

**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 Bands;)	IB Docket No. 01-185
)	
Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands)	IB Docket No. 02-364
)	

To: The Commission

COMMENTS OF IRIDIUM SATELLITE, LLC

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EXECUTIVE SUMMARY

More than nine years ago, the Commission allocated 33 megahertz of spectrum in the 1610-1626.5 and 2483.5-2500 MHz (“Big LEO”) bands to the mobile satellite service (“MSS”) to “support the growing demand for mobile communications, both domestically and internationally.” Since that time, Iridium has made the Commission’s vision of global MSS a reality. Iridium has emerged from bankruptcy to become a successful business. Indeed, Iridium is the only MSS system capable of providing service to customers virtually anywhere in the entire U.S. and throughout the world. Unfortunately, the Big LEO spectrum band plan has not kept pace with demand for MSS services or industry developments, creating a disparity in spectrum resources between the two Big LEO MSS operators that significantly constrains Iridium’s ability to continue meeting demand and to compete in the marketplace.

As the Commission has recognized and as is demonstrated in these comments, there is a compelling and pressing need for the Commission to act rapidly to establish an updated spectrum band plan for the Big LEO service in order to ensure adequate spectrum for customer needs and a pro-competitive framework for the future. To that end, Iridium supports the Commission’s conclusion that “it is now appropriate to re-examine the Big LEO spectrum plan.” Indeed, it is now time to rebalance the Big LEO band in a way that more accurately reflects the current realities of the MSS marketplace. It is time to ensure opportunities for growth in the industry. It is time to establish a fair and competitive framework going forward.

Iridium is experiencing a spectrum shortage. Notwithstanding system efficiency enhancements and upgrades, Iridium requires access to more than its current assignment of 5.15 MHz of spectrum. In the last twelve months, increased demand for Iridium’s

services has exceeded the Iridium system's capacity for long durations. Critical Iridium customer operations were degraded significantly during these periods, and the Commission's grant of special temporary authorizations of an additional 2.5 MHz was required to support these critical Iridium traffic loads.

In addition to the strain increased demand is placing on the Iridium system, Iridium faces the business challenge of competing with limited spectrum against another Big LEO operator that enjoys unintended access to a large swath of spectrum and the challenge of competing against non-U.S. MSS licensees with access to even greater amounts of spectrum. Iridium's competitive disadvantage is exacerbated by the inability of Iridium in its severely limited spectrum to provide essential services that are provided by its spectrum-rich competitors, such as full rate voice services.

In the *NPRM*, the FCC tentatively concluded that a "rebalancing of the Big LEO band will serve the public interest" and that it is now appropriate to consider making additional spectrum available to Iridium. Herein Iridium supports both the Commission's tentative conclusion that a rebalancing of the Big LEO band will serve the public interest and the FCC's intention "to proceed expeditiously on considering the appropriate amount of spectrum that each Big LEO MSS licensee should receive."

In an effort to facilitate the equitable and adequate allocation of spectrum to competing Big LEO service providers, Iridium Satellite, LLC is herewith submitting a proposed band plan that divides the available 33 MHz of spectrum into three comparably sized blocks—one for a CDMA system (Globalstar), one for a TDMA/FDMA system (Iridium), and the other to be held in reserve or reclaimed for other services to be determined by the Commission. This band plan ensures competitive parity, adequate

spectrum for both satellite operators, and non-interference between the two Big LEO systems. Indeed, Iridium's proposed Big LEO spectrum blueprint is a sound basis for achieving the Commission's goals of spectral parity between the Big LEO licensees and the fostering of a competitive MSS marketplace capable of delivering services and their attendant public interest benefits to the public.

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To: The Commission

COMMENTS OF IRIDIUM SATELLITE, LLC

Iridium Satellite, LLC (“Iridium”), by its attorneys, hereby respectfully submits these comments in response to the *Report and Order and Notice of Proposed Rulemaking*, released on February 10, 2003, in the proceedings referenced above.¹ As the Commission has recognized and as is demonstrated below, there is a compelling and pressing need for the Commission to act rapidly to establish an updated spectrum band plan for the Big LEO service in order to ensure adequate spectrum for customer needs and a pro-competitive framework for the future. In an effort to facilitate the equitable and adequate allocation of spectrum to competing Big LEO service providers, Iridium is herewith submitting a proposed band plan that provides both of the current Big LEO licensees with comparable spectrum on a non-interfering basis, while liberating 10 MHz of spectrum to be held in reserve or allocated for other purposes.

¹ 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 Bands, IB Docket No. 01-185, Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands, IB Docket No. 02-364, *Report and Order and Notice of Proposed Rulemaking*, FCC 03-15, (rel. Feb. 10, 2003) (“*NPRM*”).

I. INTRODUCTION

More than nine years ago, the Commission allocated 33 megahertz of spectrum in the 1610-1626.5 and 2483.5-2500 MHz (“Big LEO”) bands to the mobile satellite service (“MSS”) to “support the growing demand for mobile communications, both domestically and internationally.”² In the intervening years, that demand has grown exponentially and Iridium has been there to meet it. Unfortunately, the Big LEO spectrum band plan has not kept pace with that demand or industry developments, creating a disparity in spectrum resources between the two Big LEO MSS operators that significantly constrains Iridium’s ability to continue meeting demand and to compete in the marketplace.

Today, an expeditious Commission remedy is needed and needed fast. To that end, Iridium supports the Commission’s conclusion that “it is now appropriate to re-examine the Big LEO spectrum plan.”³ It is time to rebalance the Big LEO band in a way that more accurately reflects the current realities of the MSS marketplace. It is time to ensure opportunities for growth in the industry. It is time to establish a fair and competitive framework going forward.

Iridium has made the Commission’s vision of global MSS a reality. Iridium has emerged from bankruptcy to become a successful business. Indeed, Iridium is the only MSS system capable of providing service to customers virtually anywhere in the entire U.S. and throughout the world. Iridium’s success to date is all the more impressive when it is considered that the Iridium system operates in only 5.15 MHz of spectrum.

² Amendment of Section 2.106 of the Commission's Rules to Allocate the 1610-1626.5 MHz and the 2483.5-2500 MHz Bands for Use by the Mobile-Satellite Service, Including Non-geostationary Satellites, *Report and Order*, 9 FCC Rcd 536, 536 (1994) (allocating 33 megahertz of spectrum, 1610-1626.5 and 2483.5-2500 MHz, for MSS) (*modified by* 10 FCC Rcd 3169 (1995)).

³ *NPRM* ¶ 261.

However, Iridium is experiencing a spectrum shortage. Notwithstanding system efficiency enhancements and upgrades, Iridium requires access to more than its current assignment of 5.15 MHz of spectrum. For example, during the last twelve months, several Department of Defense (“DOD”) operations requiring use of the Iridium system in areas outside of the U.S., combined with extensive commercial usage in the same areas, exceeded the Iridium system’s capacity for long durations. Critical operations were degraded significantly in these regions, and the Commission’s grant of a special temporary authorization (“STA”) of an additional 2.5 MHz was required to support these critical Iridium traffic loads.⁴

In other areas of the world, Iridium often experiences periods of heavy capacity utilization that exhaust its current 5.15 MHz spectrum allocation. In addition, Iridium faces the business challenge of competing with limited spectrum against another Big LEO operator that enjoys unintended access to a large swath of spectrum and the challenge of competing against non-U.S. MSS licensees with access to even greater amounts of spectrum, including Inmarsat, ACeS, and Thuraya (with service links at 1626.5-1660.5 MHz Earth-to-space and 1525.0-1559.0 MHz Space-to-Earth).⁵ Iridium’s competitive disadvantage is exacerbated by the inability of Iridium in its severely limited

⁴ See, e.g., Letter from Thomas S. Tycz, Chief, Satellite Division, FCC to Peter D. Shields, Counsel to Iridium (May 13, 2003) (granting STA for Iridium to continue operating on 1618.85-1620.10 MHz until May 13, 2003); Modification of Licenses Held by Iridium Constellation, LLC and Iridium, US LP for a Mobile Satellite System in the 1.6 GHz Frequency Band, *Order*, DA 03-1917 (rel. June 11, 2003) (“*June 11 Order*”); Iridium Constellation, LLC and Iridium, US LP Request for Special Temporary Authorization, *Order*, DA 03-1949 (rel. June 16, 2003) (“*June 16 Order*”).

⁵ Moreover, additional spectrum was recently allocated for these services at the World Radiocommunication Conference (“WRC-03”), held June 9-July 4, 2003.

spectrum to provide essential services that are provided by its spectrum-rich competitors, such as full rate voice services.

In the *NPRM*, the FCC tentatively concluded that a “rebalancing of the Big LEO band will serve the public interest” and that it is now appropriate to consider making additional spectrum available to Iridium.⁶ Iridium agrees.⁷ Specifically, redistribution of spectrum is necessary to ensure competitive parity in spectrum allocations rather than perpetuation of today’s anticompetitive allocations that give one licensee (Globalstar) more than five times the amount of spectrum than the other licensee (Iridium). An equitable allocation of spectrum is required for Iridium to meet its current needs, as documented in recent spectrum shortage showings,⁸ as well as to meet future needs for growth and enhanced service features. Indeed, Iridium’s satellite capabilities will allow it to utilize this additional spectrum immediately, creating a more competitive framework abundant with opportunities for continued growth.

Toward this end, Iridium proposes herein a band plan that divides the available 33 MHz of spectrum into three comparably sized blocks—one for a CDMA system (Globalstar), one for a TDMA/FDMA system (Iridium), and the other to be held in reserve or reclaimed for other services to be determined by the Commission. This band

⁶ *NPRM* ¶ 266.

⁷ Indeed, it has now already been a year since Iridium filed its Petition for Rulemaking—a year in which Iridium operated with strained spectrum resources that impacted its ability to serve existing customers.

⁸ See, e.g., Letter from Jennifer D. Hindin, Counsel, Iridium to Thomas S. Tycz, Chief, Satellite Division, FCC (Apr. 14, 2003) (“April 14, 2003 Letter”); Letter from Peter D. Shields, Counsel, Iridium to Thomas S. Tycz, Chief, Satellite Division, FCC (Apr. 25, 2003); Letter from Peter D. Shields, Counsel, Iridium to Thomas S. Tycz, Chief, Satellite Division, FCC (May 8, 2003).

plan ensures competitive parity, adequate spectrum for both satellite operators, and non-interference between the two Big LEO systems.

Herein Iridium supports both the Commission's tentative conclusion that a rebalancing of the Big LEO band will serve the public interest and the FCC's intention "to proceed expeditiously on considering the appropriate amount of spectrum that each Big LEO MSS licensee should receive."⁹ The Big LEO spectrum blueprint proposed by Iridium in these comments is a sound basis for achieving the Commission's goals.

II. AS THE COMMISSION HAS CORRECTLY TENTATIVELY CONCLUDED, REBALANCING THE OUTDATED AND ANTICOMPETITIVE BIG LEO BAND PLAN WOULD SERVE THE PUBLIC INTEREST

As the Commission has recognized, the current Big LEO spectrum allocation results from an obsolete plan for the sharing of spectrum among five Big LEO licensees.¹⁰ The original plan called for four CDMA systems to share 27.85 MHz of spectrum and one TDMA system to have exclusive use of 5.15 MHz. The Commission granted rights to 27.85 MHz of spectrum to Globalstar and three other CDMA licensees based upon the assumption that the four CDMA licensees would share this spectrum. Under such circumstances, Iridium's grant of 5.15 MHz of spectrum was intended to be roughly proportionate to the spectrum authorized to its competitors.

However, of the four Big LEO CDMA systems ultimately licensed by the Commission, only the Globalstar system was built. Indeed, the Commission recognized

⁹ *NPRM* ¶ 266.

¹⁰ *See id.*; Letter from Richard E. Wiley, Counsel to Iridium Satellite LLC to Marlene H. Dortch, Secretary, FCC, 1 (Dec. 3, 2002). *See also* Amendment of the Commission's Rules To Establish Rules and Policies Pertaining To A Mobile Satellite Service In The 1610-1626.5/2483.5-2500 MHz Frequency Bands, *Report and Order*, 9 FCC Rcd 5936, 5954-59 (1994) ("*Big LEO Order*"); *on reconsideration, Memorandum Opinion and Order*, 11 FCC Rcd 12861 (1996).

the potential for this precise spectrum inequity when it allocated the Big LEO spectrum nearly a decade ago. At that time, although the Commission considered it “unlikely” that there would ultimately be only one CDMA Big LEO system, the Commission anticipated that it would be necessary to reassign Big LEO spectrum if “only one CDMA licensee goes forward.”¹¹ Thereafter, the three initially licensed Big LEOs specifically addressed the possibility that if there were ultimately only one CDMA system the Big LEO band plan might be revised. In an agreement signed by Iridium, Globalstar and Odyssey in 1996, the parties noted that if a single entity implemented a CDMA-based Big LEO satellite system, the band plan was subject to change.¹²

Now, nearly a decade later, there is only one CDMA Big LEO system, the Globalstar system, operating in over 27.85 MHz of spectrum, and one TDMA Big LEO system, the Iridium system, operating in just 5.15 MHz of spectrum.¹³ It is time to balance the band.¹⁴

¹¹ *Big LEO Order*, 9 FCC Rcd at 5959-61.

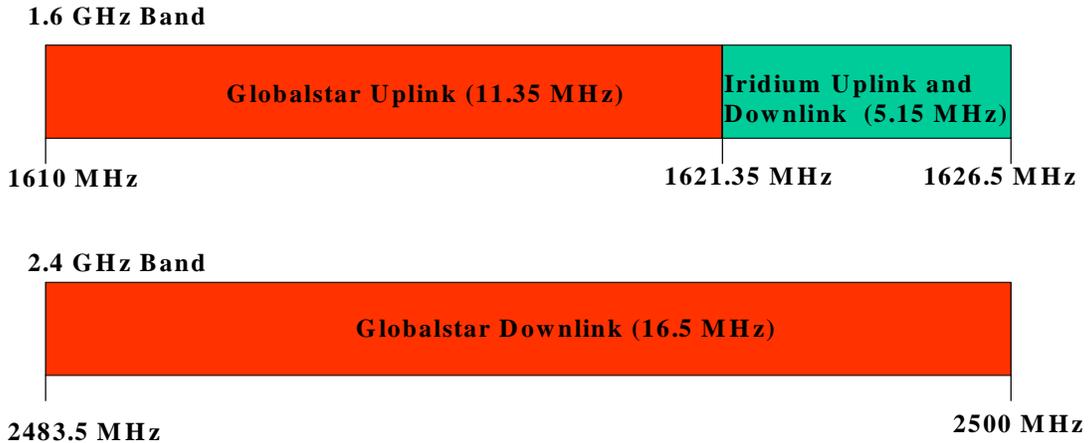
¹² See Letter from Philip L. Malet, Counsel, Motorola Satellite Communications, Inc. to William F. Caton, Acting Secretary, FCC (Feb. 26, 1997) (attaching Oct. 4, 1996 agreement signed by parties above and filed in CC Docket No. 92-166).

¹³ The remaining three CDMA Big LEO licensees have either given back or lost their licenses. See *Mobile Communications Holdings, Inc., Memorandum Opinion and Order*, 16 FCC Rcd 11766 (2001), *petition for reconsideration denied*; *Mobile Communications Holdings, Inc., Memorandum Opinion and Order*, 17 FCC Rcd 11898 (2002), *app. for review pending*; *Constellation Communications Holdings, Inc., Memorandum Opinion and Order*, 17 FCC Rcd 22584 (2002), *petition for reconsideration pending*; *Public Notice*, Satellite Policy Branch Information Satellite Applications Accepted for Filing, Report No. SPB-114, at 2 (Jan. 15, 1998) (noting TRW Inc.’s notice to the Commission that it would no longer pursue its Odyssey system and that the authorization could be cancelled).

¹⁴ Iridium also faces competition from other MSS licensees with access to even greater amounts of spectrum, including Inmarsat and Thuraya. Moreover, in the *NPRM*, the Commission granted additional rights to mobile satellite licensees to use ATC to supplement existing service—rights which Iridium cannot enjoy with only 5.15 MHz of spectrum. *NPRM* ¶ 1.

The current Big LEO band plan is depicted below:

Figure 1: Big LEO Band Plan



The CDMA uplink and downlink spectrum was to be shared among Globalstar, Odyssey, Ellipso and Constellation; however only Globalstar remains

This band plan is inherently inequitable, anticompetitive, and contrary to the public interest. Unexpectedly free from CDMA-based MSS competitors, Globalstar now has access to 27.85 MHz of frequency-separated, paired spectrum. Iridium, in contrast, has access to less than one-fifth the amount of spectrum available to its only Big LEO competitor. The competitive advantages for Globalstar are obvious. For example, with 27.85 MHz of operational spectrum, Globalstar has been free to offer full rate voice (at up to 8 kbps) and data (at up to 9.6 kbps) services. In contrast, as discussed below, Iridium was forced to cut voice and data rates in half throughout its network because of its spectrum limitations. This reduction in voice and data rates has degraded the voice quality for subscribers and slowed the data rates at which a customer can send and access

data. One immediate service quality feature that the rebalanced band plan proposed below will enable is the use of full rate voice and data vocoder capabilities.

Another example of the inequitable effect and adverse public interest impact of the current band plan is evident with respect to introduction of new services such as the ancillary terrestrial component of MSS (“ATC”). As discussed below, Iridium cannot implement ATC in only 5.15 MHz of spectrum. Globalstar, on the other hand, has access to sufficient spectrum to offer ATC. A rebalancing of the Big LEO spectrum plan would permit Iridium to introduce new technology into its network as well as begin the process of exploring the potential for integrating ATC into its existing network.¹⁵

The spectral disparity between Globalstar and Iridium has clearly placed Iridium at a competitive disadvantage. Despite efforts, discussed further below, to make the Iridium system as spectrally efficient as possible, the 5.15 MHz of spectrum currently assigned to Iridium is insufficient to meet current and projected demand. As discussed in greater detail below, Iridium urgently needs additional spectrum to relieve traffic congestion that is currently causing service disruptions on the Iridium network. As demand for Iridium services continues to grow, that congestion and its deleterious effects will only intensify if additional spectrum is not made available to handle the increasing amount of system traffic. A lack of additional spectrum also effectively will preclude the introduction of new Iridium services, as Iridium will continue to be forced to use what

¹⁵ Another example of the current band plan’s inequitable effect can be seen in the international regulatory area. Iridium recently became aware that Globalstar receives a 75% discount on its spectrum fee in Australia, based on Australia’s assumption that Globalstar is or will be sharing its 27.85 MHz of spectrum with three other CDMA operators. Yet Globalstar is not sharing spectrum with any other CDMA operator and is enjoying full use of the 27.85 MHz of spectrum. Thus, in Australia Globalstar has use of five times the amount of spectrum as Iridium but apparently pays approximately the same spectrum use fee that Iridium pays. *See* Australian Communications Authority, “Review of Satellite Licence Fees: Invitation to Comment” 10 (March 2003).

spectrum it has to cope with system congestion. As a result, without a redistribution giving Iridium a proportionate amount of spectrum, Iridium will be unable to meet the needs of MSS customers today and into the future.¹⁶

Under these circumstances, a rebalancing of the Big LEO spectrum band is timely, critical, and in the public interest. In light of the events of the past nine years, the Commission must equitably redistribute spectrum between the Big LEO licensees to comport with its initial intention to have all licensees obtain roughly equivalent amounts of Big LEO spectrum. Moreover, a failure to fairly redistribute the Big LEO spectrum would handicap severely Iridium's ability to meet the needs of its current MSS customers and limit the services available to future MSS customers.

III. IRIDIUM'S DOCUMENTED REAL WORLD SPECTRUM SHORTAGE UNDERSCORES THE INADEQUACY OF THE CURRENT BAND PLAN AND IRIDIUM'S URGENT NEED FOR ADDITIONAL SPECTRUM

Iridium's "actual current spectrum use" and demonstrated real world spectrum shortage underscore the inadequacy of the current band plan.¹⁷ Iridium first notified the Commission that it faced a near-term need for further network capacity to support its growing customer base in its July 2002 request for additional spectrum.¹⁸ Six months later, in January 2003, Iridium filed a Spectrum Report further detailing the lack of capacity available for Iridium's customers.¹⁹ Finally, with the advent of the war in Iraq

¹⁶ The Iridium System constellation is healthy and its satellites are projected to be capable of operating for at least another 10 years without replacement.

¹⁷ *NPRM* ¶ 267 (seeking comment regarding Iridium's "actual current spectrum use").

¹⁸ *See* Petition for Rulemaking of Iridium Satellite LLC (filed July 26, 2002) ("Iridium Petition for Rulemaking") (attached as Exh. A).

¹⁹ Letter from Richard E. Wiley, Counsel to Iridium Satellite LLC, to the Honorable Michael K. Powell, Chairman, FCC (Jan. 13, 2003) ("Iridium Spectrum Report") (attached as Exh. B).

and anti-terrorism activities in Afghanistan, Iridium exhausted all capacity in the Middle East region, requiring a temporary grant of additional spectrum to handle the burgeoning traffic load in that area. Each of these demonstrations shows Iridium's immediate need for additional spectrum.

A. Iridium's Past Spectrum Showings and Recent Spectrum Emergencies Have Demonstrated Iridium's Pressing Need for Additional Spectrum to Meet its Existing Customer Needs

1. Iridium's July 2002 Petition for Rulemaking

Almost one year ago, Iridium filed a formal request for additional spectrum in a Petition for Rulemaking seeking a redistribution of the Big LEO band. For the Commission's convenience, Iridium has provided a copy of that pleading as an attachment to these comments and incorporates the Petition herein by reference. In that Petition, Iridium highlighted the imbalance in spectrum resources that had developed between the Big LEO licensees since the Commission first authorized Big LEO systems to operate in the 1.6/2.4 GHz bands. In addition, Iridium detailed how a grant of additional spectrum would allow it to: (1) meet the growing demand for service to both rural and urban areas within the U.S.; (2) expand its "instant infrastructure" services in countries currently lacking any national communications infrastructure; and (3) expand provision of critical services to the U.S. military in regions of conflict. Since that time, Iridium's system capacity has only become more constrained, exacerbating the need for additional spectrum just to maintain current services.

2. Iridium's January 2003 Spectrum Report Correctly Forecast That Unmet Spectrum Demands Would Eventually Result in Service Interruptions

On January 13, 2003, in response to a Commission request, Iridium filed an extensive report that clearly delineated the shortage of spectrum capacity that it was

facing.²⁰ The report showed that demand for the Iridium satellite system was growing rapidly on both a global and regional basis. In addition, the report indicated that U.S. Government usage of Iridium services had seen dramatic increases, with 10 fold growth during the preceding two years. Moreover, the report anticipated this growth to accelerate along the same trends as it had experienced in other areas of the world, a fact that was proven with the growth in use of the Iridium service by the U.S. Government and Coalition forces in the Middle East Region beginning in early 2003.

The most salient points of the Iridium Spectrum Report were that Iridium was facing an absolute capacity shortage and that near-term action by the Commission was critical to ensure the continuing provision of high-quality services to Iridium's customers. The report's data demonstrated that regional congestion trends on the Iridium network were going to continue to increase in 2003, with satellite loading approaching 80% for a number of days—the capacity benchmark at which calls begin to be dropped from the system and new calls begin to be blocked.²¹ The congestion figures in the report were based on historical growth trends and have been borne out by the actual system loading. For the Commission's convenience, Iridium has attached a copy of the report as Exhibit B to these comments.

As the Report shows in Tables 1 and 2,²² peak loading has been steadily increasing over the last two years. In 2001, 80% or greater peak utilization occurred in at least one region in 9 days in 2001. In 2002, that number of days skyrocketed to 200.

²⁰ *Id.*

²¹ *Id.* at 7.

²² *Id.* at 5.

This year, 80% peak utilization on the Iridium network has been exceeded nearly every day; and Iridium projects that traffic will continue to reach these levels throughout this year. In the Middle East region, not only has the Iridium usage traffic exceeded the 80% level every day for the entire period, but usage has exceeded 100% of the capacity supported by the 5.15 MHz of spectrum licensed to Iridium for the majority of days this year. Even with the incorporation of the additional 2.5 MHz of spectrum provided under the STAs, Iridium experienced over 30 days in excess of 80% peak loading. Within the Western U.S. region, over 131 days have already experienced traffic loading above 50% capacity during the first half of 2003, while only 87 days experienced this loading during all of 2002. As the system usage grows, the duration and frequency of the peaks will continue to increase, causing more acquisition failures and dropped calls as described in detail below.

3. Events Since Adoption of the NPRM Confirm the Pressing Need for Spectrum to Meet Existing and Future Customer Needs

Recent military conflicts in the Middle East region have further magnified the spectrum needs of Iridium's U.S. Government customers. The U.S. Department of Defense ("DOD"), one of Iridium's largest customers, has found that the Iridium service is ideal for emergency operations where speed, mobility, and secure connectivity are required. Indeed, as NTIA has been advised, "U.S. forces ... rely heavily on the Iridium satellite system for mobile time-sensitive communications."²³

Over the last year, the extensive military efforts in Afghanistan and Iraq have led to "extraordinarily high levels of demand of [Iridium's] service in the Middle East region,

²³ Letter from Carl Wayne Smith, DISA to Karl Nebbia and Kathy Smith, NTIA (dated May 13, 2003) ("DISA May 13 Letter").

primarily from U.S. Government and Coalition Forces.”²⁴ This large increase in system congestion for the Iridium network is resulting in a growing rate of service interruptions, in the form of dropped and blocked calls. In the Middle East region, these interruptions became so pronounced this spring that on April 11, 2003, DOD made an urgent request that Iridium restore nominal service levels immediately. After Iridium demonstrated to the Commission that a lack of spectrum was the cause of the disruptions, the Commission granted Iridium authority to utilize 1.25 MHz (1620.10 to 1621.35 MHz) of spectrum for its system.²⁵

Although this “band-aid” measure provided considerable system relief, it still did not mitigate the level of service disruptions adequately. Therefore, on April 14, 2003, Iridium requested special temporary authority for use of an additional 1.25 MHz channel to relieve the pressure on the satellite constellation further from the highly concentrated use in the Middle East. On April 25, 2003, the Commission granted this request, allocating an additional 1.25 MHz of spectrum (1618.85 – 1620.10 MHz) to the Iridium system on a temporary basis.²⁶

²⁴ See *June 11 Order*, ¶ 3.

²⁵ Stamp Grant of Special Temporary Authority, File No. SAT-STA-20030414-00066, (April 14, 2003) (“This grant confirms the verbal special temporary authority received on [April 11, 2003] to operate on 1620.10-1621.35 MHz.”).

²⁶ Stamp Grant of Special Temporary Authority, File No. SAT-STA-20030425-00074 (Apr. 25, 2003).

The system demand facing Iridium in April 2003 is depicted graphically in Figure 2 below.

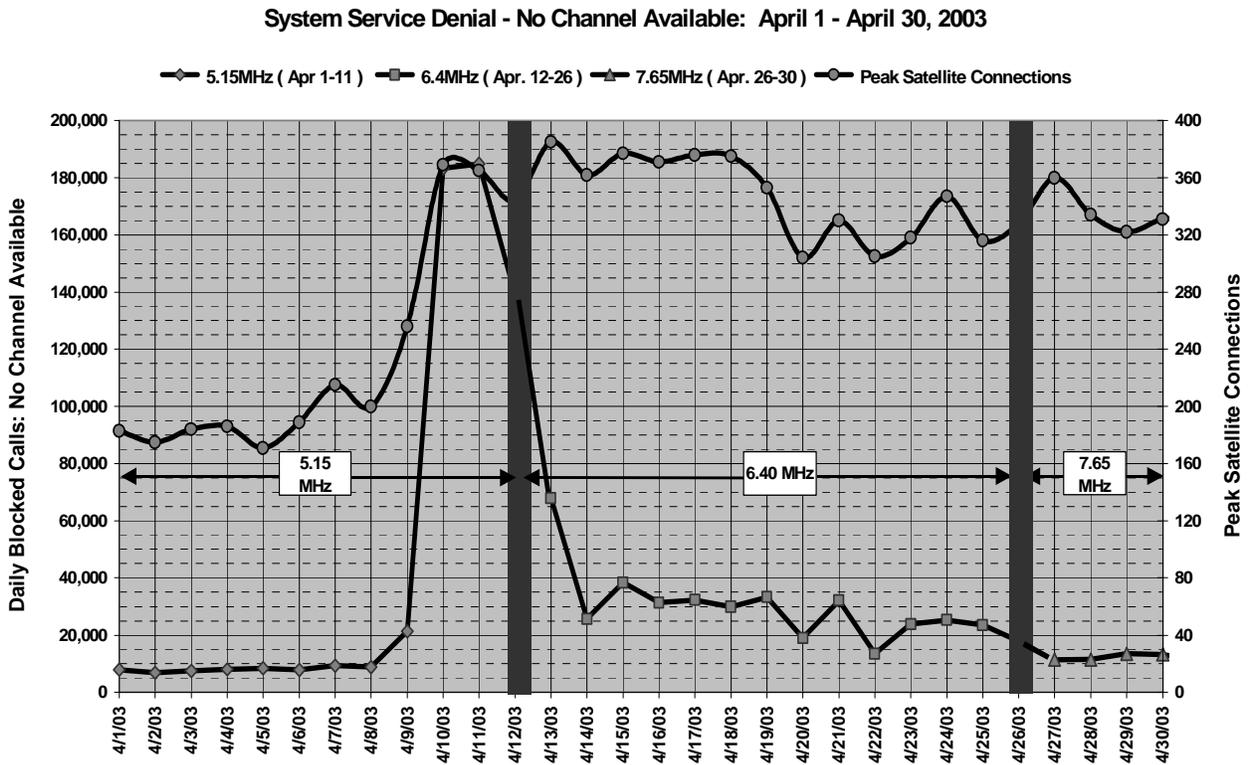


Figure 2

Note the dramatic reduction (in excess of 75%) in blocked calls with the addition of spectrum on April 12, while the blocked call rate remained relatively constant from April 12 to 26.

Iridium has carefully evaluated the radio link failures within the Middle East in the above-mentioned timeframe and has determined that the call drop rate increase within the region was directly attributable to the lack of spectrum resources. Iridium also has determined that the subsequent improvement was directly related to utilization of the additional 2.5 MHz of spectrum pursuant to the STA. Overall, the rate of Iridium dropped calls in the Middle East region has been lowered to between six and ten percent

since the incorporation of the 2.5 MHz of additional Big LEO spectrum. The above data detailing Iridium’s STA experience and the STA filings, taken together, clearly highlight Iridium’s need for additional spectrum.

4. Iridium’s Small Spectrum Allocation Limits the Number of Customers Iridium Can Support

In the *NPRM*, the Commission seeks “information on the number of customers Iridium can support using its current spectrum.”²⁷ The ability of the Iridium system to handle regional loading has been artificially constrained by the existing Big LEO band plan. With its current 5.15 MHz, the Iridium system is unable to handle satisfactorily geographically dense traffic loads that exceed approximately 180 to 200 users with single beam loading. During the recent military conflict in the Middle East, Iridium experienced demand well in excess of that maximum.

In contrast, if the full 10.5 MHz of spectrum were made available to the Iridium system, Iridium could support regional loading of 350 to 450 users with single beam loading. This would dramatically improve Iridium’s ability to support the DOD adequately in future theaters of operation, to provide other services of national and international importance, such as emergency communications for natural disaster support, and to support continued Iridium regional growth, particularly in under-developed areas.

B. Iridium Projects an Acute And Urgent Need For Additional Spectrum Brought on by Growing Demand For MSS

In addition to the spectrum required to meet current regional demand, Iridium projects that it will require significantly more spectrum in the future to satisfy growing

²⁷ *NPRM* ¶ 267.

MSS demand.²⁸ In particular, Iridium will require additional spectrum to meet the needs of users in rural areas of the United States and around the world. More capacity is also needed to offer spectrum intensive handset-to-handset data and ancillary terrestrial services.²⁹

1. General Demand for Iridium's Services is Growing Rapidly

Global usage of the Iridium system grew by more than 350% from 2001 to 2002. In the same time frame, Iridium experienced regional usage growth as high as 25 fold. This rapid growth trend has continued in the current calendar year with usage growth in excess of 355% for the first five months of 2003 over the same period in the prior year.

A similarly significant growth trend can be seen in measures of Iridium's subscriber growth. From 2001 to 2002, the number of subscribers to Iridium services increased by more than 192% worldwide. This rapid growth trend continues today with subscriber growth in excess of 172% for the first five months of 2003 compared to the same period in 2002. Moreover, use of the Iridium system by the U.S. Government has dramatically increased by 17 fold during the past 12 months. The DOD's use of the Iridium network alone has resulted in greater than 739% subscriber growth over the past 28 months.

It should be noted that, while the *NPRM* requests projected subscriber growth in 2003 and 2004, subscriber growth is not the appropriate metric by which to assess spectrum utilization. Rather, it is the system utilization characterized by call minutes and other measurements of system utilization (pages, messages, etc.) that more accurately

²⁸ *Id.* (seeking "projections of [Iridium's] future spectrum requirements").

²⁹ *Id.* (seeking comment concerning the "type of services [Iridium] plans to offer as a function of spectrum requirements").

provides insight into the spectrum utilization. Based on current trend data, Iridium projects that the annual call minute utilization will increase by over 380% from 2002 to 2003. The current forecast indicates a 2004 call minute utilization increase of roughly 190% over 2003. The impact on spectrum is dramatic, particularly since much of this traffic will be non-uniformly distributed geographically resulting in dense regional areas of extremely heavy peak usage as detailed in Section III.B.7.

The above forecasts are predicated on Iridium's current 5.15 MHz spectrum assignment, which significantly limits Iridium's ability to support regional traffic growth. If the band plan is revised and Iridium is assigned the requested 10.5 MHz of spectrum, future growth would undoubtedly increase significantly.

2. Rural U.S. Demand is Increasing

Demand for Iridium as a mobile communications solution in rural parts of the United States is increasing. In Alaska, Iridium is a critical communications service. Private aircraft, fishermen, and the general rural populace increasingly rely on Iridium for otherwise unavailable communications services. In the western region of the continental United States and Alaska, usage of the Iridium system increased by 380% from May 2001 to May 2002. This rapid growth trend is continuing in 2003, with double-digit percentage growth from May 2002 to May 2003. Similarly, Iridium continues to experience high and consistent growth in other rural regions of the United States, as awareness of Iridium's services and capabilities expands. From the first of this year through May 31, 2003, use of the Iridium network in rural U.S. areas has grown by more than 50% over the same period in 2002.

The Iridium system is suited ideally for domestic industrial applications, such as heavy construction, military and defense, homeland security, emergency services,

maritime, mining, forestry, oil and gas, and aviation. Based on current growth patterns, in the coming year U.S. maritime demand is likely to grow by roughly 30%. Iridium is also experiencing similar growth in mining, forestry, and oil and gas markets.

3. Demand for Non-U.S. Service is Increasing

Demand for use of the Iridium system outside of the United States is also increasing dramatically. Iridium estimates that well over 50% of Iridium traffic is generated outside the U.S. and that slightly more than one half of this traffic is generated by U.S. users. This estimate is based on analysis of service provider regions of operations, likely sales penetration, and the impact of the U.S. Government's use of the network; Iridium does not track the sale of its handsets outside the U.S.

Iridium has enabled military communications to overcome the rugged terrain and wide dispersal of forces in Afghanistan by providing those forces with an "early-entry, lightweight, multichannel satellite communications system and terminal equipment ... in several undeveloped staging bases."³⁰ Likewise, in Iraq, Iridium phones were, and continue to be, the most reliable, and often sole, means of communication for coalition forces on the ground.³¹ In addition, Iridium phones have been instrumental in enabling the media to provide the public with unprecedented coverage of these conflicts.

Iridium also provides critical services in remote or underserved areas of the world. These services include communications related to health care, education, public

³⁰ Robert K. Ackerman, *Special Operations Forces Become Network-Centric: Afghanistan proves the worth of total battlefield awareness*, SIGNAL Magazine, March 2003 ("March 2003 SIGNAL Magazine article") (attached as Exh. C).

³¹ See Field Report, Marine Corps Systems Command Liaison Team, Central Iraq, 20 April to 25 April 2003, at 1-2 ("Marine Corps Field Report") (attached as Exh. D).

safety and emergency situations, industrial communications and monitoring, manufacturing, political elections, and governmental and civil exchanges.

4. The Popularity of Spectrum-Intensive Handset-to-Handset Service Also is Increasing

Subscribers are increasing their use of Iridium's handset-to-handset service, which is made possible by Iridium's processing-satellite technology and unique "cut-through" service, because of its increased flexibility and extended mobility. Iridium's handset-to-handset option provides regional services independent of any existing local infrastructure, such as local PSTN services or regional gateways.³² Indeed, handset-to-handset voice traffic is 41% higher in the first five months of this year compared with the last five months of last year. In addition, handset-to-handset data usage more than doubled, growing by more than 117% in that same time frame.

Because the Iridium handset is small, lightweight, and secure, it is ideal for military emergency operations in which speed, mobility, and secure connectivity are required.³³ As militaries continue to reshape themselves into more agile forces, Iridium expects handset-to-handset usage to continue to increase.³⁴ Iridium customers in rural

³² Handset-to-handset service also enables users to share data in real time, creating a number of potential applications. See Sylvie Ellen, *Users Flock to Satellite Phone System: Enhanced Mobile Satellite Services provide voice and data communications from mobile, lightweight terminals*, Military Information Technology Magazine, May 21, 2003 (attached as Exh. E).

³³ March 2003 SIGNAL Magazine article at Exh. C. (citing U.S. Air Force praise for the "small, easily transportable" nature of the Iridium handset and noting that it has given Special Operations Forces an early-entry, lightweight, multichannel satellite communications system and terminal equipment for initial communications in several undeveloped staging bases").

³⁴ Operation Iraqi Freedom has demonstrated the impact enhanced mobile communications systems can have in making military forces more flexible, versatile, and ultimately, more effective. See Marine Corps Field Report, at 2, attached as Exh. D. (quoting one Marine Corps commander as stating, "Satellite Communications is simply the way of the future and the Marine Corps needs to start focusing on that.").

and isolated environments, where access to other telecommunications infrastructure may not be available, also have added to the volume of handset-to-handset calls, making extensive use of this feature.

While handset-to-handset service provides users tremendous flexibility and increased mobility, the service also is very spectrum-intensive. Each handset-to-handset call requires twice as much spectrum as a call connected via a regional gateway. This is because two satellite channels are required to complete the call—one for the handset-to-satellite uplink and another for the satellite-to-handset downlink. With its increasing popularity, the handset-to-handset service's spectrum-intensive nature imposes considerable strain on an Iridium satellite system already struggling to operate with insufficient spectral capacity.

5. The Rapid Growth of Data Services will Continue to Strain System Capacity

Expanded utilization of data services is imposing further demands on the already-strained Iridium satellite system. Demand for data services has grown much more rapidly than demand for voice services since Iridium's introduction of data services in June 2001. In the first five months of this year, U.S. data traffic is 34% higher than it was in the final five months of last year, the largest change occurring with handset-to-handset data, which has more than doubled, growing by 117%. Moreover, Iridium projections show that demand for data services will continue to grow significantly over the coming years, further exacerbating the need for additional spectral resources.

The introduction of packet-switched data transmissions actually has caused greater strain on the system's capacity than typical voice communications. While the more spectrally efficient data transmissions have improved capacity to some extent, that

efficiency actually has resulted in increased traffic, as subscribers increase their usage of the Iridium system.³⁵ Data compiled by Iridium reflects this phenomenon, showing that customers who use the Iridium network for data services (or both data and voice services) use five times more call minutes than typical voice subscribers. This, in turn, represents a five-fold increase in required spectral resources vis-à-vis voice-only users. As a result, the continued growth of data services will place further demands on a satellite system already experiencing a shortage of spectrum capacity. Grant of additional Big LEO spectrum would enable Iridium to simultaneously introduce higher rate data services (2X data rate) and higher voice quality services (4.8 kbps full rate vocoding), as originally intended during the design/development of the Iridium system.

6. An Important Side Benefit of Additional Spectrum is the Ability to Provide Ancillary Terrestrial Services

Aside from allowing Iridium to meet its growing demand for its current services, a redistribution of additional spectrum to Iridium would enable it to expand the number and types of services that it is technically capable of providing to include the newly authorized Ancillary Terrestrial Component (“ATC”) service. As Iridium has previously informed the Commission, no satellite operator would be able to provide ATC in 5.15 MHz of spectrum.³⁶ Even if Iridium’s satellite capacity were not severely strained, as has been demonstrated above, provision of ATC is not a practical possibility in Iridium’s 5.15 MHz of bandwidth. ATC services will require extensive amounts of satellite and terrestrial service coordination to be effective and interference-free.

³⁵ This is because a user downloading data files is likely to remain on the system longer than someone making a voice call.

³⁶ Iridium Spectrum Report, at 6, attached as Exh. B

The current Big LEO Band Plan poses two fundamental problems for Iridium's ability to provide ATC: (1) Iridium does not have frequency separation between its uplink and downlink operations; and (2) coordination between satellite and terrestrial use will require dynamic assignment of spectrum that cannot be technically accommodated in 5.15 MHz of spectrum. Given the current Big LEO band plan, Iridium is effectively denied the ability to offer ATC services. Terrestrial-satellite interference due to an inability to coordinate services and usage would prevent either service from being successfully delivered. Consequently, if the Commission does not provide additional spectrum to Iridium, the existing spectrum imbalance would be exacerbated with the roll-out by Globalstar and Mobile Satellite Ventures ("MSV") of new services such as ATC. However, with the modified band plan proposed herein, Iridium would have additional frequency separation, and terrestrial/satellite coordination could be accomplished in a technical and economical fashion. Such a result would allow Iridium to remain competitive in the MSS marketplace.

7. Additional Spectrum is Needed to Accommodate the "Peak Loading" Conditions Under Which the Iridium System Must Currently Operate

Due to the increased service demands and the expansion of regional traffic described above, Iridium has experienced steadily increasing traffic congestion over the last year and, in order to handle the congestion, has been forced to engage in "peak loading" (i.e., utilizing system capacity at elevated levels detrimental to service quality). As expected, the overloaded satellite conditions resulting from the congestion and peak loading have resulted in serious service disruptions and corresponding negative effects for Iridium customers. Congestion-based service disruptions experienced by DOD in the Middle East in April 2003 represent the most pronounced disruptions to date and are a

clear example of why the current Big LEO band plan is untenable. In order to avoid such “peak loading” conditions, the Iridium system requires additional spectrum to accommodate its increasing service demands.

To ensure quality service, Iridium monitors system performance by analyzing call establishment rates and call drop rates. Call establishment rate refers to the number of successful calls established over the total number of mobile call attempts. The call drop rate refers to the unintended disconnection of mobile call attempts during a predetermined call-holding period. With ample spectrum availability, the nominal call establishment rate for Iridium is greater than 98%, with call drop rates of less than one percent. This nominal performance is measured and monitored with unobstructed views of the satellite constellation and with commercially available equipment. Figure 3 below summarizes the call setup and drop rates as continuously tested over the Iridium system. Note that approximately 30,000 calls are evaluated every month from each of the monitoring sites located in Arizona, Virginia, Australia, Hawaii, and other locations.

Iridium AutoDialer Performance Data Summary 2003						
	January			February		
	Attempts	Established	Dropped	Attempts	Established	Dropped
Virginia to TEMPE Gateway	38331	99.3%	0.2%	34815	99.1%	0.3%
Virginia to DOD Gateway	34613	98.1%	0.3%	32419	98.1%	0.3%
Australia to TEMPE Gateway	30601	98.6%	0.7%	30949	99.8%	0.6%
	March					
	Attempts	Established	Dropped			
Virginia to TEMPE Gateway	32313	99.2%	0.3%			
Virginia to DOD Gateway	33976	98.1%	0.3%			
Australia to TEMPE Gateway	27751	98.6%	0.2%			
Summary Data (all Auto calls)	295,768	98.8%	0.4%			

Figure 3: Iridium System Call Performance 2003

Factors such as a lack of spectrum, line-of-sight obstructions, misdialed phone numbers, and low battery power all affect the Iridium system’s call drop rates. Such

factors result in a typical call drop rate of seven to ten percent. However, call drop rates increase where peak loading occurs, due to the increased difficulty in beam-to-beam and satellite-to-satellite handoffs experienced when system capacity is limited. As noted above, Iridium research shows that call drop rates can reach and even exceed 25% when satellite traffic exceeds 80% of system utilization capacity.

In addition to monitoring call drop rates, Iridium ensures service quality by monitoring satellite acquisition failures. An acquisition failure occurs when the satellite receives a new channel request and is unable to service the request since all available channels are in use. To determine when an acquisition failure occurs, the satellite must evaluate all potential channels utilized on-board the satellite and determine that all acceptable channels are in use. Under nominal loading conditions, Iridium would not experience any significant satellite acquisition failures resulting from insufficient resources. However, with the system traffic building consistently throughout the past two years and the significant expansion of regional traffic loading, Iridium has experienced serious traffic congestion over much of this year. As expected, the exceedingly limited amount of capacity available during peak loading drives up the number of acquisition failures.

Peak loading has been steadily increasing over the last two years. *See* discussion *supra* at 11-12 and in Exhibit B hereto. Even with the incorporation of the additional 2.5 MHz provided under the STAs, Iridium experienced over 30 days in excess of 80% loading. Within the Western U.S. region, over 131 days have already experienced traffic loading above 50% capacity during the first half of 2003, while only 87 days experienced this loading during all of 2002. In addition, as the number of subscribers and total system

usage increase, the duration and frequency of the peaks will only increase, causing more acquisition failures and dropped calls.

With the ever-expanding peak loading conditions, it is essential that Iridium receive additional spectrum to stem the tide of dropped calls and acquisition failures brought on by the diminishing amount of available system capacity. Indeed, Iridium's recent experiences in the Middle East bear this out. As Figure 2 (*see* Section III.A.3.) illustrates, satellite capacity was exhausted completely this spring, resulting in hundreds of thousands of acquisition failures due to limited or no channel availability for extended periods of time. The call drop rate also increased dramatically during this period, with call drop rates as high as 30%. However, as Figure 2 clearly shows, once Iridium's spectrum exhaustion was temporarily cured by the grant and incorporation of an additional 2.5 MHz of L-band spectrum pursuant to the April 11, 2003 and April 26, 2003 STAs, Iridium's acquisition failure figures and dropped call rates dramatically declined. Iridium's dropped call rates in the region fell by more than ten percent with the incorporation of the additional spectrum. Similarly, Iridium's acquisition failure rate dropped 95% from its April 11 rates after all 2.5 MHz of spectrum was temporarily allocated. Such real world experiences continue to highlight Iridium's urgent need for additional spectrum.

IV. IRIDIUM REQUIRES AT LEAST 5.35 MHZ OF ADDITIONAL SPECTRUM TO MEET ITS EXISTING AND FUTURE CUSTOMER NEEDS AND TO PERMIT IRIDIUM TO MAXIMIZE ITS SYSTEM CAPABILITIES

Iridium's satellite system was designed to utilize 10.5 MHz of spectrum. The Commission, however, assigned only 5.15 MHz to Iridium when authorizing Big LEO operations in the 1.6 GHz band, thereby necessitating system modifications and other

design changes to accommodate system demands. Even with system modifications in place, however, it is clear at this point that the 5.15 MHz of spectrum assigned to Iridium under the current band plan is still not enough to meet the continually increasing demand for MSS services; nor is it sufficient to accommodate the introduction of new services that will enable Iridium to remain competitive in the MSS marketplace.

Iridium's analysis demonstrates that the Iridium system requires an additional 5.35 MHz of spectrum to meet its current and future needs. Indeed, the Iridium System was authorized to be built to operate over 10.5 MHz of spectrum. It is time to revise the Big LEO Band plan to permit Iridium to utilize fully the spectrum in which it is designed to operate. By allowing Iridium to utilize the full 10.5 MHz contemplated in its system design, additional benefits will accrue to the public, including the introduction of new services and a higher level of quality in voice and data transmissions.

A. Iridium Has Fully Maximized Efficient Use of its Limited Spectrum

In the *NPRM*, the Commission also seeks “comment on how efficiently Iridium is using its current spectrum.”³⁷ From its inception, the fundamental design driver for the Iridium system has been the maximization of spectral efficiency and, in turn, system capacity. This led Iridium to incorporate a number of advanced technologies and advanced system design features, as described in the Technical Appendix submitted as Exhibit F hereto. In addition, after Iridium's operational bandwidth was established at 5.15 MHz, 5.35 MHz less than the original operational bandwidth design of 10.5 MHz, the Iridium design underwent two significant modifications to allow the system to go forward, albeit at a significantly reduced capacity. Since the launch of its system, Iridium

³⁷ *NPRM* ¶ 268.

also has continued to enhance its satellite software and gateway software to take advantage of efficiency-enhancing technological developments. The additional spectrum requested herein would allow Iridium to offer a full complement of services, free of existing limitations that only serve to degrade services.

1. Original Efficiency-Enhancing Design Features of the 10.5 MHz Capable Iridium System

Among the Iridium system's several distinguishing design features, its onboard processing capability is one of the more spectrally efficient. By demodulating all Big LEO band channel data (both uplink and downlink), the satellite is able to compact the baseband user data into a smaller, more efficient bandwidth. This advanced technology, seldom used on commercial spacecraft, reduces the required crosslink and feederlink spectrum, while simultaneously optimizing end-to-end link performance.

The Iridium system also is unique in its incorporation of inter-satellite crosslinks. Like onboard processing, this advanced technology is rare in commercial satellites and is used mainly in state-of-the-art DOD or NASA satellites. Inter-satellite crosslinks enable the Iridium system to provide true global coverage, while minimizing the number of gateways required worldwide. This, in turn, reduces the system-wide requirement for scarce feederlink spectrum.

On-board, real-time modulator/demodulator-to-beam switching is another design feature included in the Iridium system to maximize spectral efficiency. This unique design feature enables each satellite to assign significant percentages of the satellite modulator/demodulator hardware autonomously to a concentrated number of beams. As a result, the satellite is able to service highly concentrated traffic regions inside its

footprint. It is this feature that allowed the Iridium system to respond, almost instantaneously, to the STA grant of additional spectrum.

The Iridium system also is designed to maximize spectral efficiency by implementing intra- and inter-satellite frequency reuse. Like its terrestrial GSM counterpart, the Iridium system relies heavily on frequency reuse to maximize its system capacity and is therefore spectrally efficient. Each distinct L-band carrier frequency employed in the Iridium system can be reused in both the time and space dimension. Up to four-way reuse in time, even inside of a single beam, is accomplished via the four TDMA timeslots. Also, each carrier/timeslot combination can be reused several times inside of a single satellite footprint (i.e., reused between geographically separated beams).

The system architecture further incorporates discontinuous transmission/voice activity, dynamic power control for optimal reception, a fully synchronized network, and flexible channel assignments to handle dynamic traffic loads efficiently. All these features maximize spectral efficiency by reducing self-interference and eliminating unnecessary utilization of resources.

2. Initial Efficiency Enhancing System Modifications—To Accommodate the Current 5.15 MHz Assignment

Because the FCC assigned Iridium less than half of the 10.5 MHz of bandwidth at which the system was originally designed to operate, Iridium was forced to make two major modifications to its system. These modifications force the system to operate at less than optimal levels. The first modification was to incorporate a satellite-based, real-time, autonomous, dynamic channel management design feature, which is incorporated into the Iridium satellite payload software and allows each satellite to assign satellite capacity

autonomously to high traffic areas without ground planning or intervention. It also significantly enhances the ability of each satellite to react to real-time traffic demands independent of historical traffic patterns in the affected region. It performs this real-time function without command from the satellite control facility or gateways. This space vehicle, real-time (SVRT) dynamic software continuously allocates, de-allocates, and reallocates user-link (L-band) spectrum and hardware in response to the offered traffic load while simultaneously: a) optimizing traffic capacity; b) maximizing desired carrier-to-interference ratios between reuse beams; and c) minimizing reuse channel conflicts between satellites. This SVRT dynamic channel assignment feature is unique to current generation MSS systems and was implemented at significant cost and risk to the program. It has resulted, however, in a greatly enhanced spectral efficiency for the Iridium system.³⁸

The second major modification was the disabling of both full rate voice and full rate data services. As originally designed, the Iridium system provided both half-rate (2.4 kbps) and full-rate (4.8 kbps) voice services and half-rate (9.6 kbps) and full-rate (19.2 kbps) data services. The selection of a voice/data mode was designed to be selectable during call setup via handset-to-gateway signaling. In areas where traffic demand was high, the gateway could limit calls to half-rate, while allowing the vast majority of calls to operate at full-rate.

As a consequence of the limited spectrum made available to the Iridium system, operation has been limited to half-rate mode since the original commercial activation in

³⁸ The technical appendix (attached as Exh. F) provides additional details relating to this very unique feature.

1998. The system remains capable of implementing this full rate feature, and only software modifications on network elements would be required to implement this service.

3. Post-launch Enhancements to the Operational Iridium System

Since the launch of its system, Iridium has continued to enhance its satellite software and gateway software to take advantage of technical developments.³⁹ These enhancements have included power control refinements, satellite access and handoff algorithm enhancements, and introduction of low-bandwidth messaging services. With the original design features of the Iridium system and the subsequent modifications made to accommodate the Commission's authorization of limited operational bandwidth, these software enhancements constitute a concerted and sustained effort to exploit every technological advantage available to make the Iridium system as spectrally efficient as possible. Despite these efforts, however, Iridium remains in need of additional spectrum to alleviate the strain currently placed on its system, to allow it to introduce the services necessary for Iridium to remain competitive, and to enable the Iridium system to operate at its optimal level.

V. THE COMMISSION SHOULD ADOPT A BALANCED AND PROCOMPETITIVE BIG LEO BAND PLAN THAT ENSURES EQUITABLE AND ADEQUATE SPECTRUM FOR BOTH BIG LEO LICENSEES

As the previously submitted system congestion demand showings indicate, the Big LEO spectrum band plan must be modified to provide spectrum parity and ensure that each licensee is treated in a substantially similar fashion. Absent expeditious action

³⁹ *NPRM* ¶ 268 (“[H]as Iridium been able to develop more efficient spectrum use as a result of its experience operating a global MSS system? Has Iridium been able to modify its system to take advantage of any technical developments in spectrum use since the launch of its system?”).

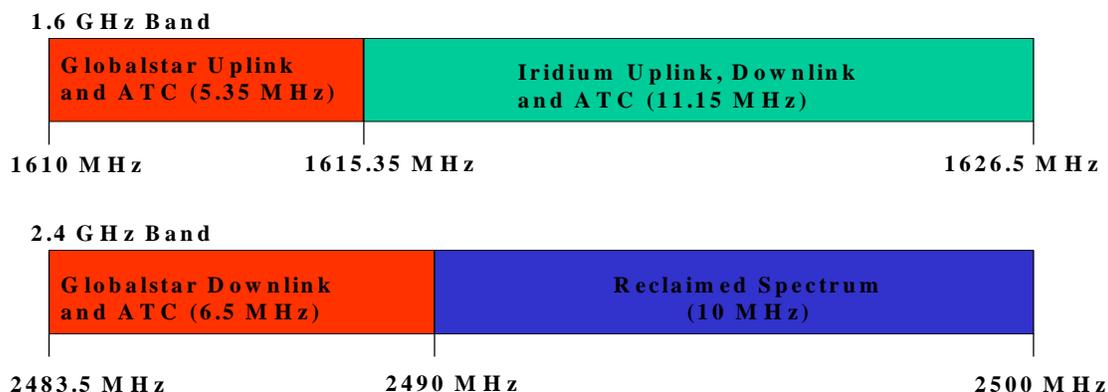
by the Commission to rectify the current spectral imbalance, Iridium will be unable to: (1) meet its customer needs; (2) utilize ATC capabilities recently granted by the Commission; and (3) effectively compete with the other Big LEO licensee, which has to date enjoyed an unintended and undeserved spectrum windfall. The Commission should craft a band plan that provides a level playing field for Iridium while ensuring the ongoing vitality of both Iridium and Globalstar. Iridium and Globalstar have had limited preliminary discussions regarding a band plan that would accomplish these goals, but the parties have yet to reach a consensus on a common approach.

A. A Balanced and Pro-Competitive Band Plan Can Be Readily Adopted for the Big LEO Service And Would Serve the Public Interest

The Commission must move forward in establishing an equitable spectrum plan for Big LEO licensees.⁴⁰ Iridium's satellite constellation was authorized and built to support 10.5 MHz of spectrum. With Commission approval, Iridium is positioned to deploy immediately an additional 5.35 MHz of spectrum for its customers within its existing satellite network. As detailed below, maximizing the spectrum for Iridium's system would allow Iridium to deploy enhanced and new services to the public. In order to maximize these public interest benefits, Iridium proposes the following band plan for the Big LEO spectrum:

⁴⁰ In the *NPRM*, the Commission encouraged Globalstar and Iridium to work cooperatively to develop a mutually acceptable band plan for the Big LEO spectrum. *NPRM*, ¶ 266. The FCC noted that the development of such a consensual plan would expedite the approval process, but asserted that it would move forward to rebalance the band plan even without such a mutually agreed upon plan. To that end, Iridium and Globalstar have engaged in discussions aimed at reaching a consensus plan. However, the parties have been unsuccessful to date in reaching any type of mutually acceptable agreement.

Figure 4: New Band Plan



Iridium urges the Commission to allocate an additional 5.35 MHz of spectrum for exclusive TDMA/FDMA (Iridium System) use. By altering the Big LEO band plan to create spectrum parity between the two Big LEO entities, the Commission will ensure a robust, competitive marketplace for mobile satellite services.

B. Iridium’s Customer Needs Will Be Met With This New Band Plan

Under this modified band plan, Iridium would have sufficient capacity to meet its current customer needs, satisfy continued growth trends for its system, and potentially enable the deployment of new capabilities in the future. As described in Section III.B, Iridium’s satellite network is dealing with system congestion on a daily basis that adversely affects the quality of service provided. Customers on the Iridium system, including the U.S. Government and customers in rural and underserved areas, rely on Iridium’s network for critical communications services in many places where no other alternative can supply similar levels of quality communications services. In addition, Iridium has clearly seen through the temporary addition of new spectrum to its network

that its main system limitation is lack of spectrum access. After Iridium obtained authority to utilize additional spectral capacity, the service interruptions experienced by U.S. Government and Coalition forces in the Middle East were substantially alleviated.⁴¹ With more spectrum bandwidth made available to the network, the system again performed as expected and required by Iridium customers. Because a lack of spectrum is the major impediment to Iridium's ability to offer current, new, and superior quality services, it is incumbent on the Commission to adopt, in an expeditious fashion, the new Big LEO band plan proposed by Iridium.

C. Iridium's Proposed Band Plan Will Also Permit The Support Of Advanced and More Robust Services to its Subscribers

Iridium will not only be in a position to support its ongoing customer demands for voice services with this modified band plan, it will also be able to continue to provide and introduce data and other advanced services. Data services and handset-to-handset services are a growing market for the Iridium network. Although data services are inherently packet-based and therefore more efficient traffic for the Iridium system, the volume of demand for data services has escalated at a rate that far surpasses the trends associated with voice services. In addition, Iridium faces substantial competition from other data-focused satellite providers that have access to more spectrum, and thus, higher data speeds for attracting customers. The band plan proposed by Iridium would permit the network to support higher data rates (9.6 to 19.2 kbps) immediately and a greater number of data users, a requirement that Iridium subscribers have clearly been seeking.

⁴¹ See DISA May 13 Letter, ¶ 2 (“The Department of Defense (DoD), through monitoring capabilities available at the DoD Iridium Gateway facility, has noted improved Iridium system performance since implementation of the two current Special Temporary Authorizations (STAs).”).

Moreover, handset-to-handset services, which require twice the spectrum as compared to a handset-to-network voice communication, can be handled more readily by the system.

The other immediate service quality feature that the modified band plan will enable is the use of full rate voice and data vocoder capabilities. As detailed herein, Iridium has been forced to cut voice and data rates in half throughout its network because of the spectrum allocation provided in the Big LEO band. This reduction in voice and data rates has degraded the voice quality for subscribers and slowed the data rates at which a customer can send and access data. However, with the new band plan, Iridium will be able to modify its operations to support full rate voice channels and improved voice quality for its customers as well as higher speed data transmissions. Because the Iridium constellation contemplated such system parameters, these modifications are simply accomplished through software changes on network elements.

In the future, Iridium plans to continue rolling out other advanced services throughout its network and also anticipates that the proffered band plan will accommodate these services. ATC will require extensive new bandwidth if it is to be integrated in a seamless and interference-free fashion with Iridium's current operations. Indeed, even Globalstar has previously recognized that advanced services, including services such as ATC, would require at least 10 to 15 MHz of paired spectrum.⁴² The new Big LEO spectrum plan would permit Iridium to introduce new technology into its network as well as to begin the process of exploring the potential for integrating ATC into its existing network.

⁴² Globalstar, L.P. Petition for Reconsideration, The Establishment of Policies and Service Rules for the Mobile-Satellite Service in the 2 GHz Band, IB Docket No. 99-81, at 4 (filed Nov. 3, 2000).

D. Some Spectrum Must Be Utilized as a Guard Band Between Iridium and Globalstar

In the *NPRM*, the Commission sought comment on how Iridium would use the 1615.35 to 1616 MHz band that it was not previously authorized to utilize.⁴³ Iridium's satellite system only can use 10.5 MHz of spectrum immediately. As a result, the additional spectrum provided for in this band plan will allow for 10.5 MHz of usable spectrum for the Iridium System and a guard band of 0.65 MHz between Globalstar and Iridium operations.

Iridium believes that a guard band is necessary due to Doppler corrections made independently between the two systems and the use of ATC by Globalstar and, potentially, by Iridium in adjacent channels. The Commission has a long established policy that spectrum guard bands, where necessary to ensure interference-free operations, are in the public interest.⁴⁴ In attempting to protect MDS operations in the 2500 to 2690 MHz band, the FCC found that 2 MHz of guard band spectrum was necessary to ensure non-interference between Globalstar's ATC base stations and MDS receivers.⁴⁵

As Iridium's proposed band plan locates all of its operations within the 1.6 GHz band, any potential Iridium ATC base station operation would be adjacent to the uplink and/or ATC mobile operation of Globalstar's MSS/ATC system. The technical analysis performed by the FCC to protect MDS receivers with 2 MHz of guard band spectrum certainly applies in similar fashion to Iridium and Globalstar base station/uplink/ATC

⁴³ *NPRM* ¶ 268.

⁴⁴ See Service Rules for the 746-764 and 776-794 MHz Bands and Revisions to Part 27 of the Commission's Rules, *First Report and Order*, 15 FCC Rcd 476, 491 (2000); *NPRM* ¶ 204.

⁴⁵ *NPRM*, Appendix C, 4.2.3, pp. 246-48.

mobile operations. However, Iridium does not anticipate that, if it integrates ATC with its MSS system, base station facilities will operate at the absolute band edge of its assigned spectrum, which obviates the need for as broad a guard band as required between Globalstar and MDS operations in the 2.4 GHz band. The Doppler effect corrections referenced above will require approximately 80 kHz of guard band spectrum between Iridium and Globalstar operations. Thus, Iridium believes that 0.65 MHz, rather than the 2 MHz needed to protect MDS operations, should suffice to ensure that both Iridium and Globalstar systems can operate without the potential for harmful interference.

E. A New Big LEO Band Plan Would Allow 10 MHz of Valuable Spectrum To Be Reserved for Other Purposes

This new band plan also enables the Commission to reserve 10 MHz of needed spectrum below 3 GHz. As noted in its recent allocation of 90 MHz of spectrum for advanced wireless services, the Commission is engaged in a continuing effort to identify additional spectrum below 3 GHz.⁴⁶ Moreover, the recent *Spectrum Policy Report* recognizes that “both industry and Commission projections for spectrum use have significantly and consistently underestimated the need for additional spectrum and the public’s utilization of new technologies and applications.”⁴⁷ The additional 10 MHz of spectrum made available under this band plan presents an unique opportunity for the Commission to reclaim underutilized spectrum and fulfill more urgent spectrum needs to serve the public interest.

⁴⁶ Amendment of Part 2 of the Commission’s Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems, *Second Report and Order*, 17 FCC Rcd 23193, 23218 (2002).

⁴⁷ Spectrum Policy Task Force Report, ET Docket No. 02-135, at 12 (Nov. 2002)(noting the “dramatic increase in overall demand for spectrum-based services and devices . . .”).

F. Iridium's Proposed Band Plan Will Not Create Harmful Interference to Iridium, Globalstar, or Any Other User of the Affected Spectrum

With recent experiences from the FCC's grant of additional spectrum to handle congestion driven by recent conflicts in the Middle East, Iridium has demonstrated that use of more Big LEO spectrum does not adversely affect the ongoing operations of Globalstar. To the contrary, as the Commission has recognized, Globalstar has been unable to demonstrate any interference problems from Iridium's use of 2.5 MHz of spectrum in the Big LEO band.⁴⁸ Iridium believes that this real-world practical experience shows that its use of additional spectrum will not undermine any Globalstar operations but will simply correct the major imbalance of spectrum between the two Big LEO competitors. As part of this modified band plan, Iridium will continue to maintain the same out-of-band emission limitations that are currently in place and, to eliminate even the remote chance that harmful interference could occur, has suggested the introduction of a spectrum guard band between Iridium and Globalstar operations. With these measures in place, the Commission can be assured, as it found in the technical appendix to the *NPRM*,⁴⁹ that Iridium's proposed spectrum plan for Big LEO licensees will not cause interference between Globalstar and Iridium adjacent channel operations.

As a Big LEO licensee, Iridium has been required to protect the activities of the Radio Astronomy Service (RAS) at a number of locations throughout the country.⁵⁰ Iridium, and the previous licensee, Motorola, have entered into a number of Memoranda

⁴⁸ See *June 11 Order* ¶ 8.

⁴⁹ *NPRM*, Appendix C, Section 3.1, pp. 240-41.

⁵⁰ 47 C.F.R. § 25.213.

of Understanding (MoUs) with the RAS to ensure that the vital scientific pursuits of RAS licensees are not subject to interference.

For example, in MoUs between Iridium and Arecibo,⁵¹ NRAO,⁵² and various other radio astronomy sites, the Iridium system is required to be compliant with out-of-band (“OOB”) emission levels in the 1610.6-1613.8 MHz band. In order to ensure compliance with these OOB emission levels, a channel crowding functionality was defined, developed, tested, and implemented on the Iridium satellites during commercial activation. This functionality ensures that, when necessary, the space-to-ground beams impinging on radio astronomy sites can be operated at the upper end of the MSS Big LEO allocation, thereby providing for significantly reduced out-of-band emissions. Furthermore, Iridium has operated (and continues to operate) its broadcast control channels at reduced power levels in order to further reduce its OOB emission levels in the 1610.6-1613.8 MHz band on a continuous 24 hours per day, 7 days per week basis.

Assignment of additional Big LEO channels to Iridium will not impact Iridium’s ability to implement the above channel crowding functionality. Rather, the additional Big LEO spectrum will enable Iridium to more efficiently implement the bandwidth compression functionality currently supported by the Iridium system. Since the channel crowding functionality is implemented on a beam cluster basis, the amount of spectrum available to support communications on exterior beams (i.e., beams outside of the RAS field-of-view) will be increased by a grant of additional spectrum. This will allow the

⁵¹ May 2001 MoU, attached to Comments of Cornell University, File Nos. SAT-MSC-20030515-00089 and SES-MSC-20030515-00666 (filed May 23, 2003).

⁵² January 2002 MoU, attached to Comments of National Radio Astronomy Observatory (“NRAO”), File Nos. SAT-MSC-20030515-00089 and SES-MSC-20030515-00666 (filed May 23, 2003).

onboard channel/frequency algorithms to minimize frequency conflicts between RAS directed beam clusters and the remaining satellite beams (i.e., non-RAS impinging beams). As such, the satellites will have greater latitude to reduce the channel allocations/occupancy on those beam clusters that emit in the direction of RAS sites.

Iridium will continue to abide by the requirements of the most recent MoUs agreed to in the new spectrum bands that would be authorized for its use in the modified band plan. Moreover, Iridium would, as it has always done with respect to RAS activities, revisit these MoUs based upon any new band plan adopted by the Commission to ensure the RAS would continue to receive no harmful interference.

Given the measures described above, it is clear that the Iridium Big LEO band plan proposal fosters all Commission goals for rebalancing the allocation: ensuring a competitive marketplace; providing new spectrum for potential new entrants or reserves for existing MSS licensees; and protecting all parties from harmful interference. Iridium urges the Commission to conclude that the proposed band plan serves the public interest and to adopt it expeditiously.

VI. CONCLUSION

There is a compelling and pressing need for the Commission to quickly adopt an updated spectrum band plan for the Big LEO MSS services and thereby ensure adequate spectrum for current customer needs and a pro-competitive framework for the future. For the above-stated reasons, the Commission should promptly adopt Iridium's proposal for a rebalancing of the Big LEO band.

Respectfully submitted,

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