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November 16, 2006

BY HAND DELIVERY AND ELECTRONIC MAIL

Scott A. Kotler
Chief, Systems Analysis Branch
Satellite Division, International Bureau
Federal Communications Commission
445 12th Street, SW
Washington, DC

Re: License Modification Applications
Call Signs E960132 & E960622
File Nos. SES-MOD-20050927-01329, SES-AMD-20051222-01791,
SES-MOD-20050927-01330 & SES-AMD-20051222-01792

Dear Mr. Kotler:

In response to your letter dated September 26, 2006, Iridium Satellite LLC and Iridium Carrier Services LLC (collectively, "Iridium") submit the following information regarding the above-referenced applications. The questions raised in your letter are set forth below, followed by Iridium's response to each question.

1. Please demonstrate that the proposed operation of ground repeaters will not cause harmful interference with operation of the Globalstar MSS system in the 1610-1621.35 MHz band to a greater extent than permitted by an existing coordination agreement.

As demonstrated in Iridium's opposition to Globalstar's first petition to deny, the peak effective isotropic radiated power ("EIRP") of the proposed equipment is lower than that of an ordinary Iridium mobile earth terminal ("MET") and therefore has an even lower risk of interference to the Globalstar MSS system in the 1610-1621.35 MHz band than an Iridium MET.[1] Moreover, as stated in Iridium's modification applications, the proposed equipment cannot operate independently of the Iridium METs or the larger Iridium MSS system.[2] Consequently, the proposed equipment will not cause harmful interference with operation of the Globalstar MSS system in the 1610-1621.35 MHz band to a greater

[1] *See* Iridium Opposition to Petition to Deny, at 3-5 (Dec. 22, 2005).
[2] *See* Iridium Carrier Modification Application, Exh. 4, at 4 (Sept. 27, 2005); Iridium Satellite Modification Application, Exh. 3, at 4 (Sept. 27, 2005).

extent than permitted under the Commission's rules or an existing coordination agreement.

2. A statement in Amended Exhibit 4 of the applications implies that an Iridium Eagle Broadband repeater will retransmit no more than three FDMA carriers at the same time. Could additional FDMA carriers aggregate at the antenna input and cause the repeater to respond? If so, what mechanism would prevent the repeater from being overloaded? If not, how would the repeater block the additional carriers? The same exhibit states that the power at the uplink antenna flange would be distributed equally to the number of carriers being retransmitted in the same time slot. Given our understanding that the repeater is simply a linear amplifier, how is the handset power controlled to assure that each handset provides equal input to the amplifier?

Additional carriers could aggregate at the antenna input and cause the repeater to respond. The first amplifier stage of the repeater is adjusted and tested for input signals that prevent input levels that could cause the unit to operate at or above the 1dB compression point.

The amplifier output power is distributed among the number of carriers being retransmitted and in relative proportion to the power level of each carrier received at the input to the amplifier. The statement in amended Exhibit 4 that the output power is distributed *equally* assumes equal carrier input power to the amplifier, but this may or may not be the case at any particular instant in time. The repeater itself has no mechanism to ensure that the power of each MET provides equal input power to the amplifier, and there is no functional need to do so.

MET transmit power levels are controlled by the Iridium network through a closed-loop process. The introduction of the repeater into the loop is transparent to both the MET and the Iridium network. For a regular outdoor MET-to-satellite link (i.e., a non-repeated link), the Iridium network continually assigns a certain transmit power level to the MET based on measured power levels. With the repeater in the loop, the power level assignment algorithm functions in an identical manner, except the power level assignment algorithm takes into account the MET's amplified power it receives and makes an appropriate power level assignment. This process occurs seamlessly through the repeater (in both uplink and downlink directions), even though the repeater is transparent to the Iridium network.

3. The applications indicate that the repeaters are designed to be capable of operating across the 1616-1626.5 MHz band, although authority is requested only for operation in frequencies above 1618.25 MHz. What prevents the repeater from causing unwanted emissions by retransmitting Globalstar

MET transmissions received in frequencies above 1616 MHz? What would prevent the repeaters from being driven into overload and creating interfering intermodulation products within Globalstar's bandwidth?

The repeater is designed to cause no harmful interference or disruption of service to the Globalstar system. Adjustments made at the installation sites will prevent overdriving of the repeater. As noted in response to Question 2 above, the first amplifier stage of the repeater is adjusted and tested to ensure that input signals from Iridium METs cannot drive the unit to its 1dB compression point. As explained below, the EIRP of a Globalstar MET is approximately 16 dB lower than the EIRP of an Iridium MET, and therefore a Globalstar MET cannot overdrive the repeater under any reasonable operating condition.

Most, if not all, Globalstar METs are tri-mode handsets that are capable of accessing terrestrial cellular or PCS networks. Consequently, in buildings where the satellite signal is attenuated, Globalstar METs are expected to switch to terrestrial mode and transmit using the stronger terrestrial signal, rather than the weaker satellite signal. The repeater is designed specifically to operate in conjunction with the Iridium system for the purpose of extending the range of Iridium METs in primarily indoor settings, a propagation environment that is well known to be challenging to MSS networks. Within these indoor settings, the repeater is unlikely to retransmit Globalstar signals because Globalstar subscribers typically are aware that their METs may not function reliably in an indoor environment where the signal is attenuated and therefore are unlikely to initiate calls indoors.

The repeater cannot extend the range of a Globalstar MET in the same manner as an Iridium MET because the repeater does not receive and retransmit Globalstar downlink signals into the building and back to an in-building Globalstar MET. The repeater is tuned only to the 1.6 GHz band (*i.e.,* Iridium's assigned uplink/downlink band), not to Globalstar's downlink band at 2483.5-2500 MHz. Globalstar subscribers cannot obtain a duplex link (*i.e.*, complete a call) through the repeater because Globalstar's downlink transmissions to the Globalstar MET remain attenuated by the building.

An in-building Globalstar MET, under rare circumstances, theoretically could establish an uplink acquisition request to the Globalstar network through the uplink path of the repeater. The Globalstar MET, however, would not be able to complete the acquisition handshake because it detects no downlink signal and hence receives no acknowledgement or instruction from the Globalstar network, the equivalent of "no signal" from a cell phone.

Consider the case of a Globalstar MET that continually attempts to establish a connection with the Globalstar network and thereby potentially mixes with other uplink signals within the repeater. A typical EIRP for an Iridium MET is approximately +6 dBW, and a typical EIRP for a Globalstar MET is approximately -10 dBW. Given an equal in-building propagation situation, the Globalstar MET's input power to the repeater's interior antenna would therefore be 16 dB lower than a typical Iridium MET. Furthermore, Iridium METs transmit using right hand circular polarization ("RHCP"), while Globalstar METs transmit using left hand circular polarization ("LHCP"). The cross-polarization isolation performance of the repeater's RHCP-tuned interior antenna to Globalstar LHCP uplink transmissions will be a statistically distributed function based upon the actual in-building multipath fading, and will range somewhere between 0 dB and 10 dB. There will also be some amount of cross-polarization rejection provided by the oppositely polarized receiving Globalstar satellite antenna (LHCP) to any retransmitted signals (RHCP). The amount of cross-polarization isolation also varies depending on the particular path and typically will be better on the outdoor path (*i.e.*, exterior antenna of the repeater to Globalstar satellite) than the indoor environment, but obviously any cross-polarization isolation provided by the Globalstar satellite further reduces the amount of interference into the Globalstar system.

Consider further the hypothetical case where the Iridium and Globalstar systems operate on identical polarizations, and a Globalstar MET in a repeater-equipped building attempts to connect to its network. The EIRP of a typical Globalstar MET is approximately 16 dB lower than that of an Iridium MET EIRP and will always produce less input power at the input to the amplifier than that capable of an Iridium MET under normal operating conditions. The amplitude of the intermodulation products produced by any variant of Iridium/Iridium, Iridium/Globalstar or Globalstar/Globalstar signals cannot be greater than that caused by the combination of two higher-powered Iridium/Iridium carriers. Thus, any intermodulation products caused by a stray Globalstar MET transmission will always be less than that caused by two or more Iridium carriers.

4. Please explain why a promotional announcement in the Iridium Eagle Broadband website specifies a 10.5 MHz signal bandwidth and a frequency range of 1616.0-1626.5 MHz.

The specification of a 10.5 MHz signal bandwidth and a frequency range of 1616-1626.5 MHz in a promotional announcement on the Eagle Broadband website was intended merely to conform to the terms of Iridium's existing blanket MET licenses, which authorize MSS handsets "capable of operating in the 1616-1626.5 MHz frequency band."[3] To avoid any potential for confusion, Eagle Broadband has deleted this specification from its website.

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[3] *Application of U.S. Leo Services, Inc.*, 11 FCC Rcd 20474, ¶ 17 (Int'l Bur. 1996).

5. In an opposition pleading filed on December 22, 2005, the applicants assert that the repeaters will not generate mean EIRP density greater than the -3 dBW/4 kHz limit specified in Allocation Table Footnote 5.364. This assertion seems inconsistent with other specifications in the applications. Please recheck your calculations and amend the applications as necessary to correct any error in this regard.

The Iridium network employs a time domain duplex ("TDD") approach whereby uplink and downlink transmissions are assigned timeslots within a defined frame duration. The TDD structure is based on a 90 ms frame length, which is composed of a 20.32 ms guard time, four 8.28 ms uplink timeslots and four 8.28 ms downlink timeslots. The Iridium network assigns the timeslot(s) to each Iridium MET. For voice communications, an Iridium MET is assigned one uplink timeslot per frame. For data communications, an Iridium MET is assigned anywhere between one and four timeslots per frame. Therefore, for data communications, it is possible for an MET to be assigned all four available uplink timeslots of a single frame for a total uplink transmit time of 4*8.28 = 33.12 ms per frame. The highest ratio of uplink transmission time to frame duration is therefore 33.12/90 = 0.368.

The repeater's output power is distributed among the number of carriers being re-transmitted at any instant in time. The unit is rated to provide simultaneous access to three Iridium METs. The maximum power that can appear at the input to the exterior transmit antenna is 7.8 dBW, regardless of the number of carriers that are being amplified. The peak gain of the exterior transmit antenna is 2.5 dBi. The maximum EIRP produced by the equipment is therefore 10.3 dBW.

From an uplink EIRP density perspective, the maximum instantaneous EIRP density will occur when a single carrier is being re-transmitted and at maximum amplifier power. The occupied bandwidth of an Iridium carrier is 31.5 kHz. The peak instantaneous EIRP density in 4 kHz is therefore 10.3 – 10*log(31.5/4) = 1.34 dBW/4 kHz. This value appears in Item E49 of the amended FCC Form 312, Schedule B, of the pending modification applications.[4]

The calculation of the *mean* EIRP density necessarily takes into account the maximum ratio of uplink transmission time to frame duration, shown above to be 0.368. The worst case mean EIRP density is then: 1.34 + 10*log(0.368) = -3 dBW/4 kHz.

6. The applications indicate that the antenna for retransmitting downlink signals will be installed inside buildings or other structures. According to a

[4] *See* Iridium Carrier Amendment, FCC Form 312, Sched. B (Dec. 22, 2005); Iridium Satellite Amendment, FCC Form 312, Sched. B. (Dec. 22, 2005).

press release displayed in the Eagle Broadband web site, however, the repeaters "enable multiple callers to use Iridium-based satellite telephones in both outdoor and indoor settings." If customers can use the downlink re-transmitter outdoors, what additional interference impact would result from such operation?

The press release, dated June 13, 2006, states the following: "Available as both fixed and mobile units, the [repeater] creates a satellite communications 'hotspot,' allowing more flexibility by enabling multiple callers to use Iridium-based satellite telephones in both outdoor and indoor settings without losing a signal." This statement is consistent with the pending modification applications, which state that "the proposed equipment is suitable for installation in buildings or other fixed structures; military, commercial, or private ships and vehicles; and permanent or temporary government, military, or commercial facilities."[5] Thus, if installed in buildings or other fixed structures, the repeater will facilitate use of Iridium handsets in indoor settings; and, if installed on ships or vehicles, the repeater will facilitate use of Iridium handsets in those limited outdoor settings. The interference impact resulting from the operation of the repeater on ships and vehicles is the same as that resulting from operations in buildings and other fixed structures.

Furthermore, when the repeater is installed in buildings or other fixed structures, it is not designed to facilitate subscriber access to the Iridium MSS system in outdoor settings. Rather, the press release statement is intended to convey the message that the repeater is designed to facilitate seamless access to the Iridium system by allowing subscribers to continue using their handsets as they move from an outdoor setting where the repeater is not required to an indoor setting where the repeater may be required to amplify and retransmit the attenuated signal..

7. Please provide a block diagram of the repeater, an enlarged frequency response plot for the cavity filter, and cascade analysis for gain, noise figure, and third-order intercept point.

(a) Block diagram of the repeater: See Attachment 1.

(b) Enlarged frequency response plot for cavity filter: See Attachment 2.

(c) Noise figure and third-order intercept point: The maximum noise figure is 1 dB, and the output third-order intercept point is 57 dBm.

[5] *See* Iridium Carrier Modification Application, Exh. 4, at 2; Iridium Satellite Modification Application, Exh. 3, at 2.

(d) Cascade analysis for gain: The repeater is adjusted and tested at each installation site to produce a nominal gain of 66 dB, measured between the input to the low noise amplifier ("LNA") and the output of the bandpass filter. The gain of the LNA is 60 dB. The output of the LNA is attenuated using an adjustable attenuator, with a typical attenuation of 32 dB. The power amplifier has a gain of 40 dB. The bandpass filter has an insertion loss of 2 dB. The end-to-end gain is therefore 60-32+40-2 = 66 dB. Cabling losses from the output of the interior antenna to the amplifier and from the amplifier to the exterior antenna vary depending on the installation, but each are on the order of 5 dB. The gain can be further adjusted so that the maximum output power to the input of the exterior antenna does not exceed 7.8 dBW.

8. What steps have been taken to inform customers that the repeaters are currently authorized only on a temporary basis?

Customers have been notified in writing that the repeaters have been authorized pursuant to a special temporary authorization and that an application for regular licensing authority is pending before the Commission.

We trust that this provides a full response to your questions and strongly urge the Commission to grant expeditiously the long-pending modification applications. Please contact the undersigned if you have any additional questions regarding this matter.

Sincerely,

Peter D. Shields
Chin K. Yoo
Counsel for Iridum

cc: William T. Lake
Counsel for Globalstar LLC
Wilmer Cutler Pickering Hale and Dorr LLP
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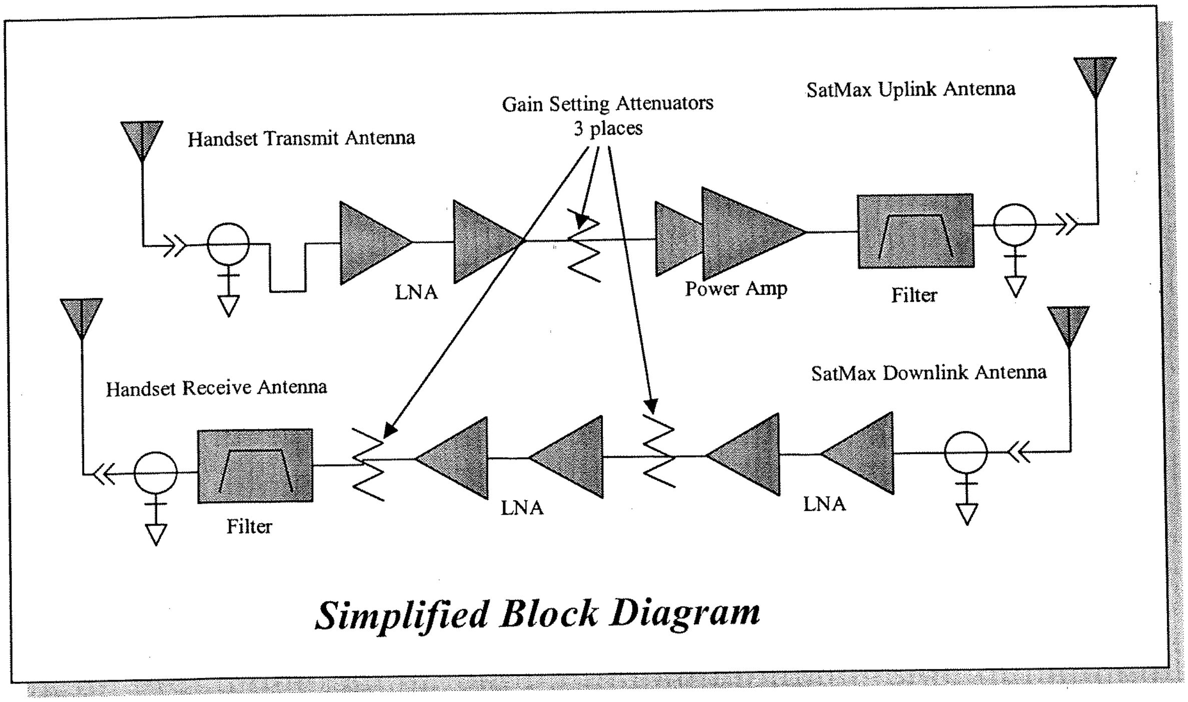
ATTACHMENT 1

Block Diagram of the Repeater



Simplified Block Diagram

ATTACHMENT 2

Enlarged Frequency Response Plot For Cavity Filter