Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Motorola Global Communications, Inc.	)	File No. 79-SAT-P/LA-97(63)
Application for Authority Construct,	)	
Launch and Operate the Celestri	)	
Multimedia NGSO System	)	

PETITION TO DENY

Hughes Communications Galaxy, Inc. ("HCG") petitions the Commission to deny the application of Motorola Global Communications, Inc. ("Motorola") for authority to construct, launch, and operate the Celestri Multimedia NGSO System (the "Celestri System Application"). HCG has an interest in this proceeding as the licensee of the GSO FSS Spaceway satellite system ("Spaceway"),[1] which would experience harmful interference from the proposed Celestri system.

I. Introduction

Conspicuously absent from the Celestri System Application is a technical demonstration that the Celestri system is capable of operating without causing harmful interference to GSO FSS satellite systems, such as Spaceway, that are already licensed in the 19.7-20.2 and 29.5-30.0 GHz bands where GSO FSS systems, under the Commission's 28 GHz Band Plan, clearly have priority over NGSO systems such as Celestri. Although Motorola

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1 See Hughes Communications Galaxy, DA-97-971 (released May 9, 1997) (corrected by Erratum released July 29, 1997).

discusses theoretical interference reduction techniques, it fails to demonstrate how it will employ such techniques in the Celestri system in a manner that will prevent harmful interference into Spaceway. In any event, Motorola's technical analysis is flawed as it ignores a number of the characteristics of the licensed Spaceway system. Motorola's failure to establish technical compatibility and its flawed technical analysis mandate dismissal of the Celestri System Application.

In proposing a system that clearly deviates from the requirements of the Commission's 28 GHz Band Plan, Motorola not only threatens the delicate balance achieved after more than three years of negotiations among various sectors of the industry,[2] but also jeopardizes the implementation and operation of licensed systems, such as Spaceway, that comply with the 28 GHz Band Plan. The proposed Celestri system represents yet another attempt in a series of efforts by Motorola and its affiliates to undermine the 28 GHz Band Plan. By denying the Celestri System Application, the FCC will protect those GSO FSS systems already licensed at 19.7-20.2 and 29.5-30.0 GHz, preserve the integrity of its 28 GHz Band Plan, and forestall any further attempts by Motorola to erode an industry-wide compromise.

II. Motorola's Attempt to Subvert the 28 GHz Band Plan Should be Dismissed

Since the FCC adopted its First Report and Order in the 28 GHz proceeding on July 17, 1996, and despite the active role that Motorola played in the negotiations that led to the

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2 See Letter from Cellular Vision USA, Inc., AT&T, HCG, Teledesic Corporation, Motorola, the University of Texas--Pan American, Phillips Electronics, Titan Informat Co., International CellularVision Association, CellularVision Technology and Telecommunications, L.P. and GE American Communications, Inc. to the FCC, CC Docket No. 92-297 (filed June 3, 1996) (the "Industry Letter"); Letter from HCG, AT&T, GE American Communications, Inc., and Motorola to the FCC, CC Docket No. 92-297 (filed June 6, 1996).

28 GHz Band Plan,[3] Motorola has been engaged in continuous efforts to undermine the years of negotiations and compromise that are represented in the 28 GHz Band Plan. First, it filed a Petition for Reconsideration that attempted to lay the groundwork for the use of the 29.25-29.5 GHz band for feeder links to the NGSO MSS systems planned by Iridium.[4] Next, Motorola's affiliate, Iridium, filed an NGSO MSS system application that seeks to use that part of the band for feeder links in a manner that is fundamentally inconsistent with the 28 GHz Band Plan, and that will cause harmful interference to Spaceway.[5] Finally, Motorola has filed the Celestri System Application, which threatens to cause interference into Spaceway and further attempts to limit use of the 29.5-30.0 and 19.7-20.2 GHz band by licensed GSO FSS systems such as Spaceway.

The negotiation history of the 28 GHz Band Plan is a chronicle of compromise and conciliation at the Commission by and among various industry sectors.[6] Although no one party is entirely satisfied with the 28 GHz Band Plan, that plan is widely recognized as a balanced solution that affords all proposed services at 28 GHz the ability to operate on reasonable terms. No other party to the 28 GHz proceeding has voiced any opposition to the 28 GHz Band Plan.

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3 See Consolidated Reply of Motorola, CC Docket No. 92-297 (filed November 4, 1996) at 1.

4 See Motorola's Petition for Partial Reconsideration, CC Docket No. 92-297 (filed September 27, 1996).

5 See Application of Iridium LLC for Authority to Launch and Operate the MACROCELL Mobile Satellite System, FCC File No. 187-SAT-P/LA-97 (filed September 26, 1997). HCG is simultaneously filing a petition to deny the MACROCELL Application.

6 See *First Report and Order*, CC Docket No. 92-297 (adopted July 17, 1996) ¶¶13-21.

Motorola's repeated attempts to re-designate the 28 GHz band in a manner that suits its own business plans cannot be countenanced by the Commission as they threaten the very foundations of the 28 GHz Band Plan. The satellite industry, relying on the certainty provided in the 28 GHz Band Plan, is just beginning to commercialize the use of the 28 GHz band. The Commission should not let that certainty be undermined by these repeated, and belated, attacks of Motorola.

II. The Celestri System Fails to Conform to the Technical Requirements of the 28 GHz Band Plan

A. Motorola's Technical Analysis is Incomplete and Inconclusive

Motorola fails to establish that the Celestri system conforms with the technical standards delineated in the 28 GHz Band Plan with respect to its proposal to use 29.5-30.0 GHz and 19.7-20.2 GHz for communications to and from its NGSO FSS system. As the NGSO FSS is a secondary service in those band segments,[7] Motorola is required by the Commission's Rules to submit "a technical demonstration that it can operate on a non-harmful interference basis to the type of satellite system with licensing priority."[8] Motorola's Celestri System Application simply fails to make such a demonstration.

Although Motorola asserts that "it is cognizant of the obligations attendant upon system operators providing service pursuant to secondary allocations, and will comply with these obligations,"[9] conspicuously absent in its application is a *conclusive technical showing* that Celestri can comply with the 28 GHz Band Plan's requirements. To the contrary, as set forth in

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7 *Third Report and Order*, CC Docket No. 92-297 (adopted October 9, 1997) ¶39.

8 Id.; see also 47 C.F.R. §§ 2.104(d)(4)(i); 2.104(c)(3)(i).

9 Celestri System Application (filed June 12, 1997), at ii n.1.

the technical analysis of HCG attached as Exhibit A, *it is clear that Celestri will interfere with the licensed Spaceway system even after using the type of interference mitigation techniques proposed by Motorola.* Moreover, it is also clear that Celestri's uplinks will fail due to interference from Spaceway and that Celestri is entitled to no interference protection in that case.

Although Motorola has suggested the use of a certain interference mitigation technique, that technique fails to eliminate interference between the two systems. Moreover, Motorola's analysis is limited to a single situation[10] and it has failed to show whether it could or would successfully employ this technique on a system-wide basis. In other words, rather than conclusively demonstrating how the entire Celestri system can share with a GSO FSS system without causing harmful interference, as it is required to do, Motorola merely asks HCG and the Commission to speculate that Motorola's analysis can be extrapolated from one situation to its entire system and asks GSO FSS licensees to trust that Motorola can and will eventually develop a comprehensive non-interfering sharing solution.

The Commission's Rules require a *definitive showing* of compatibility by NGSO FSS systems that propose to operate on a secondary basis in the 19.7-20.2 and 29.5-30.0 GHz bands.[11] *Celestri will interfere with Spaceway.* Motorola has not verified its ability to employ an interference elimination technique that will solve this problem. In short, Motorola bears the burden of demonstrating non-interference and it has wholly failed to do so. Until and unless Motorola can *conclusively demonstrate* that the Celestri system can operate in these band

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10 See id. at Appendix B, §2.

11 *Third Report and Order* ¶39.

segments *without causing harmful interference* to primary service providers, such as Spaceway, Motorola's application must be denied.

B. There is No Basis for Restricting GSO FSS Orbital Inclination

As a secondary service, the Celestri System is subject to two requirements: (i) it must not cause harmful interference to stations of primary or permitted services; and (ii) it cannot claim protection from harmful stations of a primary or permitted service. Despite these clear dictates, Motorola attempts to claim protection from GSO FSS satellites that may operate in inclined orbits in the future. There is no basis for restricting the use of inclined orbits by GSO FSS satellites simply in order to attempt to accommodate a secondary service provider such as Celestri.[12]

Motorola claims that GSO FSS system satellites operating in inclined orbit will interfere with NGSO FSS systems "causing the satellite diversity interference mitigation algorithm to expand and requiring more frequent and longer periods of reliance on alternate Celestri LEO System satellites."[13] Apparently, Motorola believes that the Celestri system, despite its secondary designation in the 29.5-30 GHz and 19.7 and 20.2 GHz band segments, has no responsibility to mitigate interference for GSO FSS satellites in inclined orbits. Instead and in explicit contradiction to the Commission's stipulation that it will "not coordinate secondary operations with respect to primary or permitted services,"[14] Motorola seeks to restrict the potential need for GSO FSS satellite operators to traverse an inclined orbit.

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12 See Erratum to Celestri Application (filed July 29, 1997), Appendix B.

13 Id. at Appendix B, 2.

14 *Third Report and Order* ¶40 n. 53; see also 47 C.F.R. §§2.104(d)(4)(ii), §2.105(c)(3)(ii).

When the Commission adopted a requirement that GSO FSS system satellites operating in an inclined orbit may not claim protection from others "in excess of the protection that would be received by the satellite network operating without an inclined orbit,"[15] the Commission was addressing the possibility of interference between GSO spacecraft.[16] Nowhere in the course of that proceeding is there *any* suggestion that §25.280 was attended to limit the operations of a primary service, the GSO FSS, vis-a-vis a secondary service, the NGSO FSS.

Moreover, the rule requiring inclined GSO satellites to control the interference that they may cause is intended to protect adjacent GSO spacecraft, not NGSO systems.[17] Finally, Motorola misquotes the Commission when it tries to rely on a statement that inclined orbit satellites may not delay the implementation of new technology. That statement, again, was made in a GSO-only context and was not intended to limit the operations of a primary service to protect a secondary service.[18] There simply is no basis for imposing a limit on the orbit of GSO FSS systems, the primary service at 19.7-20.2 and 29.5-30.0 GHz, in order to protect Motorola's proposed secondary NGSO FSS system from interference.

III. Conclusion

Motorola has failed to make the technical demonstration of compatibility about its proposed NGSO system that is mandated by the Commission's Rules. As demonstrated by

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15 47 C.F.R. §25.280.

16 See *Streamlining of Commission Rules and Regulations for Satellite Application and Licensing Procedures*, Report and Order in IB Docket No. 96-117, FCC 96-425 (released December 16, 1996) ¶16.

17 See id. ¶20 (discussing requirement that an inclined orbit satellite control interference into adjacent spacecraft).

18 See id. ¶18 (addressing concern that inclined orbit satellites may tie up scarce orbital slots).

HCG's analysis, Celestri *will cause harmful interference into GSO systems such as HCG's Spaceway system*. Moreover, Motorola has not shown how its theoretical mitigation technique would be employed by its entire system to resolve the interference potential. Finally, there is no basis for limiting the orbit of GSO FSS satellites in order to protect NGSO satellites. For these reasons, and the other reasons set forth above, the Commission should summarily deny Motorola's Celestri System Application.

Respectfully submitted,

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EXHIBIT A

Interference Analysis Between SPACEWAY™ and Celestri in the 19.7-20.2 GHz and 29.5-30.0 GHz Bands

I. Introduction

Motorola Global Communications has applied to operate the Celestri LEO System[1], a non-geostationary orbit (NGSO) Fixed-Satellite Service (FSS) system, in the 19.7-20.2 and 29.5-30.0 GHz bands, as well as other bands. In the 19.7-20.2 GHz and 29.5-30.0 GHz bands, GSO FSS systems have licensing priority over NGSO FSS systems. Thus, Celestri "shall not cause harmful interference to"[2] SPACEWAY™ stations in the 19.7-20.2 GHz band, and Celestri also must "operate on an unprotected non-interference basis"[3] to the SPACEWAY™ system in the 29.5-30.0 GHz band. SPACEWAY™ is a Ka-band Fixed-Satellite Service system which has been licensed by the Commission to be constructed, launched, and operated[4]. Using technical parameters taken from each respective system's application, this paper shows that Motorola has not

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[1] See *Application for Authority to Construct, Launch and Operate the Celestri Multimedia LEO System: A Global Network of Non-Geostationary Communications Satellites Providing Broadband Services in the Ka Band*, filed June 1997.

[2] See paragraph 49, Third Report and Order, FCC 97-378, adopted October 9, 1997.

[3] See Paragraph 39, Third Report and Order, FCC 97-378, adopted October 9, 1997.

[4] See *Application of Hughes Communications GALAXY Inc. Before the Federal Communications Commission for GALAXY/SPACEWAY™: A Global System of Geostationary Ka/Ku band Communications Satellites (174-SAT-P/LA-95 through 181-SAT-P/LA-95).* See also *In the Matter of Hughes Communications Galaxy, Inc.: Application for Authority to Construct, Launch, and Operate a Ka-Band Satellite System in the Fixed-Satellite Service and a Ku-Band Broadcast Communications Satellite System (FCC 97-971).*

made an adequate technical demonstration in its Celestri application with respect to interference with the SPACEWAY™ system.

This paper shows that the Celestri application is technically inadequate for a number of reasons. The first reason is that the Celestri application lacks critical information on Celestri's primary interference mitigation technique such that one must guess what its mitigation technique is. The second is that, even assuming what seems to be the most plausible interpretation of what its mitigation technique is, Celestri causes harmful interference to the SPACEWAY™ system on the downlink. The third is that Celestri uplinks, operating on an unprotected basis, will not be able to operate because SPACEWAY™ will cause interference at a sufficient level to preclude their operations. The fourth is that Celestri has not shown that, given its orbital parameters, it can successfully utilize what could be considered as the most plausible interpretation of its primary mitigation technique. The fifth is that Celestri is vague on whether or not its interference analysis applies to GSO FSS Ka-band systems such as SPACEWAY™.

II. Motorola's Description of Celestri's Interference Mitigation Techniques is Inadequate

Motorola indicates that Celestri will use an interference mitigation technique where "the vector from the Celestri LEO System ground station to the Celestri LEO System satellite is not within 4° of the GSO orbital arc"[5]. Exactly what is meant by

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[5] Celestri's *Application*, supra., Appendix B, p. 10.

"within 4° of the GSO orbital arc" is not stated in the Celestri application. This restriction must be clearly defined and explained so that representative interference studies and calculations can be done. There are three or more possible interpretations of this 4° rule. One is that the vector from any GSO earth station (located at any latitude) to its associated GSO satellite is outside of a 4° zone around the LEO earth station to LEO satellite vector, with the vertex of the angle in question at the LEO earth station. Another interpretation is that the LEO earth station to LEO satellite vector is outside of a ± 4° nadir angle from the GSO satellite, with the vertex of the angle in question at the GSO satellite. A third interpretation is that the LEO earth station to LEO satellite vector is wholly outside of the region within ± 4° North latitude.

III. Based on the Most Plausible Interpretation of Celestri's Interference Mitigation Techniques, Celestri Causes Harmful Interference into SPACEWAY™

Despite our lack of information on Celestri's primary mitigation technique, for the purposes of calculating interference between Celestri and SPACEWAY™, the first interpretation presented above is assumed. At this time, this seems like the most plausible interpretation. Thus, it is assumed that the vector from any GSO earth station (located at any latitude) to its associated GSO satellite is outside of a 4° zone around the LEO earth station to LEO satellite vector. The net effect of this on interference calculations is that interference from and to earth stations is mitigated by 4° off-axis earth station antenna discrimination. Attachments 1 and 2 provide detailed C/I and Eb/Io

calculations. The adjacent satellite C/I (desired carrier power-to-interference power ratio) and adjacent satellite Eb/Io (digital bit energy-to-interference power density ratio) specified in the SPACEWAY™ application are used as thresholds to determine whether Celestri causes harmful interference to SPACEWAY™.

Attachment 1 shows that Celestri downlinks cause harmful interference to SPACEWAY™ downlinks, for both SPACEWAY™ "wide area direct-to-home (DTH)" and "high power narrow spot" cases. Specifically, Celestri downlinks to its "residential user" earth stations cause an adjacent satellite C/I of 1.5 dB to SPACEWAY™ DTH earth stations. This is well below the minimum required C/I of 18.6 dB for adjacent satellite interference. Celestri downlinks to its residential user earth stations also cause an adjacent satellite Eb/Io of 3.6 dB to SPACEWAY™ "high power narrow spot" terminals. This is substantially below the minimum required adjacent satellite downlink Eb/Io of 18.5 dB. Celestri downlinks, then, do cause harmful interference to SPACEWAY™ downlinks. These calculations were based on the assumption that the interference from Celestri LEO downlinks enters into the SPACEWAY™ earth station at an antenna off-axis angle of 4°. Also, it is assumed that in the high power narrow spot case, there are at least four Celestri earth stations which collectively co-use the entire 120 MHz bandwidth of a SPACEWAY™ downlink.

Attachment 2 shows that a Celestri residential user uplink cannot operate when a SPACEWAY™ satellite news gathering (SNG) station is uplinking. In this case, the Celestri uplink has an Eb/Io of -3.5 dB, which is well below the minimum required level of 6.2 dB as stated in the Celestri application. It is assumed that the SPACEWAY™

uplink power is transmitted into the Celestri satellite receive beam at an antenna off-axis angle of 4°. Attachment 2 also shows that, with this assumption, the Celestri residential user uplink cannot operate when a SPACEWAY™ high power narrow spot terminal is uplinking. In this case, the Celestri uplink has an Eb/Io of 6.0 dB, which is slightly below the stated minimum required level of 6.2 dB.

The above examples demonstrate how, even after using an interference mitigation technique, harmful interference will occur in both the downlink to SPACEWAY™ terminals and in the uplink to Celestri LEO satellites. Further, more accurate interference studies can be done once adequate descriptions of Celestri's interference mitigation techniques are provided. The interference situation can be worse when more than one LEO satellite is considered because in actuality, several LEO satellites at one time could collectively interfere with a SPACEWAY™ terminal. In the multi-satellite case, the individual interference from each LEO satellite would have to be added together to determine the effective interference to SPACEWAY™. One test of adequacy for an NGSO to meet in the description of mitigation techniques is that the description must make obvious, for any given geometry, the level of interference caused by each NGSO satellite.

IV. Even If Celestri Implemented Interference Mitigation Techniques, It May Operationally Cause Harmful Interference into SPACEWAY™

Even though, for the purposes of performing preliminary interference calculations, Celestri is assumed to use a certain interference mitigation technique,

neither the GSO FSS industry nor the Commission has any basis to believe this or any other Celestri mitigation techniques will work. The Celestri application neither provides an unequivocal statement nor a showing that Motorola can actually implement Celestri's interference mitigation techniques. It may be the case that it is possible only a fraction of the time to keep the vector from the Celestri LEO System ground station to the Celestri LEO System satellite at least 4° away from the GSO orbital arc. For example, Celestri's mitigation technique may be adversely impacted by the failure of one or more satellites out of the constellation of 63 satellites. Perhaps at certain times and latitudes, there may be no satellite outside of Celestri's 4° avoidance zone to which a ground station can switch. It may be the case that the variance in the beam shape, antenna gains, and pointing accuracy of Celestri's phased array antennas under operational conditions may be too great to ensure a reliable Celestri interference mitigation technique. Or, the computers, software, and communications networks which would switch Celestri earth stations to alternate LEO satellites may be unable to function properly under full loading. Without further explanation and details of Celestri's GSO arc avoidance scheme, it is assumed that Celestri may operationally cause harmful interference into SPACEWAY™.

Because currently there is no known successful implementation of an arc avoidance scheme as an interference mitigation technique, Celestri must at the least provide a simulation demonstrating that their arc avoidance scheme is feasible. The simulation should be made available to GSO operators so that assumptions and results can be verified.

V. Motorola May Have Used a Wrong Set of Acceptable Interference Levels in Its Celestri Interference Analysis

The Celestri application presents results from a detailed study showing that if Celestri used its ±4° exclusion zone mitigation technique (further description is still needed), interference from Celestri into a GSO and from a GSO into Celestri would be reduced to levels which should be acceptable to both Celestri and the GSO. To determine which interference levels are acceptable, Celestri uses levels provided in the *CPM Report to WRC-95*, Chapter 2, Section I, Part C, paragraph 3.1.2. The SPACEWAY™ application specifies a required bit error rate of 10^{-10}. Celestri must show that the proposed interference thresholds provided in the *CPM Report to WRC-95* can support the 10^{-10} bit error rate in order to accommodate SPACEWAY™.

Furthermore, the CPM Report levels are "based on the performance objectives in Recommendation ITU-R S.1062"[6]. Recommendation ITU-R S.1062-1 presents recommendations on upper bounds for error rates, i.e., it presents recommendations on an error rate mask. However this document does not state that its error rate mask is universally applicable to all satellite services. It notes that "a more stringent mask may be desirable or necessary for certain services."[7] SPACEWAY™ services may require a more stringent mask, for they "include the transmission of high resolution video signals"[8]. Recommendation ITU-R S.1062-1 pertains to "satellite links within [a] public switched network"[9]. High resolution video signals require lower bit error rates, in

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[6] *CPM Report to WRC-95*, Chapter 2, Section I, Part C, paragraph 3.1.2.

[7] *Recommendation ITU-R S.1062-1*, NOTE 2.

[8] P. 18, GALAXY/SPACEWAY™'s *Application*, supra.

[9] *Recommendation ITU-R S.1062-1*, NOTE 1.

general, than does data sent on public switched networks. Then, the actual allowable error rates for SPACEWAY™ may differ from those given in ITU-R S.1062-1. As a result, the allowable interference levels for SPACEWAY™ may differ from the allowable interference levels provided in the *CPM Report to WRC-95*. Therefore, the actual allowable interference levels for SPACEWAY™ may differ from the allowable interference levels assumed in Celestri's interference analysis. Because the interference levels assumed to be acceptable in Celestri's interference analysis are under question, Celestri must positively show that these levels are applicable to SPACEWAY™ services. Celestri has not made such a showing in its application.

VI. Conclusion

In summary, the Celestri application is deficient in dealing with several crucial interference issues. The application lacks usable descriptions of Celestri's interference mitigation techniques. Furthermore, under the assumption of the simplest interpretation of its mitigation techniques, Celestri causes harmful interference to SPACEWAY™ downlinks in the 19.7-20.2 GHz band and receives harmful interference from which it cannot claim any protection in the 29.5-30.0 GHz band. Also, the Celestri application lacks information on whether Celestri's theoretical interference mitigation techniques are operationally implementable. Finally, the Celestri application does not show that its interference analysis applies to SPACEWAY™ type services.

Attachment 1 **(Celestri Comments)**

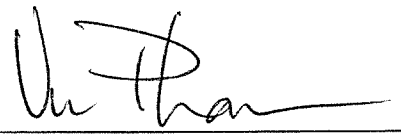
Downlink Interference to GSO Earth Station (SPACEWAY Cases)	DTH	High Power Narrow Spots	Comments
Interferor Carrier EIRP (dBW)	41.3	41.3	Celestri Application (Residential)
Bandwidth Mismatch Factor (dB)	-7.4	5.6	32.8 MHz Celestri, 6 and 120 MHz SPACEWAY
GSO E/S Antenna Gain Towards Interferor S/S (dBi)	16.9	16.9	32-25log10(4), FCC 25.209a2
Free Space Loss @ 20.0 GHz (dB)	-181.4	-181.4	Note Elevation Angle Below
LEO Orbit Altitude (km)	1400	1400	Celestri Altitude
GSO Elevation Angle to Interferor S/S (deg)	90.0	90.0	
Interferor Slant Range to GSO E/S (km)	1400	1400	
Interferor Power Received by GSO E/S (dBW)	-130.5	-117.5	
Desired Carrier EIRP (dBW)	35.2	54.0	SPACEWAY Application
GSO E/S Antenna Gain Towards Desired Signal (dBi)	46.1	41.3	
Free Space Loss @ 20.0 GHz (dB)	-210.4	-210.4	Note Elevation Angle Below
GSO Orbit Altitude (km)	35786	35786	GSO Altitude
Desired E/S Elevation Angle to GSO S/S (deg)	22.0	22.0	
Desired E/S Slant Range to GSO S/S (km)	39358	39358	
Desired Power Received by GSO E/S (dBW)	-129.0	-115.1	
C/I (dB)	1.5	2.4	
Eb/Io (dB)		3.6	92 Mbps burst rate, 120 MHz Bandwidth
Minimum Required C/I for Adjacent Satellite Interference (dB)	18.6		SPACEWAY Application
Minimum Required Eb/Io for Adjacent Satellite Interference (dB)		18.5	SPACEWAY Application
Note: This analysis is not to be construed to be comprehensive and inclusive of all potential			
incompatibilities and is intended only to be exemplary of the potential problems.			

Attachment 2 **(Celestri Comments)**

Uplink Interference to LEO Space Station			**Comments**	
(SPACEWAY Cases)	SNG	High Power Narrow Spots	High Power Narrow Spots	
Interferor Carrier EIRP (dBW)	31.8	11.5	SPACEWAY Application (4 deg off-axis)	
Bandwidth Mismatch Factor (dB)	-1.7	9.1	4.1 MHz Celestri, 6 and 0.5 MHz SPACEWAY	
LEO S/S Antenna Gain Towards Interferor (dBi)	35.3	35.3	Celestri Application	
Free Space Loss @ 30.0 GHz (dB)	-184.9	-184.9	Note Elevation Angle Below	
LEO Orbit Altitude (km)	1400	1400	Celestri Altitude	
Interferor Elevation Angle to LEO S/S (deg)	90.0	90.0		
Interferor Slant Range to LEO S/S (km)	1400	1400		
Interferor Power Received by LEO S/S (dBW)	-119.5	-129.0		
Desired Carrier EIRP (dBW)	33.2		Celestri Application	
LEO S/S Antenna Gain Towards Desired Signal (dBi)	31.3		-4 dB Beam Edge	
Free Space Loss @ 30.0 GHz (dB)	-190.5		note elevation angle below	
LEO Orbit Altitude (km)	1400		Celestri Altitude	
Desired E/S Elevation Angle to LEO S/S (deg)	22.0			
Desired E/S Slant Range to LEO S/S (km)	2663			
Desired Power Received by LEO S/S (dBW)	-126.0			
C/I (dB)	-6.5	3.0		
Eb/Io (dB)	-3.5	6.0	(2.048 Mbps burst rate, 4.1 MHz bandwidth)	
Minimum Required Uplink Eb/Io (dB)	6.2	6.2	Celestri Application (Residential)	
Note: This analysis is not to be construed to be comprehensive and inclusive of all potential				
incompatibilities and is intended only to be exemplary of the potential problems.				

Engineering Certification

We hereby certify that we are the technically qualified persons responsible for preparation of the engineering information contained in this petition, that we are familiar with Part 25 of the Commission's Rules, that we have either prepared or reviewed the engineering information submitted in this application, and that it is complete and accurate to the best of our knowledge.

By: 

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December 22, 1997

CERTIFICATE OF SERVICE

I, Karen McWhorter, hereby certify that a copy of the foregoing Petition to Deny of Hughes Communications Galaxy, Inc. was mailed first-class on December 22, 1997 to the following:

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