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Before the

**FEDERAL COMMUNICATIONS COMMISSION**

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Washington, D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

In the Matter of Application of

Iridium LLC

File Nos. 187-SAT-P/LA-97(96)

SAT-LOA-19970926-00147

Concerning the Use of the 1990-2025/

2165-2200 MHz and Associated Frequency

SAT-AMD-20001103-00156

Bands for a Mobile-Satellite System

### **Opposition to Petition for Partial Reconsideration**

Iridium LLC (“ILLC”) and Iridium Satellite LLC (“ISLLC”) (collectively “Iridium”) hereby oppose Hughes Electronics Corporation’s (“Hughes”) Petition for Partial Reconsideration<sup>1</sup> of the Order and Authorization<sup>2</sup> issued by the International Bureau (the “Bureau”) in the above referenced proceeding. The Order grants Iridium authority to launch and operate the Macrocell mobile satellite service (“MSS”) system in the 2 GHz band. Hughes’ Petition seeks reconsideration of that portion of the Macrocell License that authorizes Iridium to utilize feederlink uplinks in the 29.25-29.50 GHz band, spectrum that also may be used by Hughes’ planned “Spaceway” system.

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<sup>1</sup> See Petition for Partial Reconsideration of Hughes Electronics Corporation, Inc., File Nos. 187-SAT-P/LA-97(96), SAT-LOA-19970926-00147, SAT-AMD-20001103-00156 (filed August 16, 2001) (“Hughes’ Petition”).

<sup>2</sup> Iridium LLC, Order and Authorization, DA 01-1636, 2001 FCC LEXIS 3872 (July 17, 2001) (“Macrocell License”).

The Bureau should reject Hughes' Petition, for four reasons. *First*, the Bureau carefully considered all viewpoints—including Hughes'—before granting the Macrocell License. *Second*, Hughes' Petition requests untimely reconsideration of the policies established in the five year-old *28 GHz Order*.<sup>3</sup> *Third*, Hughes ignores coordination procedures well established by the FCC and the ITU, as well as Hughes' own demonstration—less than two years ago—that sharing is feasible. *Fourth*, the Bureau properly deferred resolution of specific interference complaints until Iridium files earth station applications, at which point any potential for interference between the two systems can be resolved through coordination with individually licensed geostationary satellite orbit ("GSO") fixed satellite service ("FSS") earth stations.

Both Iridium companies have an interest in this proceeding. ISLLC currently operates the IRIDIUM satellite system ("IRIDIUM System"),<sup>4</sup> and ILLC is the holder of the Macrocell License, which is intended to be an integrated "second generation" system operating in conjunction with the IRIDIUM System. Both licensees are authorized to use the shared band for feeder uplinks. Because Hughes' challenge to the Macrocell License implicates all MSS systems authorized to operate in the shared band, the instant opposition to Hughes' Petition is submitted on behalf of both entities.

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<sup>3</sup> See *In the matter of Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, First Report and Order and Fourth Notice of Proposed Rulemaking, 11 FCC Rcd 19005 (1996) ("*28 GHz Order*").

<sup>4</sup> *Motorola Satellite Communications*, Order and Authorization, 10 FCC Rcd 2268 (1995); Erratum, 10 FCC Rcd 3915 (1995). ISLLC has a pending application to acquire the IRIDIUM System license. Until the pending application is acted upon, ISLLC has an agreement with Motorola to operate the IRIDIUM System on ISLLCs' behalf. See Satellite Policy Branch Information, Applications Accepted for Filing, Space System License, Inc., SAT-ASG-20010319-00025, Report No. SAT-00070 (April 17, 2001) (Public Notice).

## I. Factual Background

In 1996, the Commission adopted the *28 GHz Order*, which established a band plan for spectrum in the 28-29 GHz range.<sup>5</sup> The *28 GHz Order* accommodated terrestrial services (*i.e.*, LMDS), non-geostationary satellite orbit (“NGSO”) MSS feederlinks and GSO FSS earth stations through exclusive and shared allocations. The order allocated the 29.25-29.50 GHz band for both MSS feeder uplinks and GSO FSS service uplinks with co-primary status, and established coordination criteria.<sup>6</sup> Finally, the *28 GHz Order* required MSS applicants to show they *can* share the 29.25-29.50 GHz band with GSO FSS operators.<sup>7</sup>

Following the 1997 filing of the Macrocell application, Hughes submitted a Petition to Deny seeking to deny Iridium authority to use the band 29.25-29.50 GHz for feederlinks on the grounds that: (1) the Macrocell system did not utilize repeating ground tracks as required by Section 25.258(c) of the Commission’s Rules; and (2) Iridium had failed to prove that it could coordinate with the licensed GSO FSS systems.<sup>8</sup> Iridium filed a timely and complete response to the interference concerns raised by Hughes and other GSO FSS operators. Iridium demonstrated that sharing between the Macrocell system and the GSO FSS operators was possible and that

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<sup>5</sup> See *28 GHz Order*; see 47 C.F.R. § 25.258(a).

<sup>6</sup> See 47 C.F.R. § 25.258. One of the rules adopted detailed coordination methodology for MSS systems with feederlinks in the 29.25-29.50 GHz band that employed repeating ground tracks. ILLC filed a timely Petition for Reconsideration of this rule. Earlier this year, the Commission issued its order on reconsideration in the IB Docket 92-297. Recognizing that no NGSO system licensed to use 29 GHz for feederlinks repeated its ground tracks, the FCC deleted Section 25.258(c) of the Rules. See *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, Memorandum Opinion and Order, FCC 01-164, 2001 FCC LEXIS 2894 (May 25, 2001).

<sup>7</sup> See 47 C.F.R. § 25.258(d).

<sup>8</sup> See Petition to Deny of Hughes Communications Galaxy, Inc., File No. 187-SAT-P/LA-97 (filed Dec. 22, 1997) (“*Petition to Deny*”).

Iridium was committed to coordinating prior to operating feederlinks in the shared band.<sup>9</sup>

On July 17, 2001, the Bureau granted the Macrocell License. That order noted and fully considered Hughes' Petition to Deny. In particular, the Bureau dismissed Hughes' Petition to Deny as moot insofar as it relied on Section 25.258(c) because that rule had been rescinded.<sup>10</sup> The Bureau also discussed the interference concerns raised by Hughes (and other GSO FSS operators) and found that any potential interference could be resolved through inter-system coordination.<sup>11</sup> Hughes has now filed a Petition for Partial Reconsideration seeking revocation of Iridium's authorization to use 29.25-29.50 GHz for feederlink operations.

## **II. The Bureau Has Already Fully Considered all of Hughes' Claims**

Contrary to Hughes' assertions, the Bureau expressly considered Hughes' contention that the Macrocell system could not share the 29.25-29.50 GHz band with GSO FSS operators. Indeed, the order granting the Macrocell License expressly discusses Hughes', and other's, interference concerns,<sup>12</sup> and squarely rejects them. The Bureau explained that Iridium had confirmed its commitment to coordinate the Macrocell system with authorized operators in the shared frequencies<sup>13</sup> and that "Iridium has shown its ability to [coordinate] its feederlink

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<sup>9</sup> See Consolidated Opposition and Response of Iridium LLC, File No. 187-SAT-P/LA-97 (filed Feb. 2, 1998) ("*Iridium Response*").

<sup>10</sup> See Macrocell License, ¶ 10. See *supra* note 6.

<sup>11</sup> *Id.*

<sup>12</sup> See Macrocell License, ¶¶ 10 & n.41.

<sup>13</sup> See Macrocell License, ¶ 9.

operations” in other shared bands.<sup>14</sup> Moreover, the order granting the Macrocell License noted that other GSO FSS operators conceded that they could coordinate with the MSS feederlinks.<sup>15</sup> Accordingly, the Bureau correctly determined that it reasonably could rely on Iridium’s assurance of future coordination efforts to resolve inter-system interference.<sup>16</sup>

Hughes may disagree with the conclusion reached by the Bureau, but the Bureau’s consideration and rejection of the merits of Hughes’ assertions demonstrates, *a fortiori*, that the Bureau’s order addresses all of the issues raised by Hughes’ Petition. Accordingly, because the Bureau carefully addressed all of these issues, the grant of the Macrocell License is neither arbitrary nor capricious.

### **III. Hughes Improperly Seeks Reconsideration of the 28 GHz Order**

Hughes urges the Commission to “defer action on Iridium’s Ka-band feeder link request until *Iridium* has sufficiently demonstrated that it has complied with the rules regarding use of the 29.25-29.5 GHz band.”<sup>17</sup> This request essentially is an untimely Petition for Reconsideration of the band allotment and coordination rules adopted in the *28 GHz Order*. That order established that coordination was feasible among co-primary services; it did not relegate MSS feederlinks to secondary status, but merely required NGSO MSS licensees to show that coordination between their proposed system and the GSO FSS licensees in the band was

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<sup>14</sup> See Macrocell License, ¶ 10 (referring to coordination by Iridium in the 19.4-19.6 GHz and the 29.1-29.25 GHz bands).

<sup>15</sup> See Macrocell License, ¶ 10 & n.41.

<sup>16</sup> See Macrocell License, ¶ 10 & n.43.

<sup>17</sup> See *Hughes’ Reconsideration Petition* at 10-11 (emphasis added).

possible.<sup>18</sup> ILLC made such a showing,<sup>19</sup> and the Commission properly found that Iridium had, therefore, satisfied this coordination requirement.

Rather than follow the policies set forth in the *28 GHz Order*, Hughes proposes to shift the entire burden of coordination to ILLC. This would demote NGSO feederlinks to “secondary” status. Yet, the *28 GHz Order* explicitly rejected any “first-in time” policy, and instead obligates NGSO and GSO system operators to coordinate on a co-equal basis.<sup>20</sup> Consequently, Hughes’ request is a thinly veiled attempt to reverse the co-primary allocation of the shared band.

The period for seeking reconsideration of the *28 GHz Order* has long since passed; indeed, the issues have been discussed (especially by Hughes) time and again. Moreover, downgrading NGSO feederlinks to secondary status would require a rulemaking, and it cannot be accomplished in the context of this adjudication at the Bureau level.<sup>21</sup> The Bureau should therefore dismiss Hughes’ Petition as an untimely filed Petition for Reconsideration of the *28 GHz Order*.<sup>22</sup>

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<sup>18</sup> See 47 C.F.R. § 25.258(d).

<sup>19</sup> See *Iridium Response* at 9. Several techniques were identified by studies done by the ITU-R and later adopted by the Commission, including adaptive uplink power control and cross polarization. The Macrocell application indicated Iridium intended to use these techniques to enable sharing with authorized GSO FSS operators.

<sup>20</sup> See *28 GHz Order*, ¶ 72.

<sup>21</sup> Hughes’ technical studies prove too much. Its assertion that sharing is infeasible under any circumstance itself demonstrates that Hughes requests wholesale modification of the long-settled 28 GHz band plan. Such relief cannot be afforded in the instant review of a licensing order before the International Bureau.

<sup>22</sup> See, e.g., *MCI Telecommunications Corp. v. Pacific Northwest Bell Telephone Co.*, 5 FCC Rcd 216, ¶ 41 n.38 (Memorandum Opinion and Order), recon. denied, 5 FCC Rcd 3463 (1990).

<sup>23</sup> See 47 C.F.R. § 25.258; see also 47 C.F.R. § 25.257.

#### **IV. The 29.25-29.50 GHz Band Can be Shared Through Inter-System Coordination, as the FCC's Rules and the ITU Radio Regulations Establish, and as Hughes Itself Admits**

Hughes claims that the Macrocell system cannot share the 29.25-29.5 GHz band with GSO FSS systems. However, Hughes ignores the fact that there are several well-understood techniques for sharing the band between the two services, as it previously has conceded.

First, the FCC's own rules adopt many of these sharing criteria.<sup>23</sup> Indeed, facilitating inter-service coordination was central to the adoption of the band plan in the *28 GHz Order*.<sup>24</sup> Second, modifications to the ITU Radio Regulations, first introduced at WARC-92, afford NGSO and GSO systems equal status and set forth various coordination techniques.<sup>25</sup>

Third, Hughes itself previously provided data to the Commission conceding that sharing is feasible. Just three years ago, Hughes argued that cross-polar discrimination and geographic isolation could be combined to reduce or eliminate interference to the Spaceway or IRIDIUM System spacecraft receivers.<sup>26</sup> Less than two years ago, Hughes repeated much the same claims.<sup>27</sup> Hughes' sudden change in position is puzzling, and Hughes presents no contrary evidence in this proceeding to justify its changed position.

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<sup>24</sup> See 47 C.F.R. § 25.257(a)-(c). To facilitate sharing with LMDS operators, who occupy the 29.1-29.25 GHz portion of the MSS feederlink allocation, the Commission restricted the location of MSS feederlink earth stations to ten sites within the United States. In a letter filed with the Wireless Bureau on October 6, 1997, ILLC identified its planned feederlink sites.

<sup>25</sup> ITU Radio Regs. Art. S9 (formerly Res. 46), adopted by the FCC for the 29.25-29.50 GHz band, affords NGSO and GSO systems equal status in negotiating coordination.

<sup>26</sup> See *Comments of Hughes Electronics, Inc.*, IB Docket No. 98-172 (filed Nov. 18, 1998).

<sup>27</sup> Hughes provided these data in IB Docket 98-172 to support a proposal for blanket licensing of GSO FSS earth stations in the 29.25-29.500 GHz band. See Letter from Joslyn Read, Assistant Vice-President, Hughes Network Systems/Spaceway and John P. Janka, Counsel for HNS/Spaceway to Magalie Roman Salas, CC Docket No. 98-172 (filed May 19, 2000) ("Hughes *ex parte* letter"). The FCC has not acted upon this request. IRIDIUM notes that the existing band plan and sharing criteria were grounded on individual, not blanket, licensing of GSO FSS uplinks in the band. Any change in that policy would undermine the pre-established coordination rules and potentially subvert sharing between NGSO feederlinks and GSO FSS earth stations.

Fourth, despite Hughes' claim,<sup>28</sup> Iridium's feederlinks and tracking, telemetry and control ("TTAC") earth stations outside the United States will not undermine sharing in the band.<sup>29</sup> Any such earth stations also have to be coordinated with GSO systems under ITU procedures, and interference issues can be addressed in that context; the Bureau's license adjudication proceedings are not the proper forum to resolve such issues. Moreover, it is worth noting that NGSO systems are *inherently* global<sup>30</sup> and must be able to access earth stations in other countries. This is especially true for TTAC earth stations.

To confirm the viability of sharing in the band, Iridium re-evaluated the constraints under which Iridium NGSO MSS feederlink earth stations and Spaceway GSO FSS user uplinks could share at 29.25-29.50 GHz. Appendix A presents the results of an analysis by Dr. Edward F. Miller. Dr. Miller confirms that MSS feederlinks (in both the IRIDIUM System and the Macrocell system) can share the 29.25-29.50 GHz band with GSO FSS systems so long as the latter employ well-recognized sharing techniques. These sharing techniques include opposite sense polarization and avoidance of the band when transmitting in the same geographic area as NGSO earth stations.<sup>31</sup> We note that the Spaceway system already announced that it would employ these techniques, *i.e.*, avoid any frequencies in the band 29.25-29.50 GHz within a

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<sup>28</sup> See *Hughes' Reconsideration Petition* at 9.

<sup>29</sup> This includes existing and planned earth stations operating with the current IRIDIUM system.

<sup>30</sup> See 47 C.F.R. § 25.143(b)(2)(iii) (requiring 1.6 GHz "Big LEO" systems to cover at least 75 percent of the most densely populated world).

<sup>31</sup> Hughes itself recognized this scenario in its May 2000 submission to the FCC. See *Hughes ex parte* letter. Figure 2 of that filing shows a frequency and polarization use method that could facilitate sharing. (Fig. 2 is attached.) Although IRIDIUM opposes Hughes' request for blanket licensing in the band, the May 2000 proposal remains flatly inconsistent with Hughes' current claim.



Spaceway uplink beam coverage area that contains a NGSO MSS feeder uplink station.<sup>32</sup> Given all of the above, there is no basis for Hughes' *a priori* suggestion that sharing is impossible.

**V. The Bureau Properly Deferred Specific Interference Issues Until ILLC Applies for Feederlink Earth Stations.**

In the order granting the Macrocell License, the Bureau deferred comprehensive resolution of interference complaints until ILLC applies to operate specific feederlink earth stations. Hughes objects, claiming that this decision was unprecedented and prejudices its rights in the band.<sup>33</sup> However, the FCC always processes space station applications separately from earth station applications. Contrary to Hughes' claim, earth station licenses are not granted in a processing round; rather, the Bureau typically addresses earth station licenses after allocating the relevant spectrum and after the applicant receives its space segment license. The Bureau followed long-standing procedure in this case and questions surrounding coordination of particular earth stations are not yet ripe.

Hughes' Petition presents no reason to change the agency's band plan, and coordination techniques. So long as Hughes will negotiate in good faith, co-frequency sharing between NGSO feederlinks and GSO FSS earth stations can be coordinated under the FCC's policies. For its part, Iridium re-affirms its commitment to coordinate with all relevant licensees at the appropriate time.

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<sup>32</sup> See *Reply Comments of Hughes Communications, Inc.*, CC Docket No. 92-297 (filed October 10, 1995).

<sup>33</sup> See *Hughes' Reconsideration Petition* at 5, 8-9.

**VI. Conclusion**

Hughes' Petition presents no reason to reconsider the order granting the Macrocell License. Hughes cannot twist the Bureau's rejection of its claims on the merits into any failure to consider all relevant issues. Moreover, the relief Hughes seeks amounts to an untimely petition for reconsideration of the *28 GHz Order*, which cannot be accomplished in the context of license adjudication. In addition, Hughes' request ignores long-established coordination techniques set forth both by the FCC and the ITU, as confirmed in Appendix A. Indeed, Hughes fails to acknowledge its own demonstration, made less than two year ago, that sharing between NGSO feederlinks and GSO FSS uplinks is feasible. In any event, the Bureau properly concluded that Hughes' concerns were not ripe and should be deferred until ILLC applies for specific earth stations. Accordingly, the Bureau should deny Hughes' Petition for Partial Reconsideration of the Macrocell License and confirm the co-primary sharing regime governing the IRIDIUM System.

Respectfully submitted,

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# Appendix A

Analysis Conducted by  
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September 10, 2001

September 10, 2001

## **Sharing Between NGSO MSS Feeder Link Stations and GSO FSS Services In the 29.25-29.5 GHz Band Through Coordination Agreements**

The 29.250-29.500 GHz band is shared in the United States between NGSO feederlinks and GSO FSS. There are several well-understood techniques for sharing the band between the two services. The international Radio Regulations contain provisions (Appendix S9, Section II - the former ITU-R Resolution 46)<sup>1</sup> for the international coordination between satellite systems sharing the same frequency bands. Similarly, the FCC adopted provisions for sharing, including a band segmentation plan for the 27.5-30.0 GHz uplink band (the 28 GHz Band Plan).<sup>2,3,4</sup> The 28 GHz Band Plan designates the band segment 29.250-29.500 GHz to be co-primary for MSS FEEDER LINKS & GSO/FSS.

The FCC rules address sharing between these two co-primary services in Section 25.258. Subsection (a) imposes upon both services a burden to "... cooperate fully in order to coordinate their systems." Further, Section (b) requires that "Licensed GSO FSS systems shall, to the maximum extent possible, operate with frequency/polarization selections, in the vicinity of operational or planned NGSO MSS feeder link earth station complexes, that will minimize instances of unacceptable interference with GSO FSS or NGSO MSS uplink reception." These regulations establish the framework for NGSO MSS feederlink stations and GSO FSS services sharing the band 29.25-29.50 GHz through coordination agreements.

Iridium has conducted several analyses to determine the constraints under which Iridium NGSO MSS feeder link Earth stations and Spaceway GSO FSS user uplinks could share the frequency band 29.25-29.50 GHz. The following sections present the results of those analyses. The analyses confirm that NGSO feederlinks (in both the Iridium and Macrocell systems) can share the 29.250-29.500 GHz band with GSO FSS systems so long as the latter employ well-recognized sharing techniques.

### **1. Co-frequency, Co-polarized, and Co-located Uplinks**

The case of Iridium gateways and Spaceway user uplinks being co-located results in the worst-case scenario – the in-line interference case, where the satellite receiver of the victim system is on-axis with the beam center of the transmitter system of the interfering system. At the Iridium satellite receiver in clear weather, this beam center to beam center coupling geometry produces a co-frequency, co-polarized carrier-to-interference ratio (C/I) that is 13.6 dB below the level required for acceptable performance for the TTAC uplink. (TTAC = Tracking, Telemetry, and Command) For the Gateway uplink, the C/I was 4.6 dB below the level required for acceptable performance. With rain attenuation, the results in both cases were 30 dB worse, for the Tallahassee FL Earth station. The calculations were performed for:

### Iridium System

Gateway Locations	Tempe AZ, Hawaii, Tallahassee FL
Rain Attenuation	None (clear weather) & ITU-R Model
Uplink Power	Maximum
Channels	TTAC, Gateway uplink

### Spaceway System

Characteristics from Spaceway filings and Hughes Network Systems ex parte presentation<sup>5</sup>

Seven user uplinks to produce interference in the full bandwidth of an Iridium uplink channel

GSO FSS satellite at 101W

The result of this analysis is that the co-frequency, co-polarized, co-location scenario must be avoided because of the GSO FSS uplinks causing unacceptable interference to the NGSO MSS uplinks.

The solution to the potential sharing difficulty is already contemplated in the FCC's rules. In particular, Section 47 C.F.R. § 25.258(b) now obligates GSO FSS systems to operate in the vicinity of NGSO MSS feeder link Earth stations with frequency/polarization selections that will minimize instances of unacceptable interference. These techniques are addressed in the next section.

## **2. Co-frequency, Cross-polarized, Geographically Separated Uplinks**

Sharing the 29.250-29.500 GHz band is feasible so long as GEO FSS systems employ opposite sense polarization and avoid the band when transmitting in the same geographic area as NGSO MSS Earth stations. This scenario was recognized by Hughes itself in its May 2000 submission to the FCC.<sup>5</sup> Figure 2 of that filing shows a frequency and polarization use method that enables sharing. (Fig. 2 is attached.) In particular, Spaceway previously planned on avoiding any frequencies in the band 29.25-29.50 GHz within a Spaceway uplink beam coverage area that contains a NGSO MSS feeder uplink station, as represented by the "Beam Type X" in the figure. Beam Types 1 and 2, immediately adjacent to the Type X beam, use frequencies in the 29.25-29.50 GHz band, but the Spaceway user uplinks are cross-polarized to the NGSO MSS feeder links. Beam Types 3 and 4, one beam area removed from the Type X beam, use frequencies in the 29.25-29.50 GHz band and are co-polarized with the NGSO MSS feeder links.

Analyses were performed by Iridium and Macrocell for the coordination method shown in Figure 2 from Hughes. The same Iridium and Spaceway characteristics given in section 1 were used in the analyses.

Within the Beam Type X, there is no co-frequency operation. Thus, there is no direct interference between systems. The possibility of adjacent channel interference was not

considered here. Also interference potentially generated by intermodulation products in the satellite receivers was not considered.

For the Type 1 and Type 2 beams, (co-channel, cross-polarized, adjacent beams), the clear weather analyses showed received C/I at the Iridium satellite receivers of 11.4 dB and 20.4 dB above the threshold of acceptable performance, for the TTAC and the Gateway uplink channels, respectively. These calculations were performed for the worst case placement of the NGSO MSS Earth stations, i.e. on the border of the Type X beam with the Type 1 or Type 2 beam. For placement of the Iridium Earth station at the center of the Type X beam, the C/I margins above the unacceptable interference level would be about 50 dB greater. With rain attenuation taken into account, the C/I values fall to 18.6 dB and 9.6 dB below the threshold of acceptable C/I performance for the TTAC and Gateway uplink channels, respectively, for Tallahassee FL.

For the Type 3 and Type 4 beams, (co-channel, co-polarized, one beam area removed), the clear weather analyses showed received C/I at the Iridium satellite receivers of 37.5 dB and 46.5 dB above the threshold of acceptable performance, for the TTAC and the Gateway uplink channels, respectively. These calculations were performed for the worst case placement of the NGSO MSS Earth stations, i.e. on the border of the Type X beam closest to the Type 3 or Type 4 beam. For placement of the Iridium Earth station at the center of the Type X beam, the C/I margins above the unacceptable interference level would be even greater. With rain attenuation taken into account, the C/I values fall to 7.5 dB and 16.5 dB above the threshold of acceptable C/I performance for the TTAC and Gateway uplink channels, respectively, for Tallahassee FL.

Thus, as Hughes itself recognized, neither Iridium nor Macrocell spacecraft receivers will be subject to harmful interference in the 29.250-29.500 GHz band, so long as co-frequency GSO FSS systems coordinate as contemplated in the rules employing opposite sense polarization and geographic isolation.

### **3. Potential Interference into Spaceway Satellite Receivers from Iridium Uplinks**

The coordination approach discussed in the previous section also reduces to acceptable levels the potential interferences into Spaceway satellite receivers. The use of geographical separation of Iridium and Spaceway Earth stations together with the frequency/polarization selections used result in avoidance of the co-polar, in-line interference situation with Spaceway receivers as the victim receivers.

Hughes itself recognized this in its earlier submission.<sup>6</sup> There, Spaceway demonstrated how the cross polar discrimination, the Iridium uplink antenna discrimination, and the Spaceway satellite receive antenna discrimination all combined to provide acceptable levels of interference to the Spaceway receivers when the co-polar, in-line interference geometry was avoided. Hughes presents no contrary evidence in this proceeding.

### **4. Avoidance of Planned NGSO MSS Uplink Earth Station Sites**

In addition to the three Iridium Earth station sites used in these analyses, notice has been given for seven other NGSO MSS feeder link sites in the United States and Puerto Rico.<sup>7</sup> In the complete NGSO MSS/GSO FSS coordination process these sites would need to be taken into account by frequency/polarization selections for GSO FSS user links “in the vicinity of operational or planned NGSO MSS feeder link earth station complexes, that will minimize instances of unacceptable interference with GSO FSS or NGSO MSS uplink reception.”<sup>4</sup>

## **5. Other Items Pertinent to NGSO MSS and GSO FSS Uplink Coordination**

The coordination process must take account of the possibility of interference being generated at the Iridium satellite receivers due to intermodulation products being formed within the receiving system due to the presence of two or more relatively high level signals within the wide bandwidth of the receiving system (400 MHz). This level of detailed calculation would be performed during the detailed coordination procedures.

In the frequency/polarization selection for use in the different GSO FSS “Beam Types”, sufficient guard band must be provided to avoid adjacent channel interference into the NGSO MSS satellite receivers.

Further analyses, to examine the possibilities of adjacent channel interference from GSO FSS user uplinks into NGSO MSS feeder links, needs to be conducted during the coordination process to assure that the sharing methods chosen provide full protection to the NGSO MSS uplinks.

For the analyses results presented here, maximum NGSO MSS uplink power was used. With Automatic Power Control (APC) used when contemplated by the FCC’s rules on the NGSO MSS uplink, any interference effects on uplink performance would quickly increase the uplink power to suppress the interfering effect, thereby driving the uplink transmitter to maximum power, if needed. Thus the use of maximum transmitter power in the clear weather case is warranted. The APC also increases transmitter power up to the maximum, if needed, in the case of rain attenuation.

## **6. Consideration of Blanket Licensing**

The analyses in this report have shown that frequency/polarization selections by GSO FSS systems, in the vicinity of operational or planned NGSO MSS feeder link Earth station complexes, can minimize instances of unacceptable interference to NGSO MSS uplink reception. However, the frequency and polarization selections used are dependent upon Earth station site-specific characteristics, including latitude, longitude, rain zone, antenna height, elevation angle to the satellites, and others. These characteristics determine the frequency use, the polarization use, and the Earth station separation distance (NGSO MSS to GSO FSS separation) that are required to protect the NGSO MSS feeder uplinks from interferences caused by the NGSO FSS user uplinks. Thus, blanket licensing of NGSO FSS Earth stations in the band 29.25-29.50 GHz is not

practicable, and coordination is required of the GSO FSS users with each NGSO MSS Earth station site.

## 7. Conclusions

Sharing between NGSO MSS feeder link stations and GSO FSS services in the 29.25-29.50 GHz band can be achieved through coordination agreements based upon the current ITU Radio Regulations and FCC rules. Analyses have shown that the use of frequency/polarization selections, in the vicinity of NGSO MSS feeder link Earth stations can prevent unacceptable interference to NGSO MSS and GSO FSS uplink receivers. The coordination approach had been initially proposed by Hughes Spaceway. In this submission, Iridium and Macrocell verified the effectiveness of the general approach in providing interference protection to Iridium uplink receivers. The application of the general coordination approach to specific NGSO MSS Earth station sites can therefore be deferred until actual and detailed good faith coordination of the NGSO MSS and GSO FSS systems.

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## References:

1. ITU-R Radio Regulations, Article S9, Section II – Procedure for Effecting Coordination
2. First Report and Order and Fourth Notice of Proposed Rulemaking, CC Docket No. 92-297, “In the Matter of Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services”, paragraphs 42, 72-74, Adopted: July 17, 1996.
3. Memorandum Opinion and Order, CC Docket No. 92-297, “In the matter of Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.50-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services”, Adopted: May 16, 2001.
4. 47 C.F.R. Section 25.258
5. Hughes Network Systems ex parte notice, IB Docket No. 98-172, May 19, 2000, Technical Appendix A: GSO FSS / NGSO MSS Feeder Link Sharing Principles in the 29.25-29.5 GHz Band.
6. Reply Comments of Hughes Communications, Inc., CC Docket No. 92-297, First Report and Order and Fourth Notice of Proposed Rulemaking, “In the Matter of Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services”, October 10, 1995.
7. Notification of Earth Station Complex Locations in Accordance with Section 101.103(h)(2) of the Rules (CC Docket 92-297), by Motorola and Iridium North America to the FCC, October 6, 1997



**ILLUSTRATIVE SPACEWAY & MSS MEO FEEDER LINK SHARING PLAN FOR  
CONTIGUOUS U.S., 29.250 - 29.500 GHz**

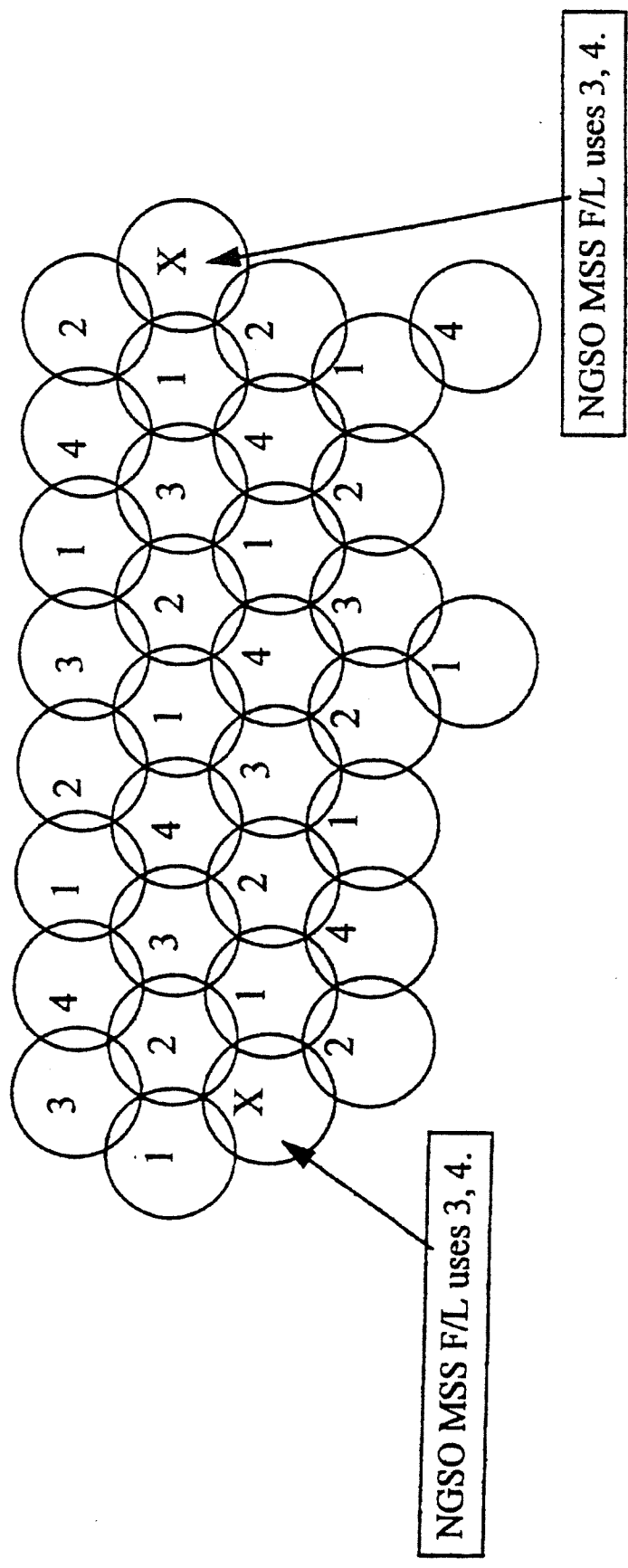
Beam Type 1 = RHC Polarization, 29.250-29.375 GHz

Beam Type 2 = RHC Polarization, 29.375-29.500 GHz

Beam Type 3 = LHC Polarization, 29.250-29.375 GHz

Beam Type 4 = LHC Polarization, 29.375-29.500 GHz

Beam Type X = No SPACEWAY beam in the 29.250-29.500 GHz band (beam(s) using other band(s) will be utilized.)



**FIGURE 2**

## ENGINEERING CERTIFICATION

I am Edward F. Miller, Consultant, and I hold Bachelor, Master, and Ph.D. degrees in Electrical Engineering, from Case Institute of Technology, New York University, and Case Institute of Technology, respectively. I practiced professionally in communications systems engineering, communications systems analysis, technology development, and regulatory analyses. I worked three years at Bell Telephone Laboratories, thirty-one years at NASA, Glenn Research Center, and seven years as an independent regulatory consultant.

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in the report "Sharing Between NGSO MSS Feeder Link Stations and GSO FSS Services in the 29.25-29.5 Band Through Coordination Agreements" (September 10, 2001), that I am familiar with Part 25 of the Commission's Rules, that I have either prepared or reviewed the engineering information submitted in this report, and that it is complete and accurate to the best of my knowledge.

By: Edward F. Miller

Edward F. Miller, Ph.D.  
Consultant for Iridium Satellite, LLC

10 September 2001

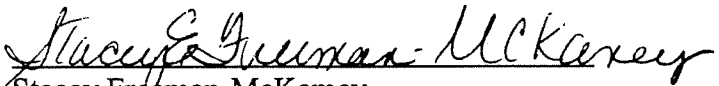
September 10, 2001  
Jacqueline A. Clifford

JACQUELINE A. CLIFFORD, Notary Public  
State of Ohio, Cuyahoga County  
My Commission Expires July 29, 2004

**CERTIFICATE OF SERVICE**

I do hereby certify that true copies of the foregoing "Opposition to Petition for Partial Reconsideration" were hand-delivered, followed by regular U.S. mail delivery, the 10<sup>th</sup> day of September, 2001 to the following:

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