

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

In the Matter of)	
)	
Iridium Satellite LLC)	File Nos. SES-MOD-20130416-00322;
)	Call Sign E960132
)	
Iridium Carrier Services LLC)	File No. SES-MOD-20130416-00323;
)	Call Sign E960622
)	
Applications for Blanket Earth Station)	
AMS(R)S Authority)	

REPLY OF INMARSAT TO IRIDIUM OPPOSITION

Inmarsat Inc. (“Inmarsat”) replies to the opposition of Iridium Satellite LLC and Iridium Carrier Services LLC (together, “Iridium”)¹ to Inmarsat’s request to hold in abeyance² the processing of Iridium’s applications (“Applications”) for authority to operate AMS(R)S terminals. In its Opposition, Iridium has declined to address the substantive deficiencies in the Applications identified by Inmarsat. Moreover, Iridium fails to address the critical public safety issues raised by interference that would arise from Iridium’s proposed operations.

I. INTRODUCTION

As an initial matter, it is well established that in certain circumstances Iridium’s new AMS(R)S service will not perform as intended in the existing radiofrequency environment under which countless aircraft successfully operate today. In short, the new Iridium terminals, which will receive service in part of the L band, are not able to coexist in close proximity with the thousands of fully-compliant Inmarsat aeronautical earth stations (“AES”) transmitting in an

¹ Iridium, Opposition to Request to Hold in Abeyance, File Nos. SES-MOD-20130416-00322, SES-MOD-20130416-00323 (filed Jan. 9, 2015) (“Opposition”).

² Inmarsat Inc., Request to Hold in Abeyance, File Nos. SES-MOD-20130416-00322, SES-MOD-20130416-00323 (filed Dec. 19, 2014) (“Request”).

adjacent part of the L band. Various commercial, governmental, and not-for-profit enterprises rely every day on those Inmarsat terminals, and have invested hundreds of millions of dollars into those existing AES networks on thousands of aircraft. An aircraft with both Iridium and Inmarsat terminals may not be able to operate both terminal types at the same time.³ And, depending on the performance of the Iridium terminal, an Iridium terminal may not be able to operate on an aircraft within thirty (or even more) miles of an aircraft with an Inmarsat terminal.⁴

The Commission has been clear that Inmarsat and its users have no obligation to change their operations in order to accommodate this new Iridium service.⁵ Thus, the only questions are (i) how the impact of this interference is to be managed by Iridium, (ii) how it is managed by and for the aircraft that choose to install these Iridium terminals, and (iii) how all affected users of Iridium terminals are to be apprised of this potential for interference and the lack of regulatory protection under which they will operate.

In its initial filing, Inmarsat asked the Commission to defer action on the Applications until Iridium provides information on the technical characteristics of the proposed AMS(R)S

³ See Minimum Operational Performance Standards for Avionics Supporting Next Generation Satellite Systems (NGSS), RTCA, DO-262B, Appendix D, 1.3.5.1, at D-27 (June 17, 2014) (“2014 RTCA MOPS”) (“simultaneous independent operation of Iridium and Inmarsat AES equipment on the same aircraft has the potential to cause significant interference to all Iridium AMSS and AMS(R)S services.”).

⁴ See Aeronautical Communications Panel (ACP) Working Group M (Reconstituted) Report of the Twelfth Meeting, International Civil Aviation Organization (“ICAO”), Montreal, at AI-4 (June 16-19, 2008) (“ICAO Working Group M Report”) (recommending separation distance between Inmarsat and Iridium AES terminals operating within the same oceanic airspace, based on certain assumed performance characteristics of the Iridium AES terminal).

⁵ See *Iridium Constellation LLC, for Authority to Modify License for a Low Earth Orbit Mobile Satellite System*, File Nos. SAT-MOD-19961204-00139, SAT-AMD-20050816-00160, SAT-AMD-2005118-00236, Call Sign S2110, Memorandum Opinion and Order, DA 13-141 ¶ 11 (rel. Feb. 4, 2013) (making clear that grant of Iridium’s AMS(R)S space station authority does not require new restrictions on already licensed operations of earth stations in adjacent frequency bands).

terminals, which data are needed to assess and manage the interference environment (*i.e.*, determine under what circumstances a user of an Iridium terminal can expect its Iridium service to fail because that user is within “range” of another aircraft). Iridium claims that it need not provide that information on the record. In addition, Inmarsat requested clarification regarding the geographic scope of operations sought in the Applications, as well as confirmation that Iridium is not in fact seeking interference protection by proposing to operate in areas where there is no mechanism in place to manage the expected interference. Specifically, Inmarsat noted that Iridium’s existing AMS(R)S authority for its spacecraft did not cover “remote areas,” and that since the Commission had not yet defined the scope of those areas, it was far from clear how Iridium operations in those areas would be managed. Iridium blithely claims it has all of the authority it needs to operate in “remote” areas, regardless how and when they are defined.⁶

Because of the critical safety communications inherent in AMS(R)S operations, it is imperative that the interference environment be well understood and managed.⁷ Unfortunately, Iridium still has not provided the information needed to allow the Commission to fulfill one of its statutory duties: managing radiofrequency interference. Unless and until it does, Inmarsat reiterates its request that the Commission hold the Applications in abeyance. And if Iridium does not provide that information, the Commission should dismiss the Applications.

⁶ See Opposition at 6.

⁷ Instead of addressing the legitimate and well-documented risks of interference between Inmarsat and Iridium AES terminals, Iridium casts aspersions on Inmarsat. Contrary to what Iridium suggests, Inmarsat seeks to ensure that federal regulators adequately manage the risks to aircraft safety arising from the failure of Iridium’s AMS(R)S service to be able to coexist in the existing radiofrequency operating environment with existing services, and still operate reliably. In fact, just today, Inmarsat opposed a proposal before RTCA to allow a significant increase of emissions levels into the band in which Iridium operates, which would have adversely affected the operation of Iridium terminals.

II. IRIDIUM STILL HAS NOT MADE AVAILABLE NECESSARY TECHNICAL INFORMATION REGARDING THE PROPOSED AMS(R)S ANTENNA

In the Opposition, Iridium suggests that the technical details of the AMS(R)S antenna were made available in connection with the development of performance standards for Iridium's AMS(R)S antennas by the Radio Technical Commission for Aeronautics, Inc. ("RTCA") which serves as an advisory committee to the Federal Aviation Administration ("FAA").⁸ Contrary to Iridium's contention, the information that is publicly available regarding its proposed AMS(R)S antenna is insufficient to adequately assess the interference risks raised by the Applications,⁹ and in fact, raises more questions than it answers.

As an initial matter, it is not apparent that the performance of an antenna designed for a 20-year-old handset would be the same as the performance of a modern antenna designed to be mounted on an aircraft fuselage. In fact, the Iridium antenna characteristics studied in the ICAO process were those for a low-profile omni-directional terminal that was assumed to have the performance of a typical GPS antenna—not those of a historical Iridium handheld terminal with a "stick" antenna.¹⁰ Among other things, the antenna gain patterns of the two types of antennas are likely to be different, given the disparities in shape and size of each. Furthermore, the operation of a low-profile, omni-directional antenna mounted atop an aluminum aircraft would present a different operating environment (*i.e.*, signals would be reflected from the fuselage into the antenna), and thus likely result in a different interference profile, than an antenna used by a person with a handheld device.

⁸ Opposition at 7.

⁹ Iridium's assertion in its Opposition that it has provided all required technical information based on its vague reference in the Applications to "Mobile" blanket licensed terminals begs the question. Each of the antenna types authorized on Iridium's licenses that the subject of the Applications is identified as "mobile."

¹⁰ See ICAO Working Group M Report at AI-4; see also *id.* at Annex 4, Table 1.

Moreover, information Iridium provided in the RTCA's process does not support Iridium's claim that its AMS(R)S terminals would be operated within the same technical envelope as the mobile "portable handheld terminal" currently licensed.¹¹ As a threshold matter, many of the relevant technical parameters provided in connection with the RTCA's process are not apparent from the working papers submitted in the RTCA process. In fact, some of the data provided to RTCA raise more questions than they answer: three different antenna gain profiles are identified in that data.¹² No other helpful data appears to have been submitted in connection with that RTCA process, and it is unclear which of those three antenna gain profiles Iridium intends to utilize for the terminals it seeks to license through the Applications.

The missing information is critical. Among other things, the gain profile of the Iridium terminal has a direct impact on the separation distances between aircraft that are needed to avoid interference, as discussed below. Stated another way, the salient technical parameters that are needed to assess and manage the interference environment of the proposed Iridium antenna simply are not present on the record.

III. THE MISSING INFORMATION REGARDING IRIDIUM'S PROPOSED AMS(R)S OPERATIONS IS NEEDED TO MANAGE THE IMPACT OF INTERFERENCE INTO CRITICAL SAFETY SERVICES

Given the recognized interference risks posed by the operation of Inmarsat and Iridium AMS(R)S terminals in proximity to one another, Inmarsat believes that a means of managing this risk should be in place before the Commission reaches a point at which it might consider granting Iridium's Applications. The appropriate solutions may be different in the case of

¹¹ See 2014 RTCA MOPS, Appendix D.

¹² *Id.*, Appendix D, Table 2-4, at D-36.

Inmarsat and Iridium terminals being operated on different aircraft, than in the case of Inmarsat and Iridium terminals being operated on the same aircraft.

In the case of Inmarsat and Iridium terminals operating on different aircraft, interference can be managed by making sure that Iridium terminals are not used when an aircraft is in proximity to the airspace of an aircraft using Inmarsat terminals. In oceanic airspace, it is possible that suitable separation distances between aircraft using Iridium terminals and aircraft using Inmarsat terminals are likely to be maintained operationally, as a statistical matter.¹³ Critically, however, the appropriate distance depends on the performance specifications of the Iridium terminal, and, as noted above, the antenna performance characteristics assumed in an ICAO recommendation regarding oceanic airspace seven years ago do not seem consistent with more current Iridium information.¹⁴ If Iridium's proposed antenna operates at parameters that vary from those assumptions, the recommended oceanic airspace separation distances may need to be much larger to ensure that Iridium's AMS(R)S service does not fail. For instance, assuming the antenna gain of Iridium's antenna is consistent with certain of the levels specified by Iridium in the RTCA process, the separation distances required to ensure simultaneous independent operation of Inmarsat and Iridium terminals could be increased by a factor of two, three or possibly more.¹⁵

Managing this issue in "remote" areas, by maintaining separate airspace, appears more challenging. As an initial matter, the Commission has not defined "remote" areas, and Inmarsat

¹³ See ICAO Working Group M Report at AI-4.

¹⁴ See *id.* (discussing study of AMS(R)S terminal compatibility within oceanic airspace based on an assumed 30 nautical mile separation distance for an Iridium terminal that is assumed to have GPS-like terminal characteristics).

¹⁵ See 2014 RTCA MOPS, Appendix D, Table 2-4, at D-36 (identifying Iridium AES terminals operating with a maximum gain that varies from -2 dBic to 10 dBic).

does not believe Iridium's satellite authorization to provide AMS(R)S covers remote areas. Because the "remote regions" in the United States in which Iridium seeks earth station authority are over the U.S. land mass,¹⁶ it stands to reason that typical airspace separation distances that can be expected to be maintained may be smaller than those typical over oceanic regions. Thus, it is not at all clear that it is feasible for aircraft to operate Iridium terminals successfully in those areas unless they maintain a greater-than usual separation distance from aircraft with Inmarsat terminals. Moreover, as detailed above, the required separation distances for remote areas cannot be defined without knowing the performance characteristics of the Iridium terminals.

In addition, aircraft owners that have installed Inmarsat and Iridium terminals on the same aircraft need to understand the circumstances in which Iridium terminals may experience interference. In the case of terminals deployed on the same aircraft, it is possible for "market forces" to work if consumers are adequately apprised of the risk before they subscribe to Iridium's service.¹⁷ For example, in fulfilling its role to manage the radiofrequency environment, and consistent with the warnings required for Part 15 devices,¹⁸ the Commission could require the provision of the same warning to the aircraft owner recommended by RTCA:

Owners, operators and installers are cautioned that simultaneous independent operation of Iridium and Inmarsat AES equipment on the same aircraft has the potential to cause significant interference to all Iridium AMSS and AMS(R)S services. This caution applies to Inmarsat equipment that is compliant with RTCA DO-210D, including all

¹⁶ Opposition at 6.

¹⁷ See Letter from Diane Cornell, Vice President, Governmental Affairs, Inmarsat Inc., to Marlene H. Dortch, Secretary, FCC, Application for Authority to Provide Aeronautical Mobile-Satellite (Route) Service Over the IRIDIUM System, File Nos. SAT-MOD-19961204-00139, SAT-AMD-20050816-00160, SAT-AMD-20051118-00236, at 4 (filed Jan. 11, 2012).

¹⁸ See, e.g., 47 C.F.R. § 15.105.

changes, AEEC Characteristic 741, AEEC Characteristic 761, and AEEC Characteristic 781.¹⁹

With this knowledge, aircraft owners choosing to install both Iridium and Inmarsat AMS(R)S terminals could manage the interference risk by turning off the terminal that is not being used.

Given the issues above, which need to be managed in part by various aviation authorities, Inmarsat recommends that the Commission ensure that Iridium already has secured all such authorizations, should these Applications progress to the point where the Commission may consider granting them. Furthermore, given that Iridium's AMS(R)S service is not compatible with the existing interference environment, particularly in areas over the U.S. land mass, it is essential that the Commission make clear that these operations will not be protected from interference, simply because they may be used on aircraft for "safety" related services.

IV. CONCLUSION

For the foregoing reasons, and the reasons set forth in the Request, Inmarsat respectfully requests that the Commission defer action on the Applications until Iridium provides the salient technical characteristics of the proposed AMS(R)S antenna and AMS(R)S operations that are needed to assess and manage the interference environment in which these terminals will operate. Assuming that data is provided on the record, Inmarsat requests that (i) the Commission ensure that Iridium AMS(R)S users are apprised of the risk of self-interference arising from their simultaneous use of multiple AMS(R)S terminals on the same aircraft, and (ii) the Commission ensure that it is likely that aircraft with Iridium AMS(R)S terminals will operate in sufficiently-separated airspace from aircraft with Inmarsat terminals. Moreover, given the known issues with this Iridium service, and the potential use of the service for safety-related services, Inmarsat requests that the Commission reiterate that Iridium and its users bear the risk of Iridium's

¹⁹ 2014 RTCA MOPS, Appendix D, 1.3.5.1, at D-27.

AMS(R)S service failing to operate as intended in the existing radiofrequency environment. If Iridium does not provide the necessary information on the record, Inmarsat respectfully submits that the Commission dismiss the Applications.

Respectfully submitted,

/s/

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January 22, 2015

DECLARATION

I, E. F. Charles LaBerge, hereby declare as follows:

1. I am the principal engineer and managing member of EFC LaBerge Engineering and Analysis, LLC, and Professor of the Practice of Electrical and Computer Engineering at the University of Maryland, Baltimore County. I have been a regular participant in all RTCA deliberations concerning Inmarsat and Iridium satellite communication systems since 1998. During that time I have represented both the original Iridium as part of the AlliedSignal technical team that supported Iridium's initial plans for AMS(R)S service, and Inmarsat, as part of activities jointly supported by the Research and Technology Center of Honeywell Aerospace and Inmarsat. In that position, I was the author of the analysis reported to ICAO Aeronautical Communications Panel, Working Group M/12 in June of 2008. Since my retirement from Honeywell in July of 2008, I have been under contract to Inmarsat to provide consultation services that specifically include acting as the Chair of RTCA Special Committee 222, which has prepared DO-343 and DO-262B. I am the recipient of multiple awards from RTCA related to my work on aeronautical telecommunications standards for geosynchronous and low-earth orbit satellite systems, High Frequency voice and data systems, and digital VHF communication systems.

2. I have reviewed the foregoing Reply of Inmarsat to Iridium Opposition ("Reply"), including the statements in the Reply regarding the technical aspects of AMS(R)S operations and the standards, technical findings and conclusions of the Radio Technical Commission for Aeronautics, Inc. and the International Civil Aviation Organization. Such information is complete and accurate to the best of my knowledge, information and belief.

I certify under penalty of perjury that the foregoing is true and correct.


Charles LaBerge 1/22/2015

Executed January 22, 2015

CERTIFICATE OF SERVICE

I, Elizabeth R. Park, hereby certify that on this 22nd day of January, 2015, I served a true copy of the foregoing Reply of Inmarsat to Iridium Opposition via first-class mail upon the following:

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