a frequency of 1544.5 MHz and an interference tolerance level of -52 dBm.

[149] Noting that Inmarsat METs aboard aircraft are part of a safety service, Inmarsat explains that the PFD limits quantify the level at which aircraft METs will experience harmful interference, but that PFD limits can be difficult to measure accurately. *See* Inmarsat *Opposition* at 18-19.

[150] 47 U.S.C. § 25.253. *See* Appendix B.

[151] MSV asserts that the benefit of the overhead gain suppression levels we adopted in the *MSS Flexibility R&O* is far outweighed by the cost of implementing these levels of overhead gain suppression. *See* MSV *Petition* at 19-20; MSV *Reply* at 8.

[152] Inmarsat argues that the standards derived from analyses of overhead gain suppression that relied on MSV's statements cannot be changed without further detailed study. *See* Inmarsat *Opposition* at 17-18.

4. Protection of the Radionavigation Satellite Service

68. Background. In the *MSS Flexibility R&O*, we considered the need to protect reception of Radionavigation Satellite Service (RNSS) signals in the1559-1610 MHz band from out-of-band interference from ATC transmitters.[153] We decided that ATC mobile terminals and base stations should operate in compliance with the same limits on emissions in the 1559-1610 MHz band that we had previously prescribed for MSS METs in the *Global Mobile Personal Communications by Satellite (GMPCS)* proceeding.[154] MSS terminals transmitting on assigned frequencies in the 2 GHz MSS band must limit the EIRP density of out-of-band emissions in the 1559-1610 MHz frequency range to -70 dBW/megahertz or less, averaged over two milliseconds of active transmission; and must limit the EIRP of discrete emissions of less than 700 hertz bandwidth in the 1559-1610 MHz band to -80 dBW, also averaged over two milliseconds.[155] Similar out-of-band emission limits apply to operation of Big LEO MSS terminals and MSS terminals transmitting on assigned frequencies in the 1626.5-1660.5 MHz band.[156] We accordingly adopted rule provisions that likewise require ATC handsets and base stations to meet an EIRP density limit of -70 dBW/megahertz and a narrowband EIRP limit of -80 dBW on out-of-band emissions in the 1559-1610 MHz RNSS band.[157]

69. Prior to our adoption of the *MSS Flexibility R&O*, NTIA stressed that the out-of-band emission limits adopted in the *GMPCS* proceeding were devised to protect aircraft reception of RNSS signals and contended that stricter limits should be imposed on ATC transmitters in order to protect ground-based RNSS receivers as well.[158] We noted in this regard that MSV had reached an agreement with the GPS Industry Council, in which it promised to limit the EIRP density from its proposed ATC base stations to -100 dBW/megahertz in the 1559-1605 MHz band, and limit the EIRP density of emissions in that band from ATC handsets to -90 dBW/megahertz.[159] NTIA provided a technical analysis proposing out-of-band emission levels that were consistent with those agreed to by MSV and the GPS Industry Council.[160] We did not, however, adopt NTIA's proposed out-of-band emission levels for L-band ATC base stations and mobile terminals because we disagreed with certain assumptions made in its analysis.[161] Although we recognize that NTIA disagreed with our assessment of its technical analysis, we declined to adopt stricter RNSS-band emission limits for ATC transmitters than we had previously

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[153] *See MSS Flexibility R&O* at 2028-29, ¶¶ 124-126; 2051-53, ¶¶ 180-184. The RNSS includes the Global Positioning System (GPS) operating in a portion of the 1559-1610 MHz band. *See MSS Flexibility R&O* at 2028, ¶ 124.

[154] *See Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite (GMPCS) Memorandum of Understanding and Arrangements (GMPCS Order)*, IB Docket No. 99-67, Report and Order and Further Notice of Proposed Rulemaking, 17 FCC Rcd 8309 (2002) (modified in *GMPCS*, Second Report and Order, IB Docket No. 99-67, 18 FCC Rcd 24423 (2003)).

[155] *See* 47 C.F.R. § 25.216(e).

[156] *See* 47 C.F.R. § 25.216(a)-(d), (f)-(h).

[157] *See* 47 C.F.R. §§ 25.252(a)(7), (b)(3); 25.253(a)(6), (c)(7); 25.254(a)(4), (b)(4).

[158] *See MSS Flexibility R&O* at 2029, ¶ 125.

[159] *See id.* at 2053, ¶ 184. Further, MSV promised that the EIRP density of ATC handsets activated five years or more after the commencement of its proposed ATC operation would be limited to -95 dBW/megahertz in the 1559-1610 MHz band.

[160] *See* letter from Fredrick R. Wentland, Acting Associate Administrator, Office of Spectrum Management, NTIA, to Donald Abelson, Chief, International Bureau, FCC, IB Docket 01-185 (dated Nov. 12, 2002).

[161] For example, we did not agree that a 3 dB allowance for base station interference allotment for aviation GPS receivers was necessary. We also were not persuaded to establish interference standards based on a two meter separation distance.

adopted for MSS terminals in the *GMPCS* proceeding, however, because we did not find a sufficient basis in the record to support adoption of such stricter limits.[162] We stated that we planned to consider possible changes in our protection requirements for RNSS in a future rulemaking proceeding.[163] The GPS Industry Council filed a Petition for Reconsideration urging the Commission to amend the ATC rules to require all L-band ATC transmitters to operate within the stricter out-of-band emissions limits that MSV has agreed to meet.[164]

70. Discussion. We do not act on the GPS Industry Council's petition at this time. While we agree with the GPS Industry Council, NTIA, and other government agencies that it is essential to ensure that GPS does not suffer harmful interference,[165] it is also important to ensure that new technologies are not unnecessarily constrained. In this regard, we recognize that the President's new national policy for space-based positioning, navigation, and timing (PNT) directs the Secretary of Commerce to protect the radio frequency spectrum used by GPS and its augmentations through appropriate domestic and international spectrum management regulatory practices.[166] The PNT policy also directs the Secretary of Commerce, in cooperation with the Chairman of the FCC, to take the appropriate and legally permissible actions required to mitigate interference to GPS. Furthermore, the President's PNT policy calls for the establishment of an inter-agency Executive Committee, on which the Chairman of the FCC will be invited to participate as a liaison, and a National Space-Based PNT Coordination Office. It is our intention to establish discussions with other agencies, through the PNT Executive Committee and Coordination Office as appropriate, to better understand what protection levels for GPS are warranted. The results of those discussions may lead to future rulemaking proposals in order to ensure that all FCC services provide adequate protection to GPS, and produce a more complete record upon which to establish final GPS protection limits for MSS ATC licensees.

71. In the interim, the only MSS/ATC licensee, MSV, has agreed to comply with the tighter limits requested by the GPS Industry Council, and we have made compliance with these limits a condition of its license. If MSV requests a change to this condition, we will initiate a notice and comment period, and coordinate any change with NTIA and other government agencies. If additional ATC applications are filed, we will coordinate any ATC authority grant with NTIA, pursuant to the general notification process, to assure adequate protection of the GPS.

72. On our own motion, we amend the RNSS-band emission limits for ATC handsets and base stations in sections 25.252-25.254 to eliminate several minor, unintended discrepancies between those limits and corresponding emission limits in sections 25.216, in keeping with our previously stated intention to limit ATC emissions in the 1559-1610 MHz band to the same extent as emissions from MSS terminals.[167] We also amend section 25.216(i) pertaining to carrier-off-state emissions to delete language

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[162] *See id.* at 2029, ¶ 126; 2052-53, ¶ 182.

[163] *See id.* at 2029, ¶ 126; 2053, ¶ 184.

[164] The GPS Industry council states that these stricter limits were broadly supported and endorsed by NTIA, and asserts that we must make decisions based on the facts in the record, and must "articulate a satisfactory explanation for [our] action including a rational connection between the facts found and the choice made." *See* GPS Industry Council *Petition* at 3-4 (quoting *Motor Vehicle Mfrs. Assn. v. State Farm Mutual Auto. Inc. Co.*, 463 U.S. 29, 43 (1983); *Citizens to Preserve Overton Park, Inc. v Volpe*, 401 U.S. 402, 416 (1971)).

[165] *See id.* at 4. *See also* ARINC/ATA *Comments* at 2-3; Delta Airlines *Comments* at 1-2.

[166] *See* U.S. Space-Based Positioning, Navigation, and Timing Policy, December 15, 2004, Fact Sheet, available on the World-Wide Web at www.ostp.gov/html/FactSheetSPACE-BASEDPOSITIONINGNAVIGATIONTIMING.pdf.

[167] These discrepancies arose because the MSS terminal limits in sections 25.216 were revised in some respects after the adoption of the ATC rules. In order to correct these discrepancies, we will amend sections 25.252, 25.253, and 25.254 to specify measurement intervals as two milliseconds in place of the current 20 milliseconds, change the

(continued....)

that is inconsistent with our intention that the limit should restrict average EIRP density.[168] Because this amendment is merely clarifying, rather than substantive, prior public notice and comment is unnecessary.

5. Protection of Search-and-Rescue Satellite Service (SARSAT)

73. We deny a request from MSV to change the language defining coordination zones around SARSAT earth stations. In the *MSS Flexibility R&*O, we required ATC providers to "provide the Commission with sufficient information to complete coordination of any ATC base station placed within 27 km from one of the [SARSAT earth station locations] and within the radio horizon of the SARSAT earth station prior to operation."[169] MSV claims that this language could be confusing, and requests that we amend the rules so that this requirement is "for any ATC base station located within 27 km of a SARSAT and within radio horizon of the SARSAT station [sic]."[170] No other party addresses this issue.[171] We find this request to be without substance because MSV's proposed language has the same effect as the language currently in the rules.

6. Non-Forward Band Operation

74. We grant a request from MSV to clarify a note to section 25.253 that modifies the rule in section 25.149(a)(1) requiring operation in the forward-band mode.[172] The note to section 25. 253 states that our L-band technical rules are based on GSM/TDMA 800 or GSM 1800 system architecture, and that an L-band MSS/ATC operator may implement an alternate system architecture upon demonstrating that the alternate system architecture would produce no greater potential interference than the rules allow.[173] MSV requests that we clarify that the note to sections 25.253 applies to section 25.149(a)(1) so that an MSS/ATC applicant may implement a non-forward band system architecture upon demonstrating that such a system architecture will cause no greater interference than the rules permit.[174] We agree with MSV that L-band MSS operators should be able to implement a non-forward band system architecture if they demonstrate that such a system architecture will cause no greater interference to other MSS systems in the L-band than the rules permit.

(...continued from previous page)
permitted EIRP density of emissions in the 1605-1610 MHz band from ATC terminals and base stations operating in the L-Band, specified in section 25.253(d)(7) and (g)(3) from -10 dBW/megahertz to -46 dBW/megahertz, amend section 25.254(a)(4) to change the permitted EIRP density of emissions in the 1605-1610 MHz band from ATC base stations with assigned frequencies above 2483.5 MHz to -70 dBW/megahertz, establish narrowband EIRP limits in the 1605-1610 MHz segment for all ATC terminals, and prescribe stricter limits on EIRP density in the 1559-1610 MHz band for ATC terminals when in the carrier-off state.

[168] *See GMPCS*, Second Report and Order, IB Docket No. 99-67, 18 FCC Rcd 24,423, 24,455-56, ¶ 97 (2003).

[169] *MSS Flexibility R&O* at 2049-50, ¶ 177.

[170] MSV states that this requirement was intended to require coordination only when the planned ATC base station was both within 27 km of a SARSAT earth station and within the radio horizon of the SARSAT earth station, but notes that the rule itself applies this requirement to any planned ATC base station "located either within 27 km of a SARSAT station, or within the radio horizon of the SARSAT station, whichever is less." MSV *Petition*, Appx. E at 3.

[171] We note that the value of 27 km mentioned above is dependent on the EIRP of ATC base stations. MSV has requested a change in the base station EIRP. If the base station EIRP changes this value will also change.

[172] *See* MSV *Petition* at 23.

[173] *See* 47 C.F.R. § 25.253 at note.

[174] *See* MSV *Petition* at 23.

D. Licensing Issues

1. Assignment of Licenses by Competitive Bidding

75. Background. In the *MSS Flexibility R&O*, we concluded that under our decision to permit the grant of ATC authority to previously licensed MSS operators through the modification of their MSS authorizations, certain conditions for assigning licenses by competitive bidding pursuant to section 309(j)(1) of the Communications Act would not be met. Specifically, we found that our decision precluded the filing of mutually exclusive applications,[175] and that license modifications associated with ATC would not be modifications so different in kind or so large in scope as to warrant treatment as "initial" licenses subject to Section 309(j)(1).[176] We also concluded that allowing MSS operators to incorporate ATC without going through a competitive bidding process would not be inequitable to CMRS carriers or unjustly enrich MSS operators such that the modification of their authorizations should be treated as initial licenses.[177] We based this conclusion on the fact that we placed strict limitations on the ATC authority that would be available to MSS operators and the significant costs of launching and maintaining satellite operations.[178] We also found that restricting eligibility for ATC authority to licensed MSS operators was consistent with our obligations under Section 309(j)(3), which include promoting the deployment of new technologies and services in rural areas and ensuring efficient and intensive use of the spectrum.[179]

76. Cingular argues that the decision to award terrestrial rights to 2 GHz MSS licensees without an auction is contrary to Section 309(j) of the Communications Act and is wrong as a matter of law and policy.[180] More specifically, according to Cingular, the record demonstrates that segmentation of the spectrum would be more efficient than integrated MSS-terrestrial operations and therefore "an auction is compelled by statute."[181] In support of this assertion, Cingular cites a study by Telcordia Technologies (Telcordia), which Cingular states concluded that the spectrum efficiencies through dynamic frequency control claimed possible by MSS/ATC proponents were unlikely to be realized, that ATC would degrade MSS performance, and that any terrestrial use of MSS spectrum would probably be accomplished through band segmentation, in which case there would be no loss of efficiency if the terrestrial and satellite operations were performed by different parties.[182] Cingular also claims that the Commission's finding that MSS operators would not be unjustly enriched by its decision to make ATC authority available to them was unsupported and does not withstand scrutiny.[183]

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[175] *See MSS Flexibility R&O* at 2068-69, ¶ 221.

[176] *See id.* at 2070, ¶¶ 224-225; 47 U.S.C. § 309(j)(1).

[177] *See MSS Flexibility R&O* at 2071, ¶ 226.

[178] *See id.* We also found that MSS operators with ATC authority would not compete directly with terrestrial CMRS. *See id.* at 2072, ¶ 229.

[179] *See id.* at 2071-72, ¶ 228 (citing 47 U.S.C. § 309(j)(3)(A) & (D)).

[180] *See* Cingular *Petition* at 1. Cingular also claims that the decision to award terrestrial rights to 2 GHz MSS licensees without an auction is contrary to "the FCC's decision in the licensing orders to allow 2 GHz MSS applicants to succeed or fail . . . on the basis of a satellite-only authorization," *See also* Cingular *Reply* at 2.

[181] *See* Cingular *Petition* at 2.

[182] *Id.* at 16-19.

[183] *Id.* at 22-23. *See also* letter from Brian F. Fontes, Vice President, Federal Relations, Cingular, to Marlene Dortch, Secretary, FCC, IB Docket 01-185 at 5 (dated Jan. 28, 2005). Section 309(j)(3)(C) states that the Commission shall seek to recover for the public "a portion of the value of the public spectrum resource made available for commercial use and avoidance of unjust enrichment through the methods employed to award uses of that resource." 47 U.S.C. § 309(j)(3)(C).

77. Discussion. We deny Cingular's request to assign ATC authority by competitive bidding. Contrary to Cingular's contention, the Telcordia study does not demonstrate that MSS/ATC frequency sharing is infeasible. Specifically, the study fails to consider techniques for reducing self-interference that MSV proposes to incorporate into its ATC system, and that other ATC providers could also employ. The Telcordia study concludes that band sharing between MSS and ATC, even with dynamic frequency sharing, will only permit the use of very few ATC handsets in very large areas, on the order of fewer than 100 handsets in areas larger than the State of Texas.[184] According to Telcordia and Cingular, band sharing is not feasible and band segmentation is the only means by which ATC can be provided in MSS bands. However, we also have before us studies and a plan that concludes that thousands or millions of ATC handsets can operate in the United States without causing harmful interference to MSS, including a highly developed plan from MSV for ATC in the L-band. This plan offers the possibility of MSS/ATC band sharing using dynamic frequency assignment. We have chosen to credit the analyses and plans showing that MSS/ATC band sharing is possible, because MSV's plan for ATC indicates that frequency sharing is possible without harmful interference. If Telcordia and Cingular are correct, there presumably will be no ATC, for we see little business sense in building an ATC to serve fewer than 100 handsets in an area larger than Texas. If, however, MSS/ATC proponents are correct, ATC will help to expand communications options to the American public and will use spectrum more efficiently and intensively.

78. Because we reject Telcordia's conclusion that the only means by which MSS/ATC can be accomplished is band segmentation, we are not persuaded that our decision to make ATC authority in the 2 GHz MSS band available only to previously licensed MSS operators was in error, and we again conclude that it would not be in the public interest to grant terrestrial rights in this band to entities other than MSS operators. We addressed Cingular's argument in favor of band segmentation and authorizing separate entities to provide MSS and terrestrial service in the *MSS Flexibility R&O.* There we stated that band segmentation would amount to reallocation of a portion of the MSS bands, and decided that such reallocation would be unreasonable and unwarranted.[185] Further, as we stated in our discussion of substantial satellite service,[186] MSS and ATC usage will vary by area of the country. Allocating some portion of the MSS bands for terrestrial use could cause those portions to be underused in rural and remote areas. Similarly, allocating some portion of the MSS bands exclusively for MSS use would continue the current situation, in which MSS is not available in some areas, particularly urban areas with significant blockage of the satellite communication path.

79. We conclude that band segmentation would not be an "efficient and intensive use of the electromagnetic spectrum."[187] Thus, we are not persuaded that we should make ATC authority available by means of a licensing process that permits the filing of mutually exclusive applications for initial licenses, and we affirm our conclusion in the *MSS Flexibility R&O* that our decision to permit MSS operators to acquire ATC authority does not establish the requisite conditions for assigning terrestrial licenses in the MSS bands through competitive bidding.

80. Cingular's argument regarding unjust enrichment also does not lead us to conclude that we should adopt a licensing process that would make ATC authority available to entities other than MSS operators. First, we find Cingular's argument that MSS operators would be unjustly enriched to be

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[184] *See* letter from Brian F. Fontes, Vice President, Federal Relations, Cingular, to Don Abelson, Chief, International Bureau, FCC, IB Docket 01-185 at 2-3 and Attachment A (dated May 13, 2002).

[185] "The Commission has identified MSS as an important component of our overall mix of spectrum allocations. The "separate-band, separate-operator" approach, however, would, in essence, reallocate spectrum from MSS to other uses. We believe that reconsideration of the spectrum-management decision to allocate resources to MSS is unreasonable and unwarranted. . . ." *See MSS Flexibility R&O* at 1996, ¶ 58.

[186] *See supra* ¶ 20.

[187] 47 U.S.C. § 309(j)(3)(D).

flawed because it is based on a valuation of spectrum that is largely irrelevant to the heavily restricted ATC authority we authorized in the *MSS Flexibility R&O*. Second, we do not agree that the *Seventh CMRS Competition Report* includes "findings" that satellite operators are in direct competition with terrestrial wireless operators.[188] While that report includes satellite operators as "other types of operators that are competing in the mobile telephone segment,"[189] the discussion is merely a brief description of how satellite telephony works and the services and products offered. The text of the report makes clear that prices for satellite services, in particular handset prices, are not competitive with currently offered CMRS wireless plans; nor does the report extend the competitive analysis undertaken for CMRS providers (including discussions of churn, subscriber growth, market penetration, etc.) to satellite operators, as would be consistent with an assertion that these operators compete directly with terrestrial providers. Third, our decision to modify MSS operators' licenses to include ATC authority is consistent with other decisions in which the Commission has extended licensees additional operating rights without accepting competing applications that might have been mutually exclusive and required an auction.[190]

81. Finally, Cingular ignores the fact that we must consider and balance all of the objectives of Section 309(j)(3) in identifying classes of licenses to be auctioned, including "the development and rapid deployment of new technologies, products, and services for the benefit of the public, including those residing in rural areas"[191] and "efficient and intensive use of the electromagnetic spectrum. . ."[192] We concluded in the *MSS Flexibility R&O* that our decision to restrict terrestrial rights in the bands used by MSS operations to the provision of ATC by MSS operators only, and our concomitant decision not to accept terrestrial applications from other parties, is consistent with these goals.[193] Cingular's arguments do not persuade us that the objective of efficient, intensive spectrum use would be better served by band segmentation; nor has Cingular demonstrated how the other goals of Section 309(j)(3) such as the rapid deployment of services to rural areas would be better achieved by making terrestrial rights in the 2 GHz MSS band available to parties other than MSS operators. We therefore decline to reverse our decision to make ATC authority available to MSS operators through the modification of their MSS authorizations.

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[188] *See* Cingular *Petition* at 23 (citing *Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993(Seventh CMRS Competition Report)*, Seventh Report, FCC 02-179, 17 FCC Rcd 12,985, 12997, 13025-28 (2002).

[189] *See Seventh CMRS Competition* Report at 13,025.

[190] *See, e.g.*, *Amendment of the Commission's Rules to Permit Flexible Service Offerings in the Commercial Mobile Radio Services (CMRS Flexibility Report and Order)*, First Report and Order and Further Notice of Proposed Rulemaking, WT Docket 96-6, 11 FCC Rcd 8965, 8979-80, ¶ 33 (deleting footnotes US330 and US331, which prohibited PCS licensees from providing fixed service, without triggering the competitive bidding requirements of Section 309(j)); *Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licenses to Engage in Fixed Two-Way Transmissions*, MM Docket 97-217, 13 FCC Rcd 19,112 (1998), recon., 14 FCC Rcd 12,764 (1999), further recon., 15 FCC Rcd 14,566 (2000) (permitting both MDS and ITFS licensees to provide two-way services and increasing flexibility on permissible modulation types and channelization). In both the CMRS and MDS/ITFS context, the Commission did not consider accepting competing applications from non-incumbents because of the difficulties of coordinating new fixed uses with existing mobile uses in CMRS and coordinating fixed two-way transmissions with existing one-way uses in MDS/ITFS. Although we sought comment on the possibility of coordination with respect to MSS spectrum, we have concluded that, as in those prior cases, there is no practical means by which a new licensee could coordinate terrestrial uses with existing satellite rights in the spectrum. *See MSS Flexibility R&O* at 2070-71, ¶225.

[191] 47 U.S.C. § 309(j)(3)(A).

[192] 47 U.S.C. § 309(j)(3)(D).

[193] *See MSS Flexibility R&O* at 2071-72, ¶¶ 227-228.

2. Public Notice of Licensing Actions

82. We indicated in the *MSS Flexibility R&O* that applications for ATC authority that meet certain requirements will be treated as applications for minor modifications to the MSS license.[194] Inmarsat claims that this is a departure from past Commission practice and that a minor modification is one that does not have the potential to increase interference.[195] Inmarsat requests that all applications for ATC authority be open to public notice and comment, to provide the opportunity for affected parties to evaluate the applications and comment on them .[196] Further, Inmarsat requests that we require ATC licensees to notify us when they commence ATC operations, and issue a public notice to announce the start of the 18-month limited deployment period specified in the rules.[197] Inmarsat also requests that we require MSS/ATC operators to keep complete records of the locations of ATC base stations and the number of MSS/ATC handsets deployed, and to file that information with us every six months, to allow affected parties to be apprised of the scope of deployment.[198] Finally, Inmarsat requests that we place on public notice "any waiver requests made by an ATC operator after deployment of its ATC operations," arguing that any such waiver or modification of an ATC system could cause interference that was not considered in the *MSS Flexibility R&O.*[199]

83. In the *Sua Sponte Order*, we stated that "we require that the Commission place on notice for public comment any initial application for authority to add an ATC component to an eligible satellite network."[200] We therefore dismiss as moot Inmarsat's request that we make applications for ATC authority open to public notice and comment. We deny Inmarsat's request to issue a public notice at the start of the 18-month limited deployment period, and the request for specific information to be filed with us every six months. We have the authority to require MSS/ATC operators to file such information as we think necessary to evaluate the interference potential of ATC. We will seek analysis and comment from interested parties, and will make available to those parties the evidence needed to make their analyses and comments. It is impossible to determine at this point precisely what information will be necessary, and we therefore decline to require the filing of information that may not be necessary.

84. For the same reasons, we decline to adopt a rule requiring all waiver requests to be placed on notice for public comment. We agree with MSV's position that we should maintain the flexibility to decide whether waiver requests should be put on public notice individually, because some waiver requests may be innocuous, and inviting public comment would merely waste time.[201] Further, providing full notice and comment on minor or innocuous waiver requests would run the risk of allowing frivolous objections calculated merely to harass and delay ATC deployment. We will be able to determine those situations where public comment and the input of affected parties is needed. We are not persuaded that any useful purpose would be served by eliminating *ad hoc* discretion in this regard.

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[194] *See* 47 C.F.R.§ 25.150(a)(3) and (a)(4).

[195] Inmarsat states that an "amendment will be deemed to be a major amendment. . . [i]f the amendment increases the potential for interference. . . ." *See* Inmarsat *Petition* at 19 (quoting 47 C.F.R. § 25.116(b)).

[196] *See id.* at 20-23.

[197] *See* 47 C.F.R. § 25.253(c).

[198] *See* Inmarsat *Petition* at 23-24.

[199] *Id.* at 24.

[200] *Sua Sponte Order* at 13,596, ¶ 14. *See also* 47 C.F.R. § 25.117(f).

[201] *See* MSV *Opposition* at 12.

3. Conditional Licenses

85. Boeing requests reconsideration of the *Sua Sponte Order*. Boeing states that we initially adopted licensing rules for ATC under which we would grant MSS operators seeking to offer ATC conditional authorizations that prohibited them from offering ATC prior to meeting ATC gating criteria and MSS implementation milestones.[202] Boeing argues that the approach taken in the *Sua Sponte Order* will not provide greater clarity, but will cause substantial uncertainty in the process of incorporating an ATC into an MSS network.[203] According to Boeing, the licensing system adopted in the *MSS Flexibility R&O*, on the other hand, allowed MSS operators to control the timing of their business plans by scheduling each step on the way to providing MSS and ATC to customers.[204] Boeing contends that administrative convenience is the only justification we offered for changing the licensing system, and claims that the new approach will not be easier to administer, because we will still accept applications submitted by MSS licensees that have not met the gating criteria, and then will have to review additional submissions demonstrating that each gating criterion has been met. To avoid inconvenience and uncertainty, as well as time-consuming delays, Boeing requests that we return to the licensing regime adopted in the *MSS Flexibility R&O*.[205]

86. We deny Boeing's request. We made it clear in the *Sua Sponte Order* that an MSS operator is prohibited from conducting commercial ATC operations until the operator has received authorization to do so. As we stated in that *Order*, granting ATC authorization "conditioned upon" meeting the gating criteria could be interpreted as meaning that we authorized the commencement of commercial ATC operations prior to satisfaction of all the gating criteria.[206] It is also possible that an MSS/ATC operator, in possession of a conditional authority, could begin commercial operations before all the gating criteria were met to our satisfaction. In such circumstances, customers could be deprived of service for which they had contracted if we found that the gating criteria had not been met and required the MSS/ATC operator to cease operations pending satisfaction of the gating criteria.

87. At the same time, we realize that the optimum time to begin ATC operations is as soon as the MSS system meets all the gating criteria, and that delays are harmful to the business operations of MSS/ATC operators. The licensing regime we adopted in the *Sua Sponte Order* recognized this and built in the flexibility to allow an MSS/ATC applicant that needs extra time for consideration of complex issues to seek a pre-authorization ruling that some gating criteria have been met.[207] We also provided the opportunity for a licensee to receive ATC authority upon a showing that our geographic and temporal coverage, replacement satellite, and commercial service criteria have been met, provided "the MSS ATC

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[202] *See* Boeing *Petition* at 4-5. Under the approach we adopted in the *Sua Sponte Order*, according to Boeing, MSS operators will still be permitted to file applications for ATC authority before meeting all gating criteria, but we will not grant ATC authorizations until the MSS operator has demonstrated that it has met all of the gating criteria. We justified this change on the basis that such a system would be easier to administer and would provide a clear standard for when an MSS/ATC operator may begin commercial operations. *See id.* at 5-7.

[203] The process of reviewing and considering licenses applications can be long and complex, and we have offered only to endeavor to act on each application within 90 days, but made no guarantees. As a consequence, MSS operators will be unable to advise potential customers when ATC will be available, to the detriment of MSS service offerings, contends Boeing. *See id.* at 6-7.

[204] With conditional authority to offer ATC, MSS operators could even outline their ATC plans, demonstrating that each of the gating criteria would be met on a date certain, and ATC operations could then commence immediately upon meeting the gating criteria. *See id.* at 7-8.

[205] Multiple filings, each with its own set of comments and petitions in response to public notice, will make the licensing process complex and time consuming, argues Boeing. *See id.* at 8-9.

[206] *See Sua Sponte Order* at 13,594-95, ¶ 10.

[207] *See id.* at 13,593, ¶ 7.

applicant makes a satisfactory, prospective, substantial showing that its ATC operations will meet our integrated service and other gating criteria."[208] This amounts to the conditional authority Boeing requested, while at the same time ensuring that we maintain control of the authorizing process and that applicants show substantial progress toward meeting the gating criteria before receiving a grant of ATC authority. Beyond these limited circumstances, we decline to grant ATC authority to an applicant that has not yet met the gating criteria.

4. Demonstrations of Compliance

88. In the alternative, Boeing requests that we adopt an application approval process for non-operational MSS systems similar to the approach in the *Sua Sponte Order*. Specifically, we stated in the *Sua Sponte Order* that "we will grant ATC authority to an operating MSS system in actual compliance with our MSS system geographic and temporal coverage, replacement satellite, and commercial service gating criteria if the MSS ATC applicant makes a satisfactory, prospective, substantial showing that its ATC operations will meet our integrated service and other gating criteria."[209] Boeing contends that this provision allows operational MSS operators a streamlined approval process, while non-operational MSS operators will be handicapped by the time needed to construct and launch its satellite network, and by the delay of securing authority to provide ATC.[210] Boeing requests that we permit non-operational MSS operators able to make certain demonstrations that they will be within compliance with the gating criteria within one year.[211] Further, Boeing requests that we clarify how MSS operators can demonstrate that they have satisfied the gating criteria[212]

89. We agree with Boeing's argument that we should grant non-operational MSS applicants for ATC authority the opportunity to demonstrate that they will be in compliance with the gating criteria in the near future. We see no reason why an MSS operator should not be able to begin ATC operation at the same time it begins MSS operation. A non-operational MSS operator, like an operational MSS operator, is free to "without further authority from the Commission and at its own risk, engage in pre-operational build-out and conduct equipment tests" on an ATC.[213] It is subject to precisely the same conditions as an operational MSS operator, *i.e.*, it may not provide ATC service until its MSS system and ATC service meet our gating criteria. Therefore, we will grant a non-operational MSS operator the same sort of authority that we will grant operational MSS operators. Upon a satisfactory, prospective and substantial showing that a non-operational MSS licensee will soon meet the gating criteria, we will grant the MSS operator ATC authority to begin ATC operations upon actually meeting the gating criteria.

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[208] *See id.* at 13,595, ¶ 11.

[209] *Sua Sponte Order* at 13,595, ¶ 11.

[210] *See* Boeing *Petition* at 10.

[211] The non-operational MSS operator making a "satisfactory, prospective and substantial showing that its ATC service will satisfy sections 25.149(b)(4) and (b)(5) of the Commission's rules" should be granted an ATC authorization conditioned on the operator coming into compliance with sections 25.149(b)(1) (geographic and temporal coverage), (b)(2) (replacement satellites), and (b)(3) (commercial availability).[211] Boeing states that we should allow impending satisfaction of geographic and temporal coverage requirements to be demonstrated by a submission of predicted antenna gain contours, replacement satellite requirements to be satisfied by submission of a contract or certification of a satellite manufacturer listing a scheduled completion date, and the commercial availability requirement by submission of letters from handset suppliers or from customers who have contracted for service. *See id.* at 11-13. *See also* C.F.R. § 25.149(b)(1) – (3).

[212] Specifically, Boeing requests that we clarify that the demonstrations it advocated can be used to satisfy the geographical and temporal coverage, replacement satellite, and commercial availability, and that a certificate of compliance from the MSS/ATC operator will satisfy the in-band operation requirement of section 25.149(b)(5) of the rules. *See* Boeing *Petition* at 18-19. *See also* 47 C.F.R. § 25.149(b)(5).

[213] 47 C.F. R. §§ 25.136(g), 25.143(j).

90. We decline, however, to grant the clarifications Boeing requests. Boeing's proposed demonstrations lack the specificity we intend to require. Terms such as "predicted spacecraft antenna gain,"[214] "arrangements for the construction of a replacement satellite,"[215] and "letters from its suppliers of user terminals, or letters from customers that have contracted for . . . services"[216] are too vague to be granted the status of conclusive demonstrations. We will require detailed showings in any case where an MSS/ATC applicant claims that it is near to meeting our gating criteria. Although all of the factors Boeing lists will be relevant to our review of applications and may be conclusive, we reserve the right to require additional detail and certainty. Therefore, we deny Boeing's requested clarification.

E. Uplink Interference in the Big LEO Band.

1. Out-of-Band Emissions

91. Inmarsat states that it raised concerns about potential interference to its L-Band MSS system from future deployment of ATC in the Big LEO band, and that we did not address this issue in the *MSS Flexibility R&O*. Inmarsat requests that we consider its earlier arguments and adopt out-of-band emissions limits for ATC in the Big LEO band to protect MSS systems in the adjacent L-band.[217]

92. We find that we adequately addressed the potential for out-of-band interference in the Big LEO uplink band in the *MSS Flexibility R&O*. Specifically, we adopted out-of-channel emissions limits of -44.1 dBW per 30 kilohertz for ATC base stations in the Big LEO band,[218] and -57.1 dBW per 30 kilohertz for handsets in the Big LEO band.[219] We consider these limits sufficient to protect Inmarsat's satellites in the superjacent 1626.5-1660.5 MHz band. We also note that Inmarsat's only reference to possible interference to L-band MSS from Big LEO band ATC was a single paragraph which claimed only that Big LEO band ATC could cause harmful interference to Inmarsat's MSS in the L-band.[220] Because we adequately addressed the potential for out-of-band interference from ATC in the Big LEO band, we deny this request.

2. Protection of Broadcast Auxiliary Service

93. SBE requests that we reconsider the decision to allow ATC base stations in the Big LEO band. In the *MSS Flexibility R&O*, we noted that some Broadcast Auxiliary Service (BAS) operations are permitted on BAS Channel A10 (2483.5-2500 MHz) on a "grandfathered" basis, but stated that the records indicate that there are no BAS facilities licensed in this band. SBE points out that there are 87 licenses currently authorized for BAS Channel A10, according to our Universal Licensing System, though ten of these licenses are listed as "expired" or "cancelled."[221] SBE requests that we reconsider the decision to allow ATC in the Big LEO band to protect BAS Channel A10 operations. In the alternative, SBE requests that we require any Big LEO MSS operator that seeks authority to operate ATC to pay the reasonable costs of converting BAS equipment to digital operation on three narrower channels in what are

[214] Boeing *Petition* at 15.

[215] *Id.* at 17.

[216] *Id.* at 18.

[217] *See* Inmarsat *Petition* at 15.

[218] *See* 47 C.F.R. § 25.254(a)(2).

[219] *See* 47 C.F.R. § 25.254(b)(3).

[220] *See* Inmarsat, *Comments of Inmarsat Ventures PLC* 20-21 (dated Oct. 19, 2001) (in response to the *MSS Flexibility NPRM*).

[221] *See* SBE, *Petition for Reconsideration (Petition)* at 1-2.

currently BAS Channels A8 and A9.[222]

94. We will take measures to protect licensees on BAS Channel A10. The number of active BAS Channel A10 users is sufficiently small that Big LEO MSS licensees desiring ATC authorization will be able to coordinate with BAS licensees to avoid causing harmful interference to BAS Channel A10. Therefore, we note that BAS licensees using BAS Channel A10 are "grandfathered," and are entitled to operate without interference from MSS/ATC operations. Big LEO band MSS operators seeking to add ATC to their systems will be required to coordinate their use of the 2483.5-2500 MHz band with BAS licensees, or may negotiate with those licensees for relocation or some other solution to potential interference problems. To that extent, we grant SBE's request. We will not, however, mandate a relocation scheme for BAS Channels A8, A9, and A10, despite Globalstar's willingness to consider relocation of BAS licensees under certain, limited conditions.[223]

V. CONCLUSION

95. The actions we take in this *Memorandum Opinion and Order and Second Order on Reconsideration* will facilitate the development of MSS/ATC. By replacing certain uplink interference rules with a standard of interference, we allow MSS/ATC operators the freedom to design their systems to meet their customers' needs while protecting other MSS systems from harmful interference. By revising base station power limits in the L-band downlink, we allow MSS/ATC operators to build more powerful base stations while ensuring that they do not exceed the measured tolerance of MSS METs for interfering signals. Finally, by modifying the licensing rules, we provide equal opportunity for operational and non-operational MSS systems to add ATC without undue delay. These actions will advance the Commission's goal of ensuring efficient and intensive use of the spectrum, and will bring more options for high-quality communications at reasonable cost to all Americans.

VI. PROCEDURAL MATTERS

96. *Final Regulatory Flexibility Certification* The Regulatory Flexibility Act of 1980, as amended (RFA),[224] requires that a regulatory flexibility analysis be prepared for notice-and comment rule making proceedings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."[225] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[226] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[227] A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).[228]

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[222] *See id.* at 2-3.

[223] *See* Globalstar *Opposition* at 3-5.

[224] The RFA, *see* 5 U.S.C § 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[225] 5 U.S.C. § 605(b).

[226] 5 U.S.C. § 601(6).

[227] 5 U.S.C. § 601(3) incorporating by reference the definition of "small-business concern" in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

[228] 15 U.S.C. § 632.

97. As required by the RFA, an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Flexibility Notice,* and no parties responded to the IRFA.[229] After a review of the policies and rules adopted in the *Flexibility Order*, the Commission determined that there would be no significant impact on a substantial number of small entities. Thus, a Final Regulatory Flexibility Certification was included in the *Flexibility Order.*[230]

98. In addressing the issues raised by the parties seeking reconsideration of the *Flexibility Order,* no parties commented on the regulatory flexibility certification. For the reasons described below, we certify that the policies and rules adopted in the *Memorandum Opinion and Order and Second Order on Reconsideration* will not have a significant impact on a substantial number of small entities.

99. We are incorporating the Final Regulatory Analysis Certification contained in the *Flexibility Order* into this proceeding. In our reconsideration of the petitions in this proceeding, we modify our rules to permit the addition of ATC to MSS systems. We change certain technical standards for ATC in the L-band, in order to permit MSS/ATC licenses flexibility in designing and operating their ATC while at the same time preventing harmful interference from ATC to co-primary MSS licensees in the L-band. In addition, we will allow certain increases in ATC base station power. We also modify the rules for authorizing MSS operators to add ATC to their networks. We expect that these changes will facilitate the development of MSS/ATC. We believe that all entities, both large and small, will have the flexibility to design their systems to meet their customers' needs. The policies and rules adopted in this proceeding are essentially technical changes that will provide equal opportunity for operational and non-operational MSS systems to add ATC without undue delay.

100. We believe that the policies and rules adopted in this proceeding – which brings additional flexibility to existing MSS licensees -- will not affect a substantial number of small entities. There are currently five 2 GHz MSS licensees, two Big LEO MSS licensees and three L-band MSS licensees authorized to provide service in the United States. Although at least one of the 2 GHz MSS system licensees and one of the Big LEO licensees are small businesses, small businesses often do not have the financial ability to become MSS system operators because of the high implementation costs associated with satellite systems and services. We expect that, by the time of MSS ATC system implementation, these current small businesses will no longer be considered small due to the capital requirements for launching and operating a proposed system.

101. Therefore, we certify that the requirements of the Memorandum *Opinion and Order and Second Order on Reconsideration* will not have a significant economic impact on a substantial number of small entities.

102. The Commission will send a copy of the *Memorandum Opinion and Order and Second Order on Reconsideration,* including a copy of this Final Regulatory Flexibility Certification, in a report to Congress pursuant to the Congressional Review Act.[231]

103. *Final Paperwork Reduction Act Analysis*. This item does not contain proposed

[229] *MSS Flexibility Notice*, 16 FCC Rcd 15,532 at 15,565-67, ¶¶ 85-93.

[230] *MSS Flexibility R&O*, 18 FCC Rcd 1962 at 2214-15, Appendix D, ¶ 2.

[231] *See* 5 U.S.C. § 801(a)(1)(A).

information collections subject to the Paperwork Reduction Act of 1995 (PRA), Public Law No. 104-13. It also, therefore, does not contain any new or modified "information collection burden for small business concerns with fewer than 25 employees," pursuant to the Small Business Paperwork Relief Act of 2002, Public Law No. 107-198, *see* 44 U.S.C. § 3506(c)(4).

VII. ORDERING CLAUSES

104. IT IS ORDERED that, pursuant to sections 4(i), 7, 302, 303(c), 303(e), 303(f) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. sections 154(i), 157, 302, 303(c), 303(e), 303(f) and 303(r), this Memorandum Opinion and Order and Second Order on Reconsideration IS ADOPTED and that Part 25 of the Commission's Rules IS AMENDED, as specified in Appendix B, effective 30 days after publication in the Federal Register.

105. IT IS FURTHER ORDERED that the Petition for Reconsideration filed by Cingular Wireless LLC IS GRANTED in part to the extent described above and IS DENIED in all other respects.

106. IT IS FURTHER ORDERED that the Petition for Reconsideration filed by the Society of Broadcast Engineers, Inc. IS GRANTED in part to the extent described above and IS DENIED in all other respects.

107. IT IS FURTHER ORDERED that the Petition for Reconsideration filed by Mobile Satellite Ventures Subsidiary LLC IS GRANTED in part to the extent described above, IS DISMISSED as moot in part to the extent described above, and IS DENIED in all other respects.

108. IT IS FURTHER ORDERED that the Petition for Reconsideration filed by Inmarsat Ventures PLC IS GRANTED in part to the extent described above, IS DISMISSED as moot in part to the extent described above, and IS DENIED in all other respects.

109. IT IS FURTHER ORDERED that the Petition for Reconsideration filed by the Cellular Telecommunications & Internet Association IS GRANTED in part to the extent described above and IS DENIED in all other respects.

110. IT IS FURTHER ORDERED that the Petition for Reconsideration of the MSS Flexibility R&O filed by the Boeing Co. IS GRANTED in part to the extent described above and IS DENIED in all other respects.

111. IT IS FURTHER ORDERED that the Petition for Reconsideration of the Sua Sponte Order filed by the Boeing Co. IS GRANTED in part to the extent described above and IS DENIED in all other respects.

112. IT IS FURTHER ORDERED that the Final Regulatory Flexibility Certification, as required by section 604 of the Regulatory Flexibility Act, IS ADOPTED.

113. IT IS FURTHER ORDERED that the Commission's Consumer Information Bureau, Reference Information Center, SHALL SEND a copy of this Memorandum Opinion and Order and Second Order on Reconsideration, including the Final Regulatory Flexibility Certification, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Test Report

Inmarsat Terminal Interference Susceptibility Testing

1. INTRODUCTION

1.1. In the *MSS Flexibilty R&O*, we assumed a saturation level of -50 dBm for Inmarsat airborne terminals and -60 dBm for mass-produced terrestrial receivers, and used these levels to calculate protection criteria for Inmarsat mobile earth terminal (MET) receivers from signals from ATC base stations in the 1525-1559 MHz band.[232] We subsequently received filings in petitions for reconsideration from MSV and from Inmarsat regarding signal power levels that would cause harmful interference to Inmarsat METs receivers by signals from MSV's ATC base stations. MSV stated, based on tests it had performed, that the signal power level required to cause harmful interference through the mechanism of receiver overload[233] is -45 dBm at the input to the receiver low-noise amplifier.[234] In support of its argument, MSV presented data on the 1 dB compression point[235] of the front ends[236] of several Inmarsat MET receivers.[237] Inmarsat stated that MSV's 1 dB compression point technique is not a proper way to determine the harmful interference threshold of Inmarsat MET receivers.[238] Inmarsat also stated that the correct value for the harmful interference threshold in its MET receivers is -75 dBm.[239] Furthermore, Inmarsat claimed that Inmarsat MET receivers could be susceptible to intermodulation product interference[240] at signal levels much lower than those required to produce receiver overload.[241]

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[232] *See MSS Flexibility R&O* at Appendix C2, ¶ 1.12.

[233] Receiver overload occurs when a signal at the input of a receiver's amplifier reaches an amplitude sufficient to cause the amplifier to attempt to exceed its maximum possible output level, consequently distorting the output signal waveform. 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.

[234] MSV *Petition* at 16-17.

[235] When an amplifier is operated in its linear range, the gain of the amplifier is constant as the input signal level is varied, i.e. the output signal level is always G dB higher than the input signal level, where G is the gain of the amplifier in dB. As the input signal level is increased beyond the linear range of the amplifier, the 1 dB compression point of the amplifier is the input signal power level at which the gain of the amplifier becomes G-1 dB.

[236] The "front end" of a receiver typically comprises the first RF amplifier and some frequency-selective components that together establish the noise figure and RF bandwidth of the receiver.

[237] MSV *Petition* at Appendix C.

[238] Inmarsat *Opposition* at A-8.

[239] *Id.* at 16.

[240] Intermodulation products occur when two or more signals at different frequencies combine in a receiver or other device to create signals at frequencies that are the sums and differences of integer multiples of the original signals. Intermodulation product frequencies are calculated by: $f_{IM}=n*f_1 \pm m*f_2$, where f_{IM} is the frequency of the intermodulation product, f_1 and f_2 are the interfering signal frequencies, and n and m are integers greater than zero. If an intermodulation product is created by two MSV ATC base station signals on a frequency being used by an Inmarsat receiver, harmful interference to the Inmarsat receiver may occur, depending on the levels of the ATC base station signals at the input to the Inmarsat receiver. The strongest intermodulation products occur when m + n = 3, i.e. when m = 1 and n = 2, or m = 2 and n = 1. These are known as "third-order" intermodulation products.

1.2. In order to understand and resolve the 30 dB difference (-45 dBm versus -75 dBm) between the harmful interference threshold values proposed by MSV and Inmarsat, we decided to conduct independent tests on Inmarsat METs. The International Bureau asked Inmarsat to supply METs and the special test equipment required to simulate the link from the METs through its satellites to its land earth stations. The Bureau asked MSV to supply the METs on which it had conducted receiver front-end 1 dB compression point measurements.

1.3. Inmarsat arranged to have its equipment manufacturers supply four METs for testing. One of these METs is an Inmarsat Fleet 77 marine terminal, one is designed for vehicular mounting and is based on a similar Inmarsat Fleet 55 marine terminal, and two are portable METs. These METs are all capable of receiving 64 kilobit per second (kbps) 16-state quadrature-amplitude modulation (16QAM), as is used in Inmarsat's Global Area Network (GAN). All have a 64 kbps Integrated Services Digital Network (ISDN) interface, which were used to conduct bit-error-rate (BER) tests on the METs.

1.4. Inmarsat’s equipment manufacturers did not provide an airborne MET. Inmarsat held some informal discussions with Bureau staff regarding visiting an airborne MET manufacturer to conduct tests on an airborne Inmarsat MET, stating that the specialized test equipment required to test an airborne MET should not be moved from the manufacturer’s facility. However, these discussions did not progress to an on-site test, so no airborne METs were tested.

1.5. We also held informal discussions with Inmarsat regarding testing Inmarsat's higher data rate B-GAN terminals. Inmarsat informed our staff that the B-GAN terminal was in the prototype stage and that the prototype terminal would not be ready for interference testing until sometime in October, 2004, several weeks after we had planned to complete the testing. In addition, Inmarsat told our staff that it would be necessary to conduct the tests at the facility of Inmarsat's manufacturing partner, Hughes Network Systems, in San Diego, CA. We were of the opinion that testing a prototype terminal in a facility not under the Commission's control could result in questionable test data. Inmarsat has recently disclosed that the B-GAN terminal is still in the prototype stage, i.e., it is not yet a commercially-available production item like the other terminals we tested for susceptibility to interference from simulated ATC base station signals.

1.6. We did not test the METs supplied by MSV due to lack of proper test equipment and test software for these particular METs.[242]

2. METHODOLOGY

2.1. We conducted the tests on the METs supplied by Inmarsat’s equipment manufacturers in accordance with the test plan shown in Annex 1 of this report. We used specialized test equipment supplied by Inmarsat to generate the simulated Inmarsat satellite signals and to conduct bit-error-rate (BER) tests on the METs. Synthesized signal generators with built-in arbitrary waveform generators generated simulated interfering signals. We tested the receivers with three different types of signals: an unmodulated sine wave (CW) signal, a simulation of a variant of the Global System for Mobile communications (GSM) forward-link signal proposed by MSV (“MSV’s GSM”), and a simulated cdma2000®[243] signal. The CW

(...continued from previous page)
[241] Inmarsat *Opposition* at A-8.

[242] A question of handling was also raised about these METs.

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

signal would not be transmitted by an ATC base station (except perhaps for testing the base station transmitter), but it was included for reference purposes. The simulated interfering signals were combined with the simulated Inmarsat satellite signals using a two-way radiofrequency (RF) power combiner.

2.2. We used a spectrum analyzer to measure the cable and other losses from the signal generators to a convenient signal monitoring point in the test setup, and the cable losses to the point of connection to the Inmarsat METs receivers. These loss measurements used the signal generators to generate a CW signal in 250 kHz steps across the 1525-1559 MHz band, and used the spectrum analyzer to record the signal level every 250 kHz. We recorded the spectrum analyzer measurements on a floppy disk and imported into a spreadsheet. We then used the spectrum analyzer to measure the interfering signal levels at the monitoring point, and recorded the measured values using the spreadsheet. We used the spreadsheet to calculate the level of the interfering signals at the input to the Inmarsat MET receivers.

2.3. For all tests, we maintained the simulated Inmarsat signal at 1530 MHz at a C/N_0 level 2 dB higher than that required to achieve a BER of approximately 1×10^{-5} when the simulated ATC base station signal was turned off. For the single-carrier harmful interference susceptibility tests, we varied the frequency of the simulated interfering signal frequency over the 1525 to 1559 MHz band. For the third-order intermodulation product harmful interference susceptibility tests, we used the pairs of frequencies shown in the tables in section 5 of the test plan. We maintained the two signals generating the third-order intermodulation products within 1 dB of the same power level at the input to the Inmarsat MET receiver. We recorded the simulated interfering signal power levels required to achieve a BER of approximately 1×10^{-4}.

3. SUMMARY OF RESULTS

3.1. In presenting the results of the testing, we will not identify the four Inmarsat METs staff tested by manufacturer and model number, because this information is not essential for understanding the test results. Instead, we will identify the METs as "Inmarsat Terminal A, Inmarsat Terminal B, Inmarsat Terminal C, and Inmarsat Terminal D". Inmarsat Terminal B is what Inmarsat calls a "Fleet 77" MET, and Inmarsat Terminal D is the land-mobile MET derived from what Inmarsat calls a "Fleet 55" MET. Inmarsat Terminals A and C are portable MET.

3.2. Our staff found that three of the four Inmarsat MET receivers tested were more resistant to harmful interference from single simulated ATC base station forward-link signals than MSV's proposed -45 dBm overload threshold, if the interfering signal was offset in frequency by at least 5 MHz from the desired Inmarsat signal. These three METs exhibited harmful interference thresholds above -40 dBm when the interfering signals were sufficiently offset in frequency from the desired Inmarsat signal. One MET had a harmful interference threshold of approximately -52 dBm. Figure 1 shows the power levels of the simulated ATC base station signals that resulted in harmful interference to the Inmarsat MET receivers. Note that some datapoints are missing because the level of the simulated interfering signal required to cause harmful interference to the Inmarsat MET receiver exceeded the limitations of the test equipment. The ordinate of each plot is labeled with the level of the interfering signal that caused a BER of approximately 1×10^{-4} when the simulated Inmarsat satellite signal was maintained at a C/N_0 level 2 dB higher than that required to produce a BER of 1×10^{-5} when no interference was present. The abscissa of each plot is labeled with the frequency of the interfering signal; the simulated Inmarsat satellite signal was maintained at 1530 MHz.

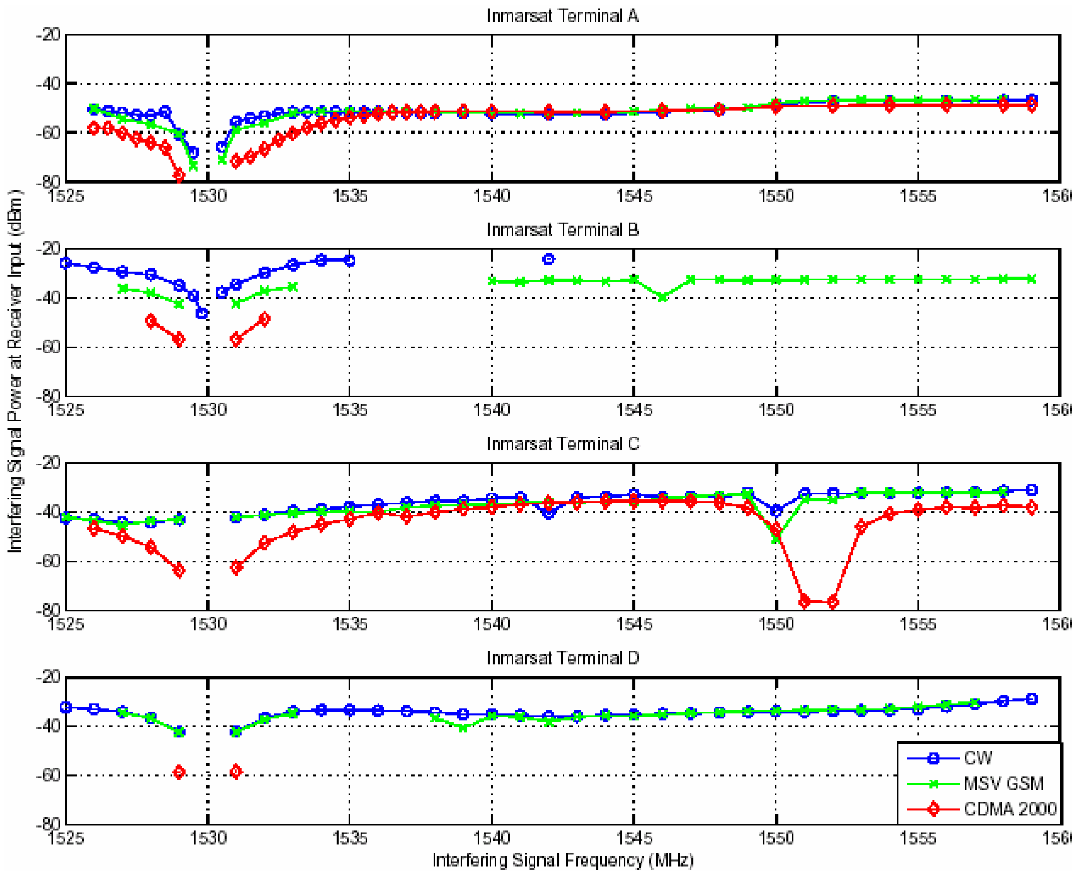

Figure 1: Inmarsat Terminal Single-Carrier Harmful Interference Levels.

3.3. The results show that in general, the simulated cdma2000 waveform resulted in harmful interference at lower root-mean-square (rms) power levels than MSV's GSM signal or the CW signal. This might be due to the higher peak-to-average power ratio[244] of the cdma2000 waveform as compared to the offset quadrature-phase-shift keyed (OQPSK) waveform used in MSV's GSM and as compared to the CW signal, which is a constant-envelope signal.[245]

3.4. Our staff found all four of the Inmarsat MET receivers to be susceptible to harmful interference from third-order intermodulation products of pairs of simulated ATC base station signals at much lower interfering signal levels than the levels required for harmful interference from a single simulated ATC base station signal. For the simulated MSV's GSM signals, the levels that caused harmful interference due to third-order intermodulation products ranged from approximately -50 dBm for the receiver most resistant to interference from third-order intermodulation products to approximately -75 dBm for the receiver least resistant to interference from third-order intermodulation products, when both of the two signals generating the intermodulation product were offset from the simulated Inmarsat satellite signal at 1530 MHz by 1 MHz or more. Note that these levels are the combined power of two signals contributing to the third-order intermodulation product -- each signal is 3 dB lower than the combined power level.

[244] Peak-to-average power ratio is the ratio of the instantaneous peak power of a signal to its time-averaged power. A CW signal has a peak-to-average power ratio of 1:1, or 0 dB. A standard GSM signal using Gaussian minimum-shift keying (GMSK) also has a peak-to-average power ratio of 0 dB. MSV's GSM signal has a peak-to-average power ratio of about 3.8 dB, and a nine-channel cdma2000 signal has a peak-to-average power

[245] A constant-envelope signal is one in which the RF envelope of the signal has constant amplitude, and the peak-to-average power ratio is 0 dB.

3.5. Figure 2 shows the combined power levels of two interfering signals contributing to the third-order intermodulation product that resulted in harmful interference to the Inmarsat MET receivers. The ordinate of Figure 2 is labeled with the combined power level of the pair of interfering signals that creates a third-order intermodulation product at 1530 MHz. The abscissa of Figure 2 is labeled with the frequency of f2, where the intermodulation product is at 1530 MHz = 2f1-f2.

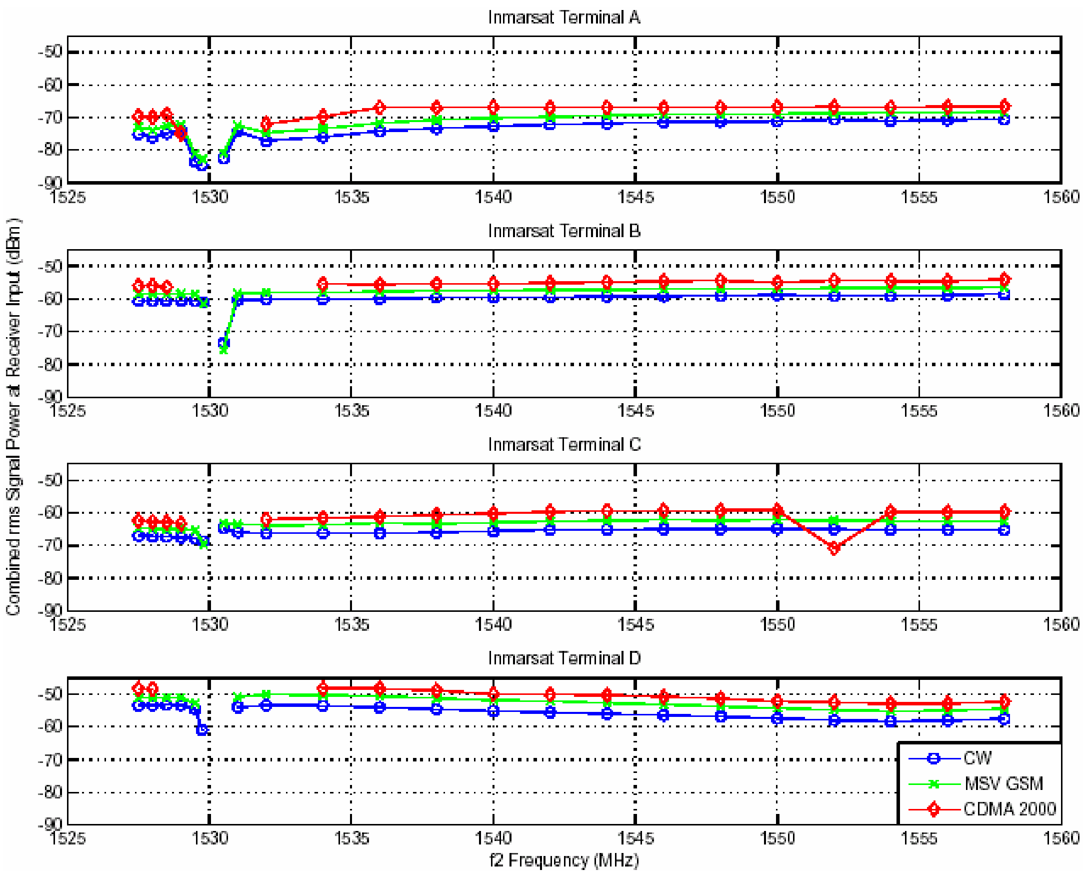

Figure 2: Inmarsat Terminal Third-Order Intermodulation Product Harmful Interference Levels.

3.6. The results show that in general, a pair of CW signals produces harmful interference due to third-order intermodulation products at a lower level than a pair of simulated MSV's GSM signals. A pair of simulated MSV's GSM signals produces harmful interference due to third-order intermodulation products at a lower level than a pair of simulated cdma2000 signals. The difference in level might be due to the fact that the simulated Inmarsat satellite signal that is being interfered with has a bandwidth of approximately 40 kHz, while a pair of CW signals produce an intermodulation product that is (at least theoretically) 0 Hz wide, a pair of simulated MSV's GSM signals produce an intermodulation product that is approximately 600 kHz wide, and a pair of cdma2000 signals produce an intermodulation product that is approximately 3.75 MHz wide. Therefore, all the energy of the intermodulation product produced by the pair of CW signals falls within the bandwidth of the simulated Inmarsat satellite signal. But the intermodulation product produced by a pair of simulated MSV's GSM signals is spread over a bandwidth approximately 15 times (11.8 dBHz) as wide as the simulated Inmarsat satellite signal, and the intermodulation product produced by a pair of simulated cdma2000 signals is spread over a bandwidth approximately 93.75 times (19.7 dBHz) as wide as the simulated Inmarsat satellite signal.

3.7. One might therefore expect MSV's GSM signal to need to be 11.8 dB stronger and the cdma2000 signal to need to be 19.7 dB stronger than a CW signal to produce the same harmful interference as the CW signal, since the third-order intermodulation product is spread over a wider bandwidth than the simulated Inmarsat satellite signal, but this is not the case. The difference is on the order of 2 to 3 dB between the CW signal and MSV's GSM signal, and the same amount between MSV's signal and the cdma2000 signal. One reason this might happen is that the higher peak-to-average ratios of MSV's GSM signal compared to the CW signal, and the cdma2000 signal compared to both MSV's GSM signal and the CW signal, may result in higher levels of interference from cdma2000 and MSV's GSM signals than that which results from a constant-envelope signal. The signal peak power levels are significantly higher than their rms powers for MSV's GSM and cdma2000. The Inmarsat satellite receiver amplifiers may experience overloading on the signal peaks. Another possible explanation is that the bandpass filters in the Inmarsat MET receivers allow some energy to come in from the frequency bands adjacent to the simulated Inmarsat satellite signal.

3.8. Figure 3 below shows the composite single-carrier harmful interference levels (top figure) and the composite third-order intermodulation product harmful interference levels for all four Inmarsat METs and for MSV's GSM and cdma2000 modulation. Solid lines in both figures show the harmful interference signal levels for MSV's GSM; dot-dashed lines show the harmful interference signal levels for cdma2000.

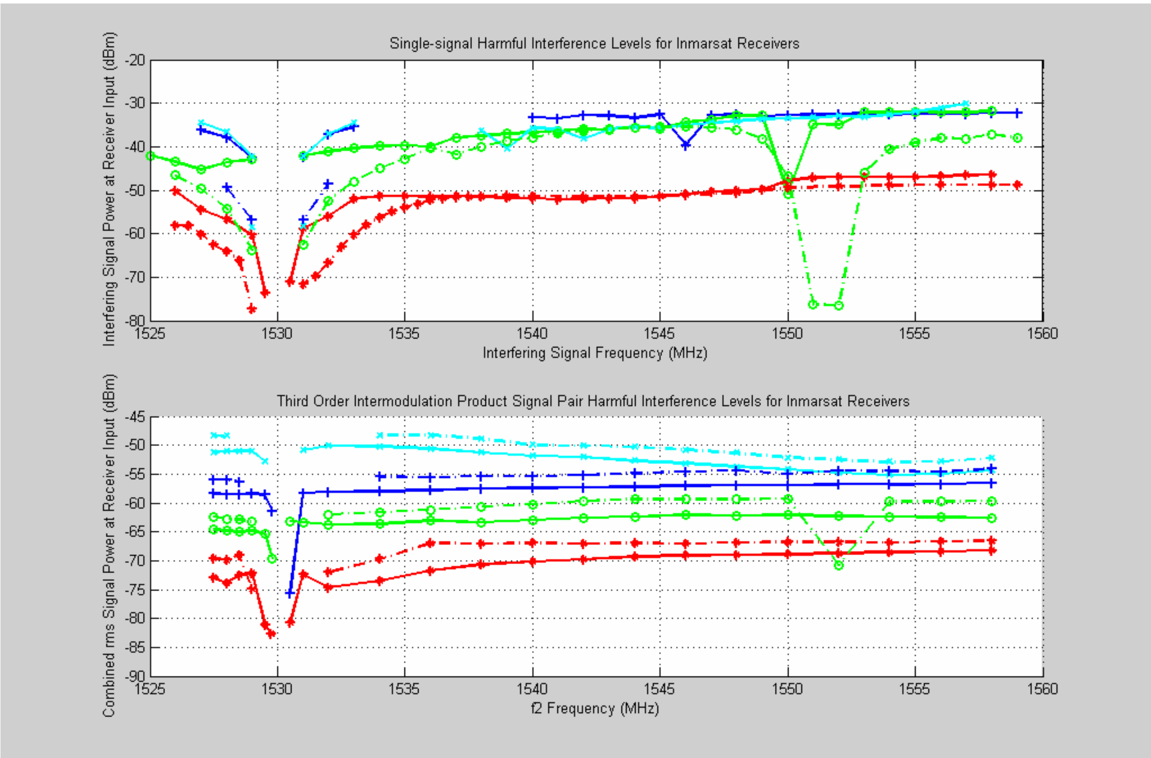

Figure 3: Single-signal and Third-Order Intermodulation Signal Pair Harmful Interference Levels for MSV's GSM and cdma2000 Modulation for Four Inmarsat Terminal Receivers

RESULTS FOR EACH MET

3.9. The ordinate of each even-numbered figure below is labeled with the level of the interfering signal that caused a BER of approximately $1x10^{-4}$ when the simulated Inmarsat satellite signal was maintained at a C/N_0 level 2 dB higher than that required to produce a BER of $1x10^{-5}$ when no interference was present. The abscissa of these figures is labeled with the frequency of the interfering signal; the simulated Inmarsat satellite signal was maintained at 1530 MHz.

3.10. The ordinate of the odd-numbered figures below is labeled with the combined power level of the pair of interfering signals that creates a third-order intermodulation product at 1530 MHz. The abscissa of these figures is labeled with the frequency of f2, where the intermodulation product is at 1530 MHz = 2f1-f2.

3.11. Inmarsat Terminal A

3.11.1. Inmarsat Terminal A is a portable Inmarsat MET. The single-carrier harmful interference susceptibility levels for this MET are shown in Figure 3. The third-order intermodulation product harmful interference susceptibility levels for this MET are shown in Figure 4.

3.11.2. Referring to Figure 4 below, one can see that the level of the CW signal that causes harmful interference to the Inmarsat Terminal A receiver is about -50 dBm at 1526 MHz, falling to about -68 dBm at 1529.5 MHz. It rises from about -66 dBm at 1530.5 MHz to about -52 dBm at 1533 MHz. The level stays in the range of about -51 to -52 dBm from 1533 MHz to about 1546 MHz, then rises to about -47 dBm at 1552 MHz and remains at this level until 1559 MHz. The simulated MSV's GSM interfering signal level closely tracks the CW signal level, except that it is somewhat lower at small frequency offsets relative to the 1530 MHz simulated Inmarsat satellite signal. The simulated cdma2000 interfering signal level is about -58 dBm at 1526 MHz, falling to about -78 dBm at 1529 MHz. It rises from about -72 dBm at 1531 MHz to about -52 dBm at 1536 MHz, and remains at this level until about 1546 MHz. It rises to about -49 dBm at about 1552 MHz, and remains at this level until 1559 MHz.

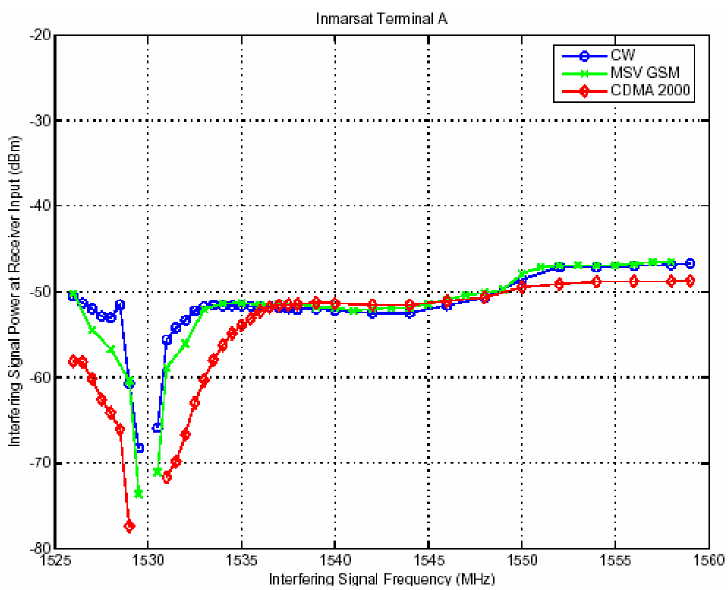

Figure 4: Inmarsat Terminal A Single-Carrier Harmful Interference Levels.

3.11.3. Referring to Figure 5 below, one can see that the combined power level of a pair of CW signals that causes harmful interference due to third-order intermodulation products in the receiver of Inmarsat Terminal A ranges from a low of about -85 dBm to a high of about -70 dBm. The level of the interfering pair of simulated MSV's GSM signals is typically about 2 to 3 dB higher than that of the CW signal pair. The level of the interfering pair of simulated cdma2000 signals is typically about 2 to 3 dB higher than that of the MSV's GSM signal pair.

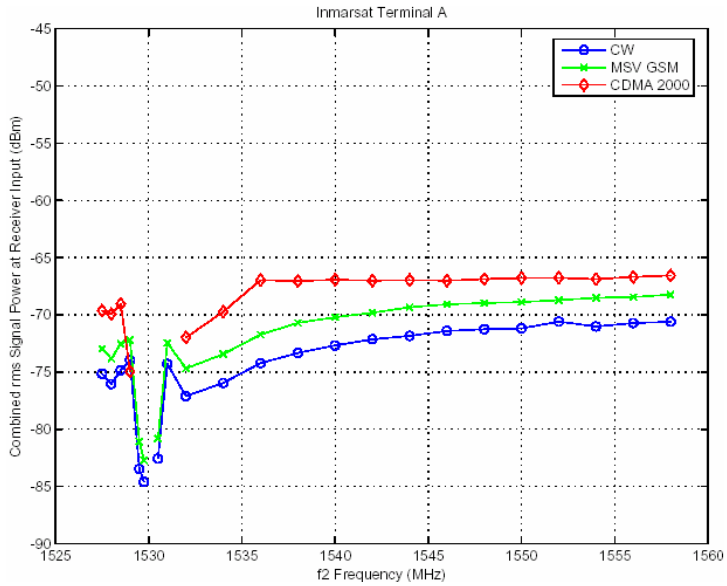

Figure 5: Inmarsat Terminal A Third-Order Intermodulation Product Harmful Interference Levels.

3.12. Inmarsat Terminal B

3.12.1. Inmarsat Terminal B is an Inmarsat Fleet 77 marine terminal. The single-carrier harmful interference susceptibility levels for this MET are shown in Figure 6. The third-order intermodulation product harmful interference susceptibility levels for this MET are shown in Figure 7.

3.12.2. Figure 6 is missing many data points because it was not possible to measure them due to limitations in the test equipment, primarily in the signal generator, because of the high power level of the interfering signal required to cause harmful interference to this terminal's receiver. The interfering level of the CW signal was measurable from 1525 to 1529.5 MHz and from 1530.5 MHz through 1535 MHz, and at 1542 MHz. The simulated MSV's GSM interfering signal level was measurable at 1527, 1528, 1529, 1531, 1532, and 1533 MHz, and from 1540 MHz through 1559 MHz. The simulated cdma2000 interfering level was only measurable at 1528, 1529, 1531, and 1532 MHz. Elsewhere, the signal generator noise at the levels required to measure the interfering signal level was too high to permit accurate measurements

3.12.3. In Figure 6 below, one can see that the level of the CW signal that causes harmful interference to the Inmarsat Terminal B receiver is about -38 dBm frequency offsets of ± 500 kHz from the simulated Inmarsat satellite signal at 1530 MHz. This level rises to about -26 dBm at 1525 MHz and 1533 MHz. Beyond 1535 MHz, the only data point that could be measured (due to equipment limitations) was about -24 dBm at 1542 MHz. The simulated MSV's GSM interfering level fell from about -36 dBm at 1526 MHz to about -43 dBm at 1529 MHz, and rose from about -42 dBm at 1531 MHz to about -35 dBm at 1533 MHz. From 1540 MHz through 1559 MHz, except at 1546 MHz, the level required for the simulated MSV's GSM signal to interfere with the simulated Inmarsat satellite signal was about -32 to -33 dBm. The dip to -40 dBm at 1546 MHz is unexplained, but was repeatable. The simulated cdma2000 interfering signal level is about -49 dBm at 1528 MHz, falling to about -58 dBm at 1529 MHz. It rises from about -58 dBm at 1531 MHz to about -48 dBm at 1532 MHz.

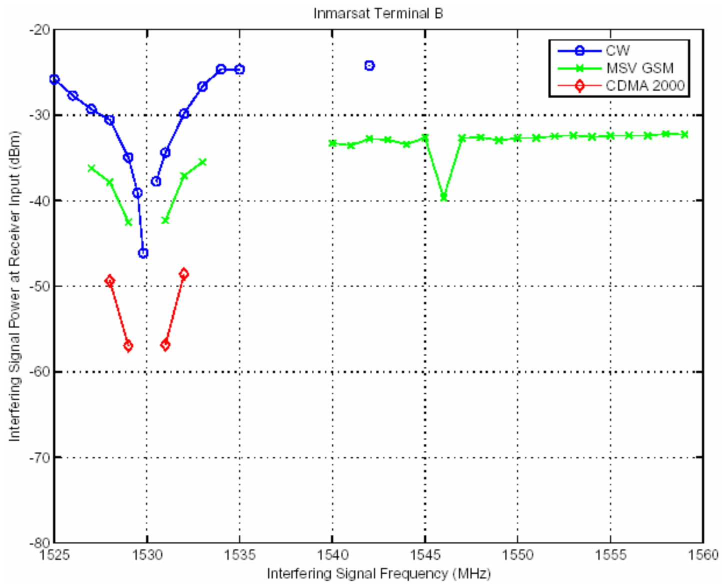

Figure 6: Inmarsat Terminal B Single-Carrier Harmful Interference Levels.

3.12.4. In Figure 7 below, one can see that the combined power level of a pair of CW signals that causes harmful interference due to third-order intermodulation products in the receiver of Inmarsat Terminal B ranges from a low of about -73 dBm to a high of about -58 dBm. The level of the interfering pair of simulated MSV's GSM signals is typically about 2 dB higher than that of the CW signal pair. The level of the interfering pair of simulated cdma2000 signals is typically about 2 dB higher than that of the MSV's GSM signal pair.

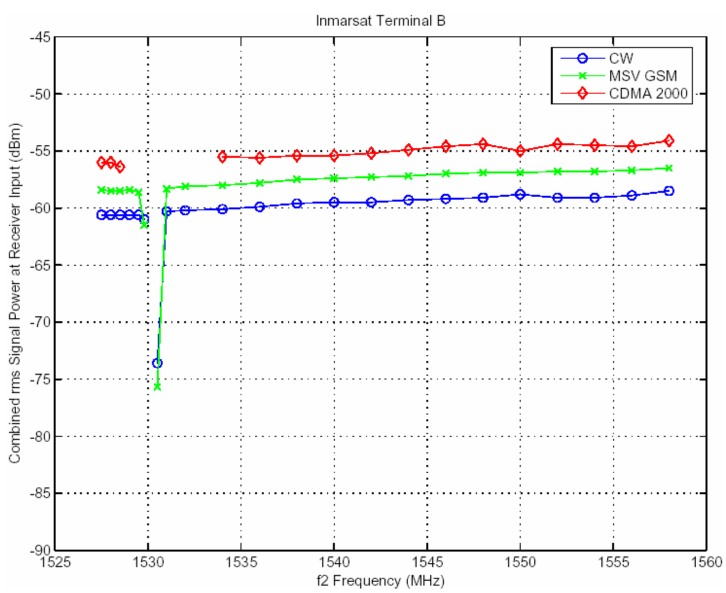

Figure 7: Inmarsat Terminal B Third-Order Intermodulation Product Harmful Interference

3.13. <u>Inmarsat Terminal C</u>

3.13.1. Inmarsat Terminal C is a portable Inmarsat MET. The single-carrier harmful interference susceptibility levels for this MET are shown in Figure 8. The third-order intermodulation product harmful interference susceptibility levels for this terminal are shown in Figure 9. This MET appears to be particularly susceptible to interfering signals offset by about 21.4 MHz. This might be due to the use of a superheterodyne receiver with an intermediate frequency (IF) in the vicinity of 10.7 MHz, and poor image rejection in the receiver.[246]

3.13.2. In Figure 8 below, one can see that the level of the CW signal that causes harmful interference to the Inmarsat Terminal C receiver is about -42 dBm at 1525 MHz. The CW interfering signal level remains in the range of -42 to -45 dBm until 1529 MHz. Beyond 1531 MHz, the CW interfering signal level gradually rises to about -35 dBm at 1529 MHz. There are two dips in the CW interfering signal level, one at 1542 MHz, and one at 1550 MHz. These dips are unexplained. The simulated MSV's GSM interfering level tracks the CW interfering signal level to within about 2 dB over most of the 1525-1559 MHz frequency range. The simulated cdma2000 interfering signal level is about -47 dBm at 1526 MHz, falling to about -63 dBm at 1529 MHz. It rises from about -62 dBm at 1531 MHz to about -35 dBm at 1545 MHz, which is the highest level it attains.

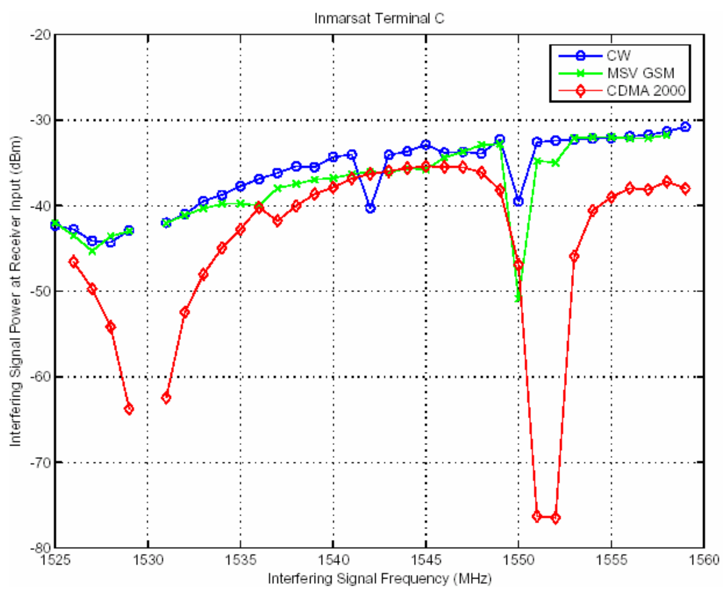

Figure 8: Inmarsat Terminal C Single-Carrier Harmful Interference Levels.

3.13.3. In Figure 9 below, one can see that the combined power level of a pair of CW signals that causes harmful interference due to third-order intermodulation products in the receiver of Inmarsat Terminal C ranges from a low of about -69 dBm to a high of about -65 dBm. The level of the interfering pair of simulated MSV's GSM signals is typically about 2 to 3 dB higher than that of the CW signal pair. The level of the interfering pair of simulated cdma2000 signals is typically about 2 to 3 dB higher than that of the MSV's GSM signal pair.

[246] In a superheterodyne receiver, the desired RF signal is converted to an intermediate frequency (IF) signal by mixing it with a signal from a local oscillator (LO). The mixing process converts signals at frequencies of both LO-RF and LO+RF to the same IF. For example, suppose the desired RF signal is centered at 1530 MHz. Suppose the LO is at 1540.7 MHz. Mixing the desired RF signal at 1530 MHz with the 1540.7 MHz LO will produce an IF signal at 10.7 MHz. However, if a signal is present at 1551.4 MHz, mixing this signal with the 1540.7 MHz LO will also produce an IF signal at 10.7 MHz.

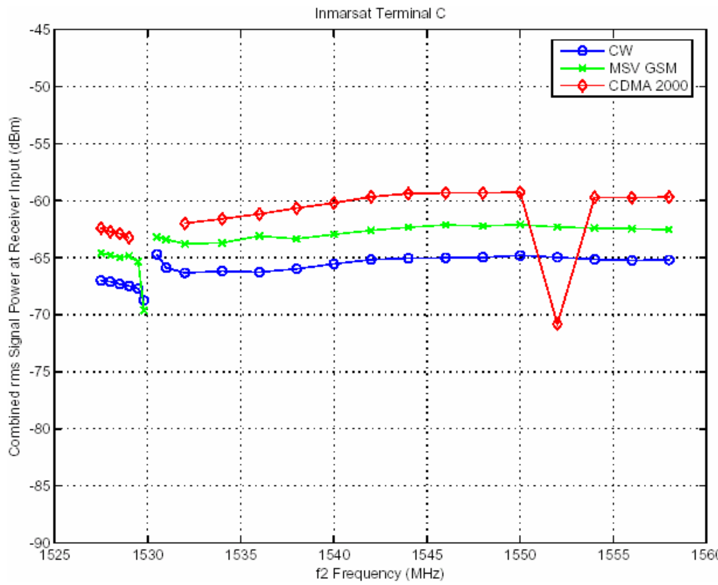

Figure 9: Inmarsat Terminal C Third-Order Intermodulation Product Harmful Interference

3.14. Inmarsat Terminal D

3.14.1. Inmarsat Terminal D is a land-mobile Inmarsat MET, designed to be mounted on the roof of a motor vehicle. It is derived from its manufacturer's similar Inmarsat Fleet 55 MET. Terminal D has two connections between its Duplexer + LNA Block and its antenna, necessitating a minor modification to the test setup shown in Section 4.1 of the Test Plan. See Figure 12 for the test setup for Terminal D. The single-carrier harmful interference susceptibility levels for this MET are shown in Figure 10. The third-order intermodulation product harmful interference susceptibility levels for this MET are shown in Figure 11. Note that some of the datapoints for MSV's GSM and most of the datapoints for cdma2000 are missing due to test equipment limitations in generating signals strong enough to cause harmful interference to this MET using these modulation techniques.

3.14.2. Figure 10 below shows that the level of the CW signal that causes harmful interference to the Inmarsat Terminal C receiver is about -32 dBm at 1525 MHz. The CW interfering signal level falls to about -42 dBm at 1529 MHz. From about -42 dBm at 1531 MHz, the CW interfering signal level gradually rises to about -32 dBm at 1534 MHz. The CW single-signal interfering level remains in the range of -28 to -35 dBm from 1535 MHz to 1559 MHz, reaching its highest level at 1559 MHz. The simulated MSV's GSM interfering level tracks the CW interfering signal fairly closely except for two unexplained dips at 1539 MHz and 1542 MHz. The simulated cdma2000 interfering signal level was only measurable at 1529 MHz and 1531 MHz because at all other frequencies, the signal generator was unable to output this signal format at a high enough level to cause the BER to degrade to 1×10^{-4}. The level at these two frequencies was about -59 dBm.

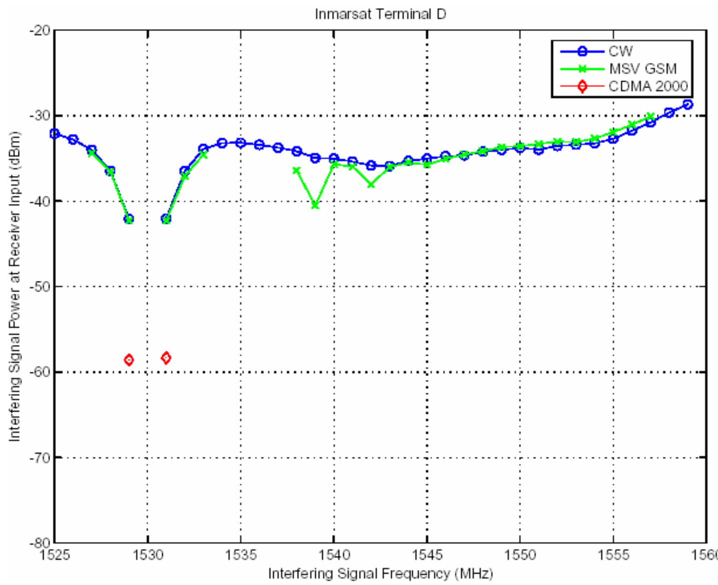

Figure 10: Inmarsat Terminal D Single-Carrier Harmful Interference Levels.

3.14.3. Figure 11 below shows that the combined power level of a pair of CW signals that causes harmful interference due to third-order intermodulation products in the receiver of Inmarsat Terminal D ranges from a low of about -61 dBm to a high of about -53 dBm. The level of the interfering pair of simulated MSV's GSM signals is typically about 3 dB higher than that of the CW signal pair. The level of the interfering pair of simulated cdma2000 signals is typically about 2 dB higher than that of the MSV's GSM signal pair.

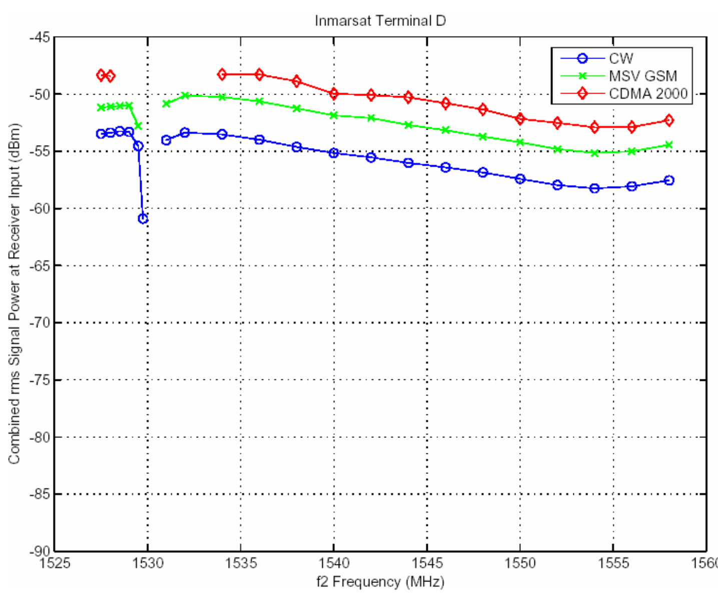

Figure 11: Inmarsat Terminal D Third-Order Intermodulation Product Harmful Interference

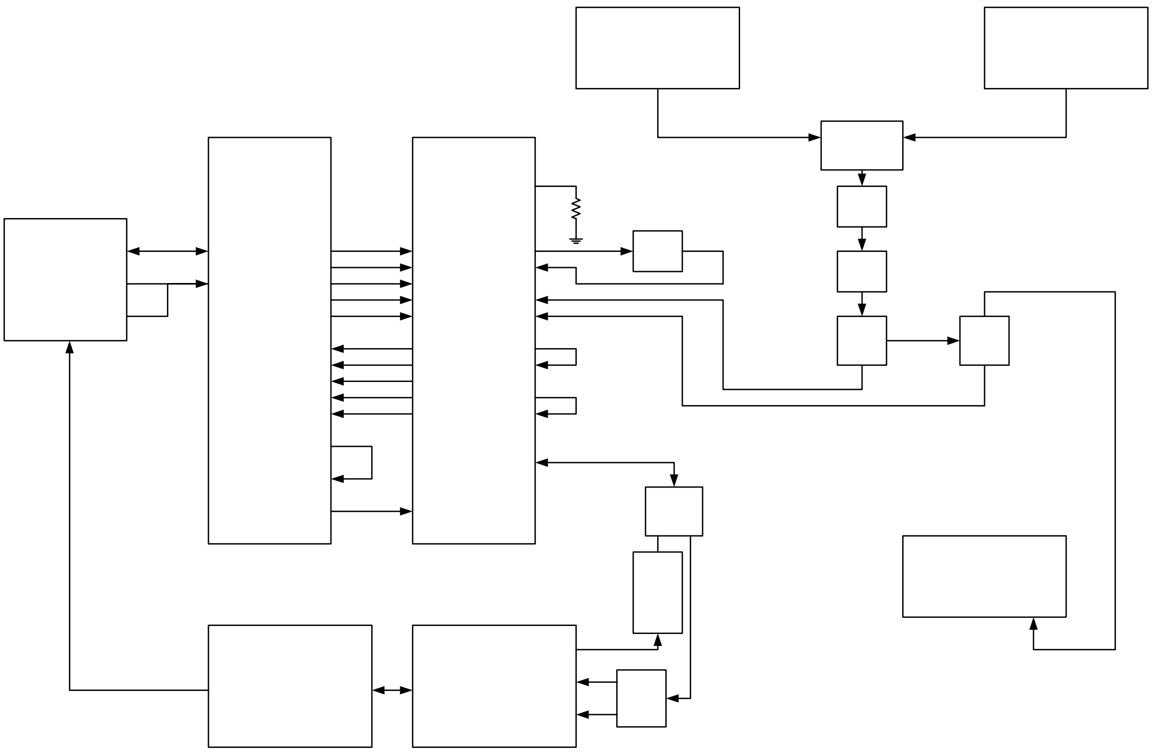

Figure 12: Test Setup for Inmarsat Terminal D

ANNEX 1

TEST PLAN

Inmarsat Terminal
Interference Susceptibility Testing

1. SCOPE

The purpose of the Inmarsat MET interference susceptibility testing is to determine the levels of interference from MSS/ATC Base Stations (BS) that will result in harmful interference to Inmarsat METs. This document defines the methods of determining interference susceptibility of Inmarsat METs submitted to the Federal Communications Commission for interference susceptibility testing.

2. APPLICABLE DOCUMENTS

- Protocol and Traffic Tester Reference Manual, Inmarsat, 28 July 2004
- Physical Layer Tester Hardware Manual, DC-190304 V1.2, Square Peg Communications, Inc., 18 August 2003

3. EQUIPMENT REQUIRED

3.1. Inmarsat-supplied test equipment

- **Physical Layer Tester**
- **Protocol and Traffic Tester**
- **SYNC and RF interconnect cables**

3.2. Commercial Test Equipment

- **Agilent E4438C Vector Signal Generator**
- **Agilent E4437B Vector Signal Generator**
- **Agilent E4440A Spectrum Analyzer**
- **Mini-Circuits ZAPD-2-N Power Combiner/Divider (3 ea.)**
- **0-100 dB Step Attenuator, 0.1 dB steps (2 ea.)**
- **Tunable L-Band Filter**
- **Appropriate RF interconnect cables and adapters**

- **ISDN and LAN interconnect cables**

3.3. Equipment-Under-Test

- **Inmarsat terminals with required accessories**

4. EQUIPMENT SETUP AND INMARSAT RECEIVER OVERLOAD TESTS

4.1. Equipment Setup

Connect the equipment as shown in Figure 1, Equipment Setup Block Diagram. Connect the 100W, 30 dB attenuator (and diplexer, if applicable) to the Inmarsat terminal as recommended by the terminal manufacturer. Connect the tunable filter if/as required.

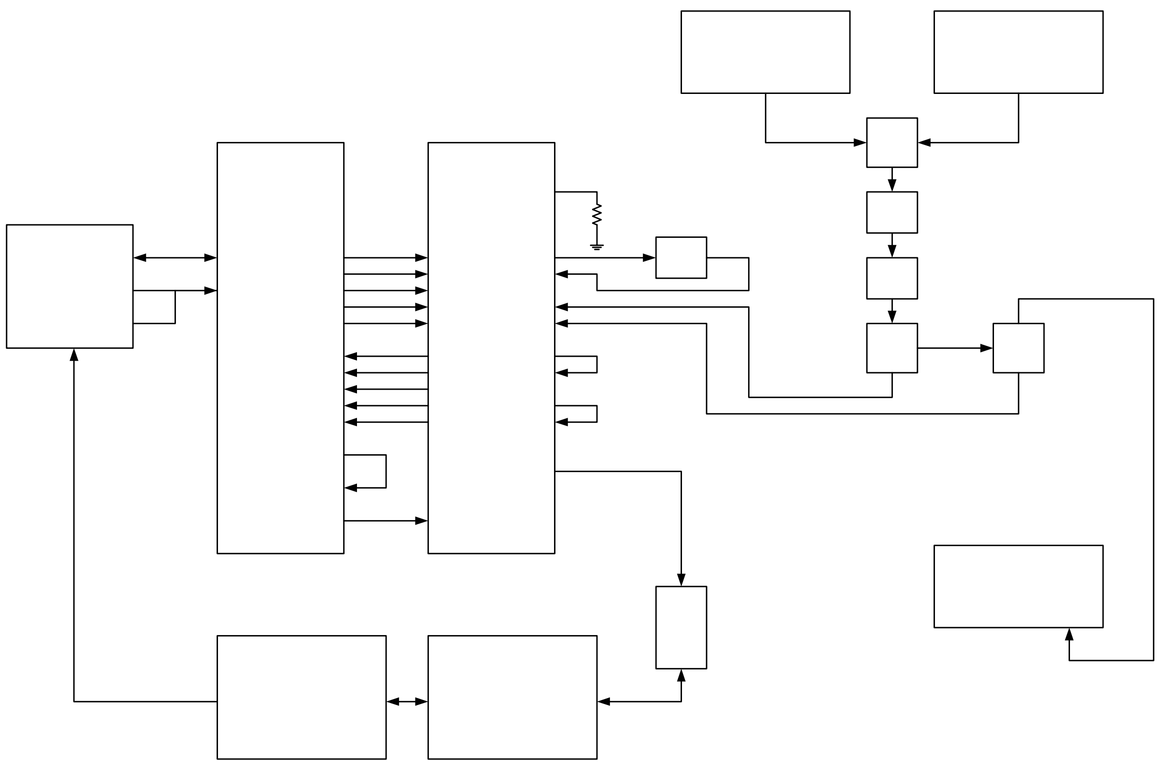

Figure 1: Equipment Setup Block Diagram

4.2. Level Calibration

The purpose of this step is to gather data on the signal level losses through the test setup so that interference levels at the input to the Inmarsat terminal receiver can be easily calculated.

4.2.1. With the step attenuator on the output of the two-way power combiner set to 0 dB, measure and record the power losses from the E4438C vector signal generator and the E4437B vector signal generator through the power dividers/combiners, step attenuator, tunable filter (if used), PLT, and 100W, 30 dB attenuator to the Inmarsat terminal diplexer antenna port over the band 1525 MHz to 1559 MHz.

4.3. Signal Generator Noise Floor Measurement and Compensation

The E4438C and E4437B vector signal generators have a signal-to-noise ratio that varies as a function of modulation type (CW, MSV's GSM, cdma2000) and frequency offset. If the signal generators are required to generate higher-powered signals, the noise floor of the signal generator output within the bandwidth of the desired Inmarsat signal generated by the Inmarsat PLT may be high enough to raise the noise floor at the Inmarsat receiver input and degrade the C/N_0 level of the desired signal.

If this is the case, there are two techniques that can be employed to mitigate the effects of the signal generator noise:

If the frequency offset between the signal generator's simulated interfering signal and the desired signal is high enough, the tunable filter can be employed to reduce the noise level in the bandwidth of the desired signal. If this technique is used, the level calibration described in section 0 will need to include the effects of the tunable filter.

If the frequency offset between the signal generated by the signal generator and the desired signal is small enough so that the tunable filter cannot be used, or if the noise introduced by the signal generator within the bandwidth of the desired signal is relatively low, the desired signal can be increased in power to maintain a constant C/N_0 despite the signal generator noise.

For all tests, monitor the noise floor using the E4440A spectrum analyzer set as follows: Center Frequency: 1529.9 if the interfering signal frequency is less than 1530 MHz, or 1530.1 MHz if the interfering signal frequency is greater than 1530 MHz; Span: 100 kHz; Reference Level: -70 dBm; Attenuator: 0 dB; Measure: Channel Power; Channel Power Integration Bandwidth: 40 kHz. Record the power spectral density measured by the spectrum analyzer with the vector signal generator RF outputs turned off. Monitor the power spectral density that occurs as tests are run, and calculate the resulting increase in the Inmarsat receiver noise floor. As long as the Inmarsat receiver noise floor increases by 1.0 dB or less, it is permissible to increase the power of the Inmarsat signal at 1530 MHz so as to maintain a constant C/N_0 level of the Inmarsat signal. If an increase of more than 1.0 dB is required, determine whether the tunable filter can be used to reduce the signal generator noise at the Inmarsat signal frequency. If neither technique can be used, record this fact and the maximum interfering signal levels that can be attained.

4.4. Baseline minimum desired signal level vs. BER tests

The purpose of this step is to determine the minimum desired signal levels required for the terminal to achieve a bit error rate (BER) of 10^{-5} and 10^{-4}, given the noise floor of the receiver, measured with a minimum of 100 errors.

4.4.1. Set the PTT/PLT for a transmit frequency of 1530 MHz for the carrier against which BER tests will be run. Set the PTT and PLT up to perform BER tests on the Inmarsat terminal. Turn off the RF outputs of the vector signal generators. Set the Tx step attenuator on the PLT and the step attenuator in the Tx IF loopback signal path for a signal level that will result in a C/N_0 about 3 dB higher than that specified by Inmarsat as being required to achieve a BER of 1×10^{-5}.

4.4.2. Start the BER test. Ensure that the terminal synchronizes to the forward-link signal and that the BER is less than 1×10^{-5}.

4.4.3. Reduce the PLT forward-link power until the BER is approximately 1×10^{-5}. Run the test until at least 100 bit errors occur. Fine-tune the forward-link power to achieve the desired BER. Record the step attenuator settings and the measured BER at which this occurs.

4.4.4. Reduce the PLT forward-link power until the BER is approximately 1 x 10^{-4}. Run the test until at least 100 bit errors occur. Fine-tune the forward-link power to achieve the desired BER. Record the step attenuator settings at which this occurs, the measured BER, and the difference between the settings for a BER of approximately 1 x 10^{-5} and a BER of approximately 1 x 10^{-4}.

4.4.5. Increase the forward-link power by 2 dB from the level at which the BER was approximately 1 x 10^{-5}. Maintain this setting except as required by section 4.3.

4.5. Interference tests with a CW signal

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from a CW (unmodulated carrier) signal over a range of interfering signal frequency offsets and power levels.

4.5.1. Set the E4438C vector signal generator up to generate a CW signal. Set the E4438C frequency to 1525 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output. Turn off the RF outputs of the E4437B vector signal generator. Set the step attenuator on the output of the two-way power combiner to 0 dB.

4.5.2. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.5.3. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by +1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.5.4. Repeat the preceding step until the signal generator frequency reaches 1529.0 MHz.

4.5.5. Set the E4438C frequency to 1559 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output.

4.5.6. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.5.7. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by -1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.5.8. Repeat the preceding step until the signal generator frequency reaches 1531 MHz.

4.6. Interference tests with a single-carrier simulated GSM signal

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from MSV's ATC Base Stations transmitting a simulated GSM forward-link signal over a range of interfering signal frequency offsets and power levels.

4.6.1. Set the E4438C vector signal generator up for a simulated GSM signal having the same data rate and time slot structure as a standard GSM signal, but using a 135.40 ksps symbol rate, OQPSK modulation, and a Root-Nyquist baseband filter with alpha = 0.3. Set the E4438C frequency to 1526 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output. Turn off the RF outputs of the E4437B vector signal generator. Set the step attenuator on the output of the two-way power combiner to 0 dB.

4.6.2. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.6.3. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by +1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.6.4. Repeat the preceding step until the signal generator frequency reaches 1529 MHz.

4.6.5. Set the E4438C frequency to 1558.5 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output.

4.6.6. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.6.7. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by -1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.6.8. Repeat the preceding step until the signal generator frequency reaches 1531 MHz.

4.7 Interference tests with a simulated single-carrier cdma2000 signal

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from MSV's ATC Base Stations transmitting a simulated cdma2000 forward-link signal over a range of interfering signal frequency offsets and power levels.

4.7.1. Set the E4438C vector signal generator up for a cdma2000 signal with a 1.25 MHz bandwidth (SR1) and at least nine channels. Set the E4438C frequency to 1526 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output. Turn off the RF outputs of the E4437B vector signal generator. Set the step attenuator on the output of the two-way power combiner to 0 dB.

4.7.2. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.7.3. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by +1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.7.4. Repeat the preceding step until the E4438C frequency reaches 1529 MHz.

4.7.5. Set the E4438C frequency to 1558 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output.

4.7.6. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.7.7. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by -1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.7.8. Repeat the preceding step until the E4438C frequency reaches 1531 MHz.

5. THIRD-ORDER INTERMODULATION PRODUCT TESTS

5.1. Purpose

The purpose of these tests is to determine the susceptibility of the Inmarsat MET receiver to interference from third-order intermodulation products from pairs of MSS ATC BS emissions with frequencies that result in a third-order intermodulation product at the same frequency as the desired Inmarsat space-to-Earth signal.

5.2. Equipment Setup

For these tests, the equipment is set up the same way as is shown in Figure 1 above. The two signal generators will each be set to provide a 0 dBm signal at the output of the two-way power combiner. Level calibration data from paragraph 0 can be used. The noise compensation technique described in paragraph 0 should be used, except that the tunable filter should not be used.

5.3. CW Third-Order Intermodulation Product Tests

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from a pair of CW (unmodulated carrier) signals at pairs of frequencies that result in third-order intermodulation products at the same frequency as the Inmarsat signal (1530 MHz).

5.3.1. Set the E4438C and E4437B vector signal generators up to generate a CW signal. Set the E4438C frequency to 1538 MHz, and the E4437B frequency to 1546 MHz. Turn off the RF output of the other E4437B vector signal generator. Disconnect the output of the two-way power combiner from the step attenuator and connect the spectrum analyzer to the output of the two-way power combiner. Set the power level of the two vector signal generators such that the rms power level at the output of the two-way power combiner is 0 dBm for each signal. Set the step attenuator to provide at least 90 dB of attenuation, and reconnect the equipment as shown in Figure 1.

5.3.2. Set the E4438C frequency to 1525 MHz, and the E4437B frequency to 1527.5 MHz. Reduce the step attenuator setting until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C and E4437B frequencies and the output power level at which this occurs.

5.3.3. Repeat the preceding step for each of the following pairs of frequencies (all in MHz):

1526 , 1528	1530.25, 1530.5
1527, 1528.5	1530.5, 1531
1528, 1529	1531, 1532
1529, 1529.5	1532, 1534
1529.5, 1529.75	1533, 1536
1534, 1538	1540, 1550
1535, 1540	1541, 1552
1536, 1542	1542, 1554
1537, 1544	1543, 1556
1538, 1546	1544, 1558
1539, 1548	

5.4. MSV's GSM Third-Order Intermodulation Product Tests

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from a pair of MSV's GSM signals at pairs of frequencies that result in third-order intermodulation products at the same frequency as the Inmarsat signal (1530 MHz).

5.4.1. Set the E4438C and E4437B vector signal generators up to generate a GSM signal with OQPSK modulation, Root-Nyquist baseband filtering with alpha = 0.3, and a symbol rate of 135.44 ksps. Set the E4438C frequency to 1538 MHz, and the E4437B frequency to 1546 MHz. Turn off the RF output of the other E4437B vector signal generator. Disconnect the output of the two-way power combiner from the step attenuator and connect the spectrum analyzer to the output of the two-way power combiner. Set the power level of the two vector signal generators such that the rms power level at the output of the two-way power combiner is 0 dBm for each signal. Set the step attenuator to provide at least 90 dB of attenuation, and reconnect the equipment as shown in Figure 1.

5.4.2. Set the E4438C frequency to 1525 MHz, and the E4437B frequency to 1527.5 MHz. Reduce the step attenuator setting until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C and E4437B frequencies and the output power level at which this occurs. Then increase the step attenuator setting by at least 10 dB.

5.4.3. Repeat the preceding step for each of the following pairs of frequencies (all in MHz):

1526 , 1528	1535, 1540
1527, 1528.5	1536, 1542
1528, 1529	1537, 1544
1529, 1529.5	1538, 1546
1530.5, 1531	1539, 1548
1531, 1532	1541, 1552
1532, 1534	1542, 1554
1533, 1536	1543, 1556
1534, 1538	1544, 1558

5.5. cdma2000 Third-Order Intermodulation Product Tests

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from a pair of cdma2000 signals at pairs of frequencies that result in third-order intermodulation products at the same frequency as the Inmarsat signal (1530 MHz).

5.5.1. Set the E4438C up to generate a single-carrier nine-channel cdma2000 signal, and the E4437B vector signal generator up to generate a single-carrier 32-channel IS-95A signal. Set the E4438C frequency to 1538 MHz, and the E4437B frequency to 1546 MHz. Turn off the RF output of the other E4437B vector signal generator. Disconnect the output of the two-way power combiner from the step attenuator and connect the spectrum analyzer to the output of the two-way power combiner. Set the power level of the two vector signal generators such that the rms power level at the output of the two-way power combiner is 0 dBm for each signal. Set the step attenuator to provide at least 90 dB of attenuation, and reconnect the equipment as shown in Figure 1.

5.5.2. Set the E4438C frequency to 1525 MHz, and the E4437B frequency to 1527.5 MHz. Reduce the step attenuator setting until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C and E4437B frequencies and the output power level at which this occurs. Then increase the step attenuator setting by at least 10 dB.

5.5.3. Repeat the preceding step for each of the following pairs of frequencies (all in MHz):

1526 , 1528	1538, 1546
1527, 1528.5	1539, 1548
1532, 1534	1540, 1550
1533, 1536	1541, 1552
1534, 1538	1542, 1554
1535, 1540	1543, 1556
1536, 1542	1544, 1558
1537, 1544	

APPENDIX B

Final Rules

For the reasons discussed above, the Federal Communications Commission amends 47 C.F.R. part 25 as follows:

PART 25 – SATELLITE COMMUNICATIONS

1. The authority citation for Part 25 continues to read as follows:

Authority: 47 U.S.C. 701-744. Interprets or applies Sections 4, 301, 302,303, 307, 309 and 332 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309, 332, unless otherwise noted.

2. Section 25.149 is amended by revising paragraph (a)(1) to read as follows:

§ 25.149 Application requirements for ancillary terrestrial components in the mobile-satellite service networks operating in the 1.5/1.6 GHz, 1.6/2.4 GHz and 2 GHz mobile-satellite service.

(a) * * *

(1) ATC shall be deployed in the forward-band mode of operation whereby the ATC mobile terminals transmit in the MSS uplink bands and the ATC base stations transmit in the MSS downlink bands in portions of the 2000-2020 MHz/2180-2200 MHz bands (2 GHz band), the 1626.5-1660.5 MHz/1525-1559 MHz bands (L-band), and the 1610-1626.5 MHz/2483.5-2500 MHz bands (Big LEO band).

Note to § 25.149(a)(1):

An L-band MSS licensee is permitted to apply for ATC authorization based on a non-forward-band mode of operation provided it is able to demonstrate that the use of a non-forward-band mode of operation would produce no greater potential interference than that produced as a result of implementing the rules of this section.

* * * * *

3. Section 25.149 is amended by revising paragraph (b)(1)(i) to read as follows:

§ 25.149 Application requirements for ancillary terrestrial components in the mobile-satellite service networks operating in the 1.5/1.6 GHz, 1.6/2.4 GHz and 2 GHz mobile-satellite service.

* * * * *

(b) * * *

(1) * * *

(i) For the 2 GHz MSS band, an applicant must demonstrate that it can provide space-segment service covering all 50 states, Puerto Rico, and the U.S. Virgin Islands one-hundred percent of the time, unless it is not technically possible, consistent with the coverage requirements for 2 GHz MSS GSO operators.

* * * * *

3. Section 25.201 is amended by revising the following definition to read as follows:

§ 25.201 Definitions

* * * * *

Ancillary terrestrial component. The term "ancillary terrestrial component" means a terrestrial communications network used in conjunction with a qualifying satellite network system authorized pursuant to these rules and the conditions established in the Orders issued in IB Docket No. 01-185, *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 Band.*

4. Section 25.216 is amended by revising paragraph (i) to read as follows:

§ 25.216 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service.

* * * * *

(i) The e.i.r.p density of carrier-off state emissions from mobile earth stations manufactured more than six months after Federal Register publication of the rule changes adopted in FCC 03-283 with assigned uplink frequencies between 1 and 3 GHz shall not exceed −80 dBW/MHz in the 1559-1610 MHz band averaged over any two millisecond interval.

5. Section 25.252 is amended by revising paragraph (a)(7) and (b)(3) as follows:

§ 25.252 Special requirements for ancillary terrestrial components operating in the 2000–2020 MHz/2180–2200 MHz bands.

(a) * * *

(7) Generate EIRP density, averaged over any two millisecond active transmission interval, greater than −70 dBW/MHz in the 1559–1610 MHz band. The EIRP, measured over any two millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such base stations, shall not exceed −80 dBW in the 1559-1610 MHz band. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

* * * * *

(b) * * *

(3) Not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than −70 dBW/MHz in the 1559-1610 MHz band. The EIRP, measured over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such mobile

terminals shall not exceed −80 dBW in the 1559-1610 MHz band. The EIRP density of carrier-off-state emissions from such mobile terminals shall not exceed −80 dBW/MHz in the 1559-1610 MHz band, averaged over a two-millisecond interval. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

* * * * *

6. Section 25.253 is amended in its entirety to read as follows:

§ 25.253 Special requirements for ancillary terrestrial components operating in the 1626.5-1660.5 MHz/1525-1559 MHz bands.

(a) An ancillary terrestrial component in these bands shall:

(1) In any band segment coordinated for the exclusive use of an MSS Applicant within the land area of the U.S., where there is no other L-Band MSS satellite making use of that band segment within the visible portion of the geostationary arc as seen from the ATC coverage area, the ATC system will be limited by the in-band and out-of-band emission limitations contained in this section and the requirement to maintain a substantial MSS service.

(2) In any band segment that is coordinated for the shared use of the Applicant's MSS system and another MSS operator, where the coordination agreement existed prior to February 10, 2005 and permits a level of interference to the other MSS system of less than 6% ΔT/T, the Applicant's combined ATC and MSS operations shall increase the system noise level of the other MSS to no more then 6% ΔT/T. Any future coordination agreement between the parties governing ATC operation will supersede this paragraph.

(3) In any band segment that is coordinated for the shared use of the Applicant's MSS system and another MSS operator, where a coordination agreement existed prior to February 10, 2005 and permits a level of interference to the other MSS system of 6% ΔT/T or greater, the Applicant's ATC operations may increase the system noise level of the other MSS system by no more than an additional 1% ΔT/T. Any future coordination agreement between the parties governing ATC operations will supersede this paragraph.

(4) In a band segment in which the Applicant has no rights under a coordination agreement, the Applicant may not implement ATC in that band.

(b) ATC base stations shall not exceed an out-of-channel emissions measurement of −57.9 dBW/MHz at the edge of a MSS licensee's authorized and internationally coordinated MSS frequency assignment.

(c) An applicant for an ancillary terrestrial component in these bands shall:

(1) Demonstrate, at the time of application, how its ATC network will comply with the requirements of footnotes US308 and US315 to the table of frequency allocations contained in § 2.106 of this chapter regarding priority and preemptive access to the L-band MSS spectrum by the aeronautical mobile-satellite en-route service (AMS(R)S) and the global maritime distress and safety system (GMDSS).

(2) Coordinate with the terrestrial CMRS operators prior to initiating ATC transmissions when co-locating ATC base stations with terrestrial commercial mobile radio service (CMRS) base stations that make use of Global Positioning System (GPS) time-based receivers.

(3) Provide, at the time of application, calculations that demonstrate the ATC system conforms to the ΔT/T requirements in subparagraphs (a)(2) and (a)(3) of this section, if a coordination agreement that incorporates the ATC operations does not exist with other MSS operators.

(d) Applicants for an ancillary terrestrial component in these bands must demonstrate that ATC base stations shall not:

(1) Exceed a peak EIRP of 31.9 -10*log(number of carriers) dBW/200kHz, per sector, for each carrier in the 1525-1541.5 MHz and 1547.5- 1559 MHz frequency bands;

(2) Exceed an EIRP in any direction toward the physical horizon (not to include man-made structures) of 26.9 -10*log(number of carriers) dBW/200 kHz, per sector, for each carrier in the 1525-1541.5 MHz and 1547.5-1559 MHz frequency bands;

(3) Exceed a peak EIRP of 23.9 -10*log(number of carriers) dBW/200 kHz, per sector, for each carrier in the 1541.5-1547.5 MHz frequency band;

(4) Exceed an EIRP toward the physical horizon (not to include man-made structures) of 18.9 -10*log(number of carriers) dBW/200 kHz, per sector, for each carrier in the 1541.5-1547.5 MHz frequency band;

(5) Exceed a total power flux density level of −56.8 dBW/m^2/200 kHz at the edge of all airport runways and aircraft stand areas, including takeoff and landing paths from all carriers operating in the 1525-1559 MHz frequency bands. The total power flux density here is the sum of all power flux density values associated with all carriers in a sector in the 1525-1559 MHz frequency band, expressed in dB(Watts/m^2/200 kHz). Free-space loss must be assumed if this requirement is demonstrated via calculation;

(6) Exceed a total power flux density level of −56.6 dBW/ m^2/200 kHz at the water's edge of any navigable waterway from all carriers operating in the 1525-1541.5 MHz and 1547.5-1559 MHz frequency bands. The total power flux density here is the sum of all power flux density values associated with all carriers in a sector in the 1525-1541.5 MHz and 1547.5-1559 MHz frequency bands, expressed in dB(Watts/m^2/200 kHz). Free-space loss must be assumed if this requirement is demonstrated via calculation;

(7) Exceed a total power flux density level of −64.6 dBW/ m^2/200 kHz at the water's edge of any navigable waterway from all carriers operating in the 1541.5-1547.5 MHz frequency band. The total power flux density here is the sum of all power flux density values associated with all carriers in a sector in the 1541.5-1547.5 MHz frequency band, expressed in dB(Watts/m^2/200 kHz). Free-space loss must be assumed if this requirement is demonstrated via calculation;

(8) Exceed a peak antenna gain of 16 dBi;

(9) Generate EIRP density, averaged over any two-millisecond active transmission interval, greater than −70 dBW/MHz in the 1559–1605 MHz band or greater than a level determined by linear interpolation in the 1605–1610 MHz band, from −70 dBW/MHz at 1605 MHz to −46 dBW/MHz at 1610 MHz. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such base stations shall not exceed −80 dBW in the 1559–1605 MHz band or exceed a level determined by linear interpolation in the 1605-1610 MHz band, from −80 dBW at 1605 MHz to −56 dBW at 1610 MHz. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP

density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

(e) Applicants for an ancillary terrestrial component in these bands must demonstrate, at the time of the application, that ATC base stations shall use left-hand-circular polarization antennas with a maximum gain of 16 dBi and overhead gain suppression according to the following:

Angle from direction of maximum gain, in vertical plane, above antenna (degrees)	Antenna discrimination pattern (dB)
0	Gmax
5	Not to Exceed Gmax -5
10	Not to Exceed Gmax -19
15 to 55	Not to Exceed Gmax -27
55 to 145	Not to Exceed Gmax -30
145 to 180	Not to Exceed Gmax -26

Where: Gmax is the maximum gain of the base station antenna in dBi.

(f) Prior to operation, ancillary terrestrial component licensees shall:

(1) Provide the Commission with sufficient information to complete coordination of ATC base stations with Search-and-Rescue Satellite-Aided Tracking (SARSAT) earth stations operating in the 1544–1545 MHz band for any ATC base station located either within 27 km of a SARSAT station, or within radio horizon of the SARSAT station, whichever is less.

(2) Take all practicable steps to avoid locating ATC base stations within radio line of sight of Mobile Aeronautical Telemetry (MAT) receive sites in order to protect U.S. MAT systems consistent with ITU-R Recommendation ITU-R M.1459. MSS ATC base stations located within radio line of sight of a MAT receiver must be coordinated with the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) for non-Government MAT receivers on a case-by-case basis prior to operation. For government MAT receivers, the MSS licensee shall supply sufficient information to the Commission to allow coordination to take place. A listing of current and planned MAT receiver sites can be obtained from AFTRCC for non-Government sites and through the FCC's IRAC Liaison for Government MAT receiver sites.

(g) ATC mobile terminals shall:

(1) Be limited to a peak EIRP level of 0 dBW and an out-of-channel emissions of -67 dBW/4 kHz at the edge of an MSS licensee's authorized and internationally coordinated MSS frequency assignment.

(2) Be operated in a fashion that takes all practicable steps to avoid causing interference to U.S. radio astronomy service (RAS) observations in the 1660–1660.5 MHz band.

(3) Not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than −70 dBW/MHz in the 1559–1605 MHz band or greater than a level determined by linear interpolation in the 1605–1610 MHz band, from −70 dBW/MHz at 1605 MHz to −46 dBW/MHz at 1610 MHz. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such mobile terminals shall not exceed −80 dBW in the 1559–1605 MHz band or exceed a level determined by linear interpolation in the 1605-1610 MHz band, from −80 dBW at 1605 MHz to −56 dBW at 1610 MHz. The EIRP density of carrier-off-state emissions from such mobile terminals shall not exceed −80 dBW/MHz in the 1559–1610 MHz band, averaged over

a two-millisecond interval. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

(h) When implementing multiple base stations and/or base stations using multiple carriers, where any third-order intermodulation product of these base stations falls on an L-band MSS band coordinated for use by another MSS operator with rights to the coordinated band, the MSS ATC licensee must notify the MSS operator. The MSS operator may request coordination to modify the base station carrier frequencies, or to reduce the maximum base station EIRP on the frequencies contributing to the third-order intermodulation products. The threshold for this notification and coordination is when the sum of the calculated signal levels received by an MSS receiver exceeds -70 dBm. The MSS receiver used in these calculations can be assumed to have an antenna with 0 dBi gain. Free-space propagation between the base station antennas and the MSS terminals can be assumed and actual signal polarizations for the ATC signals and the MSS system may be used.

7. Section 25.254 is amended by revising paragraph (a)(4) and (b)(4) as follows:

§ 25.254 Special requirements for ancillary terrestrial components operating in the 1610–1626.5 MHz/2483.5–2500 MHz bands.

(a) * * *

(4) Base stations operating in frequencies above 2483.5 MHz shall not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than −70 dBW/MHz in the 1559–1610 MHz band. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such base stations shall not exceed −80 dBW in the 1559–1610 MHz band. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

* * * * *

(b) * * *

(4) ATC mobile terminals operating in assigned frequencies in the 1610-1626.5 MHz band shall not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than −70 dBW/MHz in the 1559–1605 MHz band or greater than a level determined by linear interpolation in the 1605–1610 MHz band, from −70 dBW/MHz at 1605 MHz to −10 dBW/MHz at 1610 MHz. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such mobile terminals shall not exceed −80 dBW in the 1559–1605 MHz band or exceed a level determined by linear interpolation in the 1605-1610 MHz band, from −80 dBW at 1605 MHz to −20 dBW at 1610 MHz. The EIRP density of carrier-off-state emissions from such mobile terminals shall not exceed −80 dBW/MHz in the 1559–1610 MHz band, averaged over a two-millisecond interval. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

* * * * *

APPENDIX C: LIST OF COMMENTING PARTIES

Petitions for Reconsideration of the *MSS Flexibility R&O*:

The Boeing Company
The Cellular Telecommunications & Internet Association
Cingular Wireless LLC
Inmarsat Ventures PLC
Mobile Satellite Ventures Subsidiary LLC
The Society of Broadcast Engineers, Inc.
The U.S. GPS Industry Council

Petitions for Reconsideration of the *Sua Sponte Order*:

The Boeing Company

Oppositions to and Comments on Petitions:

Aeronautical Radio, Inc. and the Air Transport Association of America
AT&T Wireless Services, Inc.; Cingular Wireless LLC; Verizon Wireless (the Wireless Carriers)
Delta Air Lines, Inc.
Globalstar, L.P. and Globalstar USA, LLC
ICO Global Communications (Holdings) Limited
Inmarsat Ventures PLC
Mobile Satellite Ventures Subsidiary LLC
The Society of Broadcast Engineers, Inc.

Replies to Oppositions and Comments:

The Cellular Telecommunications & Internet Association
Cingular Wireless LLC
Inmarsat Ventures PLC
Mobile Satellite Ventures Subsidiary LLC
The U.S. GPS Industry Council

***Ex Parte* Comments and Letters:**

Air Trak
AOS, Inc.
American Petroleum Institute/United Telecom Council
Ass'n for Maximum Service Television
The Boeing Company
California Space Authority
The Cellular Telecommunications & Internet Association
Central Communications & Electronics, Inc.
Cingular Wireless LLC
Continental Mobile Communications
The Department of Defense
Geologic Solutions Inc.
GEOSat Solutions, Inc.
Global Communications Solutions Inc.
Globalstar, L.P. and Globalstar USA, LLC
Glocom
Hughes Supply Co.
Inmarsat Ventures PLC
Intel Corporation
International Satellite Services, Inc.

J.E.S. & Sons, Inc.
Level 3 Communications LLC
Mercedes-Benz USA
Mobile Equipment International
Mobile Satellite Ventures Canada Inc.
Mobile Satellite Ventures Subsidiary LLC
Motient, Inc.
National Ass'n of Broadcasters
Nera, Inc.
NexTel, Inc.
Office of Communications of the United Kingdom
Radio-Television News Directors Ass'n
Remote Satellite Systems, International
Satcom Direct
Sky Blitz, Inc.
Space Systems Loral
The Society of Broadcast Engineers, Inc.
Thrane & Thrane Inc.
The U.S. GPS Industry Council
Verizon Wireless
Wells Communications
The Wi-Fi Alliance
Wireless Matrix Corporation

SEPARATE STATEMENT OF
COMMISSIONER MICHAEL J. COPPS
Approving in Part, Concurring in Part

Re: *In the Matter of 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; IB Docket No. 01-185, IB Docket No. 02-364.*

I agree with today's decision in most respects. I believe that ATC is a vital tool for the MSS industry. It holds the promise of allowing MSS operators to bring improved service and new competition to most of the country through their satellite networks. Satellite has a critically important role to play in bringing the wonders of the digital era to our citizens, especially in hard-to-reach areas. ATC also allows these carriers to serve areas that cannot be reached by satellite through a terrestrial network. I place great stock in the analysis of the FCC's engineers on the interference dispute that we resolve today, and my support of this item is based on their analysis and recommendation.

When we granted ATC authority, however, I argued that the Commission should consider the importance of fees for satellite carriers who choose to use their un-auctioned satellite spectrum licenses for terrestrial uses. We must ensure that the American people are adequately compensated for private use of a public resource and that all spectrum users have the incentive to use spectrum intensively. Because the Commission again fails to do explore spectrum fees, I must concur in part.