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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

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

In the Matter of	)	
	)	
Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band	)	IB Docket No. 01-185
	)	
Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for User by the Mobile Satellite Service	)	ET Docket No. 95-18

REPLY COMMENTS OF
THE CATHOLIC TELEVISION NETWORK

The Catholic Television Network ("CTN"), by its counsel, hereby submits its reply comments in the above-captioned proceeding. These reply comments address one important aspect of the proposals before the Commission to add flexibility to the delivery of mobile satellite service ("MSS") communications: the need to protect Instructional Television Fixed Service ("ITFS") operations in the 2500-2690 MHz band.

I. BACKGROUND

CTN is an association of Roman Catholic archdioceses and dioceses that operate many of the largest parochial school systems in the United States. CTN's members use ITFS frequencies to distribute educational, instructional, inspirational, and other services to schools, colleges, parishes, community centers, hospitals, nursing homes, residences, and other locations throughout the United States. In addition, some CTN members lease a portion of their ITFS spectrum capacity to commercial Multipoint Distribution Service providers who use the channels for broadband and other commercial services.

This proceeding was initiated at the request of certain MSS operators who wish to enhance their service offerings by allowing handheld user terminals to communicate with terrestrial base stations as well as satellites. This ancillary terrestrial component ("ATC") would share the frequency bands currently used by the MSS operators exclusively for earth-to-space and space-to-earth communications. While the initial proposals were to permit ATC in the 2 GHz MSS bands and L-bands,[1] at least two parties (Globalstar, L.P. and L.Q. Licensee, Inc. ("Globalstar"), and Constellation Communications Holdings, Inc. ("Constellation")) accepted the Commission's invitation to request permission for ATC in the "Big LEO" bands at 1610-1626.5 and 2483.5-2500 MHz as well.[2] CTN is concerned with ATC in the 2.4 GHz Big LEO band, because this band is adjacent to the ITFS band at 2500-2690 MHz. CTN urges the Commission to proceed carefully with the authorization of ATC in the 2.4 GHz Big LEO band, and to do so only if appropriate technical rules are adopted that protect ITFS operations.

Currently, the Big LEO bands are configured for earth-to-space communications in the 1.6 GHz band, and space-to-earth communications in the 2.4 GHz band. The huge transmission distances and concomitant path losses involved in space-to-earth communication ensure that no interference will result to ITFS operations from Big LEO transmissions in the adjacent band. There is simply not enough signal strength from a satellite transmitter to interfere with the reception of signals from terrestrial ITFS base stations. However, the situation is completely different when Big LEO transmitters are allowed on the ground as well as in space. Interference will almost certainly result to ITFS operations from terrestrial transmitters in the 2.4 GHz band

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1 The 2 GHz MSS bands occupy 1990-2025 MHz and 2165-2200 MHz, and the L-bands occupy 1525-1559 MHz and 1626.5-1660.5 MHz. These bands are far enough away from ITFS to be of little concern to CTN.

2 *See Notice of Proposed Rule Making*, FCC 01-225 at ¶ 4 (rel. Aug. 17, 2001) ("*Notice*").

unless appropriate technical rules are established. Neither proponent of ATC in the Big LEO bands addresses this interference potential in a satisfactory way.

Globalstar asserts that "[i]nterference into services adjacent to the Big LEO bands is unlikely."[3] Globalstar mentions several specific services operating in nearby bands but fails to consider the ITFS band. Constellation "does not believe that MSS terrestrial base stations should be individually licensed,"[4] and would rely upon "limits on transmit powers, antenna heights and out-of-band emissions" to protect adjacent-channel services.[5] However, the effective protection of ITFS operations requires more detailed guidelines.

II. ANALYSIS

A. ITFS Engineering Environment

Many ITFS facilities transmit signals from a centrally located transmitter to receive sites located up to 35 miles away. Individual six-megahertz channels are interleaved, so that channel A1 (2500-2506 MHz) and adjacent channel B1 (2506-2512 MHz) may be licensed to different entities. Adjacent channel interference is predicted to occur if the ratio of the desired signal to the undesired signal at the receiver is less than 0 dB, and ITFS facilities are engineered to maintain this desired-to-undesired ("D/U") signal ratio throughout each transmitter's associated protected service area.[6]

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3 Comments of Globalstar at 9.

4 Comments of Constellation at 30.

5 *Id.* at 37.

6 *See* 47 C.F.R. § 74.903. A protected service area is a 35-mile radius circle centered on the transmitter site in which ITFS educational receive sites and commercial service subscriber equipment may be located.

Pursuant to recent rule changes, fixed transmitters located at subscriber premises may also communicate on ITFS channels with centrally located response station "hubs."[7] While the standard 0 dB D/U ratio still must be maintained between adjacent channels, complex new rules provide the methodology for calculating the combined signal strength of subscriber transceivers operating on an adjacent channel.[8] Moreover, the extreme sensitivity of response station hubs requires that they be afforded special protections from co- and adjacent-channel transmissions originating as far as 100 miles away.[9] Two-way systems must be carefully engineered to control interference, both within a single system and between systems deployed in nearby market areas. Even so, if actual interference occurs, the licensee of the offending transmitter must cure the interference or cease operations.[10]

The potential for a subscriber transceiver to be located near a sensitive ITFS receive site also creates the possibility of "brute-force overload," a condition in which excess radiofrequency energy overwhelms the initial stages of the ITFS receiver electronics. Because brute-force overload occurs in the early stages of the receiver, it hampers the receiver's ability to filter out the undesired signals through frequency discrimination. Thus, a transmitter has the ability to cause brute-force overload in a nearby receiver even when the transmitter and receiver operate on widely separated frequencies. The ITFS rules contain several provisions for the protection of ITFS receive sites from brute-force overload.[11]

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7 *See generally Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions, Report and Order*, 13 FCC Rcd 19112 (1998), *recon.*, 14 FCC Rcd 12764 (1999), *further recon.*, FCC 00-244 (rel. July 21, 2000) ("*Two-Way Order*").

8 *See* Appendix D to *Two-Way Order*.

9 *See* 47 C.F.R. § 74.939(i).

10 *See* 47 C.F.R. § 74.939(g)(7).

11 *See* 47 C.F.R. § 74.939(g)(8); 74.939(p).

B. Interference to ITFS From ATC in the 2.4 GHz Band

With the foregoing in mind, at least four different interference threats to ITFS from terrestrial operation in the Big LEO band can be identified. First, terrestrial transmitters operating in the Big LEO band just below 2500 MHz have just the same potential to cause adjacent channel interference to ITFS facilities operating on Channel A1 (2500-2506 MHz) as do ITFS transmitters operating on adjacent Channel B1 (2506-2512 MHz). To illustrate the problem, the attached Engineering Statement analyzes the effect of a terrestrial Big LEO base station transmitter operating on the frequencies adjacent to Channel A1 on a typical ITFS receive site or subscriber location within the protected service area of an ITFS transmitter on Channel A1. Using worst-case assumptions (a Big LEO base station operating at maximum power oriented towards an ITFS receive antenna near the limit of an ITFS 35-mile protected service area), the base station would cause interference to the ITFS receiver if it were anywhere within 14 kilometers of the receive site.[12] Using best-case assumptions (base station oriented towards the back lobe of the ITFS receive antenna where its sensitivity is lowest), adjacent-channel interference would still be caused if the base station were up to 0.79 kilometers away.

Second, a terrestrial transmitter operating *anywhere* in the 2.4 GHz Big LEO band has the potential to cause brute-force overload in a nearby ITFS receiver. The Engineering Statement also analyzes a typical situation that could give rise to this phenomenon. A Big LEO base station within 5,000 feet of an ITFS receive site can cause brute-force overload in the ITFS receiver if they are co-aligned.[13] If the base station is located behind the receiver, the distance reduces to 282 feet.

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12 Engineering Statement, ¶ 3.

13 *Id.*, ¶ 4.

Third, a terrestrial base station transmitter in the 2.4 GHz Big LEO band can interfere with the operation of a response station hub in a two-way system that uses Channel A1 for a return path. These highly sensitive receivers are generally omnidirectional and elevated, to receive response signals from any transceiver in the response service area. A hub could be equipped with 2.4 GHz filters to mitigate interference from a Big LEO base station, but there would have to be coordination between the licensees to implement any mitigation measures.[14]

Finally, if *mobile* transmitters are allowed to operate in the 2.4 GHz Big LEO band, it may be impossible to control the transient interference that will occur whenever a mobile handset is operated near an ITFS receiver.[15] For example, if a teacher is using ITFS to deliver instructional material to a classroom, the operation of an MSS handset in the 2.4 GHz band in the school building or nearby could temporarily prevent reception of the video material, disrupting the lesson plan.

The likelihood that actual interference will arise from one or more of these threats if terrestrial operations are authorized in the frequencies immediately adjacent to the ITFS band is high, because MSS operators intend to deploy terrestrial operations in urban areas, where ITFS systems are most densely deployed.[16] For this reason, CTN urges the Commission to proceed carefully with the authorization of ATC in the 2.4 GHz Big LEO band, and to do so only if appropriate technical rules are adopted that protect ITFS operations.

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14 *Id.*, ¶ 5.

15 Although the parties have not set forth specific band plans for the Big LEO bands, the fact that the satellite downlink band at 2.4 GHz is under consideration for mobile terrestrial handset transmissions can be inferred from the comments. *See, e.g.*, Comments of Constellation at 36 n.78; *Notice* at ¶¶ 60-62.

16 *See* Comments of Constellation at 2; Comments of Globalstar at 3-4; *Notice* at ¶ 10.

C. RECOMMENDATIONS

The technical rules for MSS operation in the 2.4 GHz Big LEO band should include, at a minimum, a requirement that no mobile operations be permitted within 6 MHz of ITFS Channel A1. This will ensure that ITFS receivers will be able to reject transient interference from mobile transmitters that are operated near receive sites, subscriber antennas, or response station hubs. Second, any fixed transmitters operating within 6 MHz of Channel A1 should be individually licensed, and should be subject to the same requirements for the protection of adjacent-channel ITFS facilities as ITFS fixed transmitters. Third, the licensee of any transmitter in the 2.4 GHz Big LEO band should be responsible for curing any actual interference caused to ITFS facilities, including brute-force overload interference, or must immediately cease operation of the offending transmitter until the interference can be mitigated.

Respectfully submitted,

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November 12, 2001

Engineering Statement of Dane E. Ericksen, P.E.

The firm of Hammett & Edison, Inc. has been retained on behalf of the Catholic Television Network ("CTN"), representing numerous Instructional Television Fixed Service ("ITFS") stations licensed to, and operated by Roman Catholic Archdioceses and Dioceses throughout the United States, in support of CTN reply comments to IB Docket 01-185 concerning an ancillary terrestrial component for the Mobile Satellite Service.

An ATC for Big LEO Poses Adjacent Channel and BFO Interference Threats To ITFS

1. The comments of Constellations Communications Holdings, Inc. ("Constellation") and the combined comments of Globalstar, L.P. and L/Q Licensee, Inc. ("Globalstar/LQL") both support an ancillary terrestrial component ("ATC") for "Big LEO" Mobile Satellite Service ("MSS") operations at 2,483.5–2,500 MHz. This band is presently used for space-to-Earth downlinking, but if an ATC were to be allowed then terrestrial base stations transmitting in this band would create both an adjacent channel interference threat to Instructional Television Fixed Service ("ITFS") stations operating on Channel A1 (2,500–2,506 MHz), and also a brute-force overload ("BFO") interference threat to receive sites anywhere in the 2,500–2,686 MHz ITFS band.

2. Although both the Constellation and Globalstar/LQL comments are unspecific on the exact technical details of an ATC for Big LEO MSS, several reasonable assumptions can be made. For starters, one can assume a maximum permissible EIRP for an ITFS station, which can be as high as 69 dBm if a directional transmitting antenna is used, pursuant to Section 74.935(b) of the FCC Rules. One can also assume a hypothetical receive site at the edge of a 35-mile (56.3-kilometer) radius protected service area ("PSA") with a free-space path loss ("FSPL") of 135.4 dB, and the FCC-specified 2-foot diameter reference receiving antenna with a gain of 20 dBi. If one further assumes a 0.5 dB jumper cable loss between the receiving antenna and the downconverter input, the receive carrier level ("RCL") of the desired Channel A1 ITFS signal can be calculated to be -46.9 dBm. Alternatively, one could assume an omnidirectional ITFS station with a maximum EIRP of 63.0 dBm, and a hypothetical receive site in the middle of the station's 35-mile PSA (*i.e.*, 17.5 miles from its associated transmitter); this again results in a RCL of -46.9 dBm.

3. Section 24.132 of the FCC Rules specifies that narrowband Personal Communication Services ("PCS") base stations can have an equivalent isotropic radiated power ("EIRP") of up to 65.4 dBm, and Section 24.232 of the FCC Rules specifies that broadband PCS base stations can have an EIRP of up to 62.1 dBm. However, because Table 4 of Appendix B of the March 8, 2001,

New ICO letter that triggered this rulemaking proposed a maximum base station EIRP of 57 dBm, that lower EIRP limit will be assumed in these calculations as also applying to 2.4-GHz Big LEO ATC stations. For free-space conditions and assuming an ITFS receive antenna that is oriented towards its transmitter is also oriented towards a 57.0 dBm EIRP Big LEO ATC base station, the closest distance that such a base station could be to a PSA-perimeter ITFS receive site and ensure a 0 dB D/U ratio is 14.0 kilometers (*i.e.*, corresponding to a FSPL of 123.4 dB). And even if one assumes the best possible orientation of the ITFS receive dish with respect to a 57.0 dBm EIRP terrestrial Big LEO base station, namely the case where the undesired signal from the Big LEO base station is in the back lobe of the ITFS receiving antenna and the receiving antenna therefore provides a rejection of 25 dB (per Figure I, Section 74.937(a) of the FCC Rules), thus reducing the necessary FSPL to 98.4 dB, the keep-away distance is still 0.79 kilometers, or more than 2,500 feet.

4. In the January 8, 1998, CTN comments to MM Docket 97-217 rulemaking ("digital, two-way, cellularized ITFS operations"), a RCL of -28 dBm was assumed as the signal level at which a conventional ITFS downconverter would be likely to experience brute force overload; based on that signal level, a BFO threat distance of 1,960 feet was derived. At Paragraph 55 of the resulting September 25, 1998, Report & Order ("R&O") to MM Docket, the Commission adopted this BFO threat distance, which now appears in Section 21.909(n) of the FCC Rules governing Multichannel Multipoint Distribution Service ("MMDS") stations and in Section 74.939(p) of the FCC Rules governing ITFS stations. For a 57 dBm EIRP Big LEO terrestrial base station, a mid-band (2,593 MHz) ITFS receive site using the 2-foot 20 dBi gain reference receiving antenna, a BFO threat distance of 1.54 kilometers, or more than 5,000 feet, can be derived if one assumes no receiving antenna discrimination. If one assumes the maximum rejection for the FCC 2-foot reference antenna of 25 dB, the BFO threat distance decreases to approximately 282 feet, but this still represents an area subject to BFO threat of about 250,000 square feet. And, of course, there is no guarantee that the relative geometries between an ITFS receive site and a Big LEO terrestrial base station would be so favorable. It should also be noted that no allowance for cross polarization would be appropriate, because ITFS and MMDS stations in the same area are typically cross polarized to each other in order to reduce interference; thus, a Big LEO terrestrial base station could always be expected to be parallel-polarized to roughly half of the ITFS or MMDS operations in a given area.

5. The response hubs adopted in the MM Docket 97-217 rulemaking, designed to receive communications for low-power upstream transmitters, would similarly need to be protected against adjacent-channel and BFO interference. However, for a fixed response hub, which would be far

fewer in number than conventional ITFS receive sites, it might be feasible to use special BFO-tolerant downconverters, ITFS bandpass filters, 2.4 GHz Big LEO band reject filters, or a combination of these mitigation measures, but, contrary to the comments of Constellation, which desires only "minimal technical rules" limiting an ATC for Big LEOs at 2.4 GHz, technical protection rules comparable to those adopted in the MM Docket 97-217 rulemaking will likely be necessary to ensure no interference to ITFS (or MMDS).

6. Just as the Constellation comments raise the concept of an "exclusion zone" to protect 1.6 GHz radio astronomy sites, terrestrial Big LEO base stations operating at 2.4 GHz will similarly need to adhere to exclusion zones defined by the PSAs of ITFS stations, since ITFS stations are no longer allowed to have discrete receive sites protected or licensed, but rather receive their protection on a PSA basis. Indeed, these calculations show that the PSA exclusion zone needs to be 35.5 miles for Channel A1 ITFS stations (*i.e.*, 35 miles plus 2,500 feet), and needs to be 35.1 miles (*i.e.*, 35 miles plus approximately 282 feet) for BFO purposes, that is, applying to ITFS stations on all other ITFS channels besides Channel A1.

7. Thus, contrary to the statement made at Page 9 of the Globalstar/LQL comments, that "interference into services adjacent to the Big LEO bands is unlikely," there is indeed a threat of both adjacent-channel and BFO interference to ITFS receive sites. Since ITFS receive sites are clustered around urbanized areas, the very same urbanized areas where MSS wants to build an ATC, the threat of interference is even more likely.

Summary

8. An ATC for Big LEO MSS at 2,483.5–2,500 MHz represents an adjacent-channel interference threat to Channel A1 ITFS stations if Big LEO terrestrial base stations operate within 6 MHz of the upper band edge, and represents a BFO interference threat to all ITFS receive sites, regardless of where in the 2.4 GHz Big LEO band those stations might operate.

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