

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

In the Matter of)	
)	
Amendment of Parts 2 and 25 of the)	IB Docket No. 17-95
Commission's Rules to Facilitate the Use of)	
Earth Stations in Motion Communicating with)	
Geostationary Orbit Space Stations in)	
Frequency Bands Allocated to the Fixed)	
Satellite Service)	

REPLY COMMENTS OF INMARSAT INC.

Inmarsat Inc. ("Inmarsat") respectfully submits these Reply Comments in response to the Federal Communications Commission's ("FCC" or "Commission") Notice of Proposed Rulemaking ("NPRM") in the above-captioned proceeding.¹ Commenters overwhelmingly support the Commission's proposals to recognize Earth Station in Motion ("ESIM") operation as an application of the Fixed-Satellite Service ("FSS"), reduce regulatory burdens on ESIM operators, and allow ESIMs to operate across the conventional Ka-band. In addition, based on the record in this proceeding, the Commission should not require U.S.-licensed Earth Stations Aboard Aircraft ("ESAA") to conform to FCC rules when operating outside of U.S. airspace and should not expand the definition of ESAA to include stratospheric platforms, which have not yet even filed applications with the Commission. Furthermore, because ESIMs will receive—not transmit—in the 18.6-18.8 GHz band, the Commission should disregard concerns that ESIM operations will impact Earth Exploration-Satellite Service ("EESS"). Finally, the Commission's

¹ *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed Satellite Service*, 32 FCC Rcd 4239 (2017) ("NPRM"). Unless otherwise noted, all comments were filed in the above-captioned docket in response to the NPRM.

existing out-of-band emission (“OOBE”) requirements address any potential interference with current or future services in the 27.5-28.35 GHz band.

I. THE RECORD SUPPORTS ESIM OPERATION AS AN APPLICATION OF THE FSS

Several commenters joined Inmarsat in supporting the Commission’s proposal to recognize the operation of ESIMs as an application of the FSS with primary status in the conventional Ka-band through the modification to non-federal government footnote NG55 to the U.S. Table of Frequency Allocations.² Inmarsat also agrees with SES that the Commission should allow ESIM operations in other Ka-band spectrum where geostationary satellite orbit (“GSO”) FSS may not be identified as primary.³ In these bands, Commission rules can ensure that ESIMs would have the same status as FSS earth stations at fixed locations.⁴ As noted in the Commission’s recent proposal in the *NGSO NRPM*,⁵ there is wide support for allowing non-geostationary (“NGSO”) FSS operation in the 17.8-18.3 GHz band on a secondary basis.⁶ Inmarsat urges the Commission to adopt this proposal, and when it does, to allow ESIM use of this spectrum with GSO FSS networks on a secondary basis.

II. COMMENTS WIDELY SUPPORT THE FCC’S PROPOSALS TO REDUCE THE REGULATORY BURDEN ON ESIM OPERATORS

Commenters voiced wide consensus for reducing the regulatory burden on ESIM operators, including the Commission’s proposals to eliminate the antenna pointing accuracy and

² See, e.g., Comments of SES S.A. and O3B Limited at 5 (“SES Comments”); Comments of ViaSat, Inc. at 8 (“ViaSat Comments”).

³ See SES Comments, at 6-7.

⁴ See *id.*, at 6-9.

⁵ See *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Notice of Proposed Rulemaking, 31 FCC Rcd 13651, 13656-58, paras. 9-10 (2016).

⁶ See Written *Ex Parte* Presentation of SES S.A., O3b Limited, The Boeing Company, Inmarsat, Inc. and ViaSat, Inc., IB Docket No. 16-408 (Aug. 4, 2017).

data logging requirements. Inmarsat's comments supported the agency's proposed shutdown and monitoring requirements,⁷ and suggested that the Commission should replace the proposed burdensome demonstrations with applicant certifications of compliance, just like the requirements of current Rule 25.227.⁸ Rather than taking "an unwarranted step toward greater regulation,"⁹ the use of a certification to affirm shutdown and monitoring requirements would reduce regulatory burdens and still meet the Commission's goals.

III. MOST COMMENTERS AGREE THAT ESIMS SHOULD OPERATE IN THE 29.25-29.3 GHZ BAND

With the sole exception of Iridium,¹⁰ commenters agree that ESIMs should be allowed to operate in the 29.25-29.3 GHz band. Inmarsat and all the other commenters who directly addressed the issue concur with the Commission that the interference risk for ESIMs would be no different than currently-operating earth stations in the conventional Ka-band.¹¹ By contrast, Iridium unreasonably asks the FCC not to allow *any* ESIM operations in the 29.25-29.3 GHz spectrum because of unsubstantiated coordination concerns.¹²

The Commission should reject Iridium's protectionist request. Particularly in this current era of spectrum congestion, where different services routinely share access to the same frequency bands, the FCC should ensure that every available MHz of spectrum is put to its highest and best use. In this proceeding, the agency rightfully is focused on developing and adopting innovative

⁷ See Proposed Rule 25.228(b) and (c).

⁸ See 47 C.F.R. § 25.227.

⁹ Comments of Kymeta Corporation and Intelsat License LLC, at 5.

¹⁰ See Comments of Iridium Satellite LLC ("Iridium Comments").

¹¹ See Inmarsat Comments, at 5-6; SES Comments, at 9-10; ViaSat Comments, at 9-10; Comments of The Boeing Company, at 6-7.

¹² Iridium Comments, at 9-17.

rules to maximize use of this important resource.¹³ Against this backdrop, Iridium’s arguments for excluding ESIMs in the 29.25-29.3 GHz band do not stand up to scrutiny.

As an initial matter, Iridium mischaracterizes the amount of downlink Ka-band spectrum available for ESIMs. Iridium describes its request as excluding only 50 MHz out of 2000 MHz available for ESIMs.¹⁴ Yet, this 2000 MHz of Ka-band spectrum includes both uplink and downlink. In fact, the Commission proposes to make only 1000 MHz of Ka-band Earth-to-space (downlink) spectrum available for ESIMs. Iridium seeks to exclude 50 MHz of this 1000 MHz, which is 5% of the total.

Iridium also conveniently fails to mention that it only operates feeder link stations in this 50 MHz of spectrum at one site in each of three states—Hawaii, Alaska and Arizona.¹⁵ It is inconceivable that all ESIM transmissions should be excluded throughout the entire U.S. and its territories to protect these few sites. In most U.S. territory, airspace and waterways it would be nearly impossible for ESIM operations to impact the Iridium system. Simply put, an ESIM operating on a flight from Miami to New York will not impair reception of Iridium transmissions at any of these three sites.

While Iridium acknowledges that coordination with fixed GSO earth stations is feasible through the establishment of exclusion zones around Iridium gateways,¹⁶ Iridium nevertheless asserts that coordination with ESIMs likely would be impossible.¹⁷ Iridium mentions several

¹³ See NPRM para. 2 (noting that the proposed rule changes “would promote innovative and flexible use of satellite technology, and provide new opportunities for a variety of uses”).

¹⁴ Iridium Comments, at 1-2.

¹⁵ Per IBFS, there are also licenses for sites in California and Pennsylvania; however, Inmarsat is not aware if these sites are routinely operated.

¹⁶ Iridium Comments, at 10-12.

¹⁷ *Id.*, at 12-17.

factors that it claims make coordination impossible for ESIMs while it is possible for fixed earth stations. In reality, all of these factors are “red herrings” as they apply to both ESIMs and fixed earth stations, either in exactly the same way or in a directly equivalent way: (1) the need for both long term and short term interference criteria (both of which are required regardless of whether the interfering earth stations are fixed or ESIMs); (2) the interference mechanism of in-line events (which applies equally for fixed earth stations and ESIMs); (3) the need to aggregate interference from several ESIMs (aggregation of interference is necessary to take into account the impact of several fixed earth stations that operate within the same Iridium channel); (4) the movement of ESIMs (transportable “fixed” earth stations operate at undefined locations and are therefore equivalent to ESIMs and a permanent earth station located at the edge of the exclusion zone would cause more interference than an ESIM that may approach the edge of the exclusion zone occasionally but then move to more benign locations, such as an ESAA which in addition moves at very high velocity (approximately 550 mph); and (5) the use of TDMA (of course, TDMA may be used by fixed earth stations as well as ESIMs).

Iridium proffers two primary reasons for opposing operation of ESIMs in the 29.25-29.3 GHz band: first, an alleged impossibility to determine a geographic exclusion region due to “unpredictable” interference from ESIMs because of the time-varying nature of the number and locations of ESIMs; and second, the difficulty of defining and enforcing protection zones around the Iridium gateway for Earth Stations Aboard Aircraft.¹⁸

The fact is that exclusion zones for ESIMs around Iridium gateways can be determined in essentially the same way—and will resemble—those for fixed earth stations. First, it is worth stating the obvious: at any given moment in time, an ESIM is located at a specific location and

¹⁸ *Id.*, at 12-17.

therefore (instantaneous) interference calculations can be done in the same way for ESIMs and fixed earth stations. Over time, the movement of ESIMs can result in either more or less interference into the Iridium gateway link. In coordination, the parties will agree on what method to use to assess interference – i.e., to consider ESIMs located at fixed (either worst case or typical) locations, or to use a more complex method where the ESIM movement is simulated, e.g., through a Monte Carlo approach.

Regarding the alleged challenge of defining exclusion zones for ESAA, specific exclusion zones for such stations are readily derived using ESIM locations at aircraft altitudes (up to about 10 km) in the same manner as for earth stations on the ground. The interference geometry, i.e., the ESIM off axis angle towards the Iridium satellite, for the ESAA scenario does not differ significantly compared to ESIMs on the ground because the 10 km height of the ESAA is not significant relative to the height of the Iridium and GSO satellites at around 780 km and 36,000 km, respectively. Hence, an exclusion zone calculated based on ESIMs at ground level will fully protect Iridium also for ESIMs operating on aircraft.

As for the question of enforcing the exclusion zones, it is the responsibility of the GSO FSS operator to ensure that the earth station ceases to transmit in the frequency band in question before the terminal enters the exclusion zone. Operators of ESIM terminals have access to the location of their terminals at all times as well as a mechanism to stop transmission or change frequencies based on given conditions such as geographical location.

As the Commission is aware, the ITU has studied compatibility with GSO FSS and NGSO MSS feeder links. During coordination, operators may rely on mitigation techniques, outlined in ITU-R Recommendation S.1419, to facilitate coordination between Iridium feeder links and GSO FSS networks. Iridium has relied on these mitigation techniques in showings to

the Commission¹⁹ to demonstrate compliance with Section 25.258 of the Commission's rules, i.e., to show its proposed NGSO MSS feeder link earth station can share with GSO FSS operations. Iridium has stated that employment of several of these mitigation techniques, including an off-axis separation of two degrees between the Iridium earth station and GSO FSS earth stations, approximately 225 km, and other factors, allows their earth station to share with GSO FSS earth stations in the 29.25-29.3 GHz band. Iridium has also relied on the narrowness of Iridium's uplink beam width as providing for a "very short duration GSO arc crossing event." Using a two-degree interference zone around the GSO arc, Iridium calculated that it takes Iridium's satellite less than five seconds to pass through the GSO arc and that crossings will be limited to 0.07% of the time. Given that Iridium's own analysis demonstrates that, using mitigation techniques, sharing between GSO FSS operations and Iridium earth stations is feasible must lead to the Commission allowing ESIM operations with GSO FSS networks in the 29.25-29.3 GHz band. The current Commission rule, Section 25.258, appropriately provides a mechanism for coordination between GSO FSS operators and Iridium. Noting the above, and considering ongoing coordination between Inmarsat and Iridium, Inmarsat is of the view that coordination between Iridium and GSO ESIMs is feasible.

IV. THE COMMISSION SHOULD NOT REQUIRE U.S.-LICENSED ESAA TO COMPLY WITH FCC RULES WHILE OPERATING IN A FOREIGN TERRITORY

Inmarsat's comments demonstrated why the Commission should not require U.S.-licensed ESAA to comply with FCC rules when operating outside of U.S. territories and airspace.²⁰ Inmarsat agrees with Telesat that harmonization of national rules with ITU rules is

¹⁹ See, e.g., Iridium Satellite LLC, Amendment to License Modification to Add New Earth Station to License E960131, SES-AMD-20070309-00334 (filed Mar. 9, 2007).

²⁰ See Inmarsat Comments, at 7.

the best practice.²¹ Designing international satellite systems to conform to an array of varying national rules while at the same time being required to meet ITU Radio Regulations leads to overly complex, costly systems, which can impact delivery of important services to end users. By contrast, permitting non-U.S. operations fosters administrative efficiency and removes a competitive disadvantage for U.S.-licensed ESAA.

V. EXPANDING ESIMS TO INCLUDE STRATOSPHERIC PLATFORMS IS PREMATURE

Elefante Group's proposal to expand the definition of ESAA to specifically include stratospheric platforms is not yet appropriate for consideration.²² To the extent stratospheric platforms operate with GSO satellites in the future, whether such operations would fall within the definition of ESAAs will need to be examined based on several factors, including the altitude of the platform. Today, without an application on file for stratospheric platforms to communicate with GSO FSS networks, Commission deliberation is premature. If Elefante (or another entity) files an application for such operations, the agency can consider this matter, taking into account technical and regulatory aspects that arise.

Inmarsat objects to Elefante's suggestion that implementation of ESIMs in the 18.3-18.8 GHz and 19.7-20.2 GHz bands not inhibit deployment of emerging innovative terrestrial solutions in these bands.²³ The U.S. Table of Frequency Allocations does not contain a primary or secondary spectrum allocation that would permit new terrestrial services in these bands. There is only footnote US139 that grandfathers a limited number of terrestrial services in portions of the spectrum provided they were licensed or applied for prior to November 19, 2012. Any of the emerging innovative terrestrial solutions proposed by Elefante would require a waiver of the Table and can be granted

²¹ Comments of Telesat Canada, at 2.

²² Comments of Elefante Group, Inc., at 2.

²³ *Id.*

only on a non-interference/non-protected basis with respect to the fixed satellite services allocated in the band. A claim of inhibiting deployment of non-authorized services has no standing and should be dismissed.

VI. CORF MISUNDERSTANDS OPERATION OF ESIMS IN THE 18.6-18.8 GHZ BAND

The National Academy of Sciences' Committee on Radio Frequencies ("CORF") raises concern that ESIM use of the 18.6-18.8 GHz band would impact Earth Exploration-Satellite Service systems.²⁴ However, CORF appears generally to misunderstand ESIM operations in the band. The 18.6-18.8 GHz band is allocated to the FSS in the space-to-earth direction, so ESIMs will only be receiving signals from FSS satellites in this band, not transmitting. The Commission has not proposed that ESIMs transmit in the 18.6-18.8 GHz band, alleviating CORF's concerns. Contrary to CORF's conclusion, the introduction of ESIMs in this band will not alter the current radio frequency environment, and EESS systems operating in this band will not be subject to any increase in potential interference. The GSO FSS satellites that operate in this band—whether to fixed earth stations or to ESIMs—will continue to meet the power flux density ("PFD") limits specified in the Commission's rules. Thus, there will be no additional impact to EESS systems from allowing ESIMs to receive signals in this band.

VII. GSA CONCERNS ARE HYPOTHETICAL AND SHOULD BE REJECTED

The Commission should reject the Global Mobile Suppliers Association's ("GSA") hypothetical, non-substantive concerns. The Commission has longstanding rules on out-of-band emission requirements for FSS earth stations, including ESIMs. Operators of terrestrial mobile deployments in adjacent bands are aware of these OOB requirements and should design their

²⁴ See generally Comments of National Academy of Sciences Committee on Radio Frequencies.

systems appropriately to operate in this known environment. Whether the OOBE originate from ubiquitously-deployed fixed earth stations or ESIMs is irrelevant. Furthermore, the GSA provides no technical characteristics of mobile systems that may be deployed in the bands or how they may be impacted by operation of ESIMs under the current rules. Thus, the FCC need not spend its limited resources on the GSA's unsubstantiated claims.

VIII. CONCLUSION

Inmarsat appreciates the opportunity to submit reply comments in this proceeding. Based on the strong consensus in the record, Inmarsat encourages the Commission to move expeditiously to adopt rules and policies that support ESIM operations with GSO FSS systems in all the Ka-band.

Respectfully submitted,

INMARSAT INC.

By: /s/ Giselle Creeser

Giselle Creeser, Director, Regulatory
Inmarsat Inc.
1101 Connecticut Avenue, NW, Suite 1200
Washington, D.C. 20036
(202) 248-5150

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