allocation.[307] To protect in-band MSS systems from interference, we adopt section 25.252(c)(2) to require that 2 GHz ATC MTs meet an out-of-channel emission level of -67 dBW/4kHz with the expectation that a MSS licensee will reserve a minimum of 10 dB in its link budget for power control within its ATC network, as is within the 10-20 dB range of standard engineering practice, to overcome the effects of structural attenuation. MSS licensees may not extend the coverage area of any ATC cell beyond the point where an ATC MT could operate at the edge of coverage of the ATC cell with a maximum EIRP' of -10 dBW.

112. Boeing also submitted substantial technical analyses on the potential for interference that ATC operations could have on its downlink operations. Specifically, Boeing addressed the impact it would expect ATC BS and MT operations to have on its aircraft earth station receivers.[308] Since we are only authorizing the Forward Band Mode of ATC operation, MTs will not be transmitting in the satellite downlink band and this potential for interference no longer exists. However, the potential for the BSs to interfere with MSS MET receivers still exits in the Forward Band Mode and we analyze the impact on Boeing's MT receivers in Appendix C1.[309] The Boeing analysis assumed an out-of-channel[310] emission level of -56 dBW/4kHz.[311] However, ICO modified this level to -100.6 dBW/4kHz to be more restrictive than originally proposed.[312] Using the more restrictive out-ofchannel level, brings the separation distance between the ATC BSs and the Boeing aircraft earth stations down from almost 22 km to 190 meters (630 feet) to avoid interference to the aircraft earth stations on or near the ground.[313] An airport is a controlled area, and maintaining a separation distance between a BS and a runway or tarmac of approximately 190 meters should be achievable. Though the separation distance is relatively small, it may be possible for in-flight earth stations to be located within 190 meters from an ATC BS (one that separated from an airport by more than 190 meters) when the aircraft is taking off or landing. To mitigate the potential interference caused to aircraft receivers either in-flight or on the ground, we first adopt section 25.252(b)(1) to limit 2 GHz BS out-of-channel emissions to -100.6 dBw/4kHz and also section 25.252(b)(4) to require MSS licensees to locate all BSs more than 190 meters from the runways and aircraft stand areas of any airport and at least 190 meters away from airport landing and take-off flight paths to mitigate potential out-of-band interference.[314]

113. There also exists the potential for the BSs to saturate or overload aircraft receivers while

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[301] The 1% increase in satellite receiver noise temperature is compared to the 6% delta T/T used to denote an unacceptable level of interference and trigger coordination among satellite systems prior to operation of a new satellite network.

[308] Boeing Comments at 10.

[309] See *infra* App. C1 § 2.2.2.

[310] By "out out-of-channel," we mean at the edge of the 2 GHz MSS licensee's Selected Assignment.

[311] Boeing Comments, App. A, Table 1.

[312] See ICO April 11,2002 *Ex* Pone Letter at 2.

[313] See *infra* App. C1 § 2.2.2. The Forward Band Mode ATC BSs would produce an increase in the satellite earth station receiver noise by 6% or less.

[314] See *infra* App. B (adopting new rules 47 C.F.R. §§ 25.252(b)(1), (b)(4)).

they are on or near the ground.[315] Boeing provides an analysis in its comments that suggests that its receivers will be overloaded by ATC transmissions when its receivers are within approximately 2 km of a BS.[316] Our analysis confirmed Boeing's calculations that, in areas where free-space propagation is the dominant mode of propagation, the ATC BSs may saturate a Boeing MET that is located within approximately 2 km of an ATC BS.[317] We analyzed this situation further, however, to take into account the effects of propagation in an urban environment (where BSs will be located) and while the aircraft receiver is on or near the ground. In urban areas where free-space propagation will not be the dominant mode of propagation, higher attenuation of the BS signals will result in less interfering power being received by a MSS MET."' Using the BS in-band EIRP of 27 dBW, and taking into account the down-tilt of the antenna of 2.5 degrees, a maximum EIRP of *25.5* dBW (27 dBW - antenna gain G with downtilt = 2.5 degrees) will result toward the horizon. Limiting the ATC BS to 25.5 dBW toward the horizon, and taking into account the effects of signal attenuation in an urban setting, we conclude that Boeing's MSS receivers, and the receivers of other MSS systems in the 2 GHz band that may be less robust to overload interference, will not undergo saturation from BSs located in urban areas when the METs are also located in the urban area. We therefore adopt this EIRP limit in our rules."' To take into account Boeing's concern of overload interference to MSS METs located outside of urban areas, we require that 2 GHz ATC BS be limited to an aggregate power level of -51.8 dBW/m^2 (in addition to the 190 meters restriction to protect MSS METs from out-of-band interference) at the runways and aircraft stand areas of any airport and airport landing and take-off flight paths to avoid the possibility of overload interference to an aircraft MSS receiver.[320]

114. We also address the potential situation where BS transmissions could overload an MSS earth station on board an aircraft that is airborne. Boeing assumes, among other things, that mainbeam coupling of the BS antenna and the airborne MSS MET exists. We developed a mathematical model to simulate the interference scenario posed by Boeing where the total interfering power from 1000 randomly distributed BSs visible to an aircraft at various altitudes is calculated at the input of an airborne MSS earth station receiver."' Our analyses further assumes that each randomly distributed BS has an EIRP of 27

[315] Receiver overload, or saturation, occurs when sufficient interference power is present at the receiver to cause it to act in a non-linear manner. This potential for interference is increased by the requirement that MSS earth stations are capable of tuning across 70% of the MSS allocation. *See* 2 *GHz MSS* Rules Order, 15 FCC Rcd at 16152, ¶ 52.

[31b] *See* Boeing Additional Technical Analysis, April 5, 2002, Table 7

[317] See *infra* App. C1 § 2.2.4.2. We note that if the antenna is tilted toward the ground at a 5 degree angle vs. a 2.5 degree angle (used by Boeing) the separation distance reduces to less than 1 km in a free-space propagation environment.

[318] See *infra* App. C1 § 2.2.4.2. Specifically, we use a program developed by the National Institute of Standards and Technology that compares the results of several propagation models and the results show that significantly higher attenuation than free space loss should be expected in an urban setting. We note, too, that the additional attenuation in the urban environment would also be sufficient to protect MSS receivers that are less robust to overload interference (i.e., -60 dBm).

[319] *See infra* App. B (adopting new rule § 25.252(a)(3), which requires MSS ATC licensees to limit BS EIRP toward the horizon to *25.5* dBW).

[320] See *supra* App. C1 § 2.2.4.2,

[321] *See infra* App. C1 § 2.2.4.3 (describing the assumptions used to simulate the interference scenario) & Attach. 1 (MathCad Model).

dBW, that the antenna follows the ITU-R model contained in Recommendation ITU-R M.1336,[322] and the antenna height is at 30m and tilted toward the ground by 2.5 degrees. Based on the results of our analysis, a relatively large deployment of ATC BSs would not cause Boeing's airborne MSS receivers to saturate while airborne and the potential for interference is low if the BS maximum EIRP toward the horizon is limited to 25.5 dBW (27 dBW – antenna gain G with downtilt = 2.5 degrees). We adopt section 25.252(a)(3) to limit BS EIRP toward the physical horizon to 25.5 dBW and an over-head gain suppression greater than 25 dB outside of the main lobe of the antenna to ensure protection of airborne MSS terminals.[323]

b. Inter-Service Sharing

115. We have also evaluated the potential interference that may be caused to systems operating in adjacent frequency allocations to the 2 GHz MSS band. Our findings are described in detail in Appendix C1, Section 3. We summarize our findings, below and conclude that ATC operations in the 2 GHz MSS allocations will not cause unacceptable interference to systems operating in adjacent frequency allocations.

116. Broadcast Auxiliary (BAS) and Electronic News Gathering (ENG) equipment operate above the 1990-2025 MHz MSS uplink allocation. The Society of Broadcast Engineers (SBE) is concerned about the potential for interference that ATC operations could cause to ENG and BAS operations in the adjacent allocation.[324] SBE is particularly concerned about the interference that could be caused if proposed BS operations are permitted in the uplink MSS allocation.[325] According to SBE, placing high-powered BSs in spectrum immediately adjacent to spectrum used for BAS receivers will require a separation distance of 2.6 km between a BS and BAS receiver. We indicated earlier that maintaining this type of separation distance is one example of a technical and operational constraint that would limit the implementation of ATC networks. Because we are adopting rules to implement Forward Band Mode ATC operations, however, the potential for BS interference to ENG and BAS equipment no longer exists. SBE indicates in its same comments that low power mobile telephone use of the MSS allocation will pose little or no risk of interfering with BAS receivers? The rules we adopt in section 25.252 to protect in-band MSS systems from out-of-channel interference will also protect ENG and BAS equipment operating in frequency bands above the MSS uplink allocation."'

117. In the Flexibility Notice, we proposed adopting out-of-band emissions limitations for ATC operations consistent with our current rules for PCS.[328] CTIA. and certain incumbent PCS licensees

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322 See ITU-R Recommendation F.1336-I, Reference *Radiation Patterns* of Omnidirectionol. *Sectoral* and *Other* Antennas in Point-to-Multipoint Systems for Use *in* Sharing Studies *in the* Frequency Range *From* I to About 70 *GHz*, available at <http://www.itu.int/rec/recommendation.asp?type=items&lang=e&parent=R-REC-F.1336-1-200005-I> (last visited, Jan. 8, 2003).

323 See infra App. B (adopting new rules 47 C.F.R. §§ 25.252(a)(3), (a)(5))

324 SBE Comments at 6-1 I; SBE Reply Comments at 1

325 SBE Comments at 8. We address SBE's additional comments on ICO's proposed duplex operations and use of a single antenna for ATC and MSS operations in Appendix C1, Section 3.1.

326 SBE Comments at 8

317 See *infra* App. B (adopting new rule 47 C.F.R. § 25.252).

328 *Flexibility* Notice. 16 FCC Rcd at 15547, 15555-56, ¶¶ 34, 55

121. We also analyzed the impact of ATC operations on the Space Operations Service allocation above the **1990-2025** MHz MSS uplink allocation. Again, since we are adopting rules to implement the Forward Band Mode of ATC operation. the MET transmissions are the only potentially interfering element of ATC with respect to Space Operations systems in this frequency range. Our analysis indicates that, using conservative assumptions developed by the ITU-R,[337] ATC MET out-of-band emissions above **2025** MHz will be significantly below the interference criteria established for the Space Operations Service.[338] Space Operations Service (and Space Research Service) systems operate above the **2165-2200** MSS downlink frequency allocation as well. In the Forward Band Mode of ATC operation, BSs would transmit in the **2165-2200** MHz MSS downlink frequency allocation. Of the two services, the Space Operations Service has the more stringent interference criteria. This is used in our evaluation of the interference potential from ATC to these adjacent band systems.

122. Our analysis concludes that Space Operations and Space Research systems receiving on the ground in the **2200-2290** MHz band would be protected from ATC out-of-band emissions.”’ A separation distance of **0.82** kilometers is required to protect a space operations downlink facility from the out-of-band emissions of an ATC base station. These receive facilities are typically located on government facilities where BSs would not be co-located and interference to space operations receivers would be in a controlled environment. The interference margin for space research receivers, by our calculations, is actually more than *5* dB and interference from BSs to space research receivers is not expected. Space research antennas generally are large antennas that track the space research satellites and they, too, are typically located on government facilities where BSs operations would be in a controlled environment. For space research receivers that are used by universities and private companies, and are located in urban areas, there are operational characteristics (i.e., the elevation angle from the earth station to the satellite would be greater than 0 degrees) that have not been taken into account in our analysis that would increase the interference margin. Given these factors, in addition to the extra attenuation that BS signals would experience in an urban setting, the interference margin for these types of space research receivers would increase, making the sharing situation more compatible.

123. We then evaluated the potential interference from BS out-of-band emission levels caused to terrestrial fixed and mobile systems operating below the **2165-2200 MHz** MSS downlink allocation. ATC BSs will operate in the Forward Band Mode under far more constrained out-of-band emission levels than those required of PCS base stations licensed to operate below **2165 MHz.**[340] Interference from BSs to mobile systems operating in the adjacent frequency allocations therefore is not an issue. Analog and digital terrestrial fixed service systems continue to operate in and below the MSS allocation?’ however,

331 See Recommendation ITU-R **SA.**1154, Provisions *to* Protect *the* Space Research *(SR),* Space Operations (SO) and Earth-Exploration *Satellite* Service *(EES)* and *to* Facilitate Sharing *with* ***the*** Mobile Service in *the* 2025-21***10*** *MHz* and *2200-2290 MHz* Bands. available at <http://www.itu.int/rec/recommendation.asp?type=items&lang=e&parent=R-REC-SA.1154-0-199510-I> (last visited, Jan. **10, 2003**).

338 *See infra* App. C1 **$3.1.**

339 **See** infra App. C1 § **3.2.**

340 For reference, the BS out-of-band emission level of -100.6 dBW/4kHz we adopt here compares favorably to the **– 75** dBW/MHz for a PCS base station operating at maximum power and with a 43+10 log P out-of-band requirement.

341 We note that because MSS licensees are required to relocate terrestrial licensees in the event that an incumbent terrestrial facility causes interference to the MSS earth station receivers within the MSS band, we address the potential for out-of-band interference to terrestrial facilities, not the potential for in-band interference. **See** 2 GHZ (continued....)

attenuated by at least 43 + 10 log P dB.[332] In addition, in the event that a PCS operator receives harmful interference from ancillary ATC base stations or mobile terminals, we will also require that the ATC operator must resolve any such interference. If the MSS ATC operator claims to have resolved the interference and other operators claim that interference has not been resolved, then the parties to the dispute may petition the Commission for a resolution of their claims. We find that compliance with these requirements will adequately protect incumbent PCS operations in the 1930 to 1990 MHz band from interference from MSS ATC and still maintain the usefulness of spectrum in the 2000-2020 MHz band for ATC operations.[333] We also find that compliance with more stringent out-of-band limitations will further the public interest in helping the Commission to establish more effective and efficient spectrum management.[334]

120. ***PCS Receiver Desensitization or Overload.*** Certain incumbent wireless carriers assert that there exists the potential for ATC mobile terminals to cause desensitization or receiver overload to PCS mobile receivers operating below 1990 MHz.[335] We do not believe that the problem of desensitization and overload is as severe as these parties contend. First, we believe that the parties may have assumed that the only interference rejection capability of an existing PCS mobile receiver is from the front-end band pass filter of the receiver. This does not take into account other factors such as additional filtering from the intermediate frequency (IF) circuitry. Additionally, the parties' assertions that receiver desensitization or overload interference will occur appear to be based on what would be considered worst-case circumstances (*e.g.*, that ATC and PCS handsets are operating in close proximity under line-of-sight conditions, that ATC handsets are operating at full power, and that the antennas of the handsets are aligned for perfect coupling). The probability of these various circumstances occurring simultaneously is relatively small. We thus believe that, while the potential for PCS receiver desensitization or overload from ATC operations exists, it is less than suggested by the commenting parties. We also believe that interference problems that may develop over time as ATC is deployed can be mitigated by future PCS handset design modifications and through a cooperative effort by PCS and MSS ATC licensees to resolve these issues.[336]

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332 In addition to adopting this -70 dBW/MHz emission to protect PCS receivers, the Commission's decision to reallocate the 1990-2000 MHz band to services other than MSS will result in a 10 MHz separation between ATC and current PCS operations. *See AWS Report and Order,* FCC 03-16.

333 In setting out requirements for attenuating out-of-band emissions by 43 + 10 log P dB at 2000 MHz and at 70 + 10 log P dB at 1995 MHz, we would expect that the actual out-of-band emissions in the PCS band at 1930-1990 MHz would be attenuated even more.

334 As noted in a recent staff report by the Spectrum Policy Task Force, the staff recommended that the Commission consider tightening out-of-band emission limits over time so that disparate uses of the spectrum can have less interference impact on each other. See Federal Communications Commission, Spectrum Policy Task Force Report, ET Docket No. 02-135, 22 (Nov. 2002), *available ar* <http://www.fcc.gov/Dailv_Releases/Dailv_Business/2002/db1115/DOC-228542A1.doc> (last visited. Jan. 29, 2003). Furthermore. as suggested in the Spectrum Policy Task Force report, we will review these out-of-band limits in about five years to determine whether they are adequate or necessary. *See id.* at *32.*

335 See CTIA Jan. 14, 2003 *Ex Pane* Letter at *5-6*

336 We note that, as a practical matter. there will be some period of time before ATC is deployed and a longer period before it has the potential to reach market penetration levels that could materially affect the likelihood of interference. We also note that the Spectrum Policy Task Force report encourages the use of voluntary receiver performance requirements to address these types of problems. See Spectrum Policy Task Force Report at 31.

required of section 25.213(b) to protect **GPS** from MSS MET out-of-band emissions. On NTIA's second point about whether the emission levels established for a mobile earth station in an MSS system should be applied to ATC BSs and MTs, **NTIA** indicates that the **GMPCS** emission limits in the 1559-1610 **MHz** band for METs operating in the 1990-2025 MHz frequency range are based on protection of **GPS** receivers used on aircraft in a precision approach landing operational scenario and not to protect terrestrial **(e.g.,** land-based) operational **scenarios.**[350] **NTIA** is correct that the **GMPCS** rules that apply to MSS equipment are based on aircraft usage of the **GPS** system. We recognize that NTIA believes that these rules do not provide adequate protection to terrestrial usage.[351] **NTIA** also expressed its concern and reluctance to limit the protection of **GPS** based on the aviation scenario only and believes strongly that protection of terrestrial uses of **GPS** such as E911-assisted **GPS** should be addressed?"

126. The record before us does not support the adoption out-of-band emission levels more stringent than those required of **GMPCS** equipment. Nor does it support expanding the limits to frequency allocations other than the 1559-1610 MHz **band.**[353] We require that 2 GHz ATC base stations and mobile terminals meet the already established **GMPCS** wideband and narrowband out-of-band emission levels to protect **GPS** operations in the 1559-1610 **MHz** band. Indeed, ICO provided ATC base station and mobile terminal equipment specifications that demonstrate that it is capable of meeting the **GMPCS** out-of-band emission attenuation **requirements.**[354] In light of NTIA's concerns, however, we plan to continue to assess the appropriate interference protection levels for **GPS.** Moreover, the Office of Engineering and Technology (OET) will issue a public notice shortly soliciting comment to assist in the examination of what changes in the level of protection for **GPS,** if any, should be established in the future. The public notice will address the out-of-band emission limits that are necessary to protect the three **GPS** civil signals for various operational scenarios (e.g., terrestrial, aviation, maritime).

c. Conclusion

127. We adopt certain technical and operational rules to provide for 2 GHz **MSS ATC** MT and BS operations in the Forward Band Mode of operation to protect in-band, adjacent channel systems within the MSS allocation and systems operating in adjacent frequency allocations. ATC MTs are required to meet an out-of-band attenuation level of 43 + 10 log **P** dB at the 2 GHz MSS band edge and increasing to 70 + 10 log **P** at 1995 MHz and 2025 MHz, respectively. ATC BS are required by our rules to meet an out-of-assigned-band emission limit of -100.6 dBW/4kHz and are limited to producing an

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establishing rules for **MSS** in the 2 GHz bands, NTIA tiled comments supporting the -70 dBW/MHz and -80 dBW emission limits in the 1559- 1610 MHz band for MES operating in the **1990-2025 MHz** band. ***See*** Comments of the National Telecommunications and Information Administration. IB Docket No. **99-81,** at 9 (filed, June 24, **1999).** ***available at*** <http://svartifoss2.fcc.gov/prod/ecfs/retrieve.cgi?native or pdf=pdf&id document=6007946277> (last visited, Dec. 30,2002).

[350] ***See*** NTIA Nov. 12,2002 Ex ***Pane*** Letter, Encl. ***2*** at 5

[351] ***GMPCS Order,*** 17 FCC Rcd at 8923-25, ¶¶ 49-52. The limits adopted in the ***GMPCS Order*** are based on an assumed separation distance of approximately 100 feet between an airborne GPS receiver and a single terrestrial transmitter.

[352] NTIA Jan. 24,2003 ***Ex Pane*** Letter at 2-3

[353] ***See, e.g.,*** **NTIA** Nov. 12.2002 ***Ex Pane*** Letter, Encl. **1** at 1 & Encl. **2** at **2** (discussing expanded frequency bands for GPS).

[354] ***See*** ICO Apr. 11, 2002 Ex ***Pane*** Letter at ***2*** (discussing out-of-band emissions in 2 GHz MSS downlink band).

and we analyze the impact of ATC operations on these adjacent band systems. Our analysis indicates that the proposed ICO BSs would meet the long-term and short-term interference criteria to protect analog terrestrial fixed systems in the adjacent frequency band." It further indicates that because the interference margins calculated for analog system are so large, more robust digital terrestrial fixed systems will not experience interference from out-of-band ATC base-station emissions.[343]

124. Last, we address the potential interference to the Global Positioning System (GPS) from ATC BSs and MTs operating in the 2 GHz band. GPS operates in a portion of the 1559-1610 MHz Radionavigation Satellite Service (RNSS) allocation. In the ***Flexibility Notice,*** the Commission recognized that the unwanted emissions from terrestrial stations in the MSS will have to be carefully controlled in order to avoid interfering with GPS receivers.[344] The Commission specifically requested comment on whether limits for base stations similar to those s cified in section 25.213(b) for mobile earth terminals (METs) are adequate to protect GPS receivers? NTIA responded to our request for comment along with several other parties.[346] NTIA asserts that there are two issues that must be considered in the request for comment on the protection of GPS: (i) the frequency range(s) over which the emission level would be applicable; and (ii) whether the emission level established for a mobile earth station in an MSS system should be applied to ATC BSs and MTs.[347] Other parties support the application of the GMPCS limits to ATC BSs and MTs.[348]

125. Since the release of the ***Flexibility Notice,*** the Commission has adopted the *GMPCS* Order that requires MSS METs transmitting on frequencies between 1990 MHz and 2025 MHz conform to two restrictions: a wideband limit of -70 dBW/MHz, averaged over 20 milliseconds, on the EIRP density of the out-of-band emissions in the 1559-1610 MHz frequency range and a narrowband limit of - 80 dBW/700 Hz, also averaged over 20 milliseconds, on emissions in the 1559-1610 MHz frequency range.'" On NTIA's first point, then, the GMPCS Order expanded the frequency range from that

(Continued from previous page)
Rules ***Order,*** 15 FCC Rcd at 16132, ¶ 78. Our analysis presumes that ATC BSs are used only to provide service in areas where direct MSS signal reception otherwise would be available absent attenuation or blockage from natural or man-made structures in that area and that any relocation of incumbent terrestrial facilities necessary to protect direct MSS reception has been completed prior to ATC operations.

341 ***See infra*** App. C1 § 3.2

343 See ***infra*** App. C1 § 3.2

344 ***Flexibility Notice,*** 16 FCC Rcd at 15559 & 15565, ¶¶ 68 & 83

345 ***Id.***

346 See, ***e.g.,*** Letter from Fredrick R. Wentland, Acting Associate Administrator, Office of Spectrum Management, National Telecommunications and Information Administration to Donald Abelson, Chief, International Bureau, Federal Communications Commission, IB Docket No. 01-185 at 1 (Nov. 12,2002) (NTIA Nov. 12.2002 *Ex **Pane*** Letter).

347 ***Id.*** at 2. NTIA also urges the Commission to adopt out-of-band emission levels for the newly allocated L2 (1215-1240 MHz) and L5 (1164-1188 MHz) frequency bands for future GPS operations. ***Id.***

348 See Globalstar July I, 2002 *Ex **Pane*** Letter at 24.

349 ***Amendment of Pans 2 arid 25 lo Implement the Global Mobile Personal Communications by Satellite (GMPCS) Memorandum of Understanding and Arrangenrents.*** Report and Order and Further Notice of Proposed Rulemaking, 17 FCC Rcd 8903, 8936, ¶ 88 (2002) ***(GMPCS Order).*** Additionally, in a separate rulemaking proceeding for (continued....)

a. Intra-Service Sharing - Protection of Adjacent Channel and Adjacent Beam MSS Operations

130. Inmarsat has conducted substantial technical studies in response to MSV's ATC proposed use in the L-band. Inmarsat, in the first instance, is concerned about the potential interference MSV ATC operations could cause to its currently operating, Inmarsat-3 satellite network. Inmarsat is also concerned about the potential impact on its future generation network, Inmarsat-4.

131. Inmarsat argues that the Commission should not allow terrestrial use of the L-band because terrestrial uses would create unacceptable interference to Inmarsat's network and the services it provides, including vital safety services provided in the L-band.)" Inmarsat claims that the terrestrial services proposed at L-band would create five main interference problems:[361]

(1) The in-band signals of MSV's ATC mobile terminals (MTs) will cause unacceptable interference to the signals being received by the Inmarsat satellites;[362]
(2) The out-of-band emissions from MSV's ATC MTs will cause unacceptable interference to the signals being received by the Inmarsat satellites;[363]
(3) ATC base station (BS) in-band signals will create unacceptable interference into the receivers of nearby Inmarsat mobile earth terminals;[364]
(4) ATC base station out-of-band emissions would create unacceptable interference into the receivers of nearby Inmarsat mobile earth terminals;[365] and
(5) MSV's ATC operations will degrade the performance of its own space-based services and reduce the traffic-carrying capacity of the MSV space segment, thereby increasing MSV's need for additional L-band spectrum.[366]

We evaluate below MSV's reply[367] to each of Inmarsat's points and conclude that MSV's use of ATC consistent with the operational restrictions adopted herein will be capable of protecting the current and future generation Inmarsat satellite networks from unacceptable interference.

(i) Effect of ATC Operations on Inmarsat Satellites

132. Inmarsat and MSV currently share the L-band spectrum with three other GSO MSS systems in North America. The United Kingdom is the licensing administration for the Inmarsat space segment. The Commission has licensed fixed earth stations (the Land Earth Station or Gateway) and

[360] Inmarsat Comments at 2.

[361] *Id.* at 12-17.

[362] *Id..* Technical Annex § 3.1.

[363] *Id.,* Technical Annex § 3.2.

[364] *Id..* Technical Annex 5 3.3.

[365] *Id.,* Technical Annex § 3.4.

[366] *Id.,* Technical Annex § 3.5.

[3b1] *See* MSV Reply. Technical App. at 1-26

EIRP of no more than **25.5** dBW toward the horizon with an overhead gain-suppression requirement. ATC operators must locate their BSs at least **190** meters from any airport runway or aircraft stand area, including take-off and landing flight paths; a power flux of **-51.8** dBW/m^2 must be maintained at the same airport areas. ATC BSs and MTs must also meet the out-of-band emission levels required of GMPCS equipment to protect GPS operations in the **1559-1610 MHz RNSS** allocation. These rules are sufficient to protect other systems operating in or near the **2 GHz MSS** allocations, while providing **2 GHz MSS** licensees the operational and technical flexibility, should they choose to implement ATC as part of their **MSS** networks.

2. L-Band

128. In **1989,** the Commission licensed AMSC, now **MSV,** to construct, launch, and operate a three-satellite **GSO MSS** system in the upper portion of the L-band.'" Recently, the Commission modified **MSV's** license to operate in the Lower L-Band as **well.**[356] MSV is authorized, consistent with international coordination arrangements, to operate **on** spectrum throughout the entire L-band not to exceed a total of 20 **MHz** of spectrum?" **MSV** currently operates one satellite, which was launched in **1995** and is coordinated with the four other non-U.S.-licensed L-band satellite operators in the North America coverage area. Today, **MSV** offers land, maritime, and aeronautical **MSS,** including voice and data, to the United States and its coastal areas.

129. **MSV** seeks authority to operate an ATC as part of **its** current and next-generation mobile satellite systems in both the upper and lower **L-bands.**[358] Generally, **MSV** proposes ATC operations that are integrated with its satellite network. This would, according to **MSV,** enable co-channel reuse of the satellite service link frequencies in adjacent satellite antenna beams to provide coverage to areas where the satellite signal is attenuated by foliage or terrain and to provide in-building coverage.''' Customers using lightweight, handheld mobile terminals could communicate through both the satellite and the ATC base stations. The satellite path would be the preferred communications link, but if the user's satellite path is blocked, the communications link would be sustained via the fill-in base stations. When a **user** travels between the two coverage areas or between base stations, the network control facility would hand off the user among facilities as required to sustain a continuous communications link. For the public interest reasons set forth above, we establish here the technical service rules for L-band ATC operations. **MSV** and other L-Band operators authorized to provide services in the U.S. may now seek to modify their authorizations, consistent with the technical rules adopted here, to operate ATC in conjunction with their space station networks on the frequency assignments authorized and coordinated for **MSS.**

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[355] **See** ***MSV*** *License* 4 FCC Rcd at 6048-49, ¶¶ 53-59. The term "upper L-Band" denotes the 1545-1559 MHz and 1646.5-1660.5 MHz bands.

[356] **See** L ***Bund*** *MSS* Rules Order, 17 FCC Rcd at 2704. ¶ 1. The term "lower L-Band" denotes the 1525-1530 MHz, 1530-1544 MHz and 1626.5-1645.5 MHz frequency bands.

[357] The Administrations that are parties to the North American MOU include the United States, Canada, Mexico, Russia and the United Kingdom. Unlike most international coordination agreements that create permanent assignments of specific spectrum. the operators' assignments change from year to year based on their marketplace needs. Each of the five operators received less spectrum than it had requested for its system, and in some cases, less spectrum than it had been authorized to use by its respective administration.

[358] See, *e.g.*, MSV Dec. 16, 2002 Ex *Parte* Letter at !

[359] MSV Mar. 1, 2001 *Ex Parte* Letter at ii

separation (when they operate co-frequency). When the MSV and Inmarsat-4 satellites operate on a co-frequency basis, the Inmarsat-4 satellite receives interference power from all of the areas on the ground in which MSV is operating both MSS and ATC on a co-frequency basis. We first identify the most sensitive potential interference situation. Our worst case analysis examines the difference in the ATC MT interference power received by both the MSV satellite and the Inmarsat-4 satellite while assuming that several of the disputed technical parameters are the same for both the MSV and Inmarsat system.[373] The methodology of our analysis is described below.

136. Both the MSV and Inmarsat satellites will have a large number of antenna beams and each beam will be assigned to provide coverage to a specific area on the ground. Both satellites can serve the same geographic area by having the overlapping beams operate on separate frequencies. More than one beam from each satellite can operate on the same frequency, as long as there is Sufficient geographic separation (antenna beam discrimination) between co-frequency beams. To assess the interference to an Inmarsat beam operating on frequency F1 from all of the MSV beams operating on the same frequency, F1, we begin with the interference power that MSV's satellite is able to accept as self interference from its own ATC operations. This self interference is quantified as the power level that causes an increase in MSV's satellite receiver noise of 0.25 dB. We note this level of interference power as $P_{0.25}$. MSV has indicated that it will implement its ATC system so that it will have an average of 10 dB (i.e., a factor of 10) antenna discrimination between the MSV satellite receiver and the ATC transmitters operating on the ground near the F1 beam coverage area. The 10 dB power differential means that the actual interference power generated by ATC transmitters near the land area served by the F1 beams can actually be 10 times higher than the power that would increase the MSV receiver noise by 0.25 dB (i.e., $P_{0.25}$). The maximum interference power generated near the ground area served by the F1 beam is then proportional to $P_{0.25}*10$. This value ($P_{0.25}*10$) represents the interference power generated near MSV's beams operating on the same frequency as the relevant Inmarsat receiver.

137. We then determine how many F1 beams the MSV network will have. MSV states that its next generation satellite will have about 200 beams and will use a 7 fold frequency reuse plan. Therefore one can assume that, MSV will operate (200/7 = 28.6) 29 beams[374] each producing $P_{0.25}*10$ interference power and a total interference power on the ground proportional to $P_{0.25}*10*29$. This value is equal to 290 times $P_{0.25}$ or $P_{0.25}*290$. Because Inmarsat and MSV are sharing on a co-frequency, geographic-separation basis, this interference power is generated on the ground in areas not directly covered by the Inmarsat antenna beam in question. The power that enters the Inmarsat F1 beam depends upon the antenna discrimination between the Inmarsat antenna beam and the land areas in which the ATC interference power is generated. Calculations, in Appendix C2, Section 1.11, show that Inmarsat has at least 25 dB (a factor of 1/300) discrimination towards the land areas in which the interference from ATC is generated. So, the interference power potentially received by the Inmarsat F1 beam is capped at $P_{0.25}*290/300 = P_{0.25}*0.96$, or slightly less than the interference power received by MSV's satellite beams.

138. This qualitative analysis assumes two things: (1) MSV's noise power will increase no more than 0.25 dB and (2) certain system parameters will be the same for both the MSV and Inmarsat systems. Both assumptions are reasonable. First with respect to 0.25 dB noise-power cap, Inmarsat correctly notes that it is very difficult to accurately and repeatedly measure the noise increase in a satellite receiver of 0.25 dB. These types of measurements, however, are not required. As discussed in detail

[373] In a separate calculation, we do take into account the different values for the parameters associated for the different satellites.

[374] This parameter is discussed in more detail in App. C2, Section 1.13. The value used here is a worst case value.

authorized METs in the United States to access the Inmarsat system.[368] Canada is the licensing administration for the TMI space stations. The Commission has also authorized MSS mobile earth terminals (METs) in the United States to access the Canadian space stations.[369] We do not wish to create a situation where either of these systems would be incapable of serving the United States in accordance with their authorizations. We evaluate the potential for interference that MSV's ATC base stations and MTs would have on the Inmarsat system, in particular. TMI supports the ATC network as proposed by MSV.[370] NTIA analyzed the potential for interference to an Inmarsat satellite receiver based upon its use to support the Global Maritime Distress and Safety System (GMDSS) and the Aeronautical Mobile Satellite En-Route Service (AMS(R)S).[371]

133. MSV, TMI and Inmarsat are able to serve METs in the United States through the use of geographic and frequency separation. In the geographic regions served by both Inmarsat and MSV, for example, the satellites use different frequencies (i.e., frequency separation). Where the two systems serve different geographic areas of the United States, each of the systems may use the same frequencies (i.e., through geographic separation). In either scenario, the Earth station transmissions of each of the systems are received by the other's space station receiver. The more stations transmitting simultaneously on the Earth (or the greater the power level from a given station or group of stations), the greater the potential for interference to the other's space-station receiver. A space network receives interference from the other system in the form of "noise."[372] The analyses conducted by MSV and Inmarsat evaluate the amount of "noise" that the other system will receive from MSV's use of ATC. Inmarsat and NTIA are concerned that the MSV ATC system may cause interference to its MSS system. Based upon the analyses below and supplemented by the L-Band Technical Appendix (Appendix C2) we conclude that the interference potential is not significant and that ATC operations will not preclude Inmarsat from continuing to serve end users in the United States now or in the future. To this end we adopt several technical limitations on L-Band ATC, also discussed more thoroughly, below.

134. The parties to this proceeding have disagreed over the correct value to use for certain of the parameters required to analyze the potential interference from the proposed MSV ATC system to the Inmarsat satellites. By making the assumption that a number of these parameters take on the same value for both systems and analyzing the difference in effect of ATC interference between the two systems, it is possible to qualitatively determine which system will receive the greatest amount of interference. MSV proposes to operate its ATC system in a way that limits interference to its own satellite and we have developed an analysis to determine the magnitude of the corresponding interference that would be received by the Inmarsat satellites.

135. As noted above, both the Inmarsat and MSV systems share the spectrum through either frequency separation (when they operate in the same geographic regions) or through geographic

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[368] *See Comsat Authorization*, 16 FCC Rcd at 21702-07. ¶¶ 82-93

[369] *See Application of SatCom Systems Inc. and TMI Communications and Company. LP.* Order and Authorization, 14 FCC Rcd 20798, 20826-28, ¶¶ 63-75 (1999).

[370] MSV Comments at i

[371] See NTIA Nov. 12, 2002 *Ex* Pane Letter, Encl. 4

[372] By "noise," we refer to any type of interference that destroys the integrity of signals on a line. See Webopedia, Noise, *available at* <http://www.webopedia.com/TERM/n/noise.html> (last visited, Jan. 8, 2003). Radio waves, electrical wires, lightning and other frequency emitters can create noise. *Id.*

than, the interference power received by **MSV.**

139. We now conduct a quantitative assessment of the potential for interference between the two systems. This analysis determines the potential for interference to Inmarsat by evaluating the ratio of noise that would be produced by **MSV's MSS** operations (if fully loaded) to noise that would be produced by **MSV's** future **MSS** and ATC operations.[378] Our calculations first assume that **MSV** and Inmarsat provide service to the same geographic region but in different sub-frequency bands of the L-Band (i.e., they are sharing the L-band using frequency separation)[379] and, second, that **MSV** and Inmarsat use the same frequency assignments where their satellite footprints do not overlap (i.e., they are sharing through geographic separation).'" The results of our analysis show that the impact of future **MSV** operations, both ATC and **MSS,** on current and future Inmarsat satellites will be significantly less than the current sharing situation in the L-band, assuming a fully loaded current system.[381]

140. Our evaluation of potential interference to Inmarsat's networks is based on **MSV's** comparison of the percentage of increased noise that the Inmarsat networks (current and future) would experience from the currently operating **MSV MSS** system to the future generation **MSV** system incorporating ATC operations.[382] Our analysis assumes that the ATC system is implemented as a TDMA GSM system. It also assumes that ATC MTs are limited to an out-of-band emission level of -67 dBw/4kHz, that the link budget for ATC reserves a minimum of 18 dB for structural attenuation and that the vocoder is used to reduce potential interference."'

141. We conclude, based on the results of our analyses in Appendix C2, that the **MSV** satellite system will produce significantly less interference to other L-Band satellites than **MSV's** current **MSS** system. Furthermore, **MSV's** proposed ATC system will produce only a small portion of the increased noise that the **MSV** satellite will cause to other systems in the L-band. Specifically, for the adjacent band case (frequency separation), **MSV's** use of ATC would contribute to the Inmarsat-4 network (the worst case) less than one quarter of one percent of the noise that **MSV's** currently licensed **MSS** system would produce without ATC.[384] The noise received by Inmarsat-4 from **MSV's** future **MSS** and ATC operations, combined, would still produce less than one quarter of one percent of the noise that **MSV's** currently operating system would produce, assuming 90,000 simultaneously operating ATC METs in the future **MSV** system.[385] For the adjacent beam case (geographic separation), **MSV's** use of ATC would

[378] See App. C2. Evaluation of L-Band ATC Proposals, Tables 2.1.1.A – 2.1.1.D

[379] *See infra* App. C2 at Table 2.1.1.A.

[380] *See infra* App. C2 at Table 2.1.1.C. Sharing through geographic separation does not necessarily imply "true" adjacent sharing. The "adjacent beam" with which ATC sharing is feasible must have sufficient beam isolation for sharing with MSV's MSS operation to occur.

[381] See App. C2 at Tables 2.1.1.B and 2.1.1.D (summarizing the results of our calculations).

[382] See MSV Jan. 11, 2002 Ex *Pane* Letter at 22.

[383] *See infra* App. C2 § 1.3.5.

[381] See *infra* App. C2 at Table 2.1.1.B. It is emphasized that the percentages of increased noise do not take into account MSV's proposed use of variable rate vocoders. For the assumptions used in our analyses. see infra App. C2 § 1.

[385] *See infra* App. C2 at Table 2.1.1.B

below, limiting the total number of base stations operating on a specific frequency effectively limits the potential interference noise at the **MSV** satellite to **0.25** dB. Second, with respect to the similarity in system parameters, both the **MSV** and Inmarsat systems will, in fact, respond similarly in similar situations or Inmarsat would gain benefit with respect to **MSV** on the following:

- ***Average Power Reduction*** - any reduction in average transmit power of the ATC transmitters whether in power control, vocoder factor and voice activation factor would affect the interference power received at both satellites equally.

- ***Outdoor Blockage*** – we agree with Inmarsat that outdoor blockage will reduce the interference power towards the Inmarsat satellite by about 3 dB, or 50%; however, because the **MSV** satellite will be, on the average, seen at a higher elevation angle than the Inmarsat satellites, we conclude that outdoor blockage will reduce the interference power more towards the Inmarsat satellites when compared with the interference received at the **MSV satellite.**[375]

- ***Polarization Isolation*** - both **MSV** and Inmarsat satellite receivers use the same type of polarization, so any reduction in average transmit power of the ATC transmitters caused by this affect would reduce the interference power received at both satellites equally.

- ***Free Space Lass*** – the average distance between CONUS and the **MSV** satellites will be slightly less than the average distance between CONUS and the operational Inmarsat satellites, so the propagation loss from the ATC transmitters to the **MSV** satellite will be slightly less than the propagation loss from the ATC transmitters to the Inmarsat-4 satellite. This differential means that the interference at the **MSV** satellite would be slightly greater than at the Inmarsat-4 satellite due to this parameter.

- ***Satellite Mainbeam Gain*** – both Inmarsat-4 and the next generation **MSV** satellite will have the same main beam gain of 41 dBi.

- ***Satellite Receiver Noise Temperature*** - the Inmarsat satellite receiver noise temperature of **600K**[376] is higher than that of the **MSV** satellite receiver of **450K.**[377] Therefore, the effect of a given low-level of interference power will be somewhat less noticeable to the Inmarsat-4 receiver than it would be to the **MSV** receiver.

In summary, this qualitative evaluation of potential interference from **MSV's** ATC **MT's** to the Inmarsat-4 satellite, assuming that the parameter values listed above would be equal for both the **MSV** and Inmarsat satellites, removes the areas of dispute over the parameter values estimating the worst case potential interference situation. The results show that one should expect the interference power received by an Inmarsat-4 beam operating cc–frequency with **MSV's** ATC network to be about the same, or less

[375] We use the term "outdoor blockage" to describe the radiofrequency attenuation that occurs when an obstacle interrupts the link-of-sight path between a transmitter and a satellite receiver. "Outdoor blockage" is distinct from "structural attenuation." We use the term "structural attenuation" to mean the signal attenuation caused by transmitting to and from mobile terminals that are located in buildings or other man-made structures that limit the transmission of radiofrequency radiation. **See** *supra* n.229. We use the two terms to distinguish between these two concepts and to avoid the confusion that might result from using the various terms that commenters employ.

[316] Inmarsat Comments, Technical Annex at Table 3.1-1

[377] MSV Reply, Technical App. at **4.**

144. MSV also requests the ability to provide ATC operations in conjunction with its currently operating first-generation MSS network.[390] According to the system characteristics for the first-generation MSV system[391] and the currently operating Inmarsat network,[392] the next-generation satellites will be about 12 dB more sensitive to interference than the current satellite systems. Since the first generation satellites are less susceptible to interference from ATC operations as proposed than the second-generation satellite systems are, the limitation on the number of ATC base stations (1725) combined with the limitation on the number of ATC base stations (863) during the one-time, 18-month, phase-in period is more than sufficient to protect the current generation satellites that are in operation. Therefore, we will permit ATC operation in conjunction with first-generation satellites so long as the rules in place to protect next-generation satellite systems are met.

145. Furthermore, MSV urges the Commission to minimize the restrictions on its planned ATC network deployment to the extent possible where its operations are not co-channel with another MSS system's operations. They argue that such situations require no restrictions and that if the amount of isolation between the cochannel operations with other MSS satellites is greater than that used to develop any restrictions, then those restrictions on co-channel operations should be relaxed accordingly.[393] Above, we discuss one such restriction. By limiting the number of base stations carriers permitted to operate on a 200 kHz channel, the noise increase to the MSV satellite is limited to 0.25 dB. We find this restriction is necessary because we are not convinced, based on the record, that MSV can accurately and repeatedly measure this low level of interference at their satellite and we believe that this limitation on MSV's satellite noise increase will provide for MSS ancillary terrestrial service and limit the potential for interference to other co-frequency MSS operators.

146. In addition, MSS operations in the L-band are to be conducted according to the frequency arrangement arrived at under the 1996 Mexico City MOU. The MOU is a confidential frequency sharing arrangement that was intended to be revisited annually by the operators until the long-term requirements of all parties are satisfied and a final agreement among the Administrations is reached. At this time, it is unclear which channels will be occupied by which MSS operator in the future because the MOU frequency arrangement is not static. Even in a static environment, parties do not always agree on the precise types of operations that constitute co-channel interference. In a dynamic environment, such as L-band MSS, we are concerned that determining the cochannel interference that arises from fluctuating and geographically discrete operations might require our continued oversight over many years with no foreseeable end.

147. For these reasons, we decline to adopt rules that would relax interference protections to other MSS licensees based on MSV's assumption that the number of co- and adjacentchannel operations in the L-band is limited. To this end, we limit MSV to 1725 base stations carriers on any given 200 kHz channel. We will, however, entertain case-by-case requests by MSV to deploy more base stations than permitted by this rule upon a showing that there would be no increase in co-channel or adjacent channel interference to other MSS providers and that the MSS licensee's satellite service would not be affected

[390] MSV Dec. 16, 2002 Ex Pane Letter at I

[391] MSV Reply, Technical App. at 4.

[392] Inmarsat Comments, Technical Annex at Table 3.1-1

[393] See. *e.g.*, Letter from Lon Levin, Vice President, Mobile Satellite Ventures, to Marlene H. Dortch, Secretary, Federal Communications Commission (Jan. 16, 2003) (MSV Jan. 16, 2003 Ex Pane Letter).

contribute to the Inmarsat-4 network (the worst case) about one tenth of one percent of the noise that **MSV's** currently licensed **MSS** system would produce without **ATC.**[386] The noise received by Inmarsat-4 from **MSV's** future **MSS** and ATC operations, combined, would produce only a little more than three percent of the noise that **MSV's** currently operating system would produce.)"

142. In sum, both of our analyses for ATC operations over **MSV's** next generation satellite network include the effects of out-of-band and adjacent-beam sharing. In general, the Inmarsat satellites appear to have more discrimination to ATC MT operations, either via antenna beam discrimination or out-of-band **roll-off,**[388] than the **MSV** satellite. As a result, the noise-floor of Inmarsat's satellite receivers would be significantly less affected by **MSV's MTs** than **MSV's** own next-generation satellite receivers. To protect co-frequency and adjacent frequency **MSS** operations in the L-band from ATC operations. we adopt several rules that are based on the ATC system operating as a TDMA **GSM** system. Under these rules, the ATC handsets must use a **1** watt peak **EIRP** and must implement both a power control of 30 dB in **2** dB steps and a vocoder algorithm that is capable of reducing the time averaged power by **7.4** dB. Specific out-of-band emissions are adopted for the **MTs**. In addition, the number of base stations permitted to operate on a **200 kHz** channel is limited to **no** more than **1725.** An **MSS** licensee shall also reserve a minimum of 10 dB in its link budget for power control within its ATC network, as is within the range of standard engineering practice to overcome the effects of structural attenuation. **In** addition, **MSS** licensees shall not extend the coverage area of any ATC cell beyond the point where an ATC MT could operate at the edge of coverage of the ATC cell with a maximum EIRP of -10 dBW.

143. We believe we have accurately analyzed the potential for interference from **MSV** ATC transmitters to Inmarsat; however, we recognize that both Inmarsat and **MSV** reach somewhat different conclusions **on** the circumstances under which interference would occur. Recognizing the importance of providing adequate interference protection to Inmarsat, and in particular the safety-related services it provides to ships and aircraft, we will permit **MSV** to operate only **50%** of its permitted **base** stations per channel (*viz.*, **50%** of **1725, or 863** stations) during an initial 18-month, phase-in **period.**[389] This restriction will be equivalent to imposing an additional **3** dB of protection for Inmarsat during initial deployment. The 18-month phase in period will permit Inmarsat and **MSV** to study whether any interference has resulted, giving enough time to observe any seasonal variations and to analyze the results of the study. After the 18 month period, **MSV** may operate all **1725** base stations per channel. While we adopt rules to prevent harmful interference, we do not intend to prohibit L-band **MSS** operators from agreeing to less restrictive limitations **on MSS** ATC. We support and encourage private negotiations among interested parties in the band and will consider waiver requests of these rules based on negotiated agreements.

386 **See** *infra* App. C2 at Table 2.1. I.D. It is again emphasized that the percentages of increased noise do not **take** into account MSV's proposed use of variable rate vocoders.

387 **See** *infra* App. C2 at Table 2.1.1.D.

388 We note that Inmarsat-4 will have approximately 25 dB of antenna discrimination towards the ATC transmitters compared with MSV's planned 10dB average discrimination in the adjacent beam situation. **In** the adjacent band situation, the ATC transmitter will have at least 50 dB out-of-hand roll-off to the Inmarsat satellite while the MSV system receives the transmissions in-band.

389 We intend the initial 18-month, phase-in period to occur only once. For example. if the phase-in period were met during the life of MSV's current-generation satellite system, the deployment MSV's next-generation satellite system would not restart a new phase-in period.

value of –60 dBm.[399] The -60 dBm value is considerably more conservative (by 15 dB) than the threshold value of –45 dBm measured by MSV for an Inmarsat mini-M terminal.[400] Assuming a -60 dBm threshold value for receiver overload should be sufficient to take account of Inmarsat's MET receiver susceptibility to overload interference principally because a -50 dBm value is the standard for airborne terminals.[401] Furthermore, we use a value of –12.5 dB as the amount of antenna discrimination between the base station antenna and Inmarsat's MET at 100 meters. Recommendation ITU-R F.1336 indicates that it is possible to have as much as 24 dB of antenna discrimination between an ATC base station antenna and a MET located 100 meters from the base station.[402] We therefore believe that the 12.5 dB value proposed by MSV in its analysis is reasonable to use in ours. Last, we assume a value of 86 dB of attenuation due to path loss in our analysis of overload interference. The 76 dB value proposed by Inmarsat is close to the calculated free-space-loss if the antenna is located on a 50-meter tower 100 meters from the MET. We base our use of 86 dB on a program formulated by the National Institute of Standards and Technology, which compares various propagation models and produces a range of expected loss from 80 to 94 dB due to path loss for this situation.[403]

152. Taking the above factors into account, our analysis indicates that any signal loss between an MSV ATC base station and the Inmarsat MET greater than approximately 86 dB should be sufficient to protect an Inmarsat MET from overload interference in an urban environment.[404] Indeed, all of the propagation models, except free-space, predict an urban environment loss greater than 86 dB at virtually all locations, even most of those within 100 meters of the MSV base station. The actual loss is a strong function of the surrounding environment and the propagation model used. It is possible that in limited situations, particularly in urban settings, the free-space loss between an Inmarsat terminal and a base station may be less than 86 dB. Nevertheless, all of the urban and city propagation models used predict a loss significantly higher than the free-space model and we do not expect overload interference from ATC base stations to Inmarsat METs in an urban environment to be problematic. We do not anticipate that many ATC base stations will be deployed outside of urban areas and the probability of unacceptable interference to METs outside of urban areas will be low. Although there may be a few instances where an Inmarsat MET receiver will be overloaded by a nearby ATC base station, we provide further protection by adopting section 25.253(c)(2), which limits ATC base stations to a maximum EIRP level of 14.1 dBW toward the horizon to protect other MSS system METs from overload interference.[405]

153. Though in these cases, occasional, limited periods of saturation of Inmarsat's terminals operating in these areas could occur, we expect this to occur rarely. This possibility must be considered in light of the already limited usage of L-Band terminals in urban settings due to line-of-sight interruption between the Inmarsat terminals and the satellite due to buildings, trees and other obstructions. As discussed above in this Order, we believe that the use of an ATC system in addition to a MSS system is a

399 *See infra* App. C1 § 1.2.4.

400 *See* MSV Reply, Technical App. at 14.

401 See Boeing April 8, 2002 *Ex Parte* Letter, Technical Analysis at 10.

402 *See infra* App. C2 at Figure 1.8.A.

403 *See infra* App. C2 § 1.6.

404 *See infra* App. C2 § 2.2.1.A.

405 *See infra* App. B (adopting new rule 47 C.F.R. § 25.253(e)(2)).

beyond that permitted in the rules.[394] Any request should also indicate whether or not all affected parties to the 1996 Mexico City MOU agree to the proposed additional terrestrial operations.

(ii) Effect of ATC Base Stations on Inmarsat MES

148. Inmarsat raised concerns about the potential for interference that MSV's ATC base stations could cause to its MET receivers?" This potential for interference may exist in four ways: (1) overload[396] of the Inmarsat land-based MET receiver when it is near an ATC base station; (2) out-of-band interference to the Inmarsat land-based MET receiver from ATC base stations; (3) aggregate interference to an airborne Inmarsat MET receiver from a large number of MSV base stations visible from an aircraft; and (4) overload of an airborne Inmarsat MET receiver from an ATC base station. We evaluate each of these potential interference situations. Our evaluation assumes that the ATC base. stations must operate with no more than 19.1 dBW per carrier and no more than 3 carriers per cell. The base station must use a left-hand-circular-polarization (LHCP) antenna with 16 dB of peak gain and an overhead gain suppression of 40 dB outside of the main lobe of the antenna. The EIRP towards the horizon must be limited to 14.1 dBW per carrier and the base station will implement a power control algorithm of 30 dB in 2 dB steps. We examine the potential for interference from MSV's base stations in these four cases and determine it to be minimal.

149. ***Inmarsat MET Receiver Overload.*** Inmarsat claims that if an MSV base station is operating within 100 meters of one of its METs, the MET will receive a signal that is significantly above that which would saturate or overload its MET receiver. Inmarsat assumes in its analysis that MSV will have 25 carriers per ATC cell, that its MET will overload or saturate when exposed to –120 dBW of interfering power (or –90 dBm), that the MSV base station antenna discrimination would be 0 dBi when the MSS terminal is 100 meters from a base-station antenna (*i.e.*, there would be no antenna discrimination), and that the signal attenuation from the base station to the MET would be free-space loss (*i.e.*, no blockage from buildings or other sources is taken into account)."'

150. In contrast, MSV states that the maximum number of carriers per ATC cell in its design is only 3, that it has tested a representative ensemble of satellite terminals to determine actual, as-built desensitization/overload thresholds that demonstrates the saturation level to be –45 dBm, that, in practice, its base station antennas will typically be on a tower or building and the angle from the base-station antenna main-beam to the MET receiver would lead to a discrimination value of –12.5 dB, and MSV uses the Walfisch-Ikegami (WI) propagation model which predicts 94 dB of loss versus the 76 dB of free space loss assumed by Inmarsat.'"

151. In our analysis of ATC base stations overloading Inmarsat MET stations, we use three camers per cell in accordance with MSV ATC design parameters. We also assume a receiver saturation

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[394] See *generally* App. B (adopting 47 C.F.R. § 25.253)

[395] Inmarsat Dec. 6, 2001 *Ex Pane* Letter at 7.

[396] Receiver "overload" or "saturation" occurs when the input total power is sufficient to drive the receiver from its normal, operational linear state, into a non-linear state. The resulting non-linear state results in the distortion of the desired input signals and, for severe overload, the inability of the receiver to operate.

[397] Inmarsat Comments. Technical Annex at Section 3.3.1

[398] MSV Reply, Technical App. at § III

polarization discrimination.

157. Based on our analysis of out-of-band interference from ATC base stations to Inmarsat MET receivers, and taking all of the above factors into account. we conclude that an Inmarsat MET could experience **a** noise increase of approximately **3%.** This is in contrast to **600,000%** calculated by Inmarsat in its **analysis.**[412] The Noise to Interference ratio (N/I) that corresponds to **3%** is **15** dB (i.e., the noise produced by the ATC base station in the Inmarsat MET will be **15** dB below the noise floor of the receiver) and the Inmarsat MET receiver performance should not be adversely affected by the **MSV** base station. This situation should not be problematic. As discussed above in this Order, we believe that a more efficient use is made of the spectrum by having both ATC and MSS operations in the urban environment rather then the **MSS** operations alone. We adopt an ATC Base Station out-of-band emission limit of **-57.9** dBW/MHz in section **25.253(b)** to protect other **MSS** system METs from ATC out-of-band **interference.**[413]

(iii) Effect of ATC on Airborne Inmarsat Terminals

158. ***Out-of-Band Interference to Airborne Inmarsat METs.*** Inmarsat performed an analysis to assess the possibility of an airborne Inmarsat terminal receiving interference from a large number of **MSV** ATC base stations at various elevation angles while the aircraft is flying at a worst-case altitude of **302** meters (1000 **feet).**[414] From an altitude of 302 m, a circular area approximately **164** kilometers (100 miles) from edge-to-edge[415] is visible from the aircraft. Inmarsat's analysis conservatively assumes that there would be **1000** ATC base stations in this visible area and Inmarsat refers to ITU-R Recommendation **F.1336**[416] as evidence that, at best, an antenna isolation of **only approximately** 10 dB is available from any one of the ATC base station antennas within that visible **area.**[417] We compare Inmarsat's analysis with **MSV's** assessment of the potential for interference to Inmarsat airborne receivers.[418]

159. One important factor in analyzing the potential for interference, however, is the amount of isolation expected to occur between the aircraft terminal and the ATC base stations in the area visible to the aircraft. We developed such a model to determine the amount of isolation that should be expected based on Inmarsat's parameters. Specifically, our model randomly distributes 1000 potentially interfering ATC base station transmitters across the area visible to the aircraft flying at an altitude of **302** meters. It

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412 *Id.*

413 *See infra* App. B (adopting new rule **47** C.F.R. § 25.253(c)).

414 Inmarsat Comments, Technical Annex, § 3.3.2.

415 An MSV Base station antenna with **a** height of 30 meters is visible from an aircraft at an altitude of 302 meters at a distance of 81.9 kilometers.

416 ITU-R Recommendation F.1336, ***Reference Rndiorion Patterns of Omnidirectional, Sectoral and Other Antennas in Point-To-Multipoint Systems for Use in Sharing Studies In The Frequency Range from 1 GH: to about 70 GHz, available at*** <http://www.itu.int/itudoc/itu-r/archives/rsg/1998-00/rwp9d/43844.html> (last visited. Jan. 10.2003).

417 Inmarsat Comments, Technical Annex, § 3.3.2. Inmarsat compares its assumption that MSV's ATC base station antennas will have only 10 dB of overhead antenna discrimination to the aircraft versus MSV's assumption that a maximum isolation of 40 dB is achievable.

418 MSV Jan. 11, 2002 *Ex Parte* Letter at *22-25;* MSV Reply. Technical App. at *22,*

more efficient use of the spectrum than the use of MSS systems alone.

154. Certain open areas such as airports and harbors, even within an urban environment, offer large building-free areas where signal propagation from a base station is best characterized as free-space propagation. We have analyzed these areas and we adopt limits to protect airborne and maritime Inmarsat terminals in these locations.[406] Maritime Inmarsat terminals, such as the Inmarsat-B terminal, utilize larger antennas than the typical airborne Inmarsat terminal. The use of different antennas means the protection criteria for airports will differ from the protection criteria for harbors. Based upon calculations contained in Table 2.2.1.3.A of the L-Band Technical Appendix C2, the MSV base station should be placed 470 meters from a runway or aircraft stand area. This assumes that two base stations are visible to the aircraft. Additionally, the ATC base station shall produce a power flux density at the edge of the airport of no more than -73.0 dBW/m^2 per 200 kHz. We adopt section 25.253(c)(3) to codify these limits on ATC base station emissions near airports to protect aircraft earth stations. In the case of Inmarsat terminals operating on boats and ships, we find that a separation distance of 1.5 km (0.9 miles) is required for the protection of the Inmarsat-B terminal from an ATC base station if there is a clear view of the water from the base station. We adopt this separation distance in our Rules. Additionally, a pfd of -64.6 dBW/m^2 per 200 kHz shall be maintained at the waters edge of any navigable waterway. We, therefore, adopt section 25.253(c)(5) to codify these limits on ATC base station emissions near harbors and navigable waterways to protect maritime Inmarsat terminals[407]

155. *Out-of-Band Interference to* Inmarsat *METs*. Inmarsat also expressed concern about the possibility of out-of-band interference from MSV's ATC base stations to its MET receivers.[408] In MSV's analysis, it assumes an out-of-band suppression level of -57.9 dBW/MHz (-118 dBW/Hz) for its base stations based on Ericsson's commitment to designing MSV's equipment to meet that value.[409] MSV assumes, as in the overload case, that there will be 12.5 dB of antenna discrimination between the ATC base station and the Inmarsat MET. It also assumes 8 dB of polarization isolation between the base station antennas and the MET antennas used by Inmarsat!" Alternatively, Inmarsat assumes an out-of-band emission value of –27 dBW/200 kHz (-80 dBW/Hz), no antenna gain discrimination from the ATC base station to the Inmarsat terminal, and 3 dB of polarization isolation?"

156. The details of both MSV's and Inmarsat's analyses are compared in Appendix C2, Table 2.2.1.2.A. The table also contains the assumptions we used in analyzing the impact of out-of-band interference. We use the out-of-band emission attenuation value that MSV proposed and which its equipment manufacturer is committed to meeting. For the reasons discussed in the receiver overload section, above, we use a –12.5 dB value for antenna discrimination between the ATC base station and the Inmarsat MET and assume a propagation loss between the transmitter and receiver in an urban environment of 86 dB of attenuation. Since the two systems will use orthogonal circular polarized antennas, and both antennas are viewed outside of their main beams, we do not assume a large value of

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[406] *See infra* App. C2 § 2.2.1.B.

[407] See *infra* App. B (adopting new rule 47 C.F.R§ 25.253(e)(5)).

[408] Inmarsat Comments, Technical Annex, § 3.4.

[409] See MSV Jan. 1 I, 2002 *Ex* Pane Letter at 26; MSV Comments at Ex. E

[410] See MSV Jan. 11, 2002 *Ex Porte* Letter at 26.

[411] Inmarsat Comments, Technical Annex, Table 3.4-1.

By more advanced spacecraft, Inmarsat is specifically referring to those having higher antenna gains and higher gain-to-receiver noise temperatures (G/T) ratios. We disagree. The advance in spacecraft technology to which Inmarsat is referring is due to advances in technology that generate high-gain, multiple-beam antenna patterns. There are two situations to consider: (1) in-beam/out-of-band and (2) out-of-beam/in-band (or co-frequency). In the first situation, isolation between the two systems is provided by the transmitter out-of-band specifications. If two different MSS systems cover the same geographic area with two different generation satellites, the newer generation system with the higher gain antenna will not necessarily suffer a larger degradation in receiver noise floor. Table 2.1.1.A of Section 2.1 of Appendix C2 analyzes this co-beam, adjacent channel case and shows that the MSS terminals of the fully loaded current-generation MSV system will cause a 3.5% increase in noise temperature of each beam of the current generation Inmarsat MSS system that has four beams covering the United States. For the next-generation system with 100 beams covering the United States, the increase in receiver noise is 3.8% or approximately the same. In this case, the next-generation system has a larger number of smaller antenna beams (100 vs. 4) each with appreciably higher gain (41 dBi vs. 27 dBi). While the next generation system has higher gain, which makes each individual MSV MSS terminal result in a higher increase in interference, the area covered by each beam is smaller. Because the beam is smaller, it encompasses fewer MSS terminals and the two effects balance resulting in the approximately same total noise for the current and next generation systems.

163. Table 2.1.1.C of Appendix C2 addresses the second case where the intersystem isolation is created by the spacecraft antenna. The Table indicates that the interference level does, in fact, go up as the antenna gain increases. Two of the current MSV MSS terminals in the side-lobes of the Inmarsat 3 satellite antenna will increase the Inmarsat receiver noise level by 58.6%. Because of the higher satellite antenna gain on the Inmarsat 4 satellite, the same MSS terminals in the side lobes of the Inmarsat 4 satellite, antenna increase the receiver noise by 794%. However, using the next generation MSV MSS terminals, the increase in the receiver noise levels is reduced to 1.8% and 23.9% respectively for Inmarsat-3 and Inmarsat-4. This indicates that, considering only the MSS operations, there will be a limit to the differences in technology between the systems that can share on a co-frequency basis. If one system implements a very sensitive satellite system ahead of another MSS system the new system may be at a disadvantage. With respect to the ATC, we note that in the case of both Inmarsat-3 and Inmarsat-4, the calculated noise floor increase from ATC operations is significantly less than from the MSV MSS operations. The issue, therefore, is not that ATC could constrain the future development of the MSS, but that the imbalance between current and future MSS systems that are operating on a co-frequency basis could end up constraining antennas used on the most advanced MSS system.

164. Appropriate Technical Factors for Calculating ATC Limits in the Uplink *Band.* Inmarsat states that the ATC should be limited so that the increase in the Inmarsat receiver noise floor is no more than 1%, and a 20 dB margin 'to allow future spacecraft technology development' should be used in calculating this 1%.[426] We are not aware any national or international requirement to limit the interference to or from any system to an increase in system noise of 1%. Historically, a 6% increase in a system's noise temperature has been used as a coordination trigger for space systems. That is, if the interference power from one space system causes a noise temperature increase of less than 6% in another space system then coordination is not required. However, as Inmarsat has shown the typical increase in noise level of the Inmarsat 3 satellite, resulting from the L-Band MSS coordination process, is on the order of 29%. which is much higher[427] than the typical coordination trigger of 6%.[428] Inmarsat also

[426] Id. at 17.

[427] In a coordination process system operators are not bound by any particular inter-system interference limit.

then calculates the line-of-sight distance from each visible base station to the aircraft, sums the propagation loss between each base station and the aircraft antenna, yielding the aggregate ATC base station signal attenuation level (i.e., isolation factor). Our model calculates an expected isolation of 105.1 dB between an airborne Inmarsat MET and the population of ATC base stations visible to the aircraft.[419] Our interference analysis also uses MSV's out-of-band suppression value of 68 dB in the part of the frequency band used by Inmarsat and it assumes that an average gain of 0 dB from the Inmarsat antenna will be available because the antenna will be mounted on the upper surface of the aircraft.

160. Our results show that there is a potential increase in the Inmarsat receiver noise floor of approximately sixteen percent[420] as opposed to MSV's calculated value of five percent.[421] However, a better criterion to use is the interference-to-noise ratio (I/N) at the receiver. According to our calculations, the worst case I/N is approximately -8 dB, whereas MSV's I/N works but to be -13 dB. In other words, the interference is 8 dB less (or reduced by a factor of 9) than the self-inherent noise of the Inmarsat airborne receiver. This level of added noise would not hinder the operation of the airborne receiver. Moreover, the situation improves dramatically as the aircraft altitude is increased. For example, raising the altitude to 5000 ft increases the I/N ratio to approximately -17 dB. At this point the interference is negligible. To ensure the protection of airborne METs of other MSS systems, we adopt section 25.253(e), which requires a maximum overhead gain suppression of 40dB.

161. *Inmarsat Airborne Receiver Overload.* Inmarsat also contends that there exists the possibility of an airborne Inmarsat terminal being overloaded by ATC base stations!'* Our analysis of potential saturation of airborne Inmarsat terminals again uses Inmarsat's parameters of 1000 base stations visible to a low-flying aircraft at 302 meters (1000 feet) and that the same isolation factor of 105.1 dB would result. We use the –50 dBm receiver overload threshold for the airborne terminals.[423] Based on these input parameters, we conclude that there exists 10 dB of margin against receiver overload from ATC base stations. As indicated for the out-of-band case, however, as the altitude of the aircraft is increased the margin against saturation increases significantly. Given the conservative nature of our model (e.g., antenna gain patterns, 1000 base stations in the visible area,[424] the lowest acceptable aircraft altitude, and no account of terrain shielding), overload from ATC base stations is not expected to be an issue for airborne Inmarsat terminals.

(iv) Other Inmarsat Arguments

162. *Constraint of Future Development of MSS.* Inmarsat claims that adopting ATC limits designed to protect only today's spacecraft would preclude more advanced spacecraft from operating!"

[419] In comparison, MSV calculates an isolation factor of 101.6 dB. *See* MSV Reply, Technical App. at 24.

[420] See *infra* App. C2 § 2.2.3.

[421] MSV Reply, Technical App. at 23

[422] Inmarsat Comments, Technical Annex § 3.3.2

[423] See *infra* App. C2 at Table 2.2.3.2.A.

[414] In developing this computer model, we assumed maximum of 1000 base stations was assumed. While we realize that the area visible to an aircraft increases with altitude, we kept constant the number of base stations at 1000. This number of base stations was felt to be conservative.

[425] Inmarsat Nov. 6,2002 *Ex Parte* Letter, Attach. I at 14-15

measure such a small increase in the noise floor of a satellite receiver due solely to ATC transmissions. Factors such as equipment inaccuracies, changes in downlink atmospheric losses, the difficulty of separating the ATC emissions from multiple L-Band sources within the MSV system and the effect of having multiple L-Band MSS systems contribute to the impracticality of this technique. It is possible, however, to limit the maximum number of ATC transmitters that can operate at one time. from the United States temtory and we take this approach. We adopt a limit of 1725 Base Stations that can be deployed to operate on any 200 KHz channel in section 25.253(c) to achieve the same effect.

168. Inmarsat maintains that all co-frequency transmitters within the affected side lobes of its MSS satellites' uplink beams must be constrained, and that this includes any ATC transmitters in the US, Canada, Mexico and Central and South America.[436] ATC transmitters greater than approximately 3 or 3% satellite beam-width, away from an Inmarsat beam will be decoupled from the beam in question by at least 30 dB and will not contribute substantially to co-channel interference in that beam.[437] Additionally, as shown by Inmarsat, beams within approximately 2 to 2 ½ beam-widths of the coastline of the United States, Canada, Mexico, Central America and the Northern pan of South America are constrained from Inmarsat co-channel operations because of the MSS operations of other L-Band MSS systems.[438] This potentially leaves a small set of Inmarsat beams that could potentially be affected by ATC co-frequency operations. However, as we have stated, if the interference power generated by the ATC is significantly less than that generated by the co-frequency MSS operations then there should not be an interference issue.

169. ***Appropriate Technical Factors for Calculating ATC Limits in the Downlink Band.*** Inmarsat enumerates a number of technical factors it believes should be taken into account in calculating limits for any ATC operation for protection of an Inmarsat receiver from saturation in the downlink band.[439] This subject is treated in detail in the Technical Appendix C2.[440] Inmarsat also addressed what it calls "appropriate"[441] technical factors to protect an Inmarsat MET from unwanted emissions. Again this subject is treated in the Technical Appendix C2. As discussed in detail in the Appendix C2, Section 1, we have considered Inmarsat's assumptions, as well as MSV's and we can not agree with all of Inmarsat's proposed technical factors.

b. Inter-service Sharing - Protection of Adjacent Service Systems

170. Several services are allocated spectrum that is between and adjacent to the 1525-1559 MHz and 1626.5-1660.5 MHz L-band MSS spectrum. Between the frequency bands, the AMS(R)S and aeronautical terrestrial services are allocated spectrum in the upper L-band, and the GMDSS and Search and Rescue Satellite (SARSAT) downlinks operate in portions of the lower L-band. At the top edge of the uplink MSS band, above 1660 MHz, the Radio Astronomy Service is allocated spectrum within and adjacent to the L-Band spectrum. Below the 1626.5 MHz MSS band edge, Big LEO MSS systems

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[436] Inmarsat Nov. 6, 2002 *Ex Pane* Letter at 11.

[431] Id. at 7.

[438] *See* Inmarsat Sept. 12, 2002 *Ex Pane* Letter at I0.

[439] Inmarsat Nov. 6, 2002 *Ex Pane* Letter at 19.

[440] *See infra* App. C2 § 2.2.1.A.

[441] Inmarsat Nov. 6, 2002 *Ex Pone* Letter at 20.

contends that, without prejudicing the L-Band **MSS** coordination process. the ***same*** increase in Inmarsat **4** system's noise temperature can be expected from **MSV's** next generation **MSS** operations.[429] We conclude that as long as the increase in receiver noise from the **ATC** is significantly less than the increase in noise resulting from the **MSS** operations, that sharing is feasible. and we disagree with Inmarsat's suggested 1% limit. Inmarsat also suggests that a 20 dB margin be used in determining the increase in noise to an **MSS** satellite receiver from **ATC** to allow for future spacecraft technology development. **As** discussed above, we conclude that the **MSS** operations are the limiting factor in co-frequency sharing between **MSS** systems and not the **ATC** operations. Therefore, no specific margin is required.

165. **MSV** argues that it is possible to use a specific technique for measuring the **ATC** emissions being received at its spacecraft.[430] **MSV** asserts that it can use its satellites to monitor the level of aggregate interference caused by its terrestrial communications services to its satellite system. **To** be assured that its own network will inter-operate with maximum efficiency, **MSV** indicates that its system will be deployed with built-in monitoring capabilities to assess on a real-time basis the terrestrial signal that is generated by MSV's terrestrial operations.'" Based on inputs from monitoring, closed loop feedback control will be imposed on the terrestrial network such that the aggregate terrestrial signal being measured by **MSV's** satellites does not approach potentially harmful limits. Moreover, **MSV** indicates that it is prepared to monitor and report the aggregate signal power being received at its satellites from its mobile terminals operating in the terrestrial mode, and limit those operations accordingly to the extent necessary to protect its own satellite operations and those of Inmarsat!" This technique would permit measurement of the aggregate terrestrial uplink power at the **MSV** satellite. **MSV** states that the techniques that it can **use** are proprietary because of possible patentable ideas. But a total increase in noise power at the satellite receiver of 0.25 dB, **MSV** states, can be measured.

166. Inmarsat opposes the use of "aggregate uplink **PFD** limits" as a way of constraining L-band emissions!" It contends that it would be difficult to apportion the **PFD** among various countries in view of the **MSS** satellites and among the various systems operating in this band would, for a number of reasons, be difficult to measure.[434] Inmarsat maintains that because **MSV's MSS** satellite operates at a different orbital location than the Inmarsat spacecraft, the level of terrestrial interference that each spacecraft actually receives from **MSV's** terrestrial terminals will vary.[435] Inmarsat also indicated that it would be difficult to monitor and control L-Band terrestrial emissions via aggregate emission limits.

167. We agree with Inmarsat that it would be difficult to monitor and control L-Band emissions on an aggregate basis. We are. not convinced that it is possible to accurately and repeatedly

(Continued from previous page)

[428] Inmarsat May **10,2002** Ex Pone Letter at 3.

[429] This is also close to the increase in Inmarsat **4** noise temperature, resulting form **MSV's** MSS operations that we calculated in Table **2.1.1.C (33.5%** versus **29%)**

[430] MSV Reply, Technical App. at 10-11.

[431] Id. at 10.

[432] Id. at 11.

[433] Inmarsat Nov. 6. **2002** Ex Pane Letter at 18.

[434] Id. at **12.**

[435] Inmarsat Reply at 17.

172. **On** a related matter, the Aviation Industry Parties jointly oppose the FCC's ATC proposal insofar as it would permit licensing terrestrial base stations to provide land mobile service in the upper L-band **MSS/AMS(R)S allocation.**[448] Current aviation requirements and new initiatives, the Parties assert, depend upon continued access to interference-free use of the upper L-band **MSS** allocation with real-time priority and preemptive access to the entire spectrum in the allocation when the need arises. According to the Parties, the proposal by **MSV** to add a terrestrial land mobile service to the L-band MSS allocation would increase the risk of interference to critical safety communications with aircraft in flight and diminish the unique spectrum available for aviation **systems.**[449] **NTIA** analyzes potential interference to the Inmarsat-4 satellite based upon its usage **in** the AMS(R)S and GMDSS services!" **NTIA** asserts that, based upon **MSV's** analysis, interference to Inmarsat-4 satellite receivers could be possible."' **NTIA** also expresses concern over possible interference from ATC BSs to Inmarsat METs operating as **AMS(R)S** receivers!" We address the potential for **MSV's** ATC system to interfere with the Inmarsat system, specifically, and conclude that it is possible to provide ATC in the L-Band without causing unacceptable interference to Inmarsat's current and planned satellite networks. Also, we require **MSV's** ATC system operators, as mentioned above, to demonstrate how the ATC system is capable of complying with the AMS(R)S priority and preemption requirements that it is obligated to meet under Footnote US308 and under the ITU Radio Regulations.

173. In the *Flexibility* Notice, we noted that, according to Footnote US309, terrestrial stations are permitted to operate in the frequencies allocated to the **AMS(R)S.**[453] The Aviation Industry Parties and **MSV** do not take issue with **US309** with respect to potential interference that could be caused to stations operating under the footnote allocation. Rather, ICO and **MSV** contend that the existence of the footnote for aeronautical terrestrial stations in the **AMS(R)S** supports their claim that it is possible to have a footnote allocation for ATC operations.[454] The incorporation of ATC into the **U.S.** Table of Allocations

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[448] Aviation Industry Comments at 6-10

[449] The Aviation Parties add that their industry will be making increased demands on the Inmarsat system and the upper L-band spectrum for safety communications, that MSV's system is not interoperable with the AMS(R)S system described in the Standards and Recommended Practices (SARPS) of the International Civil Aviation Organization (ICAO), and that MSV's system does not provide any significant coverage on over-ocean routes and in remote areas of the world where ground infrastructure is inadequate. **See** Aviation Industry Comments at 6-10; Boeing Reply at **8.**

[450] **See** NTIA Nov. **12,2002** Ex ***Pane*** Letter at Encl. 4

[451] Specifically, NTIA calculates that interference would occur if more than 661 MTs transmitted simultaneously **on** the same frequency as an Inmarsat-4 beam. See NTIA Nov. **12,2002** ***Ex Parte*** Letter, Encl. **4** at 6. MSV has asserted that **2000** MTs operating **on** the same basis would not cause harmful interference. **See** MSV Jan. **11, 2002** Ex ***Pane*** Letter at 25.

[452] See NTIA Nov. 12, 2002 ***Ex*** Pane Letter at Encl. 3.

[453] *Flexibility Notice,* 16 FCC Rcd at 7, ¶ 12 n.27. We note that footnote **US309** expressly provides that "[t]ransmissions in the bands 1545.5-1559 MHz from terrestrial aeronautical stations directly to aircraft stations, or between aircraft stations . . . are also authorized when such transmissions are used to extend or supplement the satellite to aircraft links. Transmissions in the band 1646.5-1660.5 MHz from aircraft stations . . . directly to terrestrial aeronautical stations, or between aircraft stations. are also authorized when such transmissions are used to extend or supplement the aircraft-to-satellite links." **See** 47 C.F.R. § 2.106 n.US309.

[454] See ICO Comments at 48; MSV Comments at 32. Indeed, there are **no** terrestrial stations operating in conjunction with AMS(R)S systems currently in operation that could receive interference. See AIP Comments at 7.

operate in the MSS allocation from 1610-1626.5 MHz. Several services *are* allocated spectrum adjacent to the 1525-1559 MHz band as well. Below the 1525 MHz band edge, Mobile Aeronautical Telemetry systems operate in the 1435-1525 MHz allocation. Above the 1559 MHz band edge, the Global Positioning System operates in the 1559-1610 MHz Radionavigation Satellite Service (RNSS) allocation. We assess the potential for L-Band ATC operations to interfere with these services.

(i) Systems Operating Within the 1525-1559 MHz and 1626.5-16605 MHz Bands of the L-Band Spectrum

171. Footnote US308 to the U.S. Table of Allocations provides priority to AMS(R)S systems in the upper L-band.[442] In 1993, NTIA and the Federal Aviation Administration (FAA) proposed a minimum set of capabilities to ensure that METs operating in the band 1545-1559 MHz and 1646.5-1660.5 MHz comply with Footnote US308 and ITU Radio Regulation S5.357A.[443] MSS METs that are authorized to provide MSS in the upper L-band are subject to meeting these conditions. MSV's ATC operations (MT and base stations) must meet the same conditions to protect AMS(R)S to comply with footnote US308. Indeed, MSV demonstrates in its comments that its ATC system will possess inherent features for handling priority communications to comply with the same priority and preemption requirements that its MSS system must comply with according to US308.[444] Specifically, MSV's ATC system will be capable of prohibiting entire populations of mobile terminals from accessing its system to provide spectrum for AMS(R)S.[445] In addition to its priority capabilities, the MSV system will also be capable of preempting active channels automatically and immediately (i.e., in less than one second, the MSV gateway would be able to allocate the preempted resource(s) to the AMS(R)S).[446] Terminals would be preempted from providing MSS and ATC through MSV's ability to simultaneously preempt corresponding satellite and terrestrial resources by the use of a centralized and common control facility for space and ground assets.[447] Based on MSV's representations, we conclude that its ATC system will meet the priority and preemption requirements that it is obligated to meet to comply with Footnote US308. We adopt section 25.253(a)(5) to require that, at time of license application, ATC operators demonstrate how they will comply with the requirements of US308.

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[442] 47 C.F.R. § 2.106, n.US308. Footnote US308 to the U.S. Table of Frequency Allocations provides as follows: "In the frequency bands 1549.5-1558.5 MHz and 1651-1660 MHz, the Aeronautical-Mobile Satellite [R] requirements that cannot be accommodated in the 1545-1549.5 MHz, 1558-1559 MHz, 1646.5-1651 MHz and 1660-1660.5 MHz bands shall have priority access with real-time capability for communications in the mobile satellite service. Systems not interoperable with the services shall operate on a secondary basis." The ITU Radio Regulation contains a similar priority-and-preemptive-access requirement. See ITU Radio Regulations. S5.357A, *available* at <http://people.itu.int/~meens/Pt2/RR/s5note2.htm> (last visited, Dec. 24, 2002). In addition, we note that in the 1545-1549.5 MHz, 1558-1559 MHz, 1646.5-1651 MHz and 1660-1660.5 MHz bands, MSS is secondary to AMS(R)S and the 1660-1660.5 MHz band is reserved for AMS(R)S with the further condition that mobile earth stations operating in these bands shall not cause harmful interference to stations in the Radio Astronomy Service.

[443] See Letter to Cheryl Tritt, Chief, Common Carrier Bureau, Federal Communications Commission. from Richard D. Parlow, Associate Administrator, Office of Spectrum Management, NTIA, and Gerald Markey, Manager, Spectrum Engineering Division, FAA (Jan. 14, 1993).

[444] See. *e.g.*, MSV Comments, Technical App.. Section V.

[445] MSV Comments. Technical App. at 8-9

[446] *Id.*, Technical App. at 10

[447] *Id.*, Technical App. at 11

Recommendation on protection requirements for Radioastronomy stations.[463] The RAS sites in the United States are identified in section 25.213(a)(1)(i) and (ii) of the Commission's Rules.[464] ATC operators should take all practicable steps to avoid causing interference to U.S. RAS observations in the 1660-1660.5 MHz band, consistent with Recommendation ITU-R RA.769-1 of the International Radio Regulations. Since RAS observatories in the U.S. are located in remote areas specifically to avoid receiving interference from radio frequency transmitters operating in and near the RAS spectrum, we anticipate that the potential for ATC METs to interfere with Radioastronomy observations in the 1660-1660.5 MHz band is significantly mitigated.

(iii) Systems Operating Within the 1525-1559 MHz Band Portion of the L-Band Spectrum

176. Search and Rescue Satellite (SARSAT) downlink operations are conducted in the 1544-1545 MHz band in accordance with Footnote S5.356 of the International Radio Regulations.[465] SARSAT uplink transmissions are located around 406 MHz from Emergency Position Indicator Radio Beacon (EPIRB) transmitters, which are downlinked in the 1544-1545 MHz band to various earth station receivers in located in the United States. The locations of these Earth stations are listed in the Appendix C2, Table 3.3.A. **MSV** is not authorized to provide **MSS** service in the 1544-1545 MHz band so the potential for interference is strictly an out-of-band case.[466] We note, however, that some of the SARSAT earth stations listed in Table 3.3.A. are located in or near urban areas where ATC base stations would be located.[467] In its filing, **NTIA** calculated the minimum coordination distance between a SARSAT station an ATC BS.[468] Our calculation, although based upon a different type of analysis, substantially agree with the analysis performed by NTIA.[469]

177. In Section 3.3 of Appendix C2, we analyze the potential for interference between transmitting ATC base stations operating in bands adjacent to the receiving SARSAT earth stations. We base our analysis on the **MSV** ATC base stations being capable of meeting an out-of-band emission level of -57.9 dBW/MHz as in our other interference analyses. We calculate that if an ATC base station is located more than 86 km from the SARSAT receivers, under free-space loss conditions, interference to the SARSAT earth station will not occur.[470] However, by using a rough terrain model, the distance is

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[463] ***See*** ITU-R Recommendation, ITU-R RA.769-1, ***Protection Criteria Usedfor Radioastronomical Measurements.*** available at <http://www.itu.int/rec/recommendation.asp?type=items&lang=e&parent=R-REC-RA.769-1-199510-I> (last visited, Jan. 10,2003).

[464] See 47 C.F.R. §25.213(a)(1)(i)-(ii).

[465] ***See*** ITU-R, Radio Regulations, n.S5.356, ***available*** at <http://people.itu.int/~meens/Pt2/RR/s5note2.htm#S5.356> (last visited Dec. 24,2002): 47 C.F.R. § 2.106 n.S5.356 (incorporating international rule into domestic table of allocations). S5.356 states that the use of the band 1544-1545 MHz by the mobile-satellite service (space-to-Earth) is limited to distress and safety communications.

[466] ***See L-Band MSS Rules Order,*** 17 FCC Rcd at 2712, ¶ 19.

[467] ***See*** NTIA Nov. 12.2002 ***Ex Pane*** Letter at Encl. 5

[468] ***See*** NTIA Nov. 12.2002 ***Ex Pane*** Letter at Encl. 5

[469] ***See infra*** App. C2 § 3.3.

[470] ***See infra*** App. C2 at Table 3.3.B. This result is based on the worst case scenario of the main-beam coupling between the SARSAT receive antenna and the ATC base station transmitting antenna using free-space loss.

is addressed in Section III.F of this Order.[455]

174. Similar to the priority granted to AMS(R)S in the upper L-Band, footnote US315 to the U.S. Table of Allocations provides priority to the GMDSS in the lower L-band spectrum.[456] Recently, the Commission established rules listing the minimum set of capabilities to ensure that METs operating in the bands 1530-1544 MHz and 1626.5-1645.5 MHz frequency bands comply with Footnote US315 and ITU Radio Regulation S5.353A.[457] MSS METs that are authorized to provide service in the lower L-Band are subject to meeting these conditions.[458] ATC operations (MT and base stations) must meet the same conditions to protect GMDSS to comply with footnote US315. MSV demonstrates in its comments that its ATC system will be capable of prohibiting entire populations of mobile terminals from accessing its system thereby providing priority to GMDSS automatically and immediately (*i.e.*, in less than one second, the MSV gateway would be able to allocate the preempted resource(s) to the GMDSS).[459] Terminals would be preempted from providing MSS and ATC through MSV's ability to simultaneously preempt corresponding satellite and terrestrial resources by the use of a centralized and common control facility for space and ground assets.[460] NTIA expressed concern that ATC operations could cause interference to GMDSS receivers.[461] Based on MSV's representations, we conclude that its ATC system will meet the priority and preemption requirements that it is obligated to meet to comply with Footnote US315. We adopt section 25.253(a)(5) to require at time of license application, ATC system operators to demonstrate how they will comply with the requirements of US315.[462]

(ii) Systems Operating Within the 1626.5-1660.5 MHz Portion of the L-Band Spectrum

175. A portion of the Radioastronomy Service (RAS) allocation in the L-band overlaps with the L-Band MSS allocations from 1660-1660.5 MHz. The ITU has conducted studies and developed a

455 See infra § III.F

456 47 C.F.R. § 2.106, n.US315. Footnote US315 to the U.S. Table of Frequency Allocations provides as follows: "In the frequency bands 1530-1544 MHz and 1626.5-1645.5 MHz, maritime mobile-satellite distress and safety communications, *e.g.*, GMDSS, shall have priority access with real-time capability in the mobile-satellite service. Communications of mobile-satellite system stations not participating in the GMDSS shall operate on a secondary basis to distress and safety communications of stations operating in the GMDSS. Account shall be taken of the priority of safety-related communications in the mobile-satellite service." Similar language is contained in the ITU's Radio Regulation 5.353A.

457 See *L-Band MSS* Rules Order, 17 FCC Rcd 2720-2722, ¶¶37-40.

458 See 47 C.F.R. § 25.136(d)

459 MSV Comments, Technical App. at 10

460 Id., Technical App. § V.

461 See NTIA Nov. 12, 2002 Ex *Parte* Letter, Encl. 3 (addressing potential interference to both AMS(R)S and GMDSS receivers from MSV BS). For our analysis of this sharing situation, see *infra* App. C2 § 2.2.2.

462 See *infra* App. B (adopting new rule 47 C.F.R. § 25.253(a)(5)).

Radio Coordinating Council (AFTRCC) for non-Government MAT receivers.[474] For government MAT systems, the licensees must supply the Commission with sufficient information to coordinate with the Interdepartment Radio Advisory Committee (IRAC) on a case-by-case basis prior to operation.[475] A listing of current and planned MAT receiver sites can be obtained from the AFTRCC for non-Government sites and through the IRAC Liaison for Government MAT receiver sites.

180. We also evaluated the potential interference to the Global Positioning System (GPS) from ATC BSs and MTs operating in the L-band. GPS operates in a portion of the **1559-1610 MHz** Radionavigation Satellite Service (RNSS) allocation. In the ***Flexibility Notice,*** the Commission recognized that the unwanted emissions from terrestrial stations in the MSS will have to be carefully controlled in order to avoid interfering with GPS receivers.[476] The Commission specifically requested comment on whether limits for base stations similar to those specified in section 25.213(b) for mobile earth terminals (METs) are adequate to protect GPS receivers.[477] NTIA responded to our request for comment along with several other parties.[478] NTIA asserts that there are two issues that must be considered in the request for comment on the protection of GPS: (i) the frequency range(s) over which the emission level would be applicable; and (ii) whether the emission level established for a mobile earth station in an MSS system should be applied to ATC BSs and MTs.[479]

181. Since the release of the ***Flexibility Notice,*** the Commission has adopted the ***GMPCS Order*** that requires MSS METs transmitting on frequencies between **1610** MHz and **1660.5** MHz conform to two restrictions: a wideband limit of -70 dBW/MHz, averaged over 20 milliseconds, on the EIRP density of the out-of-band emissions in the **1559-1605** MHz frequency range and a narrowband limit of -80 **dBW/700** Hz, also averaged over 20 milliseconds, on emissions in the **1559-1605** MHz frequency range.[480] The wideband emission level in the 1605-1610 MHz is determined by linear

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414 AFTRCC is a professional organization of Radio Frequency Management Representatives from major aerospace manufacturing companies. **See** Aerospace and Flight Test Radio Coordinating Council Organization. ***available af*** <http://www.aftrcc.org/afintro.htm> (last visited, Dec. **30,2002).**

475 IRAC is a government forum designed to assist the Assistant Secretary of the Department of Commerce in assigning frequencies to U.S. Government radio stations and in developing and executing policies, programs. procedures, and technical criteria pertaining to the allocation, management, and use of the spectrum. **See** IRAC Functions and Responsibilities, ***available at*** **<http://www.ntia.doc.gov/osmhome/iracdefn.html>** (last visited, Dec. **30,2002).**

476 ***Flexibility Notice.*** 16 FCC Rcd at 15559 **& 15565, ¶¶ 68 & 83.**

477 *Id.*

478 ***See. e.g.,*** NTIA Nov. **12, 2002** Ex ***Pane*** Letter at **1-4;** Globalstar July 1, **2002** Ex ***Pane*** Letter at **24;** Letter from Bruce D. Jacobs. Counsel, Mobile Satellite Ventures L.P. and Raul R. Rodriguez, Counsel U.S. GPS Industry Council to Marlene H. Dortch. Secretary, Federal Communications Commission, IB Docket No. 01-185 at **1-2** (filed July **17,2002)(*MSV/USGPSIC Agreement*).**

479 See NTIA Nov. **12.2002** Ex ***Pane*** Letter at 2. NTIA also urges the Commission to adopt out-of-band emission levels for the newly allocated L2 **(1215-1240** MHz) and L5 (1**164-1**188 MHz) frequency bands for future GPS operations.

480 ***GMPCS Order,*** 17 FCC Rcd at **8936, ¶** 88. Additionally. separate licensing Orders for MSS METs in the L-band, NTIA filed comments urging the International Bureau to require METs to meet the **-70** dBW/MHz and **-80** dBW emission limits in the 1559-1610MHz band. **See** Comments of the National Telecommunications and Information Administration, IB Docket No. 99-81, at 9 (filed, June **24,** 1999), ***available af***
(continued...)

reduced to less than **27** km. As shown in Appendix C2, in many areas around the SARSAT stations, the radio horizon is less them **27 km**. Therefore, path profiling (i.e., selecting locations for ATC base stations where main-beam coupling would be less likely to occur) would further reduce this distance. MSV shall take all steps to avoid causing interference to the SARSAT earth station located at the sites listed in Table 3.3.A of Appendix C2. We adopt section 25.253(f)(1) to require the ATC base station licensee to provide the Commission with sufficient information to complete coordination of any ATC base station placed within **27** km from one of the locations listed in Table 3.3.A and within the radio horizon of the SARSAT earth station prior to operation.

(iv) Systems Operating Adjacent to the 1626.5-1660.5 MHz Portion of the L-Band

178. MSV's ATC MTs will transmit to ATC base station receivers in the **1626.5-1660.5** MHz frequency band. Below the **1626.5** MHz band, Big LEO systems operate in the **1610-1626.5** MHz MSS allocation. Big **LEO** MSS MET emissions are limited in **EIRP** density by national and international regulations!" Additionally, Big **LEO** MSS METs are subject to the out-of-band emission mask contained in section 25.202(f) of the Commission's rules. Given these parameters, Big **LEO** systems must be capable of tolerating MET emissions in the **1610-1626.5 MHz** band that range from -47 dBW/4KHz to –58 dBW/4kHz. The peak EIRP of MSV's ATC MTs is 0.0 dBW with a bandwidth of 200 kHz. Using the same section 25.202(f) out-of-band emission mask that applies to Big **LEO** terminals yields a maximum ATC MET emission level of –60 dBW/4kHz that could be present in the Big **LEO** frequency band. Since this value is lower than the more restrictive emission levels that Big LEO METs are permitted to emit in the Big **LEO** band, out-of-band emissions from **MSV's** ATC METs will not interfere with Big **LEO** systems operating in the adjacent spectrum.

(v) Systems Operating Adjacent to the 1525-1559 MHz Band

179. Mobile Aeronautical Telemetry (MAT) systems operate below **1525 MHz** in the 1435-**1525** MHz allocation in the United States and its possessions. MSV analyzed the interference situation and asserts that, under the worst-case scenario, there would be no interference to an MAT receiver if it is located at least **0.9 km** from an MSV ATC base station.[472] However, we believe that radio line of sight would be the appropriate mgger for coordination between ATC base stations in the L-band and MAT stations operating in the adjacent spectrum because this trigger was used previously to coordinate Satellite Digital Audio Radio Service (SDARS) terrestrial repeaters operating near the **2360-2390 MHz** MAT allocation."' We adopt section 25.253(f)(2) to require L-band ATC operators to take all practicable steps to avoid locating ATC base stations within radio line of sight of 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

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[411] See ITU Radio Regulations, Article 5, Table of Frequency Allocations, S5.364, ***available at*** <http://people.itu.int/~meens/Pt2/RR/s5note2.htm> (last visited. Dec. 24, 2002); 47 C.F.R. § **2.106** (incorporating **S5.364** into the domestic table of allocations). Specifically. Big LEO METs are limited to an EIRP density of -15 dBW/4kHz in parts of the band where airborne electronic aids to air navigation are being developed. and –3 dBW/4kHz elsewhere in the band.

[412] A smaller distance of 0. I km would be the result if there is no direct line of sight between the ATC base station and the MAT receiver. **See** MSV Jan. 11, 2002 ***Ex Parte*** Letter at 29.

[473] ***See*** Letter from William K. Keane, Counsel, Aerospace and Flight Test Radio Coordinating Council, to Magalie Roman Salas, Secretary, Federal Communications Commission, IB Docket No. 95-91 (filed Sept. '19, 2000) (submitting an agreement between AFTRCC and XM to use a line of sight trigger).

this issue through the OET public notice.

183. To protect GPS operations, therefore, we require L-band ATC BSs and MTs to meet the already established GMPCS wideband and narrowband out-of-band emission levels. MSV provides ATC base station equipment specifications that MSV claims demonstrates that its equipment manufacturer, Ericsson, is committed to meeting specific out-of-band emission attenuation requirements."' Furthermore, in order to demonstrate that its base stations will be capable of meeting the -70 dBW/MHz and -80 dBW for discrete spurious emissions measured in a 700 Hz bandwidth to protect GPS, MSV will operate its ATC base stations with a maximum transmit power of 23.9 dBW EIRP, per sector. and it will incorporate a 1.2 MHz guard band between the ATC base station transmission and the band edge of the RNSS allocation and the band edge of MSV's assignment.[488] Based on this information, MSV's base stations should be capable of meeting the -70 dBW/MHz (and -80 dBW for discrete spurious emissions) out-of-band emission levels in the RNSS allocation as required by other transmitters currently operating in frequency bands adjacent to GPS operations and interference to GPS aviation uses, as envisioned in the context of the GMPCS proceeding, is not expected.

184. On July 17, 2002, an agreement was submitted to the FCC jointly by the GPS Industry Council and MSV. This agreement specifies that the MSV ATC base stations will "[u]se filtering to achieve -100 dBW/MHz, or lower'' emissions in the 1559-1605 MHz frequency band. Also, the ex parte filing states that the ATC Terminals will "[u]se filtering to achieve -90 dBW/MHz, or lower, in [the] short-term" and will "migrate to -95 dBW/MHz, or lower, for new terminals in 5 years (from the date MSV service is operational)'' for emissions in the [1559-1605 MHz] band. The limits spelled out in this agreement are well below the GPS protection limits contained in the *GMPCS Order* and contained in the Commission Rules. We recognize the importance of the GPS system to commercial, government and consumer users. We fully support and encourage negotiations among parties whose operations may affect GPS. In certain instances, concerns have been expressed, including by Federal agencies, regarding protection of GPS operations. Though we are adopting the existing limit of -70 dBW/MHz for ATC operations, we plan to continue to assess the appropriate interference protection levels for GPS. As discussed above, OET will issue a public notice shortly soliciting comments from all stakeholders to assist in the examination of what changes in the level of protection for GPS, if any, should be established in the future.

c. Technical and Operational Provisions for L-Band ATC

185. ***Additional Spectrum to Support ATC.*** Inmarsat contends that MSV's ATC operations will degrade the performance of its own space-based services, reduce the traffic-carrying capacity of the MSV space segment, and thereby increase MSV's need for additional L-band spectrum.[489] Alternatively, Inmarsat argues that if MSV does not need the spectrum that it has currently coordinated for its satellite system's use, then under the MOU coordination process. the excess spectrum should be made available to another MSS provider that needs it[490] MSV asserts that by carefully increasing its intra-system noise level (i.e., self-interference) and limiting it to 0.25 dB due to ATC operations, it can use its coordinated

[487] MSV Comments, Ex. E

[488] MSV uses a base station EIRP of 19.1 dBW/200 kHz per carrier and 3 carriers per sector or a total of 23.9 dBW per sector. *See* MSV Comments, Technical App., Ex. E.

[489] Inmarsat Comments, Technical Annex § 3.5

[490] Inmarsat Reply at 26.

interpolation from –70 dBW/MHz at 1605 MHz to –10 dBW/MHz at 1610 MHz. On NTIA's first point, then, the *GMPCS Order* expanded the frequency range from that required of section 25.213(b) to protect GPS from MSS MET out-of-band emissions. On NTIA's second point about whether the emission levels established for a mobile earth station in an MSS system should be applied to ATC BSs and MTs, NTIA indicates that the GMPCS emission limits in the 1559-1610 MHz band for METs operating in the 1610-1660.5 MHz frequency range are based on protection of a GPS receivers used on aircraft in a precision approach landing operational scenario and not to protect terrestrial operational scenarios.[481] NTIA is correct that the GMPCS rules, and the rules that we adopt here, that apply to MSS equipment are based on aircraft usage of the GPS system.[482] NTIA also expressed its concern and reluctance to limit the protection of GPS based on the aviation scenario only and believes strongly that protection of terrestrial uses of GPS such as E911-assisted GPS should be addressed.[483] We are extending this standard to apply to terrestrial based GPS subject to further consideration through a public notice that will be issued by OET.

182. The record before us does not support the adoption out-of-band emission levels more stringent than those required of GMPCS equipment. Nor does it support expanding the limits to frequency allocations other than the 1559-1610 MHz RNSS band. It would not be appropriate to apply more stringent out-of-band emission levels unilaterally to ATC equipment any more than it would be appropriate to apply more stringent out-of-band emission levels to terrestrial mobile systems such as PCS. Furthermore, we disagree with certain of the assumptions made by NTIA in its analysis to support its position that the out of band levels for L-Band ATC base stations and mobile terminals should be made more stringent than for GMPCS and terrestrial mobile equipment. For example, we do not agree that a 3 dB allowance for BS interference allotment included in the NTIA analysis for terrestrial GPS receivers or the 6 dB allowance for BS interference allotment included in the NTIA analysis for aviation GPS receivers are necessary.[484] We also are unpersuaded at this juncture by NTIA's assertion that it is appropriate to establish interference standards based on a 2 meter separation distance given that the probability of a L-band ATC MT transmitter located within 2 meters of a GPS receiver[485] ts relatively small.[486] We recognize that NTIA disagrees with this assessment, which further warrants consideration of

(Continued from previous page)
<http://svartifoss2.fcc.gov/prod/ecfs/retrieve.cgi?native or pdf=pdf&id document=6007946277> (last visited, Dec. 30, 2002).

[481] See. *e.g.*, NTIA Nov. 12,2002 *Ex Pane* Letter at 1-4.

[482] *GMPCS Order,* 17 FCC Rcd at 8923-25, ¶¶ 49-52. The limits adopted in the *GMPCS Order* are based on an assumed separation distance of approximately 100 feet between an airborne GPS receiver and a single terrestrial transmitter.

[483] NTIA Jan. 24,2003 *Ex Parte* Letter at 2-3

[484] See NTIA Nov. 12,2002 *Ex Pane* Letter, Encl. I at 7

[485] Id., Encl. 2 at 8

[486] We estimate that the probability of an L-band ATC MT being located within two meters of a GPS receiver is on the order of 0.024%, assuming a cell size of 1 kilometer radius that is served by three sector antennas and 21 randomly distributed terminals within the cell. See *supra* § III(D)(1)(b). NTIA. however, states that the –70 dBW/MHz EIRP limit for ATC MTs results in a required distance separation of 107.8 meters between the GPS receiver and the ATC MT. For the same cell size (1 km radius) and the same number of MTs, NTIA states that the probability increases to 73%. We will seek comment on what constitutes appropriate protection for GPS operations through a public notice.

number of 90,000 simultaneously transmitting MTs, we require that ATC operators report to the Commission, on an annual basis, the peak traffic on the ATC system and to limit this peak traffic to no more than 90,000 ATC MTs. These reporting requirements are in addition to any other reponing requirements and licensing conditions ultimately applied to an ATC authorization.

3. Big LEO Systems

189. In 1992, the World Administrative Radio Conference (WARC-92) allocated the 1610-1626.5 MHz band on a co-primary basis to the Mobile Satellite Service (MSS) in the Earth-to-space direction, and the 1613.8-1626.5MHz band in the space-to-Earth direction on a secondary basis. WARC-92 also allocated the 2483.5-2500 MHz band on a co-primary basis to MSS operations in the space-to-Earth direction.[493] In 1994, the Commission domestically allocated the 1610-1626.5/2483.5-2500 MHz bands to the MSS in the U.S.[494] In that same year, the Commission released the service rules for MSS systems in these frequency bands which, among other things, established licensing procedures for time division multiple accesdfrequency division multiple access (TDMA/FDMA) operations in the 1621.35-1626.5 MHz portion of the allocation and code division multiple access (CDMA) operations the 1610-1621.35 MHz and 2483.5-2500 MHz bands.'"

190. Currently, Globalstar and Iridium are licensed and operational in the Big LEO Bands. Both systems are required to protect Radio Astronomy Service (RAS) observations that take place in the 1610.6-1613.8 MHz portion of the band by limiting MET emissions and (in Iridium's case) satellite out-of-band emissions in the RAS band and avoiding simultaneous operations during RAS observations within several coordination areas throughout the U.S.[496] Big LEO licensees are also required to protect systems operating in the frequency bands immediately adjacent to the MSS allocation. Specifically, Big LEO MSS MET out-of-band emission levels must be significantly attenuated to protect systems operating in the Radio Navigation Satellite Service (RNSS) allocation such as the U.S. Global Positioning System (GPS) and the Russian Global Navigation Satellite System (GLONASS).[497] Globalstar is the only Big LEO system authorized to operate in the 2483.5-2500 MHz band in the downlink direction. Globalstar's system is required to share the downlink spectrum with industrial scientific and medical (ISM) equipment; Broadcast Auxiliary Service (BAS) electronic news gathering (ENG) equipment; private land mobile operations; fixed microwave services both in the 2483.5-2500 MHz band and in the band below 2483.5 MHz; and the multi-point distribution service/instructional television fixed service (MMDS/ITFS) systems operating above 2500 MHz.

191. Globalstar proposes to deploy ATC in a Forward Band Mode of operation in conjunction

[493] See ITU Radio Regulations Article 5.

[494] *See Amendment of Section 2.106 of the Commission Rules to Allocate the 1610-1625 MHz and the 2483.5-2500 MHz Bands for Use by rhe Mobile-Satellite Service, Including Non-Geostationary Satellites,* Report and Order, 9 FCC Rcd 536, 536, ¶ 1 (1994) *(Big LEO Order).*

[495] *See Big Leo Service Rules Order,* 9 FCC Rcd at 5954-5965, ¶¶43-63. Hereafter we refer to these frequency bands as the "Big L E O bands. Globalstar is licensed to operate its MSS system in the 1610-1621.35/1483.5-2500 MHz bands and Iridium is licensed to operate its MSS system in the 1621.35-1626.5 MHz band.

[496] *See 41* C.F.R § 25.213

[497] *See GMPCS* Order, 17 FCC Rcd at 8928,164 (2002) (establishing specific out-of-band emission levels that Big LEO MSS METs must meet according to a specified time schedule).

and licensed MSS frequency assignments for ATC operations. MSV has based its interference analyses on this objective. Using this and other conservative assumptions, MSV claims, it can operate its proposed terrestrial facilities, including thousands of ATC terminals operating simultaneously on each of MSV's carrier frequencies, without risk of causing harmful interference to its own satellite operations or to any of the co-channel, adjacent channel, or adjacent band operations of Inmarsat.[491]

186. The analyses we discussed earlier show that if MSV limits its system noise to an increase of 0.25 dB due to ATC, the impact on Inmarsat's current and planned satellite networks is not significant. Furthermore, our analyses confirm that MSV will be able to provide for thousands of simultaneous nationwide ATC users and MSS users by using ATC assignments in geographic areas where MSS is not capable of being delivered directly by satellite that would otherwise go unused. Indeed, MSV will still need to coordinate spectrum with other L-band operators to support its MSS requirements and its ATC operations must adhere to the same frequency assignments that support its MSS requirements. Therefore, use of the spectrum that is coordinated for MSS to support MSV's ATC operations would not be at the expense of other L-Band MSS operations or MSV's own MSS operations. In this regard, MSV will only be permitted in MSS coordination negotiations to base its spectrum requirements on MSS operations without ATC.[492]

187. ***Recordkeeping Requirements for ATC Operations.*** We determined earlier that if MSV limits the number of co-frequency, 200 kHz bandwidth, base station carriers to less than 1725, the aggregate effect of ATC on Inmarsat's current and future satellite networks will not be significant. This same number of simultaneously transmitting ATC METs (1725) will increase MSV's satellite receiver noise level by 0.25 dB and, therefore, this same number of simultaneously transmitting, co-frequency METs was used to evaluate the co-frequency interference effects on other MSS systems. Since MSV's proposed TDMA- GSM ATC system can, at most, serve a single MET transmitting per base station carrier, by limiting the number base station carriers to 1725 on any single frequency, we limit the maximum increase in MSV's satellite receiver noise level to 0.25 dB and, correspondingly, limit the co-frequency interference to other MSS systems. This 1725 limit is not a limit on the total number of base stations or a limit on the simultaneously number of transmitting METs. This is a limit on the number of base stations operating on any one frequency. To ensure that MSV's ATC operations will not cause unacceptable interference to other MSS systems, we adopt section 25.253(c) to limit the number of co-frequency base stations to 1725 which is less that the 2000 proposed by MSV.

188. To enforce the limit we place on ATC base stations in section 25.253(e), we also require L-band ATC operators to maintain a record of the total number of base stations throughout the U.S. operating on any given 200 kHz of spectrum. ATC operators must provide this information to the Commission, upon request, to resolve any interference complaint it receives from any L-band MSS operator that ATC operations are causing co-channel interference to its MSS network. Additionally, we will condition ATC authorizations such that the licensee must monitor and report, on an annual basis, the number of co-frequency base station carriers implemented. Since, MSV may only implement an ATC system in sub-bands obtained through the L-Band MOU coordination process, based upon its MSS needs, the total number of base stations is determined by the total coordinated MSS bandwidth. During future coordination, the L-Band spectrum identified for the various MSS operators may be aggregated. Furthermore, since the adjacent channel interference to other MSS systems was based upon a total

[491] MSV Reply at 13

[492] MSV states that is committed to continuing to limit its coordination efforts to gaining access to spectrum for its satellite operations. See MSV Reply at 17.

applying for ATC authorization in its licensed MSS spectrum from 1621.35-1626.5 MHz, though the record lacks sufficient information to demonstrate how an ATC network could operate in conjunction with a TDMA/FDMA MSS system. Also, given Iridium's petition for additional Big LEO MSS spectrum, it would be premature to adopt rules to implement ATC in those portions of the Big LEO bands implicated by the Notice of Proposed Rulemaking. To prevent the actions we take today from prejudicing the outcome of our Notice of Proposed Rulemaking, however, we will permit CDMA licensees to deploy ATC in the 1610-1615.5 MHz portion of the 1.6 GHz band and the 2492.5-2498 MHz portion of the 2.4 GHz band.[507] The disposition of the spectrum from 1615.5-1621.35 MHz will be determined by the Commission's ruling on the Notice of Proposed Rulemaking. Here, we address the potential interference concerns raised by in-band MSS, and adjacent band system licensees below. We conclude, generally, that Big LEO ATC can operate in the designated CDMA portions of the Big LEO bands using either cdma-2000 or IS-95 system characteristics without causing interference to other in-band MSS systems and systems operating in adjacent allocations to the MSS spectrum.

193. With regard to permitting ATC base stations to operate in the 2492.5-2498.0 MHz portion of the 2483.5-2500 MHz MSS band, because the use of the remainder of the band will not be decided by this Order and in order not to prejudice possible future action by the Commission, it is necessary that any ATC base stations installed in the 2492.5-2498.0 MHz band be tunable across the entire 2483.5-2500 MHz MSS allocation. To this end, we adopt section 25.254(a)(4) which requires that the applicant demonstrate that the base stations are, in fact, tunable across the entire 2483.5-2500 MHz MSS allocation.

a. Protection of In-band Systems in the 1610-1626.5 MHz Band

194. Globalstar demonstrates that at least two CDMA systems operating in the 1.6/2.4 GHz bands would be able to coordinate use of the assigned frequencies so that both could provide ATC and MSS without causing harmful interference to the other. ATC operations in the uplink band would be made possible by placing limitations on ATC mobile terminal aggregate EIRP levels in one portion of the band while the already established aggregate EIRP level for MSS mobile earth terminals would continue to apply in another portion of the uplink band.[508] MSS operations would continue to share the whole downlink band through application of satellite power flux density limits and limiting ATC base station operations to certain portions of the downlink band in a given geographical area.[509] Moreover, Globalstar maintains that the Radioastronomy Service (RAS) which operates in the MSS uplink band would be protected from ATC interference in accordance with the existing coordination agreement which uses exclusion zones and power limits to protect RAS observations from MSS mobile earth terminal

195. First we address the possibility of multiple CDMA system access to the Big LEO frequency bands. The Commission concluded that the Big LEO band arrangement would accommodate four CDMA systems and one TDMA/FDMA system.[511] Based on Recommendation ITU-R M.1186

[507] See discussion *infra* at § IV(B).

[508] Globalstar Supplemental Comments at 35.

[509] Globalstar Bondholders Mar. 13, 2002 *Ex Parte* Letter at 33.

[510] *Id.* at 25.

[511] *See Big LEO Service Rules* Order, 9 FCC Rcd at 5954-5965, ¶¶ 43-63

with its Big LEO system,[498] and it proposes to operate its ATC base stations in the MSS downlink band using either cdma-2000 or IS-95 system characteristics.'" Therefore, Globalstar's ATC mobile terminals will transmit in the same uplink band as the MSS mobile earth terminals and the ATC base stations will transmit in the same downlink band where its MSS satellites transmit.[500] Under the Globalstar ATC proposal, ATC would temporarily receive its own block of spectrum in regions around ATC base stations and the MSS service would not use the same frequency channels that are assigned to the ATC service in the regions near ATC base stations on a dynamic basis. The frequency assignments would be changeable and managed according to total demand, peaking periods, geographic distribution of terminals. fixed versus mobile usage, etc.[501] Though Iridium does not object to the technical feasibility of ATC, (indeed Iridium indicates that it is technically possible for Iridium to incorporate an ATC network into its currently authorized Big LEO system), Iridium does question whether ATC would be a commercially viable option for its currently licensed TDMA/FDMA Big LEO network?" In place of providing technical information on how ATC could be incorporated into its currently licensed TDMA/FDMA Big LEO system, Iridium provided general information on its alternative to ATC a Secondary Terrestrial Service (STS). Moreover, Iridium has filed a petition with the Commission requesting additional spectrum for its Big LEO system in the 1.6 GHz band.[503] For reasons indicated elsewhere in this Order, we decline to adopt Iridium's STS proposal[504] and we address Iridium's petition for additional spectrum in a Notice of Proposed Rulemaking.[505]

192. To implement the decision in this Order, we adopt rules for ATC used in conjunction with Big LEO MSS systems. Big LEO CDMA licensees will be permitted to deploy ATC systems using either cdma-2000 or IS-95 system characteristics?" The rules we adopt today do not bar Iridium from

[498] *See* Globalstar Bondholders Mar. 13,2002 *Ex Pane* Letter at 13

[499] *See* Letter from William D. Wallace, Counsel to Globalstar, L.P. to Marlene Dortch, Secretary, Federal Communications Commission, IB Docket No. 01-185 (filed May 29,2002). Globalstar incorporates by reference the cdma2000 system characteristics contained in the "Final Report-Spectrum Study of the 2500-2690 MHz band (March 30, 2001), Tables I and 2 of App. 2.1, and to the Recommended Minimum Performance Standards for Base Stations supporting Dual Mode Wideband Spread Spectrum Cellular Mobile Stations (IS-97A) and Recommended Minimum Performance Standards for Mode Wideband Spread Spectrum Cellular Mobile Stations IS-97.

[500] Globalstar Bondholders Mar. 13,2002 *Ex Pane* Letter at 13-15.

[501] Globalstar Supplemental Comments at 25.

[502] The currently licensed Iridium system is required to operate both its uplink and downlink transmissions in the 5.15 megahertz of spectrum from 1621.35-1626.5 MHz. "New Iridium has no doubt that, as a purely technical matter, it can operate a terrestrial signal within the existing TDMA allocation without causing interference to its satellite signal. The larger question is whether this can be accomplished in a commercially viable manner:' *See* Iridium Comments at 4.

[503] ***See Amendment of Parts 2.106, 25.143 and 25.202 of the Commissions Rules to Require Operarion of LEO MSS Systems Using TDMA/FDMA Techniques in the 1615.5-1626.5 MHz Frequency Bands,*** Petition for Rulemaking. at 4-7 (filed July 26,2002) (proposing a new band arrangement for Big LEO CDMA and TDMA/FDMA systems. Iridium makes no request for additional spectrum in the 2483.5-2500 MHz band).

[504] See discussion *supra* at § III(B)(3)

[505] *See* discussion *infra* at § IV(B).

[506] Globalstar provided sufficient technical information for us to consider in developing our rules for ATC systems used in conjunction with CDMA MSS systems.

U.S. from ATC mobile terminals.

b. Protection of Systems Operating in Bands Adjacent to 1610-1626.5 MHz

197. We address the potential interference to the Global Positioning System (GPS) from ATC BSs and MTs operating in the Big LEO-bands. GPS operates in a portion of the 1559-1610 MHz Radionavigation Satellite Service (RNSS) allocation. In the *Flexibility Notice,* the Commission recognized that the unwanted emissions from terrestrial stations in the MSS will have to be carefully controlled in order to avoid interfering with GPS receivers.[516] The Commission specifically requested comment on whether limits for base stations similar to those specified in section 25.213(b) for mobile earth terminals (METs) are adequate to protect GPS receivers.[517] NTIA responded to our request for comment along with several other parties?'' NTIA asserts that there are two issues that must be considered in the request for comment on the protection of GPS: (i) the frequency range(s) over which the emission level would be applicable; and (ii) whether the emission level established for a mobile earth station in an MSS system should be applied to ATC BSs and MTs.[519] Globalstar supports the application of the GMPCS limits to ATC BSs and MTs.[520]

198. Since the release of the *Flexibility Notice,* the Commission has adopted the ***GMPCS Order*** that requires MSS METs transmitting on frequencies between 1610 MHz and 1660.5 MHz conform to two restrictions: a wideband limit of -70 dBW/MHz, averaged over 20 milliseconds, on the EIRP density of the out-of-band emissions in the 1559-1605 MHz frequency range and a narrowband limit of -80 dBW/700 Hz, also averaged over 20 milliseconds, on emissions in the 1559-1605 MHz frequency range.[521] The wideband emission level in the 1605-1610 MHz is determined by linear interpolation from –70 dBW/MHz at 1605 MHz to –10 dBW/MHz at 1610 MHz. On NTIA's first point, then, the ***GMPCS Order*** expanded the frequency range from that required of section 25.213(b) to protect GPS from MSS MET out-of-band emissions. On NTIA's second point about whether the emission levels established for a mobile earth station in an MSS system should be applied to ATC BSs and MTs, NTIA indicates that the GMPCS emission limits in the 1559-1610 MHz band for METs operating in the 1610-1660.5 MHz frequency range are based on protection of a GPS receivers used on aircraft in a precision

516 *Flexibility Notice,* 16 FCC Rcd at 15559 & 15565, ¶¶ 68 & 83.

517 ***Id.***

518 **See *generally*** NTIA Nov. 12,2002 *Ex* Pane Letter; Globalstar July 1.2002 ***Ex Parte*** Letter at 24; ***MSV/USGPSIC Agreement*** at 1-2

519 NTIA Nov. 12,2002 Ex ***fane*** Letter at 2. NTIA also urges the Commission to adopt out-of-band emission levels for the newly allocated L2 (1215-1240 MHz) and L5 (1164-1 188 MHz) frequency bands for future GPS operations. Id.

520 **See** Globalstar July 1,2002 Ex *Parte* Letter at 24

521 ***GMPCS Order,*** 17 FCC Rcd at 8936, ¶ 88. Additionally. separate licensing Orders for MSS METs in the L-band, NTIA filed comments urging the International Bureau to require E T s to meet the -70 dBW/MHz and -80 dBW emission limits in the 1559-1610MHz band. See Comments of the National Telecommunications and Information Administration. IB Docket No. 99-81. at 9 (filed,June 24, 1999).***available** at*
<http://svartifoss2.fcc.gov/prod/ecfs/retrieve.cgi?native or pdf=pdf&id document=6007946277> (last visited, Dec. 30. 2002).

which establishes the parameters that CDMA MSS system operators use to coordinate their operations in a manner that enables them to reuse the same spectrum[5]" Globalstar asserts that at least two CDMA MSS systems can deploy an ATC network in the Big LEO bands without causing mutually unacceptable interference. Constellation agrees with Globalstar that ATC operations can be effectively coordinated among CDMA licensees using channel assignments.[513] We agree with Globalstar and Constellation that at least two CDMA MSS systems would be able to operate in the Big LEO bands if the systems implement ATC operations. Indeed, Recommendation ITU-R M.1186 has been used successfully by CDMA MSS operators to coordinate the operations of their systems and its framework will facilitate the coordination ATC used in conjunction with the CDMA MSS systems to avoid causing mutually unacceptable interference. Since Globalstar is currently the only CDMA licensee in the Big LEO bands, interference from Globalstar's ATC system to another CDMA system is not an issue. However, the amount of Big LEO spectrum designated for CDMA operations is subject to the outcome of our Notice of Proposed Rulemaking and there exists the possibility that a second, future, CDMA MSS system could enter the Big LEO bands.[514] We would require a second CDMA MSS system to coordinate its network (including ATC if it is part of the MSS network) using the Recommendation ITU-R M.1186 parameters. To this end, we provide a way for Globalstar to readily implement ATC, we leave open the possibility for multiple CDMA MSS entry, and do not preclude the possibility that Iridium could be granted access to additional Big LEO spectrum for its TDMA/FDMA system.

196. We also evaluated the potential interference that ATC systems could cause to the Radio Astronomy Service (RAS) which operates in the 1610.6-1613.8 MHz band at various locations in the U.S. As we indicated earlier, Big LEO MSS mobile earth terminals are required to protect the RAS from out-of-band emissions interference. Big LEO MSS ATC operators must: (1) ensure the Big LEO network is capable of determining the position of its mobile earth terminals; and (2) take specific measures to prevent interference to RAS observations in the event any of the licensee's mobile earth terminals enter any of the preestablished coordination zones around the U.S. RAS sites?" Globalstar proposes that the same limitations be placed on Big LEO ATC systems and there were no objections to this approach. We see no reason why the same procedures that apply to protect RAS observations in the 1610.6-1613.8 MHz band from MSS MET operations could not also apply to ATC mobile terminals. We therefore apply our rules that currently apply only to Big LEO MSS METs to include MSS terminals with ATC capability. Specifically, we adopt section 25.254(d) to provide interference protection to RAS observations in the

[512] See ITU. Recommendation ITU-R M.1186, *Technical Considerations* for the Coordination *Between* Mobile Satellite service *(MSS) Networks* Utilizing Code *Division Multiple* Access (CDMA) and *Other* Spread Spectrum Techniques *in the 1-3 GH:* Band, available *at* <http://www.itu.int/rec/recommendation.asp?type=items&lang=e&parent=R-REC-M.1186-0-199510-I> (last visited, Feb. 3,2003). We do note, however, that the assertions made by Globalstar were presumably based on the use of 11.35 MHz and 16.5 MHz of spectrum in the uplink and downlink bands, respectively. Additional information is needed in' the context of the *Notice* of Proposed *Rulemaking* to determine how many CDMA MSS systems could operate ATC in the band sharing arrangement ultimately adopted by the Commission. See *infra* § IV(B).

[513] See Constellation Comments at 16.

[514] See discussion, infra § IV(B) (seeking comment on whether a second processing round should be established for additional MSS licenses).

[515] See 47 C.F.R. § 25.213 of the Commission's rules. All 1.6/2.4 GHz Mobile Satellite Service systems shall be capable of determining the position of the user transceivers accessing the space segment through either internal radiodetermination calculations or external sources such os LORAN-C or the Global Positioning System. During periods of radio astronomy observations, land mobile earth stations shall not operate when located within geographic protection zones defined in 47 C.F.R. § 25.213 (a)(1)(i)-(iv).

interference from Big LEO ATC base stations.[528] SBE specifically commented that MSS ATC base stations in the 2483.5-2500 MHz band will cause out-of-band interference in TV BAS ENG Channels A8 and A9.[529] SBE also claims that ENG channel A10 (2483-2500 MHz) is operating at the same frequency as the Big LEO space-to-earth (downlink) component and that brute force overload of ENG receivers would occur.[530] We also note that fixed and mobile services are permitted to operate in these frequency bands. Specifically, Private Land Mobile Services and Fixed Microwave Services that include video transmissions operate in this same frequency range.'"

202. The IS-95 system characteristics that Globalstar proposes as a candidate for its ATC operations allow for higher EIRP levels for base stations than for cdma-2000 base stations.[532] We evaluate the affects of the potentially more interfering ATC network using IS-95 system characteristics. As explained in greater detail in Appendix C3, Section 4.2, the amount of interference caused to BAS equipment is a function of how close (geographically) the ATC base station is located to the BAS receivers of these systems. By selecting certain operating frequencies for the ATC base stations and the BAS assignments, one can simultaneously operate the equipment without causing mutually unacceptable interference at shorter distances. We evaluated the separation distance as a function of frequency assignment and conclude that ATC base station operations (using either cdma-2000 or IS-95 characteristics) can be conducted so as not to cause adjacent band interference to BAS systems operating below 2483.5 MHz given the band-sharing arrangement we adopt for ATC operations in the band and the availability of information on the BAS.[533] The fixed and mobile operations in the adjacent 2450-2483.5 MHz band include many video links that are generally similar to, but of a lower power than, those of BAS. By analogy to the analysis in the appendix for BAS, we would expect that ATC base stations could be operated on selected frequencies so that interference to these fixed and mobile stations could be avoided. Insofar as fixed and mobile operations in this frequency range are similar to the BAS characteristics, we conclude that adjacent band interference to these systems will also be avoided through coordination.[534] ATC operators will be required to protect all existing licensees in the adjacent bands.

203. Additionally, there are several hundred BAS, fixed and mobile facilities licensed on a grandfathered basis throughout the U.S. where the receivers could potentially receive brute force overload interference from ATC base stations operating in the 2483.5-2500 MHz band. To avoid causing brute force overload interference to BAS, fixed and mobile equipment, ATC operators, prior to construction and operation of ATC base stations, must consult local coordination committees for information on the frequencies used and the geographic locations of these systems that may receive brute force overload

[528] See SBE Comments at 10

[529] *Id.*

[530] *Id.*

[531] See. *e.g.*, 47 C.F.R. §§ 90.20, 90.35, 90.103 & 101.147. There are nearly 500 active licenses under Parts 90 and 101 in the band 2450-2483.5 MHz, including critical public safety functions.

[532] CDMA-2000 base stations operate at 10W of power with a 17dBi antenna while IS-95 base stations operate at 20W of power with a 19dBi antenna. See Globalstar May 29, 2002 *Ex Pane* Letter. Technical Statement Attach. at 2 (including the system characteristics for cdma-2000 and IS-95 systems).

[533] See discussion *infra* at ¶ 191 & App. C3 § 4.2.

[534] Globalstar has indicated that it is willing to coordinate with existing fixed service installations. See Globalstar March 13, 2002 *Ex Pane* Letter at 25.

approach landing operational scenario and not to protect terrestrial operational scenarios.[522] NTIA is correct that the GMPCS rules. and the rules that we adopt here, apply to aircraft usage of the GPS system. We recognize that NTIA believes that these rules do not provide adequate protection to terrestrial terminals.[523]

199. The record before us does not support the adoption of out-of-band emission levels more stringent than those required of GMPCS equipment. Nor does it support expanding the limits to frequency allocations other than the 1559-1610 MHz RNSS band. It would not be appropriate to apply more stringent out-of-band emission levels unilaterally to ATC equipment any more than it would be appropriate to apply more stringent out-of-band emission levels to terrestrial mobile systems such as PCS.[524] As indicated above, concerns have been expressed, including by Federal agencies, regarding protection of GPS operations. NTIA also expressed their concern and reluctance to limit the protection of GPS based on the aviation scenario only and believes strongly that protection of terrestrial uses of GPS such as E911 assisted GPS should be addressed." Though we are adopting the existing limit of -70 dBW/MHz (wideband emissions) and -80 dBW (narrowband emissions) for ATC operations; however, we plan to continue to assess the appropriate interference protection levels for GPS. As discussed above OET will issue a public notice shortly soliciting comment from all stakeholders to assist in the examination of what changes in the level of protection for GPS, if any, should be established in the future.

200. To protect GPS operations, Globalstar proposes that interference to GPS and GLONASS in the adjacent frequency band be limited by applying the same out-of-band emission specifications that are required of Globalstar's MSS mobile earth terminals to ATC mobile terminals.[526] We agree with Globalstar's approach. The recent adoption of our GMPCS rules is the culmination of several years' work to strike a balance between the MSS system operations in the Big LEO bands (among others) and the protection requirements of RNSS systems such as GPS operating in the frequency band immediately adjacent to the MSS allocation.[527] We apply the same out-of-band emission levels to ATC base stations and mobile terminals' protection of adjacent systems in the RNSS allocations as those adopted in the GMPCS proceeding. We adopt section 25.254(b)(4) to apply the GMPCS out-of-band emission levels to Big LEO ATC mobile terminals.

c. Protection of Systems Operating in and Near the 2483.5-2500 MHz Band

201. The Society of the Broadcast Engineers (SBE) contends that TV BAS equipment operating below 2483.5 MHz and MMDS/ITFS equipment operating above *2500* MHz will experience

[522] See NTIA Nov. 12, 2002 *Ex Pane* Letter at 5

[523] *GMPCS Order,* 17 FCC Rcd at 8923-25, ¶¶ 49-52. The limits adopted in the *GMPCS* Order are based on an assumed separation distance of about 100 feet between an airborne GPS receiver and a single terrestrial transmitter.

[524] For a discussion of the basis for our assumptions about cell size, the number of randomly distributed terminals and other factors that lead us to different conclusions about the requisite level of protection for GPS than NTIA reached, *see, e.g., supra* § III(D)(1)(b).

[525] NTIA Jan. 24,2003 Ex *Pone* Letter at 2-3.

[526] See Globalstar Bondholders Mar. 13.2002 Ex *Pone* Letter at 26

[527] *See CMPCS Order,* 17 FCC Rcd at 8928, ¶ 64

of lower 2.4 GHz ISM band making interference to ISM devices a non-issue

206. In summary, we adopt a band arrangement for Big LEO ATC operations based on the technical information provided by the Big LEO licensees and users of the adjacent frequency allocations. We apply the same out-of-band emission limits to ATC capable terminals and base stations that apply to MSS mobile earth terminals to protect RNSS systems operating below 1610 MHz. Additionally, we apply the same operational rules to ATC terminals that currently apply to Big LEO MSS mobile earth terminals to protect RAS observations within the Big LEO uplink band. Furthermore, by requiring ATC base stations to operate at EIRP and out-of-channel emission levels consistent with cdma-2000 or IS-95 architectures, the band arrangement we adopt today for Big LEO ATC base stations will not cause adjacent band interference to BAS and MMDS/ITFS users of the allocations adjacent to the Big LEO downlink band. We also adopt coordination provisions for ATC base stations that cause brute force overload to BAS and other licensed services in the 2.4 GHz band.

E. Statutory Considerations

1. Section 303(y)

207. In the *Flexibility Notice,* we sought comment on whether permitting ATC in the MSS spectrum would be consistent with section 303(y) of the Act.[540] Section 303(y) of the Act[541] gives the Commission additional authority to allocate spectrum to provide flexibility of use, provided that the use is consistent with international agreements to which the United States is a party; and, if after notice and comment, the Commission finds that such an allocation would be in the public interest; would not deter investment in communications services and systems, or technology development; and would not result in harmful interference among users.[542]

208. As a preliminary matter, we find that our decision to permit qualifying MSS licensees to incorporate ATC does not require that we make a finding under section 303(y). The Commission has previously found that the section 303(y) review requirement applies only to flexible use determinations by the Commission that would enable the sharing of specific spectrum bands by services treated as distinct by the international and domestic allocations process, and not as a precondition to adoption of flexible intra-service regulations.[543] Our decision today grants limited flexibility by permitting the reuse of already licensed spectrum. We do not adopt new allocations in the 2 GHz, L- and the Big LEO MSS bands, but rather indicate that ATC is permissible by footnote in the domestic table of allocations; therefore, we find that we are not required to make any findings under section 303(y) of the

[540] *Flexibility Notice,* 16 FCC Rcd at 15544, ¶ 25

[541] 47 U.S.C. § 303(y).

[542] The Commission also has general authority to allocate spectrum for flexible use and has previously noted that nothing in the language or legislative history of section 303 of the Communications Act. 47 U.S.C. § 303, suggests any limitation on the Commission's discretion to prescribe the nature or number of the service or services to be rendered over radio frequencies. *See Allocation of Spectrum Below 5 GHz Transferredfrom Federal Government Use,* 1998 WL 812430, Memorandum Opinion and Order, ET Docket 94-32, ¶ 15 (rel., Nov. 25, 1998); *see also In the matter of Allocation of Spectrum Below 5 GHz Transferred from Federal Government Use,* Second Report and Order, 11 FCC Rcd 624 at 633-4, ¶¶ 20-21 (noting that Commission precedent supports the permissibility of allocating spectrum in a manner that allows for its use by a broadly defined service).

[543] *Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Pan 27 of the Commission's Rules,* 15 FCC Rcd 476.486, ¶ 22 (2000).

interference. ATC operators shall take such steps necessary to avoid causing brute force overload interference to previously licensed facilities. If a mutual agreement to this effect cannot be reached, the Commission must be notified and it will take such action as may be necessary to ensure that a mutually acceptable arrangement is amved at.[535] In any event, ATC operators will be required to protect against adjacent-channel and brute-force overload interference to previously licensed users. Coordination among the shared services within the 2450-2483.5 megahertz band varies from service to service. Part 90 licensees are not required to coordinate their operations within the band. Part 74 licensees coordinate among other BAS licensees. And Part 101 licensees are required to coordinate according to section 101.103(d). In the past, the Commission has encouraged participation in situations where it has not expressly required coordination in this band or established procedures for inter-service coordination. ATC operators will be required to take measures to protect against all types of interference to existing licensed services in this band.

204. Globalstar contends that ATC base stations operating below 2498.0 MHz will not interfere with MMDS/ITFS.[536] We evaluated in Appendix C3, Section 4.2, the worst case potential for ATC base stations to interfere with currently deployed MMDS/ITFS operations above 2500 MHz under various situations and we agree with Globalstar that ATC base station operators (using either cdma-2000 or IS-95 characteristics) would protect existing MMDS/ITFS equipment, provided that ATC base station operations are below 2498.0 MHz. ATC base stations using either cdma-2000 or IS-95 characteristics can be located within a meter of MMDS/ITFS equipment without causing unacceptable interference.[537] We also note that the Commission has before it a petition to refarm the band above 2500 MHz to provide for cellular-like services and the use of the band is subject to change."' Therefore, we will permit ATC base stations using cdma-2000 or IS-95 characteristics in the portion of the downlink band from 2492.5-2498.0 MHz.

205. Although unlicensed ISM equipment is not subject to any protection from current MSS downlink operations, our research indicates that most unlicensed ISM equipment manufacturers build out-of-band signal rejection features into their hardware.[539] As indicated above, in order for Big LEO ATC base stations to protect licensed adjacent band receivers, the operating frequency is an important factor in reducing interference while keeping the geographic separation distance between the equipment to a minimum. For other reasons, we are limiting ATC base station operations to assignments above 2492.5 MHz which places the frequency band edge of the ATC base stations greater than 25 MHz from the users

[535] *See, e.g.*, 47 C.F.R. § 74.604.

[536] Globalstar Bondholders March 13, 2002 *Ex Pane* Letter at 26

[537] *See* discussion *infra* at App. C3 § 4.2.3 (comparing geographic separation distances as a function of frequency separation).

[538] ***See Amendment of Pan 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems,*** First Report and Order and Memorandum Opinion and Order, 16 FCC Rcd 17222, 17240-42, ¶ 33-36 ***(ITFS/MMDS Order); Wireless Telecommunications Bureau Seeks Comment on Proposal to Revise Multichannel Multipoint Distribution Service and the instructional Television Fixed Service Rules,*** Public Notice, RM-10586, 17 FCC Rcd 20526 (rel. Oct. 17, 2002), ***available at*** <http://svartifoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6513307317> (last visited, Dec. 24, 2002).

[539] *See* WaveLAN Technical Bulletin 003/A, Lucent Technologies, ***available at*** <http://www.novocmp.de/prod/wirl/WLAN/bilder/Download/Tb-003.pdf> (last visited, Dec. 12.2002).

investment to move forward with ATC. We find that grant of flexibility to incorporate ATC makes previously unusable spectrum and spectrum of limited use in particular locations, available for more innovative services, thereby promoting investment and the development of mobile satellite technology. For example, without ATC, in some cases, MSS operators are unable to provide service in urban areas reliably, because of a variety of factors discussed above. ATC will enable MSS providers to reuse their licensed spectrum to improve signal reliability. As a result, MSS operators will be in a better position to offer improved, more commercially valuable mobile satellite services. MSS operators may be able to offer nationwide mobile satellite services with a ubiquitous signal at more affordable prices. Without ATC, unused or underutilized licensed MSS spectrum would be used less efficiently or used less intensively.

211. The Commission has long recognized that increased flexibility in spectrum usage promotes technological development, innovation, investment, economic growth, and consumer choice. For example, our CMRS policies have emphasized flexible use of spectrum resources, and this broad flexibility has been the basis of a series of regulatory actions extending over many years by which the Commission has encouraged investment and innovation in wireless telecommunications technologies.[551] While we recognize that the flexibility to implement ATC that we adopt for MSS Operators today is limited, we nevertheless find that it is likely to increase competition in mobile satellite services, which will result in improved MSS services and increased investment and enhanced technology development in the MSS industry.[552] We also find that our technical rules, which are designed among other things, to protect adjacent users and services from harmful interference from ATC operations are sufficient to mitigate any concerns expressed in the record about financial disincentives in adjacent services.

b. Consistency with International Agreements

(i) L-Band

212. Inmarsat claims that granting ancillary terrestrial operations to MSS operators is inconsistent with various international agreements to which the United States is a party, including the International Telecommunications Union (ITU) Radio Regulations and the Mexico City Memorandum of Understanding. We disagree with Inmarsat's analysis and find that granting the flexibility to implement ATC in the L-band, subject to conditions necessary to protect other users of the band, is consistent with all relevant international agreements to which the United States is a party.

(a) ITU Radio Regulations

213. Inmarsat argues that granting the proposed flexibility is inconsistent with the ITU Radio Regulations, the product of an international treaty to which the United States is a party.[553] Inmarsat argues that the proposed terrestrial allocation is inconsistent with the Radio Regulations because there is no primary allocation for terrestrial services in the United States in the L-band and, therefore. such use would be a non-conforming use.[554] As a non-confonning use, Inmarsat argues the proposed terrestrial

[551] See *supra* § III (A)(4).

[552] See *Seventh CMRS Competition Report*, 17 FCC Rcd at 13017-18

[553] Inmarsat Sept. 12, 2002 Ex *Parte* Letter at 4.

[554] *Id.*

Communications Act. We note, however, that parties have raised important issues in response to our questions in the *Flexibility Notice* concerning 303(y) that merit discussion here. We have previously considered the criteria contained in section 303(y) under our broader public interest mandates in the statute, when making decisions that may affect the broader allocation through service rules, and we believe it is in the public interest to do so in this proceeding in light of the issues raised in the record.[544] Accordingly, while the flexibility to provide ATC that we grant today is subject to limiting conditions, we nevertheless find that permitting qualifying MSS licensees the flexibility to incorporate ATC, which will permit them to improve service to certain geographic areas by improving signal quality through the use of terrestrial facilities in the 2 GHz, L-band, and the Big LEO MSS bands, is consistent with the criteria in section 303(y) of the Act and with the Commission's long standing policy of granting spectrum users additional flexibility to implement new services.[545] We have already determined elsewhere in this Order that providing flexibility for MSS licensees to incorporate ATC serves the public interest[546] and would not result in harmful interference."' We address below the remaining elements raised by commenters.

a. Investment Incentives

209. Some commenters state that granting MSS licensees the flexibility to incorporate ATC service will attract investment to the band in question.[548] Other commenters argue that there is insufficient evidence on the record on the issue of capital investment and whether it would be spurred or deterred by granting ATC.[549] Others claim that granting ATC in certain bands, such as the upper L-band, would deter investment in new technologies employing these frequencies.[550]

210. We disagree with commenters claiming that there is not enough evidence of potential

[544] *Id.*

[545] *See, e.g., Common Carrier Point-to-Point Microwave Radio Service.* First Report and Order, 29 F.C.C. 2d 870 (1971); *Amendment of Pans 2 & 22 of the Commission's Rules to Permir Liberalization of Technology & Auxiliary Service Offerings in the Domestic Public Cellular Radio Telecommunications Service,* Report and Order, 3 FCC Rcd 7033.7037, ¶¶ 24-30 (1988); *Amendment of Pans 2 & 22 of the Commission's Rules to Permit Liberalization of Technology & Auxiliary Service Offerings in the Domestic Public Cellular Radio Telecommunications Service,* Memorandum Opinion and Order, 5 FCC Rcd 1138.1139, ¶ 10 (1990); 47 C.F.R. § 22.901 (cellular services); 47 C.F.R. Parts 24 and 27 (broadband PCS and Wireless Communications Services rules); *PCS Second Repon and Order, 8* FCC Rcd 7700.7710-13, ¶¶ 19-24 (1993); *Allocation of Spectrum Below 5 GHz Transferred from Federal Government Use,* Second Report and Order, 11 FCC Rcd 624, 627-38, ¶¶ 6-28 (1995); *Amendment of the Commission's Rules to Permit Flexible Service Offerings in rhe Commercial Mobile Radio Services,* First Report and Order and Notice of Further Proposed Rulemaking, 11 FCC Rcd 8965,8967, ¶ 3 (1996) (CMRS); *Establishment of Rules and Policies for the Digital Audio Radio Satellire Service in rhe* 2310-2360 *MHz Frequency Band,* 12 FCC Rcd 5754, 5787-816, ¶¶ 81-153 (1997) (DARS); *IFTS/MMDS Order,* 16 FCC Rcd at 17235-38, ¶¶ 22-30 (ITFS and MMDS).

[546] *See supra* § III(A).

[547] *See supra* § III(D) and Apps. C1-C3.

[548] *See, e.g.*, ICO Comments at 29; Celsat Comments at 12-13; Globalstar Comments at 8; MSV Comments at 21; Loral Comments at 9; Globalstar Bondholder Comments at 24 n.38.

[549] *See, e.g.*, Cingular/Sprint July 31, 2002 *Ex Parte* Letter at A-1 I: AT&T Wireless Comments at 11-13; Telephone and Data Systems Reply at 8.

[550] *See* Aviation Industry Parties Comments at 9-10

Technical Appendix, we believe that granting MSS licensees greater latitude in choosing their precise system architecture will not cause harmful interference to systems of other parties of the MoU and should improve spectrum **efficiency.**[565] While we recognize that Inmarsat, which is also a party to the Mexico Citv MoU, mav disagree with our interference and spectrum-efficiency conclusions,[566] we have evaluated its claims, and we have addressed its concerns by placing constraints on MSV's ATC operations designed to overcome the potential for interference that lnmarsat has identified. Moreover. nothing in this Order is intended to adjust the spectrum assignment to which signatories are entitled under the Mexico City MoU. The only "purpose" of the Mexico City MoU is to establish a process to develop operating agreements for the operation of geostationary mobile satellite service networks in the L-band in the region around North America. Because the MoU adjusts the parties' L-band spectrum assignments, based on present and future *satellite* spectrum usage, we agree with MSV's assertion that parties could not legitimately identify terrestrial ATC usage to justify a larger MSS satellite spectrum **assignment.**[567] We therefore conclude that permitting the integration of terrestrial infrastructure into licensed MSS systems remains fully consistent with the **terms** of the Mexico City MoU, to which the Commission is party.

(ii) Other Bands

216. With respect to the other bands at issue in this proceeding, namely the 2 GHz MSS and Big Leo bands, our analytical framework is similar. Our action today must be consistent with international agreements regarding spectrum, of which the principal governing law is the ITU Radio Regulations, the product of an international treaty to which the United States is a **party.**[568] In ITU Region 2, the 2 GHz MSS band is allocated for terrestrial mobile and fixed services, and mobile satellite services on a co-primary **basis.**[569] Consequently, our action today, permitting ATC in the 2 GHz MSS band, is consistent with the relevant international agreements to which the United States is a party without requiring ATC to operate **on** a non-interference basis .

217. In the Big **LEO** band, there is an allocation for terrestrial mobile and fixed services in the 2.4 GHz service downlink band, but no allocation in the **1.6 GHz** uplink band?" Therefore, in the uplink band ATC will be a non-conforming **use.**[571] As a non-conforming use, ATC must not, under applicable

[565] See discussion infra at IILD.

[566] **See,** *e.g.*, Inmarsat Sept. **12,2002** Ex Pane Letter, Attach. I at 4.

[567] **See** MSV Reply at **17** ("MSV is committed to continuing to limit its coordination efforts to gaining access to spectrum for its satellite operations."); **see** *also, e.g.*, MSV Reply at **15** ("Authorizing terrestrial operations in the L-band is consistent with the ITU Radio Regulations as well as the Mexico City Memorandum of Understanding (MoU), because such operations will be on [a] non-interference basis to other systems, [and] will not be a factor in L-band coordination negotiations . . . "); MSV Jan. **10,2002** *Ex* Pane Letter at 4 ("ATC operations will not require MSV to coordinate access to more spectrum").

[568] **See** International Telecommunication Convention. Oct. **2, 1947.63** Stat. **1399.** T.I.A.S. No. **1901.30** U.N.T.S. 316. This international treaty is the basic instrument that created and vested certain rights with the ITU. Signatory countries to the treaty retain any rights not explicitly granted to the **ITU.**

[569] See **47** C.F.R. § **2.106** (Table of Frequency Allocations).

510 **See** ***id.***

511 ITU, Radio Regulations § 4.4.

services must not, under applicable Radio Regulations,'" cause harmful interference outside of the United States.[556] According to Inmarsat, the proposed terrestrial operations will cause harmful interference to the operations of the Inmarsat, Russian, Japanese"' and Mexican L-band satellite systems."' Furthermore, Inmarsat argues that IMT-2000 studies?" contained in ITU Recommendations, confirm the need for separate bands for the satellite and terrestrial components of mobile communications systems in order to avoid harmful interference.[560] MSV acknowledges that, under applicable ITU Radio Regulations, its ATC operations will be required to operate on a non-harmful interference basis to all other services and systems, and argues that it will not cause harmful interference to the operations of the Inmarsat. Russian, Japanese and Mexican L-band systems."'

214. As we have discussed above, we find that with appropriate technical limitations terrestrial service can be provided in the L-band without causing harmful interference to other L-Band users, including mobile aeronautical telemetry and radio astronomy operations.[562] ITU Radio Regulations provide for the operation of communications systems that do not conform to the service allocation, provided that the services are on a non-harmful interference basis.[563] Accordingly, we conclude that our approach to permitting ATC in the L-band is consistent with applicable ITU regulations.

(b) Mexico City MOU

215. We believe that our decision to remove domestic barriers to improve the delivery of MSS signals in particular areas in the United States is consistent with our commitments under the Mexico City MoU. Under the MoU, parties agreed to attempt to avoid harmful interference and to use spectrum assignments in the most efficient manner practicable. [564] As described in detail above and in the

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555 ITU, Radio Regulations, *Art.* 4 §§ 4.4, 8.5.

556 Inmarsat Sept. 12,2002 *Ex Parte* Letter at 4

557 It should be noted that Japan is not currently a party to the MOU in North America. Mexico and Russia have provided no objections to ATC in this proceeding. Moreover, TMI (the fifth party to the MOU and a Canadian licensee) is on the record supporting ATC.

558 Inmarsat Comments at 18

559 ITU-R M. 1036 Annex I

560 Inmarsat Sept. 12, 2002 *Ex Parte* Letter at 4

561 MSV Reply at 15

562 See *supra* § III(D)(2)

563 ITU RR No 4.4 requires that "Administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations in this Chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment. shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations." See ITU, Radio Regulations § 4.4.

564 *See also, e.g., SatCom Systems, Inc.*, Order and Authorization. FCC No. 99-344, 14 FCC Rcd 20798.20813. ¶ 32 (1999)(noting that "the Commission must condition all licenses on the outcome of the international coordination process" and that "the U.S. Administration will continue to advocate the coordination of additional spectrum for the [MSV] system in the coordination process").

bands used by MSS operators, we conclude that our decision today precludes any possibility of the filing of mutually exclusive applications that would implicate the auction provisions of section 309(j)(1).[578] As we have explained, we find, based on the record and our analysis, that establishing shared usage of the same frequency band by separate MSS and terrestrial operators would likely compromise the effectiveness of both systems, particularly satellites already operating in the L-band and Big LEO band. Faced with a choice of either making limited terrestrial authority available to MSS operators or declining to grant any terrestrial rights in the MSS bands, we find that to withhold all terrestrial rights in these bands would not be in the public interest. At the same time, we find that the integration of an ATC into authorized and existing MSS systems serves the public interest.[579] Under these circumstances, and particularly in light of the fact that only MSS operators will be able to acquire terrestrial rights in the MSS bands, we agree with those commenters who argue that section 309(j)(1)'s requirement of mutually exclusive applications will not be met.

222. Certain commenters disagree with the Commission's suggestion that the obligation to use competitive bidding under section 309(j) "does not appear to be implicated and argue that reallocation of this spectrum by competitive bidding is required by section 309(j).[580] These commenters argue that the assertion that there is no "mutual exclusivity" in this proceeding because ATC service would be linked to pre-existing MSS authorizations is "plainly erroneous."[581] They contend that, had ancillary services been a part of the original MSS authorizations, there would have been a much larger pool of mutually exclusive applicants, and competitive bidding procedures would have been required?" They further assert that "section 309(j) is violated where the Commission fundamentally changes the manner in which spectrum can be used shortly after licensing, where such a change would have likely created mutual exclusivity in the first place."[583] They argue that the Commission's reliance on a prior finding of no mutual exclusivity is based upon "facts no longer in existence," and is "no more than an end run around the statutory scheme" to avoid compliance with section 309(j).[584]

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578 47 U.S.C. § 309(j)(1) states:

> (1) GENERAL AUTHORITY.—If, consistent with the obligations described in paragraph (6)(E), mutually exclusive applications are accepted for any initial license or construction permit, then, except as provided in paragraph (2), the Commission shall grant the license or permit to a qualified applicant through a system of competitive bidding that meets the requirements of this subsection.

519 *See* supra §§ III(A)(1)-(4) (describing how ATC may increase MSS spectrum efficiency. foster public safety, encourage the deployment of services and reduce business inefficiencies and costs).

580 Cingular-Verizon Comments at 7-11; AT&T Wireless Comments at 16; TDS Comments at 2, 3-7; Cingular-Verizon Reply at 3-1; Rural Telecommunications Group at 5-6; SBE Comments at 2; CTIA Comments at 7-9.

581 Cingular-Verizon Comments at 8-9.

582 *Id.* at 9.

583 Cingular-Verizon Reply at ii.

584 Cingular-Verizon Comments at 9 (quoting *Burlington N. R.R. v. Transp. Bd.*, 75 F.3d 685,694 (D.C. Cir. 1995)). Cingular-Verizon assert that the reason for adopting the 2 GHz band plan that avoided mutual exclusivity – to expedite the development of a satellite-only service to unserved communities – no longer exists. Cingular-Verizon Comments at 8-9; see also. *e.g.*, Letter from Brian F. Fontes, Vice President, Cingular Wireless LLC. et al., to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 01-185 at 4 (filed, Dec. 26. 2002).

Radio Regulations?" cause harmful interference to systems of other services operating outside of the United States – and we have concluded that it will not. Therefore. we conclude that permitting ATC in the Big LEO band is consistent with the relevant international agreement to which the United States is a party.

218. We further note that the 2 GHz, Big LEO and L-band MSS bands are each included in the ITU allocations for IMT-2000.[573] We agree with the commenters that argue that IMT-2000 contemplates a separate satellite component? however, permitting ATC in the United States will not hinder further implementation of the terrestrial IMT-2000 deployment in the United States and abroad.[575] Therefore, ATC use of each of the satellite allocations proposed is consistent with the international obligations of the United States under the Radio Regulations. Finally, we have independently reviewed the complete record in this proceeding and conclude that granting such flexibility is consistent with international agreements to which the United States is a party.

2. Section 3096)

219. We find 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, pursuant to section 309(j) of the Communications Act.

a. Section 309(j)(1)

220. In the ***Flexibility Notice,*** we observed that limiting terrestrial service rights in the MSS bands to MSS operators providing terrestrial service on an ancillary basis did not appear to implicate our obligation to use competitive bidding under section 309(j). We reasoned that, because terrestrial rights would be linked to pre-existing MSS authorizations and operations, there would be no mutually exclusive applications triggering the competitive bidding provisions of section 309(j).[576] In support of this position, a number of commenters argue that the Commission issued MSS system licenses in a manner that avoids the "mutual exclusivity trigger" of section 309(j), and no new mutual exclusivity will be created by authorizing only MSS licensees "to operate ancillary facilities in the same bands allocated to MSS and subject to the same frequency selection, assignment, and coordination procedures established for their MSS systems."[577]

221. Because we will grant ATC authority by modifying MSS operators' rights under their existing authorizations, and we decline to allow terrestrial operations separate from MSS operations in

572 ***id.*** §§ 4.4, ***8.5***

513 IMT-2000 stands for International Mobile Telecommunications-2000 and it is sometimes referred to as third generation mobile systems (3G) or advanced mobile systems.

574 ***See*** Provisional Final Acts of WRC-2000 Article S5.351A and Resolution 225, Use ***of Additional Frequency Bands for the Satellite Component of IMT-2000.***

575 ***See. e.g.***, Celsat Comments at 9-10; Loral Comments at 8-9; MCHI Comments at 3-5; ICO Reply at 12

576 *Flexibility Notice*, 16 FCC Rcd at 15549, ¶ 39

577 Constellation Comments at 20-21; ***see also*** Loral Comments at 10-14; ICO Comments at 38; MSV Comments at 26, 34-35; MSV Reply at 19-20; Constellation Reply at ***5-8;*** Celsat Reply at 18; Globalstar Reply at 12-15: ICO Reply at 12-13.

required an auction.[591]

226. We are also not persuaded that allowing MSS operators to incorporate ATCs without going through a competitive bidding process is inequitable to CMRS carriers or will unjustly enrich those MSS operators such that we must treat the modifications of their authorizations as initial licenses.[592] The modifications we permit today may indeed make MSS licenses more valuable. However, given the strict limitations we are placing on ATC authority, and the significant costs of launching and maintaining satellite operations, we do not believe that such added value will rise to a level that constitutes unjust enrichment or requires that we consider the modification of MSS licenses to include ATC authority as the assignment of initial licenses.

b. Section 309(j)(3)

227. We also find that our decision to restrict terrestrial rights in the bands used by MSS operators to the provision of ATC by MSS operators only, and our concomitant decision not to accept terrestrial applications from other parties, is consistent with the Commission's obligations under section 309(j)(3). Section 309(j)(3) states that "[i]n identifying classes of licenses and permits to be issued by competitive bidding, in specifying eligibility and other characteristics of such licenses and permits, and in designing the methodologies for use under this subsection, the Commission shall include safeguards to protect the public interest in the use of the spectrum and shall seek to promote" certain objectives, including the development and rapid deployment of new technologies, products, and services for the benefit of the public, including those residing in rural areas, and the efficient and intensive use of the electromagnetic spectrum.[593] As we have explained in detail above, we find that our decision to accept requests from MSS operators to modify their licenses to permit the provision of ATC, without allowing the provision of separate terrestrial services in the same bands, will promote these goals.

228. We find, for example, that MSS operations have the potential ability to bring new technologies and services to consumers in rural areas, and that providing MSS operators with the flexibility to incorporate ATCs in their systems should enable them to achieve this goal.[594] We also find that limiting eligibility for terrestrial rights in the MSS bands to qualified MSS operators is consistent with the goal of ensuring efficient and intensive use of spectrum because it will allow for the use of MSS

[591] *See, e.g. CMRS Flexibility Report and Order,* II FCC Rcd at 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 Pans 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licenses to Engage in Fixed Two-Way Transmissions,*** 13 FCC Rcd *191* 12 (1998), ***recon.,*** 14 FCC Rcd 12764 (1999), ***further recon.,*** 15 FCC Rcd 14566 (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 MDSIITFS. 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.

[592] See Cingular/Verizon Comments at 10-1 I (alleging unjust enrichment); RTG Reply at *5* (alleging windfall)

[593] 47 U.S.C. § 309(j)(3).

[594] *Id.* § (309)(j)(3)(A)

223. We find no merit in the argument that our decision to grant ATC authority solely to current MSS licensees requires an auction because, had ancillary terrestrial services been a part of the original MSS authorizations, there would have been a pool of mutually exclusive applicants and competitive bidding procedures would have been required?" The fact that mutually exclusive applications might have been filed had we originally included ATC authority in MSS licenses does not mean that we must now grant terrestrial rights in the MSS bands through procedures that allow parties other than MSS operators to apply, particularly since we find that it is in the public interest to do otherwise.

224. We also reject the argument that we are required to treat ATC authorizations as initial licenses subject to the auction requirements of section 309f.j). We agree with those commenters who argue that, because the terrestrial rights associated with a grant of ATC authority to MSS operators will be directly linked to existing MSS authorizations, there will be no separate "initial" authorizations, and therefore no requirement to use competitive bidding to assign such rights.[586] We disagree with those commenters who argue that granting ATC authority to MSS operators only "would create a new terrestrial offering" that would go "far beyond mere ancillary service," and that such authority therefore is required "to be deemed 'initial' under section 309(j)."[587] As we have made clear, MSS operators will not be allowed to use ATC authority for more than ancillary service.

225. The Commission has recognized that in certain instances it may be appropriate to treat a major modification as an initial application.[588] In particular, the Commission has stated that "certain types of mutually exclusive applications to modify existing licenses . . . may be so different in kind or so large in scope and scale as to warrant competitive bidding if mutual exclusivity exists."[589] Under the rules and policies we adopt in this Order, an eligible MSS operator will have its space-station license modified to permit ATC subject to stringent requirements and service rules designed to ensure that any terrestrial components are ancillary to the principal MSS authority the Commission previously granted.[590] Thus, to implement an ATC, an MSS licensee must (1) launch and operate its own satellite facilities; (2) provide substantial satellite service to the public; (3) offer ATCs on a commercially bundled basis with MSS, including offering satellite-capable equipment at the point of sale; (4) observe existing satellite geographic coverage requirements; and (5) limit ATC operations to the authorized satellite footprint. In light of these requirements, we find that the license modifications associated with ATC will not be modifications so different in kind or so large in scope and scale as to warrant treatment as "initial" licenses subject to section 309(j)(1). We note that the modification of MSS licensees' authorizations to include ATC authority without competitive bidding is consistent with other decisions in which we have extended licensees additional operating rights without accepting competing applications that might have

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585 Cingular-Verizon Comments at 9

586 Constellation Comments at 20-21; Loral Comments at 10-12

587 Cingular-Verizon Reply at 6 (internal quotations added).

588 *See Implementation of Section 309(j) of the CommunicafionsAct – Competitive Bidding for Commercial Broadcast and Instructional Television Fixed Service Licenses.* MM Docket No. 97-234, First Repon and Order, 13 FCC Rcd 15920, 15925-8, ¶¶ 13-19 (1998) (*Broadcast/ITFS Auction First Repon and Order);Implementation of Section 309(j) of the Communications Act – ConipetrtiveBidding.* PP Docket No. 93-253. Second Report and Order, 9 FCC Rcd 2348, 2355, ¶¶ 37-40 (1994) (*Competitive Bidding Second Reponarid Order).*

589 *Competitive Bidding Second Report and Order,* 9 FCC Rcd at 2355. ¶¶ 37-38.

590 *See supra* § III(C) (discussing MSS ATC service rules)

3. Section 332

231. Section 332 of the Communications Act addresses the regulatory treatment of mobile services, and generally requires that providers of commercial mobile service be treated as common carriers for purposes of the Act while providers of private mobile service are not treated as common carriers.[601] Section 332(d)(1) of the Act defines "commercial mobile service" as "any mobile service . . . that is provided for profit and makes interconnected service available (A) to the public or (B) to such class of eligible users as to be effectively available to a substantial portion of the public, as specified by regulation of the Commission."[602] The Commission has determined that when Congress defined CMRS, it intended the CMRS classification to apply to all mobile services that are for profit and that provide interconnected service to the public or a substantial portion of the public.[603]

232. In the 2 *GHz MSS Rules Order,* the Commission addressed the regulatory treatment of mobile services delivered by satellite. The Commission concluded that it had discretion to regulate the provision of the space station segment of 2 GHz MSS on a non-common carrier basis.[604] It indicated, however, that mobile earth station licenses, if used to provide a mobile service that meets the definition of CMRS under section 332(d) of the Act, would be regulated as CMRS.[605] The Commission explained that, if the service were to be offered to the public. as described in section 332(d)(1) of the Act, then the service would fall within the statutory definition of CMRS.[606] With respect to the L-band, we note that MSV, the MSS licensee in that band, was licensed as a common carrier for both the space segment and mobile handset licenses.[607] With respect to the Big LEO band, there are two operating systems, Iridium and Globalstar. In each case, we have regulated handsets actually providing service to the general public as CMRS.[608]

233. Although MSS can qualify as CMRS under the Communications Act, the Commission has acknowledged the operational and network differences between satellite and terrestrial systems and has deferred implementation of certain CMRS carrier obligations on satellite-based CMRS licensees.[609]

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601 *See generally* 47 U.S.C. §§ 332 (c)(1)-(c)(2).

602 47 U.S.C. § 332(d)(1)

603 *See Implementation of Sections 3(n) and* 332 *of the Communications Act, Regulatory Treatment of Mobile Services,* Third Report and Order, GN Docket No. 93-252.9 FCC Rcd 7988,7993, ¶ 2 (1994).

604 *See* 2 *GHz MSS Rules Order,* 15 FCC Rcd at 16172.¶ 93.

605 *Id.* at 16173.1 97.

606 *Id.* at 16173, ¶ 96.

607 *See Amendment of Pans* 2, 22 *and 25 of the Commission's Rules to Allocate Spectrumfor and to Establish Other Rules and Policies Pertaining* to *the Use of Radio Frequencies in a Land Mobile Satellite Servicefor the Provision of Various Common Carrier Services,* GEN Docket No. 88-1234. Memorandum Opinion, Order and Authorization, 4 FCC Rcd 6041 (1989).

608 *See Space Station System Licensee, Inc.*, Memorandum Opinion, Order and Authorization, 17 FCC Rcd 2271, 2289, ¶ 45 (2002) *(Iridium Authorization)*; *Vodafone Americas Asia. Inc.*, Order and Authorization. 17 FCC Rcd 12849, 12855, ¶ 18 (2002) (*Globalstar Authorization*).

609 *See Revision of the Commission's Rules to Ensure Compatibility With Enhanced 911 Emergency Calling Systems,* CC Docket No. 94-10?, Report and Order and Further Notice of Proposed Rulemaking, 11 FCC Rcd (continued....)

spectrum in urban areas where that spectrum is otherwise unusable.[595] We agree with those commenters that argue that it would be technically less efficient and inadvisable for different operators to provide MSS and terrestrial wireless service in the MSS bands assigned to MSS licensees?% Specifically, as explained above, we find merit in the argument that there are spectrum efficiency benefits to dynamic allocation and that those benefits can only be realized by having one licensee control both the MSS and terrestrial rights to the spectrum in question.

229. We recognize that section 309(j)(3) also includes as one of its objectives the avoidance of unjust enrichment. As indicated above, however, we find that a grant of ATC authority to qualified MSS operators under the conditions prescribed in this Order should not result in the unjust enrichment of MSS licensees.[597] We also do not believe that MSS, even with ATC, will be directly competitive with the terrestrial services offered by CMRS carriers. While there is always some competition on the margin between two mobile voice and data services, the operating, functional, and cost characteristics of MSS with ATC are sufficiently different from CMRS terrestrial services that we do not believe they will be close substitutes for each other for the vast majority of customers. Thus, we do not believe there is any substantial competitive inequity to CMRS carriers from our grant of ATC to MSS operators. In addition, we note that section 309(j)(3) requires us to consider a number of objectives, which we must consider together and sometimes balance against each other. Having thoroughly considered the record and our statutory obligations, we conclude that our decision today is not inconsistent with section 309(j)(3)(C) and, indeed, generally furthers the objectives of section 309(j)(3).

c. Other Matters

230. In the Flexibility Notice, we sought comment on how section 647 of the Open-Market Reorganization for the Betterment of International Telecommunications Act[598] would affect the authorization of terrestrial service separate from MSS authorizations and flexible terrestrial use not ancillary to MSS operations.[599] We also asked commenters to address whether the decision of the U.S. Court of Appeals for the D.C. Circuit in National Public Radio, *Inc. v.* Federal Communications Commission is in any respect applicable to the ORBIT Act exemption from competitive bidding for international and global satellite communications services and the issues raised in this proceeding[600] In light of our decision that granting only MSS operators the right to provide terrestrial service in MSS bands does not implicate the competitive bidding provisions of section 309(j) of the Communications Act, we need not address arguments regarding the applicability or non-applicability of the ORBIT Act.

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595 See. *e.g.*, MSV Comments at 36 (citing 47 U.S.C. §309(j)(3)(D)).

5% See, *e.g.*, Inmarsat Supplemental Comments at 5-15; Boeing Supplemental Comments at 8; Globalstar Supplemental Comments at 4-7; Celsat Supplemental Comments at 1-5; MSV Supplemental Comments at 4-9; ICO Supplemental Comments at 3-18.

597 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) (emphasis added).

598 Open-Market Reorganization for the Betterment of International Telecommunications Act, Pub. L. No. 106-180, 114 Stat. 48 (enacted March 12, 2000) (ORBIT Act) (codified at 47 U.S.C. §§ 761 *et seq.*)

599 *Flexibility Notice*, 16 FCC Rcd at 15549, ¶ 39

600 *National* Public *Radio v. Federal Communications Commission*, 354 F.3d 226 (D.C. Cir. 2001)

required by statute to apply to all CMRS providers should be applied to specific MSS ATC offerings. However, requirements that must be applied to all common carriers will also apply to MSS CMRS.[617]

F. Modification of Table of Allocations

235. In the *Flexibility* Notice, we sought comment on whether a footnote to the U.S. Table of Allocations contained in section 2.106 of our rules indicating that MSS operators are permitted to integrate terrestrial operations into their MSS systems would be sufficient to permit such operations.[618] Commenters addressing this issue support the use of footnotes,[619] some of whom note that such an approach is consistent with the Commission's decision to add footnote US327 to the Table of Allocations for terrestrial service in DARS.[620]

236. A licensee's authorized MSS assignments are conditioned on coordination agreements and based on the ITU Radio Regulations. MSS coordination agreements and the ITU Radio Regulations provide varying regulatory statuses to terrestrial operations in the frequency bands in which we permit ATC.[621] Due to our decision today that ATC networks are to be closely tied to a licensee's MSS network operations from a technical and operational standpoint, and our decision to allow an MSS licensee to operate an ATC network only on its frequency assignments for its satellite network, we agree with the commenters that adding footnotes to the U.S. Table of Allocations for the respective MSS bands is sufficient to permit ATC operations in the 2 GHz MSS, L-band and Big LEO MSS allocations. The new footnote, US380, reads as follows: "In the bands 1525-1559 MHz, 1610–1660.5 MHz, 2000-2020 MHz, 2180-2200 MHz, and 2483.5-2500 MHz, a non-Federal Government licensee in the mobile-satellite service (MSS) may also operate an ancillary terrestrial component in conjunction with its MSS network, subject to the Commission's rules for ancillary terrestrial components and subject to all applicable conditions and provisions of its MSS authorization.'"'

G. Licensing Requirements

1. Modification of MSS Space-Station Authorizations

237. In the *Flexibility* Notice, we sought comment on modifying a U.S.-licensee's space station license to authorize the provision of ATC. We proposed that we would license the terrestrial facilities provided that the licensee has requested a modification to its license and demonstrated that it has met the established eligibility criteria.[623] We noted, however, that the terrestrial components of MSS

617 See, *e.g.*, 47 C.F.R. §§ 20.63, 20.64; *Communications Assistance for* Low *Enforcement Act,* Pub. L. No. 103-414, 108 Stat. 4279 (1994) (codified as amended in scattered sections of 18 U.S.C. and 47 U.S.C. §§ 229, 1001-1010, 1021).

618 *Flexibility Norice.* 16 FCC Rcd at 15559-60, ¶¶ 69-71

619 *See. e.g.*, MSV Comments at 32 & Reply at 26-27; Constellation Comments at 24; ICO Comments at 48-49.

620 See 47 C.F.R. § 2.106 US 327; *Amendment of the Commission's Rules with Regard to the Establishment and Regulation of New Digital Audio Radio Services.* GEN Doc. No. 90-357, Report and Order, 10 FCC Rcd 2310 (1995); see *also* Celsat Reply at 17; Motient Reply at 32.

621 *See supra* § III (E)(1)(b).

622 See App. B (adopting US380, 47 C.F.R. § 2.106).

623 *Flexibility Norice,* 16 FCC Rcd at 15553-54, ¶ 50

Depending on the types of end-user services offered, however, the ATC component that MSS licensees may offer may more closely resemble traditional CMRS networks than traditional satellite networks. Accordingly, some patties have argued that to the extent ATC components resemble traditional terrestrial CMRS networks, MSS licensees should be required to meet the same CMRS obligations that terrestrial CMRS providers must observe.[610] Cingular and Sprint, for example, state that "MSS licensees [providing ATC] presumably would use mobile switches just like those of the terrestrial CMRS providers, and they also propose to sell terrestrial only handsets, which would presumably be similar to the terrestrial CMRS handsets in the market today."[611] Other parties, such as Globalstar, however, claim that the Commission should not consider ATC the regulatory equivalent of terrestrial CMRS because MSS will be used by persons living and/or working outside areas of traditional wireline or terrestrial wireless coverage for the foreseeable future.[612] As a nascent service, Globalstar asserts, the Commission should impose minimal regulatory requirements on MSS ATC.[613]

234. We reaffirm our previous findings in the 2 *GHz MSS Rules Order*, and hold that, if a mobile handset authorization meets the statutory definition of CMRS in section 332(d)(1) of the Act, then the service will be regulated as CMRS. We reject the arguments of Globalstar that our decision should rest on who the likely users of the service are, the size of the handsets, the cost of the service, or our assessment of whether MSS is a true competitor in the CMRS market. If MSS licensees seek to provide terrestrial mobile service in MSS bands, then the terrestrial component of the MSS ATC service shall be subject to the same regulatory treatment as any other operator providing the same or similar services in any other band.[614] As indicated in the 2 *GHz MSS Rules Order*, we continue to reserve the right to review individual applications on a case-by-case basis to determine if this regulatory classification is appropriate.[615] We also retain our authority to forbear from applying certain provisions of Title II to CMRS providers as necessary.[616] We also will address, on a case-by-case basis, whether provisions not

(Continued from previous page)
18676, 18718, ¶ 83 (1996), *recon.*, Memorandum Opinion and Order. 12 FCC Rcd 22665 (1997); ***Amendment of Pans 2 and 25 to Implement the Global Mobile Personal Communicationsby Sarellite (GMPCS) Memorandum of Undersranding and Arrangements,*** Notice of Proposed Rulemaking, 14 FCC Rcd 5871,5907, ¶ 98 (1999); ***International Bureau Invites Further Comment Regarding Adoption of 911 Requirements for Satellite Services.*** Public Notice, 16 FCC Rcd 3280 (2000); ***Revision of the Commission's Rules to Ensure Compatibility With Enhanced 911 Emergency Calling Systems,*** Further Notice of Proposed Rulemaking. 17 FCC Rcd 25576 (2002), ***available at*** <http://hraunfoss.fcc.gov/edocs public/attachmatch/FCC-02-326A1.doc> (last visited Dec. 26, 2002).

610 ***See, e.g.,*** Letter from Brian Fontes. Cingular Wireless LLC, and Luisa Lancetti, Sprint Corporation, to Donald Abelson et al., Federal Communications Commission, IB Docket No. 01-185 at 9-10 (tiled Dec. 2, 2002) (Cingular/Sprint Dec. 2,2002 ***Ex Parte*** Letter) (arguing that the Commission should confirm that providers of terrestrial services in the MSS band will be subject to the statutory requirements and regulations applicable to other terrestrial mobile services, including CALEA, E911, local number portability. number pooling and TTY).

611 Cingular/Sprint Dec. 2.2002 ***Ex Parte*** Letter at 10.

612 See Globalstar Comments at 11

613 ***Id.***

614 Accordingly. even if an MSS licensee offers only non-common-carrier ***satellite*** services. the Commission will require the MSS licensee to comply with common carrier rules for its ***rerrestrial*** component if the terrestrial component of its service offering will. in fact, be offered on a common carrier basis.

615 ***See 2 GH: MSS Rules Order.*** 15 FCC Rcd at 16174. ¶ 97

616 ***See*** 47 C.F.R. § 20.15; ***see also*** 47 U.S.C. § 332(c)(1)(A)

provide the flexibility to MSS licensees to use their licensed spectrum more efficiently, we implement geographic area licensing for all MSS ATC base stations in the United States that do not pose a potential hazard to the environment, public health, scenic and historic locations, tribal lands, aviation and related concerns.[633] Specifically, section 1.1301 and related provisions of our rules describe certain types of facilities that require additional Commission scrutiny under the NEPA.[634] These provisions apply to all Commission actions, including licensing, that may have a significant impact on the quality of the human environment.[635] Similarly, our Part 17 rules on antenna structures govern every radiating or receiving transmission system and provide detailed guidance on antenna height, location, lighting and similar issues to protect aviation.[636] As with other terrestrial transmission or reception equipment, therefore, we will require individual licensing of ATC base stations in any situation that may pose an adverse effect to the environment, public health, scenic and historic locations, tribal lands aviation or related concerns.[637]

240. We adopt a blanket authorization process to implement geographic area licensing of ATC base station facilities operating in the U.S. coverage of the MSS space segment (*i.e.*, the 50 states, and U.S. territories and possessions, such as Puerto Rico and the U.S. Virgin Islands). Blanket ATC base station authorization shall be conditioned upon the MSS licensees' satisfaction of the requirements of this Order in providing ATC and the rules adopted herein. We will require MSS licensees to modify their space station licenses using FCC Form 312, and accompanied by the appropriate fee, to request blanket authority to construct and operate ATC base station facilities.[638] MSS licensees shall provide specific information and certifications describing the ATC operations in the following categories: information demonstrating that the terrestrial facilities will comply with the technical restrictions adopted herein; a statement that the terrestrial facilities will comply with the Commission's rules regarding environmental impact;[639] and that the terrestrial facilities will comply with Part 17 of the Commission's rules regarding antenna structure clearance with the Federal Aviation Administration; and a certification that the terrestrial facilities will be operated consistent with all international agreements. Any applications meeting these requirements will be treated as minor modifications.[640] As with any minor modification, if upon Commission review the Commission deems it in the public interest to seek comment on an MSS ATC application, the Commission at its discretion may provide public notice and opportunity for comment. We recommend that licensees seeking approval of non-conforming operations submit separate applications for blanket authority, listing the technical parameters of those individual facilities that do no meet our rule requirements to prevent delay in the grant of applications for conforming facilities filed concurrently.[641]

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[633] See. *e.g.*, MSV Comments at 29 ("Individual applications and prior Commission approval should be required only if construction and operation of the facility would have a significant environmental effect.").

[634] 47 C.F.R. § 1.1301 *et seq.*

[635] 47 C.F.R. § 1.1303.

[636] See, *e.g.*, 47 C.F.R. §§ 17.1-17.58.

[637] See App. B (47 C.F.R. §§ 25.147(a)(4)-(5))

[638] As a result, authorization for ATC will run in parallel with the MSS satellite system license and will expire upon expiration of the space-station license, unless renewed.

[639] See 47 C.F.R. Part I, Subpart I.

[640] See 47 C.F.R. § 25.151(c)(1).

[641] MSV notes that it has already applied to launch and operate a next-generation MSS system that included a request to operate ancillary terrestrial base stations. MSV Comments at 29 (citing *Application of Motient Services*
(continued....)

operations could allow two-way traffic that could originate and terminate on the terrestrial component of the network without having to transverse the satellite component of the network. This architecture could entail a significant number of fixed stations deployed in a multi-cellular network, particularly in urban areas, that would allow traffic to be handed off from one cell to another. In the 2 GHz MSS bands, we also noted that not all incumbent fixed operations may be relocated, and that these incumbent fixed operations will remain co-primary until 2010.6" Therefore, we sought comment on whether to authorize the terrestrial facilities separately or on a blanket licensing basis, for the U.S. coverage of the MSS space segment (i.e., the 50 states, and U.S. territories and possessions, such as Puerto Rico and the U.S. Virgin Islands) or a smaller area.[625]

238. Commenters addressing the issue generally support authorizing ATC operations by modifying an MSS operator's space station license and state that individual coordination of base stations is not needed.[626] MSV, for example, urges the Commission to adopt licensing requirements that "facilitate rapid deployment" the MSS operators' ancillary terrestrial component.[627] A few commenters supported individual licensing requirements on the grounds that doing so would promote inter-service coordination.[628] Most commenters, however, characterized our alternative proposals to require some form of site-by-site licensing for each ATC base station as redundant, burdensome and of little practical value to other licensees or the Commission. According to MSV. for example, "requiring individual licensing of [terrestrial] facilities will be burdensome and unnecessary."[629] Instead, MSV recommends adopting a procedure similar to the one used for base stations in the Wireless Communications Service, which requires individual applications only where construction or operation of the facility would have a significant environmental effect.[630] MSV recommends that the Commission extend its existing policies and rules for the geographic-area licensing of terrestrial base-stations to MSS ATC operators. Under this approach, the Commission would not routinely review the proposed construction of base-station facilities built to support transmission equipment used by MSS licensees; however, the Commission would review any towers that require either a showing of compliance with the National Environmental Policy Act (NEPA),[631] or an antenna structure registration under Part 17 of our rules.[632]

239. Geographic area licensing provides licensees the flexibility to adjust spectrum usage dynamically, depending upon market demands. Given that one of the policies behind granting ATC is to

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[624] *Id.* at 15554-55, ¶ 52.

[625] *Id.* at 15555, ¶ 52

[626] *See, e.g.,* ICO Comments at 47; MSV Reply at 27.

[621] MSV Comments at 28-29.

[628] *See, e.g.,* SBE Comments at 3.

[629] MSV Comments at 29

[630] *Id.*

[631] *See National Environmental Policy Act of 1969*, 42 U.S.C. § 4321

[632] 47 C.F.R. §§ 17.1-17.58. Under Part 17 of the Commission's rules, all antenna structures of more than 200 feet in height or within the flight path of an airport must be registered with the Commission prior to construction. *See* 47 C.F.R. § 17.7(a) ("....of more than 60.96 meters (200 feet) in height above ground level."). If the antenna structure may have a significant environmental effect, as defined by section 1.1307 of the Commission's rules, *see* 47 C.F.R. § 1.1307. the applicant must file an Environmental Assessment (EA) as part of its registration application. *See* 47 C.F.R. § 1.1308; *see also Streamlining the Commission's Antenna Structure Clearance Procedure,* Report and Order, II FCC Rcd 4272.4289. ¶ 41 (1995).