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FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In re Application of)
)
MOTOROLA SATELLITE COMMUNICATIONS, INC.) File Nos. 9-DSS-P-1(87)
) CSS-91-010
For Authority to Construct, Launch, and)
Operate a Low Earth Orbit Satellite)
System in the 1610-1626.5 MHz Band.)
)
ELLIPSAT CORPORATION) File No. 11-DSS-P-91(6)
)
For Authority to Construct Ellipso I,)
an Elliptical Orbit Communication)
Satellite System in the 1610-1626.5 MHz)
and 2483.5-2500 MHz Bands)

COMMENTS OF
COMMUNICATIONS SATELLITE CORPORATION

Communications Satellite Corporation ("COMSAT") hereby submits the following comments in regard to the applications filed by Motorola Satellite Communications, Inc. (Motorola) and Ellipsat Corporation (Ellipsat) to construct, launch, and operate low earth orbit (LEO) satellite systems in the 1610-1626.5 MHz and 2483.5-2500 MHz portion of the radiodetermination satellite service (RDSS) band.¹ Motorola's "Iridium" system represents a highly ambitious technical, operational, and logistical undertaking. According to its application, Motorola intends to employ 77 LEO satellites in the provision of U.S. domestic and international mobile-satellite services. Ellipsat's Ellipso system is primarily a U.S. domestic

¹ While COMSAT's comments will focus primarily on the Iridium proposal, many of our concerns apply equally to Ellipsat's application.

RDSS system with the capability to provide mobile-satellite voice services interconnecting with the public switched network and cellular mobile telephone switching offices.

COMSAT generally supports use of the RDSS band for the Iridium and Ellipso systems. However, Motorola's application raises a number of broad issues which the Commission should consider prior to the grant of any operating authority. COMSAT believes that the most efficient and expeditious way to treat these issues is through a rulemaking proceeding. A rulemaking would also give the Commission the opportunity to evaluate the Iridium proposal in conjunction with the Ellipsat and other LEO applications which may be filed pursuant to the Commission's cut-off procedure.²

I. INTRODUCTION

The scope of the proposed Iridium system is clearly of global magnitude. It envisions a multi-national consortium with ownership held by Motorola and other entities such as telephone companies, industrial, and financial concerns.³ Subject to national laws,

² See Satellite Applications Acceptable for Filing; Cut-Off Established for Additional Applications, Report No. DS-1068, DA-91-407, released Apr. 1, 1991.

³ While the Iridium application is vague on the possible ownership arrangements, it appears from other public documents provided by Motorola that private and government owned telephone companies could have ownership in the Iridium space segment and also own and operate terrestrial gateways (ground stations) that would link Iridium subscribers with public telephone systems. See Personal Communications for the World, May 1991, Paper presented by Motorola at the May 1991 meeting in Montevideo of the CITELE PTC-1 Ad Hoc Group for New Telecommunications Technologies, OAS/Ser.L/XII.2 AHG-TT/21-9, May 22, 1991 (CITEL Paper).

operators would be licensed or franchised around the world to access the Iridium system and provide a range of services to public, government, business, and personal users. The application seeks authority to operate the Iridium system within the U.S. and its territories and possessions, as well as between the U.S. and foreign points. Motorola also proposes to seek authority from other Administrations to provide mobile-satellite capacity domestically within foreign countries.⁴

Motorola describes the Iridium system as a global RDSS, voice, and data communications system providing mobile services using Iridium terminals. The Iridium network will also communicate through gateways to existing communications networks, such as the public switched telephone network (PSTN) and terrestrial cellular telephone systems.⁵ According to Motorola, the system is designed to allow worldwide usage of the telephone regardless of the subscriber's home location.⁶ The application states that the Iridium system will offer a range of specific services: (1) radiodetermination and ancillary services that include RDSS, two-way messaging, and global paging services; (2) data and facsimile services; and (3) two-way high quality digital voice communications using handheld portable and vehicle mounted terminals.⁷ Motorola would offer some or all of these services to subscribers who would

⁴ Iridium Application at 3-4.

⁵ Id. at 35.

⁶ CITEL Paper at 3.

⁷ Iridium Application at 35-37.

have access to a variety of Iridium terminals for applications on land, at sea, and in the air.

Motorola states that the Iridium system is not intended to compete with existing telephone systems, which have greater capacity and lower rates. Furthermore, Motorola does not intend that the system will bypass local, national, or international regulatory organizations. According to it, the markets for Iridium consist primarily of: (1) sparsely populated areas with insufficient demand to support land-based service (fixed or mobile); (2) areas in many developing countries with no existing telephone service; (3) small urban areas with no mobile communications infrastructure; and (4) a variety of specialized applications inaccessible with current technology. Motorola estimates on page 34 of its application that the worldwide total number of subscribers will exceed 6 million in 2001. However, in the CITEL Paper, Motorola estimates 1.8 million subscribers in 2001 and 2.8 million by 2006.⁸

Motorola projects the cost of the 77-satellite constellation with 10 ground spares, including pre-operational expenses, research and development, and launch costs, at \$2.5 billion. Adding the system control facility, interest, and depreciation through the year 1997, the costs are projected to exceed \$3.7 billion. These cost projections do not include the gateway ground stations, which control user access and provide interconnection to the PSTN. Independent gateway operators are expected to finance construction

⁸ CITEL Paper at 5-6; Iridium Application at 19-35.

of these stations, which Motorola estimates will cost \$16 million each.⁹ Thus far, Motorola has filed applications for two gateway stations to serve the eastern and western halves of the U.S. It also proposes to locate two additional sites in eastern and western Canada to provide coverage within Canada as well as Alaska.¹⁰

Motorola's application comes at a very critical time, as the U.S. is now in the final stages of preparing its proposals for the upcoming World Administrative Radio Conference (WARC-92), including important provisions for new mobile-satellite service (MSS) allocations in the 1-3 GHz range. Thus far, the Commission has proposed to add MSS allocations in the RDSS bands at 1610-1626.5 Mhz and 2483.4-2500 MHz, and in the band 1613.8-1626.5 MHz in the space-to-earth direction (reverse-band to the existing RDSS) on a secondary basis, subject to further studies demonstrating that Iridium can share with other services operating in that band.

During the WARC-92 preparatory process, COMSAT supported the Commission's proposals for the RDSS bands by advocating the use of these bands for generic MSS. COMSAT also endorsed the Commission's proposed footnote RR 733Z as a reasonable and flexible way to regulate the apparent incompatibility between the low-density/CDMA carriers employed by RDSS systems, like Geostar, and the higher-density/discrete FDMA or TDMA carriers other MSS systems typically utilize. COMSAT continues to support the Commission's endeavors with regard to the RDSS bands. We believe that the band 1610-

⁹ Iridium Application at 114-115.

¹⁰ Id. at 84.

1626.5 MHz is the appropriate part of the spectrum for LEO MSS systems such as Iridium.

However, in order to address the issues surrounding the Iridium application and ensure that the public will derive the greatest possible benefit from emerging LEO technologies, COMSAT recommends that the Commission consider Iridium and other LEO proposals in the context of a notice and comment rulemaking proceeding. Through a rulemaking, the Commission and interested members of the public will have the opportunity to address some of the broad policy, regulatory, technical, and operational issues the present LEO applications raise.

II. THE COMMISSION SHOULD CONDUCT A RULEMAKING PROCEEDING PRIOR TO GRANTING ANY OPERATING AUTHORITY

Motorola's Iridium concept raises a number of broad policy, technical, and operational issues which will effect the design and operation of future non-geostationary satellite systems (non-GSO), as well as existing, planned, and future GSO mobile-satellite systems. These issues go beyond the scope of those normally encountered in a standard licensing situation. Moreover, the global nature of Iridium, adds another dimension -- the interests and concerns of foreign administrations and other international entities. Under the circumstances, COMSAT recommends that the Commission conduct a notice and comment rulemaking proceeding to resolve the major issues stemming from the proposed Iridium system prior to the issuance of any construction and operating authority.

These issues are set forth in Sections III and IV, *infra*.

A rulemaking in this instance would not be out of the ordinary. In the past, the Commission has conducted a comprehensive rulemaking before processing applications for new and novel services. For example, the Commission held a rulemaking before granting Geostar authority to implement its RDSS system.¹¹ Similarly, a rulemaking preceded licensing of the various separate system applications.¹² COMSAT sees no reason why the Iridium application and other non-GSO proposals should be handled in a different fashion.

A rulemaking is also necessary since Motorola has requested that the Commission award its system a "pioneer's preference."¹³ Under newly adopted Section 1.402 of the Commission's Rules, 47 C.F.R. § 1.402, applicants seeking the pioneer's preference must submit, inter alia, a petition for rulemaking requesting either an allocation of new spectrum for a new service or a rule amendment to

¹¹ See Amendment of the Commission's Rules to Allocate Spectrum for, and to Establish other Rules and Policies Pertaining to, a Radiodetermination Satellite Service, 58 Rad. Reg. 2d 1416 (1985), recon., 104 F.C.C. 2d 637 (1986). In fact, the Commission later imposed a freeze on all applications for use of that portion of the RDSS band until the allocation proposals were finalized. See Amendment of Part 2 of the Commission's Rules to allocate Spectrum for Mobile-Satellite Services in the 1530-1544 Mhz and 1626.5-1645.5 MHz Bands, 5 FCC Rcd 1255 (1990).

¹² See In the Matter of Establishment of Satellite Systems Providing International Communications, 101 FCC 2d 1046 (1985), recon., 61 Rad. Reg. 2d 649 (1986), further recon., 1 FCC Rcd 439 (1986).

¹³ See In the Matter of Establishment of Procedures to Provide a Preference to Applicants Proposing an Allocation for New Services, GEN. Docket No. 90-217, FCC 91-112, Report and Order released May 13, 1991 (Pioneer's Preference Order).

permit use of a new technology. Under the pioneer's preference, the Commission will not grant final operating authority unless favorable action is taken on the petition. Thus, it is standard for the Commission to conduct a notice and comment rulemaking before issuing licenses for new service offerings such as Iridium.

A rulemaking also has certain advantages. First, Motorola's proposal merits prompt consideration, which the Commission can accomplish most effectively in a rulemaking that identifies and addresses the issues in a comprehensive manner. Second, a rulemaking proceeding would provide the vehicle for the development of U.S. policy guidelines regarding Iridium, thereby enabling the U.S. government, private sector, and public users to map strategies for the future. Isolated actions on individual applications of the magnitude of Iridium cannot adequately set a course for the future. Proactive government and U.S. industry involvement at the national and international level is necessary for successful implementation of U.S. policies. A rulemaking would serve these interests.

Given the need to evaluate the Iridium system in a broader context, COMSAT believes it would be imprudent for the Commission to grant Motorola's request for a waiver of Section 319(d) of the Communications Act of 1934. It is important that the Commission provide the appropriate framework within which all parties can address the issues, assess the Iridium application, and lay the best possible basis for success. Moreover, allowing Motorola to begin construction of its system prior to any thorough examination of the Iridium system and associated issues could make it extremely

provide protection to radio astronomy from mobile uplink transmissions before its application can be granted.

There is less possibility of interference to radio astronomy from sidebands of transmitters in channels outside the radio astronomy band (1610.6-1613.8 MHz) with Motorola's proposal than with Ellipsat's proposal because, unlike Ellipsat, Motorola does not plan to use spread spectrum modulation. Nevertheless, Motorola's mobile terminals would have to contain sufficient filtering to comply with the $-237 \text{ dBW/m}^2/\text{Hz}$ standard with respect to out-of-band emissions as well.

B. The Use of the 1610.6-1613.8 MHz Band
Should Not Be Expanded to
Include MSS Uplink Transmissions.

The band from 1610.6-1613.8 is not allocated for MSS uplinks. Therefore, before Motorola's application can be granted, the Commission must decide whether the band should be authorized for MSS uplink transmissions. CORF does not believe that it is in the public interest for this band to be used for MSS uplinks, for the reasons that follow.^{2/}

As a general proposition, mobile (as opposed to fixed) uplinks operating in radio astronomy bands present a major problem to radio astronomers because of the difficulty of preventing them from operating in the vicinities of radio

^{2/} To the extent Ellipsat proposes to provide MSS communications rather than RDSS communications, the same applies with respect to Ellipsat.

astronomy sites. When these uplink transmissions to satellites originate from aircraft (as opposed to terrestrial mobile uplinks), the problem is compounded because they cause interference to any radio astronomy observatory within a wide area around the aircraft, and terrain shielding offers no protection. Thus, as a general proposition, MSS uplinks are highly incompatible with co-channel radio astronomy observations.

These problems were theoretically resolved with Geostar-type RDSS systems by taking advantage of the particular capabilities of that system. However, time sharing (blanking) is not possible with mobile satellite services, such as voice telephony. The alternative is to frequency-share, i.e., avoiding use of the 1610.6-1613.8 MHz band for MSS in the vicinity of radio astronomy sites. This assumes that the Motorola system is capable of preventing mobile users from operating in this band when they enter the region around a radio astronomy site. However, Motorola has not shown that its system can prevent mobile users from using the band in this fashion.

Even if Motorola's system can protect radio astronomy observatories, non-geostationary satellites are inherently international, and other countries may authorize similar systems that may not provide this protection.

Any MSS system operating in this band would have to have the capability to protect new radio astronomy observatories as they are established and discontinue protection for those that no longer use these bands.

Finally, if MSS uplinks are permitted in the 1610.6-1613.8 MHz radio astronomy band, the use of the band can be expected to increase dramatically, vastly increasing the potential for interference to radio astronomy observations.

For all these reasons, CORF believes that MSS uplinks should not be permitted in the 1610.6-1613.8 MHz band. Starting MSS services above 1613.8 MHz would give Motorola and any other company that is authorized to provide MSS services in the 1610.6-1613.8 MHz band 12 megahertz of spectrum, from 1614 to 1626 MHz. If additional spectrum is needed for new MSS uplinks, it should be found in a band other than 1610.6-1613.8 MHz.

C. The Band 1610.6-1613.8 MHz
Should Not Be Used for
Downlink Transmissions to
Provide Either RDSS or MSS Service.

Motorola's proposal to use the 1610-1626.5 MHz band for downlinks is inconsistent with the Table of Allocations, both domestic and international. CORF believes that, at least with respect to the 1610.6-1613.8 MHz band, no satellite downlink transmissions, either for RDSS or MSS, should be permitted.

Co-channel satellite downlinks are incompatible with radio astronomy observations because they transmit signals down into extremely sensitive radio telescopes that are pointed at the sky. Terrain shielding provides no protection from such satellite signals.

In CORF's opinion, there is no practical way to protect radio astronomy observation sites around the world from co-channel RDSS or RDSS or MSS downlinks in the 1610.6-1613.8 MHz band.

Motorola believes that it could avoid interference to radio astronomy sites simply by not using the frequencies 1610.6-1613.8 MHz in downlink beams that cover areas in which radio astronomy sites are found. The problem with Motorola's proposal is that in practice the transmissions from Motorola satellites in cells that do not directly cover a radio astronomy site would leak into adjacent cells that do include radio astronomy sites. Given the widespread nature of the potential interference and the number of observatories around the world observing in the 1610.6-1613.8 MHz band^{8/}, as a practical matter it would be difficult for MSS satellites to use the frequencies from 1610.6-1613.8 MHz for downlinks anywhere without potentially interfering with radio astronomy observations.

CORF is also concerned that if the U.S. permits Motorola to operate satellite downlinks in this band, other countries may also authorize non-geostationary satellite downlinks in this band. Because low-earth-orbit satellites are inherently international in their service, even if Motorola could protect

^{8/} U.S. astronomers do collaborate with astronomers in other countries on research involving foreign radio telescopes and therefore have an interest in protecting those observatories as well as those in the United States.

radio telescopes in the United States, other countries' satellite downlinks might not.

For these reasons, CORF opposes the use of RDSS or MSS downlinks in the 1610.6-1613.8 MHz band.

IV. Radio Astronomy Bands Should
Be Avoided in Selecting Frequencies
for Motorola's Satellite-to-
Satellite Link in the
22.55-23.55 GHz Band.

Motorola proposes to use 200 MHz of spectrum out of the 1-GHz-wide band from 22.55-23.55 GHz for satellite-to-satellite links.

If this proposal is adopted, the 200 MHz assigned to Motorola should not include two 50-MHz-wide radio astronomy bands, from 22.81-22.86 GHz and 23.07-23.12 GHz (see footnote 879 to the U.S. Table of Allocations, 47 C.F.R. §2.106). Since Motorola only needs 200 MHz of spectrum from a band that is 1 GHz wide, it should be possible for the Commission to avoid these radio astronomy bands in assigning frequencies to Motorola.

Conclusion

The Commission should avoid assigning frequencies to Ellipsat or Motorola for uses that would be incompatible with radio astronomy operations. In particular, RDSS uplink transmissions in the 1610.6-1613.8 MHz band should comply with the requirements established for RDSS sharing with radio astronomy. In this

connection, the protection areas around observatory sites need to be expanded.

Ellipsat has not satisfactorily demonstrated that it can protect radio astronomy observations in the 1610.6-1613.8 MHz band from harmful interference, and its application should not be granted until it does.

With respect to Motorola's application, MSS uplinks should not be allowed in this band, and no satellite downlink transmissions (RDSS or MSS) should be permitted.

Adequate filtering must be used in connection with Ellipsat's RDSS downlink transmissions from 2483.5-2500 MHz to avoid second-harmonic interference greater than -241 dBW/m²/Hz to radio astronomy operations at 4990-5000 MHz.

Finally, in selecting 200 MHz of spectrum in the 22.55-23.55 GHz band for Motorola's intersatellite links, radio astronomy bands at 22.81-22.86 GHz and 23.07-23.12 GHz should be avoided.

Respectfully submitted,

NATIONAL ACADEMY OF SCIENCES'
COMMITTEE ON RADIO FREQUENCIES

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