Viasat

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Radio Spectrum Management Policy and Planning
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Viasat Response to "Allocation of 24 – 30 GHz Spectrum" Consultation Paper

Viasat thanks RSM for the opportunity to provide comments to the Ministry of Business, Innovation and Employment ("the Ministry") on the "Allocation of 24 – 30 GHz Spectrum" (the "Consultation Paper"). Viasat, together with its subsidiary, Inmarsat New Zealand Ltd would like to submit our recommendations on the Consultation Paper[1].

Introduction: Enabling the Economic Benefits of New Zealand's ESIM Ecosystem

On 30 May 2023, Viasat Inc. acquired Connect Topco Limited and all its subsidiaries, including Inmarsat New Zealand Ltd, currently wholly owned subsidiaries of Viasat Inc. Viasat is a leading global provider of communications technology and services, focused on making connectivity accessible, available and secure for current and future users worldwide, including in New Zealand.

Viasat's current Ka-band satellites include Inmarsat-5 F1, F3 and F4, Inmarsat-6 F1 satellites (known as Global Xpress ("GX") satellites), the "Viasat-3" fleet, and GX-7 satellites. These satellites provide coverage over New Zealand. These satellites provide a wide range of connectivity solutions and services to customers in New Zealand, including:

1. Aviation services

   As a pioneering aviation connectivity provider, Viasat provides services for the commercial aviation sector throughout the Asia Pacific region, including New Zealand, for in-flight connectivity ("IFC") to passengers and crews throughout their flight journey from New Zealand to any part of the world. Seamless, consistent, reliable, high-speed global connectivity has modernised aviation – with further exciting advances to come.

   Air New Zealand is equipped with Viasat's Ka-band user terminals for communication with GX satellites as well as future Viasat-3 F3 and GX-7 satellites for IFC. It is currently available on many aircraft within the Air New Zealand fleet, operating on Trans-Tasman, Pacific Islands, and US routes. There are also other airlines equipped with Viasat's Ka-band user terminals for IFC that overfly, transit, or land at New Zealand airports. Business jets based in New Zealand have Viasat's Ka-band satcom installed, as well as visiting aircraft. Viasat also provides Ka-band satcom systems to the New Zealand Defence Forces.

[1] Consultation document: https://www.rsm.govt.nz/projects-and-auctions/consultations/allocation-of-24-30-ghz-spectrum.

2. Maritime services

   Communication is crucial to the day-to-day operations of shipping. This includes voice and data communications and reporting between the ship and its land-based office and between other ships. There is also the requirement of updating vital navigation and weather charts, and remote access to onboard systems for maintenance and problem resolution. Furthermore, Ka-band satcom enables email, webcam image transfers from the ship, positioning reports, and daily domain controller synchronisation. Viasat provides maritime services for shipping, the fishing industry, transport operators (tourism and passenger transport), and cruise liners.

   New Zealand has a significant maritime industry which caters to the building of super yachts and ocean yacht racers. Many yachts have been built in New Zealand, some of which remain permanently in New Zealand and a number of which pass through New Zealand waters on regular basis. There is the America's Cup racing based in New Zealand and the round-the-world Volvo Ocean yacht race, which uses New Zealand as a port. Viasat's Ka-band systems are in use in a number of these vessels.

3. Land services

   Land-based Ka-band satcom systems are used by multiple New Zealand Government departments. Some examples include the New Zealand military and visiting military, the New Zealand Police, the Ministry of Foreign Affairs, the New Zealand Fire Service, the New Zealand Special Forces, and the New Zealand Defence Forces.

<u>Key issues identified in the Consultation Document</u>

While welcoming the Ministry's discussion document, the current proposals will limit Viasat's ability to provide the full range of FSS/ ESIM (Fixed Satellite Service/ Earth Stations In Motion) services in New Zealand. This is a substantial economic opportunity loss. Further, we note that the report is light on economic analysis of the use of the 24 - 30 GHz band.

Viasat respects the New Zealand Government's Cabinet decision on the 27.5 – 28.35 GHz frequency range, which establishes a shared-use between the Mobile Service (MS) and the Fixed Satellite Service (FSS). We recommend, however, that RSM implement the decision in a manner that maximises economic benefit, reduces costly technical burdens, and enables the New Zealand FSS/ ESIM ecosystem to flourish unimpaired by terrestrial 5G use. For this purpose, Viasat strongly recommends allocating the 27.5–28.35 GHz range as an FSS-primary band, in line with the global FSS ecosystem, including Earth Station in Motion (ESIM). Any deployment of terrestrial mobile services should be for secondary use in this band. This is one of our four key recommendations for this consultation process.

<u>Fundamental aspects of our recommendations</u>

1. <u>Characteristics of the frequency range 24 – 30 GHz</u>

Terrestrial use of millimetre wave bands is seen as providing services at hotspots and FWA (Fixed Wireless Access), in addition to all the other frequency bands used by 5G and other terrestrial technologies. It is not expected that terrestrial use of millimetre wave bands will be implemented on a wide scale due to the small cell size and limited terrestrial reach (limited coverage area), making it less economical for mobile operators. Business case modelling assumes that mobile demand will be mainly consumed indoors. Hence, the 26 GHz band (24.25-27.5 GHz) is well-suited and an ample amount of spectrum for such terrestrial use cases in New Zealand.

On the other hand, the 28 GHz uplink band (27.5 – 29.5 GHz) paired with its 18 GHz downlink band (17.7 – 19.7 GHz) offers significant advantages for satellite communications, as part of the Ka-band, enabling the deployment of ubiquitous end-user terminals and fixed satellite links nationwide and throughout the region. Satellite broadband is crucial for delivering high-speed internet for mobility (*i.e.*, aviation and maritime) and in underserved and unserved areas on land where users are on the move or are not within reach of terrestrial broadband coverage.

2. New Zealand demographics

Viasat is of the view that allocating the 24.25-27.5 GHz (26 GHz band) to the Mobile Service provides ample capacity for FWA and 5G private networks for national mobile service providers, given New Zealand's demographics and urban characteristics. We note that the economic, technical, and/or other policy reasons for the RSM's proposed expansion of the Mobile Service into the 28 GHz band (27.5-29.5 GHz), on a shared basis, are not explained in the document, creating a policy analysis gap in the report's proposals. A policy analysis must come first and serve as the foundation for any subsequent technical analysis. Without such policy analysis, technical studies are unlikely to guarantee the highest economic use of the 24 -30 GHz spectrum.

We note that the total New Zealand population of 5.3 million[2] is primarily concentrated in specific urban spots (over 50% live in the four largest cities, and approximately 85% live across urban areas). The rural population in New Zealand is approximately 15%. The New Zealand landmass is approximately 285,000 square kilometres, larger than the United Kingdom (pop. 69 million) and similar to Italy (pop. 59 million). New Zealand is a low-population-density country, which is a key factor in its terrestrial mobile broadband profile. The RSM report does not provide details on how New Zealand's terrestrial mobile broadband demographics justify a requirement for additional mobile bandwidth beyond the 26 GHz band (24.25 – 27.5 GHz), considering that urban New Zealand is also receiving services via all the IMT bands below 1 GHz and all the IMT bands between 1-10 GHz and above 30 GHz. In contrast, FSS/ESIM services are constrained to the Ku and Ka satellite bands.

There is no evidence suggesting that mobile terrestrial services, such as hotspots and 5G FWA, have reached capacity limits in the 26 GHz band in the United Kingdom and Italy. RSM's rationale for seeking additional terrestrial mobile capacity beyond the 26 GHz band in New Zealand is unclear. RSM's proposed sharing scheme would adversely affect the development of the New Zealand FSS/ ESIM ecosystem if FSS is not allocated on a primary status in the band 27.5 -28.35 GHz band.

3. Consumer experience and consumer benefit

Today's consumers, businesses and governments expect connectivity everywhere – to be able to connect via broadband while travelling, to post content in online platforms, and have continuous access to cloud-based applications. This is only possible with FSS/ ESIM. FSS/ ESIM delivers truly ubiquitous, high-speed broadband on aircraft, vessels, trains, and other vehicles. FSS/ ESIMs are also critical in connecting government agencies and first responders

[2] Statistics can be found at: https://www.stats.govt.nz/information-releases/national-population-estimates-at-30-june-2025/.

following disasters, where local terrestrial communications infrastructure is disabled, damaged or destroyed.

Aeronautical Earth Station in Motion ("A-ESIM") is used for providing gate-to-gate IFC to the aircraft. Maritime Earth Station in Motion ("M-ESIM") is used for providing pier-to-pier internet connectivity to ships. Both rely on satellite Ka-band spectrum, hence, sufficient and appropriate spectrum allocation is crucial for reliable IFC and maritime internet connectivity services. The 18/28 GHz bands provide the necessary additional capacity to the long-standing 29.5-30 GHz Ka portion (19.7 – 20.2 GHz and 29.5 – 30.0 GHz), allowing airlines and ships to offer improved speeds and, crucially, to accommodate demand growth.

ESIMs are highly important for New Zealand, as the country is connected to the world through aviation and maritime transport infrastructure, including at airports and ports. ESIMs also provide crucial high-speed continuous connectivity in the country's remote and geographically challenging areas, for mobile platforms (marine, air, land) and as an essential component of national disaster recovery, defence, and safety infrastructure.

Further, the 28 GHz band provides higher throughput to consumers. For example, allowing Air New Zealand to offer this level of connectivity would enhance its IFC (In-Flight Connectivity) and strengthen its competitive edge. It would also drive revenue growth and high passenger satisfaction. In addition, IFC is now a critical component of the passenger experience and is becoming an increasingly important factor in a passenger's choice of airline. Airlines that provide a premium gate-to-gate internet experience attract and retain customers, ultimately increasing passenger volumes and associated revenue.

4. Appropriateness of ESIM operational rules: a critical matter for the success of the New Zealand ESIM ecosystem

The second key recommendation we are submitting concerns RSM's views on the application of ITU-R Res. 169 (Resolution 169) in the 28 GHz band. We note that the operational rules for the use of ESIM will be critical for the success of New Zealand businesses that rely on the New Zealand ESIM ecosystem. We believe that RSM's approach to the use of ITU-R Res. 169 is not in alignment with the intended purpose of this Resolution.

WRC-15 and WRC-19 both determined that GSO ESIM in these parts of the Ka band are an application of the FSS[3]. WRC-19 extended the decision of WRC-15 and opened the entire 27.5-30 GHz and 17.7-20.2 GHz bands to GSO ESIM, consistent with applicable provisions of the ITU Radio Regulations.

As ESIMs are part of the FSS allocation throughout the Ka band, they are entitled to primary status with respect to secondary services and to co-primary status with respect to other co-primary services. For the benefit of the implementation of ESIM in New Zealand, Viasat highlights that the provisions of Res. 169 (WRC-19) explain that Res. 169 does not limit ESIM operations in the 27.5-29.5 GHz band, or parts thereof, within an Administration's borders. Res. 169 instead guides the rare cross-border case in which terrestrial services may be allocated and operate in the very same frequencies as ESIM.

[3] *See* Resolution 156 (WRC-15, Geneva) "Use of the frequency bands 19.7-20.2 GHz and 29.5-30 GHz by earth stations in motion communicating with geostationary space stations in the fixed-satellite service" considering e), resolves 1.1; Resolution 169 (WRC-19, Sharm el-Sheikh) "Use of the frequency bands 17.7-19.7 GHz and 27.529.5 GHz by earth stations in motion communicating with geostationary space stations in the fixed-satellite service" resolves 6.

The operational conditions for ESIM being proposed by RSM will limit the full range of ESIM uses. For example, a full A-ESIM operation enables gate-to-gate connectivity without the need to switch off the IFC service to passengers during take-off, landing and taxiing. A full M-ESIM operation enables pier-to-pier service. The application of Res. 169, as interpreted by RSM, would not allow gate-to-gate and pier-to-pier ESIM. Moreover, any sharing scheme in the band 27.5-28.35 GHz that considers FSS (including ESIM) as a) co-primary service, b) secondary service, or c) a geographically restricted service, would impair the full realisation of the New Zealand ESIM ecosystem, and impose high costs and unnecessary technical complexities to ESIM. Such technical, economic and operational burdens would not impact the terrestrial mobile service, which would have unrestricted access to the full 26 GHz band, in addition to all the bands identified for IMT above 30 GHz, below 1 GHz, and between 1-10 GHz. Hence, a shared-band scheme in the range 27.5-28.35 GHz that does not entitle FSS (including ESIM) to primary status would undoubtedly result in a significant imbalance in spectrum resources to the detriment of the New Zealand ESIM ecosystem. Such an imbalance would be exacerbated by applying Res. 169 in the manner interpreted by RSM, as if New Zealand had "internal cross-border" management requirements with terrestrial services.

The following excerpts of Res. 169 are noteworthy:

- Resolves 1.2.4 provides: "the provisions in this Resolution, including Annex 3, set the conditions for the purpose of protecting terrestrial services from unacceptable interference from aeronautical and maritime ESIMs **in neighbouring countries** in the frequency band 27.5-29.5 GHz";

- Paragraph 1 of Annex 3 provides: "The parts below contain provisions to ensure that maritime and aeronautical ESIMs do not cause unacceptable interference **in neighbouring countries** to terrestrial service operations when ESIMs operate in frequencies overlapping with those used by terrestrial services at any time to which the frequency band 27.5-29.5 GHz is allocated and operating in accordance with the Radio Regulations (see also resolves 3 of this Resolution)";

- Part II of Annex 3 provides power flux density (PFD) limits for the 27.5-29.5 GHz band segment when an aeronautical ESIM is operating "**within line-of-sight** of the territory of an administration";

- Most importantly, the *further resolves* provides that **an administration may authorize ESIMs within its own territory without reference to the power flux density levels contained in Res. 169** where doing so does not affect other administrations.

5. <u>No need to change from a General User Radio Licence (GURL) regime to an "application licensing regime" (i.e. ESIM) for user terminals</u>

Our third recommendation relates to the licensing regime to be applied to FSS services, including ESIM. RSM proposes to depart from the current GURL regime (akin to a class licensing system) for satellite user terminals in the Ka band and instead implement a *service or application licence* in the band, for example, for ESIM uses. Viasat is of the view that ESIM and other FSS services can appropriately follow a compliance regime implemented through a defined set of power and frequency parameters within a GURL's national regime, reducing administrative burdens. This is possible through the establishment of an FSS/ESIM user terminal GURL across the 27.5-30 GHz range, with FSS as the primary service. Establishing application-specific licences will likely require periodic reviews and significantly increase administrative burdens, creating investment uncertainty for ESIM and other FSS applications.

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6. Ensuring NGSO-NGSO and NGSO-GSO coexistence and equitable access to the orbit-spectrum resource, including the 24-30 GHz band

Our fourth recommendation relates to a silent topic in the consultation document: that spectrum and orbits are shared and finite resources, including for the 24-30 GHz band, and the ongoing implementation of very large-scale NGSO constellations that are constraining the availability of these finite resources used by systems serving New Zealand.

Today's Ka-band Ultra-High Throughput (UHT) GSO satellites are extremely efficient in how they use spectrum to provide innovative services with smaller user terminals than ever before, including user terminals smaller than 45 cm. Taking advantage of technological advancements, satellites like ViaSat-3 can provide more than 1 Tbit/s of total capacity each and dynamically direct capacity and coverage where and when they are most needed.

Managing NGSO-NGSO interference and NGSO interference into GSO/Multi-orbit networks is critical to ensure the continuing availability and reliability of these vital GSO/Multi-orbit services in New Zealand. The Ministry must ensure that the ITU rules that constrain the level of unacceptable radio interference generated by NGSO systems are implemented within New Zealand. This is necessary to ensure continued availability, innovation and competition for the benefit of New Zealand, including the availability of small user terminals used by GSO/Multi-orbit satellite systems. Both GSO/Multi-orbit and smaller NGSOs need regulatory certainty for interference-free spectrum sharing and investment, including national spectrum access, to plan their operations and services for end users.

The existing Equivalent Power Flux Density (EPFD[4]) limits of Article 22 of the ITU Radio Regulations are the mechanism that ensures coexistence, while maintaining a level of equitable access. Relevant ITU Radio Regulations' provisions include:

a) RR No. 22.2 that requires NGSO systems not to cause unacceptable interference to, or claim protection from, GSO networks;
b) In most of the Ka band and Ku band, a requirement that NGSO systems meet certain equivalent power flux density (EPFD) limits; and
c) A limit of the amount of EPFD that can be generated by any single NGSO system, and by all NGSO systems in the aggregate.

Proposals to degrade or even eliminate EPFD limits, and a lack of national enforcement, are not a narrow engineering concern but a determinant of global market power in satellite communications. Degrading EPFD limits would allow large-scale NGSO operators, especially

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4 Equivalent Power Flux Density (EPFD) is a regulatory metric established by the International Telecommunication Union (ITU) to protect geostationary orbit (GSO) satellite networks from unacceptable interference caused by non-geostationary orbit (NGSO) systems. Formally, EPFD quantifies the aggregate power flux density (PFD) produced at the Earth's surface (or at a GSO satellite's receive antenna) by all satellites in an NGSO constellation, taking into account: satellite transmission power, antenna patterns, orbital geometry, and propagation effects. EPFD limits are set in the ITU Radio Regulations Article 22, and are intended to ensure that NGSO operations do not cause unacceptable interference to GSO networks in frequency bands that both types of systems share. Unfortunately, there have been shortcoming identified in ITU-R WP4A that are currently under discussion to improve the measurements of sources of NGSO interference into GSO and multi-orbit systems.https://www.itu.int/pub/R-REG-RR.

vertically-integrated first movers, to expand aggressively, dominate the scarce Ku and Ka-band satellite spectrum, and entrench first-mover advantages that foreclose meaningful competition. Vertical integration of launch capacity further amplifies this risk by securing privileged access to orbit-spectrum resources and excluding competitors.

The likely outcome of EPFD degradation is not a competitive market of many providers, but a global monopoly[5] or duopoly[6] in low-Earth orbit (LEO) satellite broadband. At the same time, EPFD degradation would undermine the operation of GSO/ Multi-Orbit systems, particularly those that rely on small user terminals, and particularly when such interference impairs service reliability (*e.g.,* increases service unavailability).

The existing EPFD limits (and compliance) achieve three significant objectives:

a) Preventing unacceptable interference into GSO/Multi-Orbit systems,
b) Enabling multiple NGSO systems to share the radio spectrum without unduly constraining newcomers, and
c) Enabling smaller NGSOs with a degree of level-playing conditions for equitable spectrum access through preventing spectrum resource lock-in.

Degrading or eliminating EPFD limits, or non-compliance with existing limits, counteract these three objectives. EPFD limits achieve these objectives by moderating NGSO systems' interference levels (single-network and on aggregate across all NGSO networks), constellation density, and orbital configurations. By contrast, degradation or elimination of EPFD limits would permit unconstrained radio interference, unsustainable larger satellite deployments, and unwarranted broader spectral footprints from large-scale NGSOs. When combined with vertically integrated launch services, degrading or eliminating EPFD limits would create an irreversible regulatory asymmetry, tilting the satellite broadband market toward irreversible concentration.

6a. The UK Parliamentary Report "Act Now or Lose Out" and emerging EU-level legislation

We note that the United Kingdom and the European Union have recognised the significant issues posed by the overconsumption of spectrum and orbital resources by large-scale NGSO systems (aka mega-constellations or giga-constellations).

For example, the United Kingdom has recently released a Parliamentary Committee Report[7] ("Act Now or Lose Out"). This Parliamentary report highlights the growing "spectrum grabbing" issues posed by large-scale NGSO systems. Some noteworthy statements of the report include:

[5] Media article on spectrum demands being placed on smaller NGSOs can be found here: https://www.wsj.com/business/telecom/spacex-wields-dominance-in-rocket-launches-to-boost-starlink-fde71f17.

[6] Media article "There will be two players in LEO" can be found here: https://www.satellitetoday.com/connectivity/2025/08/01/amazon-ceo-tells-investors-there-will-be-2-players-in-leo/.

[7] Report can be found at: https://committees.parliament.uk/committee/773/uk-engagement-with-space-committee/news/210034/government-needs-to-take-action-if-uk-is-to-be-a-winner-in-new-race-for-space/.

"Other threats to a safe operating environment in space include the global competition over satellite spectrum allocation" (p.18)

"We assess what policy approaches the UK should take to addressing the space debris challenge, as well as other collective issues such as… spectrum management." (p.19)

"Another issue is the availability of radio spectrum, a finite resource which allows satellites to send and receive information." (p.37)

"The growth in the number of satellites in space requires increasingly careful management of spectrum, as spectrum is a finite resource—if too many satellites use the same frequencies, their signals can interfere with one another" (p.101)

"However, recent shifts in the use of space and satellites, such as the emergence of mega-constellations…, may require a shift in the approach taken by regulators, who are "really rushing to catch up". (p.101)

"…increasingly, the work of the ITU is at risk of being undermined by the actions of individual nations, with some national regulators…, becoming "much more partisan and aggressive". (p.101)

"The international regulation of spectrum will become increasingly important as Low Earth Orbit becomes increasingly congested. Some states have already become more assertive and are challenging international rules when it comes to spectrum allocation." (p.101)

"Ensuring access to finite radio spectrum should be a priority when it comes to UK space and telecoms policy. The UK Space Agency should continue working closely with Ofcom to ensure that UK interests are represented at the International Telecommunications Union, especially spectrum allocation" (p.101)

"A Senior Fellow (Space Power) at the Council on Geostrategy, expressed his view that the UK's current approach to space is not appropriate in the context of current global trends. He argued that the current policy approach "was created before the world took a very different turn geopolitically" and "before we had the rise of mega constellations and very strong players monopolising various parts of the global space industry" (p.20)

The European Commission is circulating its draft EU Space Act[8], which also aims to remedy some of the significant issues posed by large-scale NGSO systems[9]. The draft Act seeks to address the safety and market risks related to large-scale NGSOs with specific attention to systems larger than 1,000 satellites. For example, the act deals with issues related to collision risks, as thousands of satellites in a few LEO shells massively increase collision risks and space-traffic complexity. Spacecraft operators must "limit radio pollution" (Act Section 2) and comply with additional safety and debris-mitigation standards for large constellations. The Act does not replace radio spectrum regulation (ITU and EC radio spectrum directives) but the Commission does recognise the need to ensure access to sufficient spectrum for satellite services as a space sustainability problem.[10] Importantly, the Act recognises that large-scale

[8] EU Space Act can be found here: https://epthinktank.eu/2025/09/22/eu-space-act-eu-legislation-in-progress/.

[9] Summary of draft Act can found here: https://www.european-space-act.com/.

[10] Details of the EU Space Act: https://defence-industry-space.ec.europa.eu/document/download/918ee802-a3e5-42ea-91a1-032c7e0ab8a9_en?filename=Communication.pdf.

NGSO constellations are increasingly becoming systems that augment the risk profile of space operations, thereby increasing the likelihood of catastrophic events. Thus, the Act imposes specific and additional obligations on large NGSO systems. Furthermore, under the theme of "resilience of space infrastructure" (Chapter 2), the Act addresses cybersecurity, prevention of outages and uninterrupted satellite communications. The inherent risk is that if a large-scale NSGO system is compromised physically or in terms of security (noting the global nature), the impacts could be systemic and unprecedented in severity.

In light of the above issues, the Ministry must establish NGSO space segment authorisation processes that preserve healthy competition, ensure sustainable development, and manage interference from large-scale NGSOs. RSM must incorporate measures that mitigate the potential negative impact of large NGSO systems and propose safeguards such as mandatory compliance with the ITU Radio Regulations, Article 22 and Resolution 76 aggregate EPFD limits. However, given SpaceX's recent FCC filings, which include (i) a proposal to degrade the EPFD limits established in Article 22 and Resolution 76 of the ITU Radio Regulations[11], and (ii) separate filings seeking authority to operate without regard to the EPFD limits, and seeking authority to launch an additional 29,988 satellites in LEO, taking it to an unprecedented total of almost 50,000 satellites,[12] there is a crucial need for RSM to further strengthen the regulatory measures for mitigating the risks presented by large NGSO systems.

This same operator has included in its filings 51+ GHz of spectrum, representing 68% of all satellite spectrum under 200 GHz. In short, there is good reason for concern that an operator could attempt to further entrench its dominant spectrum position in ways that would further undermine the competitive landscape and the introduction of diverse and innovative satellite services by multiple operators.

The preclusive nature of the above operator's planned orbital deployment further amplifies these concerns:

- Almost 50,000 satellites across prime LEO orbits
- Taking up 444 km of LEO orbital range (240-684 km), encompassing the most valuable LEO real estate
- Hundreds of steerable beams per satellite operating at elevation angles as low as 5 degrees and employing very wide beams to serve antennas as small as 15 cm

In this regard, Viasat proposes the following:

11 *See In the Matter of Revision of the Commission's Rules to Establish More Efficient Spectrum Sharing Between NGSO and GSO Satellite Systems*, Petition for Rulemaking, RM-______ (Filed 9 August, 2024), https://www.fcc.gov/ecfs/document/10809160739016/1.

12 *See Space Exploration Holdings, LLC*, Call Sign S3069, File Number SAT-MOD-20241011-00224 (Filed 11 October 2024), https://licensing.fcc.gov/cgi-bin/ws.exe/prod/ib/forms/reports/swr031b.hts?q_set=V_SITE_ANTENNA_FREQ.file_numberC/File+Number/%3D/SATMOD2024101100224&prepare=&column=V_SITE_ANTENNA_FREQ.file_numberC/File+Number and File Number SAT-AMD-20241017-00228 (Filed 17 October 2024), https://licensing.fcc.gov/cgi-bin/ws.exe/prod/ib/forms/reports/swr031b.hts?q_set=V_SITE_ANTENNA_FREQ.file_numberC/File+Number/%3D/SATAMD2024101700228&prepare=&column=V_SITE_ANTENNA_FREQ.file_numberC/File+Number.

Recommendation A – Protect GSO/Multi-Orbit networks from unacceptable interference generated by NGSO systems

The potential for disruption to GSO networks from co-frequency NGSO systems is well-known. This concern prompted the development of various ITU Radio Regulations (RR) designed to protect GSO networks from interference generated by NGSO systems. These regulations define the terms under which both GSO and NGSO systems can coexist. The principal provision for coexistence, No. 22.2 in the RR, requires NGSO systems to not cause *unacceptable* interference to GSO networks. EPFD limits apply in certain bands that, if actually met during operation, fulfil the RR No. 22.2 obligation with respect to an NGSO system. There are two types of EPFD interference limits:

- "Aggregate" EPFD limits constrain the amount of interference that all NGSO systems may generate in total, on a cumulative basis. These aggregate limits must be shared and apportioned among all NGSO systems using overlapping frequencies.
- "Single-entry" EPFD limits constrain the amount of interference that one NGSO system itself may generate with respect to GSO networks. The single-entry limits were established based on an apportionment to a single NGSO system of a portion of the applicable "aggregate" EPFD limits.

Single-Entry EPFD limits to be met by a single NGSO system

Based on the data provided in a given ITU EPFD input filing, the ITU's Radiocommunication Bureau (BR) does a limited assessment of the EPFD levels, based on ITU-R Recommendation S.1503[13], that could be generated by an NGSO system with respect to *one particular combination of earth station location and GSO satellite location* (so-called "worst-case geometry"). This limited assessment has little bearing on the interference that an NGSO system can be expected to produce at various locations within New Zealand.

The ITU alone cannot effectively check all of the ways an NGSO system operator may try to artificially specify EPFD inputs in a way designed to "pass" the ITU's spot checks regarding EPFD without reflecting how the NGSO system actually would operate and affect every nation. And there are multiple and well-documented examples of this already occurring. Consequently, it is imperative that the individual administrations and regulators that consider authorising, or granting market access to, NGSO system operations take responsibility for ensuring that NGSO operators specify accurate and appropriate EPFD system parameters, and otherwise comply with the relevant EPFD limits.

In a recent contribution to WP4A[14], it was demonstrated how one NGSO operator has artificially designed a single PFD mask of one of the orbital shells, to force the current algorithm to select a specific and favourable, but non-representative, 'worst-case geometry' (WCG) for the entire NGSO system. Without inclusion of that particular PFD mask of the orbital shell, which has not been authorised by the filing administration for operation, S.1503-2 software produces higher EPFD with a lower number of satellites. Such practices therefore conceal the interference produced by all other PFD masks of the same NGSO system filing that actually contain higher PFD levels at locations outside the WCG, leading to large exceedances of the

[13] ITU-R S.1503: Functional description to be used in developing software tools for determining conformity of non-geostationary-satellite orbit fixed-satellite service systems or networks with limits contained in Article 22 of the Radio Regulations.

[14] *See* WP4A document 4A/94 (18/04/2024) *Working document towards a preliminary draft revision of Recommendation ITU-R S.1503-4 - Underestimation of non-GSO interference arising from the use of worst-case geometry in S.1503 and necessity to supplement it with grid-based EPFD analysis*.

limits at geometries other than WCG. These EPFD limit exceedances are not identified in the examination based on S.1503-2, which may result in a flawed favourable finding for an NGSO system based on an engineered PFD mask that forces the software to evaluate interference towards GSO networks in a limited and non-representative location on Earth. As the ongoing work in ITU Working Party 4A reflects, there are significant shortcomings in the outdated Recommendation S.1503 software used by the ITU. Fortunately, alternative commercial software is available, and more is being developed that allows a more accurate assessment of the expected interference within New Zealand.

Aggregate EPFD limits to be met by *all* NGSO systems, collectively

ITU Radio Regulations Resolution 76 (Rev. WRC-23) defines the aggregate EPFD limits that must be met by all NGSO systems, collectively, and calls for administrations to take all possible steps to ensure that the aggregate interference into GSO FSS and GSO BSS networks caused by NGSO systems does not exceed those limits. In the event that the aggregate EPFD limits are exceeded, it further calls for administrations to take all necessary measures expeditiously to reduce the aggregate EPFD levels to the limits given in Tables 1A to 1D of Res. 76.

A critical component of the aggregate EPFD assessment is to define a methodology by which multiple NGSO operators would reduce EPFD levels in case of any exceedance. Such a reduction in EPFD level must be proportional to the contribution of each NGSO system towards the aggregate EPFD. Unequitable sharing of the aggregate EPFD budget amongst NGSO systems would hinder opportunities for other parties including national NGSO systems and new entrants.

Before authorising any NGSO system to operate in New Zealand, RSM should define a methodology for how the aggregate EPFD budget can be shared amongst all NGSO systems and how the NGSO systems will reduce their EPFD levels, in case of exceedances. It is unreasonable to assume that NGSO licensees will adapt their operations if the aggregate EPFD exceedance is evaluated in New Zealand at a later time, especially when there is no methodology defined upfront at the time of license grant. At the very least, it will be a long process that will cause harm to GSO operations throughout the time of the aggregate EPFD exceedances by the NGSO systems. Moreover, should interference issues arise, isolating and identifying individual EPFD contributions of every NGSO system toward the aggregate EPFD will be an impossible task.

Therefore, Viasat encourages RSM to conduct an independent assessment of potential for interference, from a single NGSO system and all NGSO systems collectively, within New Zealand's national territory that are not covered by the limited assessments performed by the ITU's BR regarding ITU filings for the LEO system. The following assessment should be required from an NGSO operator:

- A demonstration of compliance with the single-entry and aggregate equivalent power flux density (EPFD) limits prescribed in the ITU Radio Regulations Article 22 (Art. 22) and ITU Resolution 76, respectively. This should include:
    - A demonstration for the LEO constellation as a whole;
    - A demonstration for the specific portions of the LEO constellation proposed to serve New Zealand (including the exact satellite altitudes and inclinations proposed to be used);
    - A demonstration for a suitable number of representative geographic locations within New Zealand and for all GSO satellite networks serving, or proposed to serve, New Zealand;
    - A demonstration of how the LEO system avoids interference to GSO networks created by numerous LEO earth station and satellite antenna

sidelobes, and earth station antenna backlobes, particularly when phased array antennas are employed;
    - A demonstration for the operation of the LEO constellation alongside the operation of all other co-frequency NGSO constellations serving New Zealand; and
    - Information on the ITU filing under which each of the NGSO systems seek to operate in New Zealand and where the NGSO system operates under multiple filings, each application should contain EPFD input files (*e.g.*, SRS and mask database) that represent their system as a whole and that are consistent with their ITU submission.

In order to ensure that the expected interference evaluated based on the above assessment is not exceeded during NGSO operation, RSM should consider imposing the following conditions on current and prospective licensees:

- Each individual NGSO system shall comply with the single-entry EPFD limits in Art. 22 and all NGSO systems, collectively, shall comply with aggregate EPFD limits in Resolution 76 (Rev. WRC-23)
- The NGSO operator shall operate its system as a single constellation for purposes of the EPFD limits, no matter how many ITU filings it may seek to operate under;
- The NGSO operator shall confirm that its deployed NGSO system is fully consistent with its ITU filings; and
- The NGSO operator shall comply with all the parameters provided in its ITU filing, specifically:

    - Maximum number of co-frequency beams serving a specific location in New Zealand, commonly known as "Nco,"
    - Minimum GSO arc avoidance angle, commonly known as "alpha angle,"
    - The downlink power flux density mask (PFD mask), taking into account the actual characteristics of the NGSO system as deployed, including the radiation pattern of its satellite antenna.

As mentioned above, the aggregate EPFD limits define the interference that all NGSO systems, collectively, can generate towards the GSO network and thus establish a total interference budget that must be shared by *all* NGSO systems. If, for example, one NGSO operator is allowed to operate with two NGSO systems (e.g., Generation 1 and Generation 2) and each one has a separate "share" of that aggregate budget, that NGSO operator will be able to consume a disproportionate share of the total aggregate EPFD budget, which must be shared amongst *all* NGSO operators. To avoid this result, it is critical to evaluate all the NGSO satellites operated by a given NGSO together as a single system.

The need for the conditions discussed above is reinforced by the Director of the ITU's Radiocommunication Bureau recently released a report, which explains that the practice of splitting a NGSO satellite system into several filed systems, "may affect the effectiveness of single-entry limits contained in Art. 22 to protect geostationary systems or have an impact in the implementation of Resolution 76 (Rev.WRC-15)."[15]

[15] Director, ITU Radiocommunication Bureau, Preliminary Draft Report of the Director to WRC-23 on the Activities of the Radiocommunication Sector Experience in the Application of the Radio Regulatory Procedures and Other Related Matters, Addendum 2 to Document 4-3 (September 2023), at 28-29. Resolution 76 is discussed below. It addresses compliance with limits on the entirety of the aggregate EPFD↓ created by all NGSO systems of all operators.

Recommendation B - Ensure large NGSO constellations share FSS frequencies and orbital resources effectively with other NGSOs

Large NGSO systems with thousands of satellites operating in FSS bands, particularly when they employ small user terminals, can consume significant portions of the "look angles" toward space and LEO orbits as well, preventing use of the sharing tools that have been employed successfully for decades among certain NGSO systems in FSS bands. This threat to NGSO spectrum sharing occurs when large LEO constellations "blanket the sky," causing many in-line interference events limiting and sometimes completely blocking other NGSO systems from sharing the same spectrum. A large NGSO system would rarely (if ever) experience this problem itself because it has a far greater number of satellites than smaller NGSO constellations, which provides the large NGSO system with alternative communications paths in which the same spectrum remains available for its use. The upshot is that a large NGSO system would have little incentive to avoid in-line interference events; large numbers of in-line interference events would harm smaller NGSO systems without materially impacting the large NGSO system's operations. As a result, the large NGSO system can hinder other satellite operators, including new entrants, from accessing and using shared spectrum and orbital resources in the public interest.

To avoid this result and to ensure large NGSO constellations share FSS frequencies and orbital resources effectively with other NGSO systems, it is critical for RSM to require an NGSO operator in FSS bands to:

- Operate with only 1/n of the look angles in a given country, where n is the number of NGSO systems authorised to serve New Zealand in the same frequency band (whereby NGSO systems serving a country in overlapping frequencies would divide the range of satellite azimuths as seen from a location on the Earth (*i.e.*, "look angles") whenever the potential for NGSO/NGSO interference exists at that location);
- Coordinate in good faith and in advance with other NGSO systems so that all n look angles may be used to serve New Zealand by different NGSO systems; and
- Maintain an orbital tolerance of +/- 2.5 km for the apogee and perigee of each NGSO satellite, and a 0.5° tolerance for each orbital inclination the NGSO system employs, in order to ensure other NGSO systems may access the shared LEO space (or comply with such other orbital tolerance requirements as RSM deems appropriate to ensure the ability of other satellites and systems serving its territory to operate in the same, or overlapping, orbits occupied by the NGSO system).
- Address Low-Elevation Operations:
    - Restrict NGSO system operations below 10 degrees elevation in high-interference risk scenarios.
    - Require enhanced coordination for operations between 5-15 degrees elevation angles.
    - Implement dynamic interference monitoring for low-angle transmissions near GEO service areas.

Add a specific reference to Article 22 in the licensing framework, reinforcing the commitment to enforcing compliance with the existing Article 22 EPFD framework.

Viasat recommends that RSM review the coordination terms used to provide service within New Zealand to ensure that those agreements do not unduly constrain other NGSO systems and do not result in a disproportionate use of available look angles by a single NGSO operator.

Summary of Viasat's recommendations

1. **For the frequency range 24.25 – 27.5 GHz:** we support allocating this band to the terrestrial Mobile Service on an exclusive basis. This allocation would provide ample capacity for terrestrial uses, such as hotspots and FWA, given New Zealand's demographics, the characteristics of this frequency range, and the New Zealand mobile broadband market profile.

2. **For the frequency range 27.5 – 28.35 GHz:** we respect the Cabinet's decision to allocate this band on a shared basis between FSS and the Mobile Service. However, we strongly recommend that this shared use be implemented in a way that maximises the economic benefit of the spectrum by making FSS the primary use and Mobile Service a secondary use. Not doing so would be detrimental to the development of the New Zealand FSS/ ESIM ecosystem. Moreover, not making FSS the primary service would result in unnecessary operational, economic and technical barriers to New Zealand FSS/ ESIM.

3. **For the frequency range 28.35 – 29.5 GHz:** we support the allocation of this band for FSS use on an exclusive basis.

4. **For the frequency range 29.5 – 30 GHz:** we support the allocation of this band for FSS use on an exclusive basis. We strongly object to any provisions for this band that impose minimum elevation angles on FSS gateways, as it would constrain FSS systems operating with elevation angles lower than 20 degrees. This band should not be treated as a shared-use band with MS.

5. **Across the frequency range 27.5 – 30 GHz:** we strongly recommend that the Ministry:

    a. Re-align its interpretation of ITU-R Resolution 169 as intended by the provisions of this Resolution - a cross-border management framework. There should be no operational restrictions on ESIM services in New Zealand (A-ESIM, M-ESIM and L-ESIM).
    b. Maintain the GURL licensing regime for FSS/ ESIM user terminals.
    c. Issue compulsory directives in the licensing regime for NGSO systems (details provided above in Recommendations A and B) to comply with the ITU Radio Regulations EPFD limits of Article 22 in this band, and across the spectrum bands where these limits apply, as to:
        c.1 Protect GSO/ Multi-Orbit networks from unacceptable interference generated by NGSO systems
        c.2. Ensure large NGSO constellations share FSS frequencies and orbital resources effectively with other NGSOs
    d. FSS gateway elevation angles should not be constrained by secondary MS use or MS use in bands adjacent to FSS primary use.

We look forward to the outcomes of this consultation process, as we are actively investing in making New Zealand a Trans-Tasman and world-class satellite-enabled hub.

Respectfully,

Cristian L. Gomez
VP, Government and Regulatory Affairs
Asia Pacific
Viasat

Enclosed: Annex containing responses to specific questions posed in the Consultation Document.

Annex: Viasat's response on specific questions relating to 24.25 – 27.5 GHz

Q10. Does the mobile BS you wish to operate meet the −60 dBW/MHz Category B spurious emissions limit from Recommendation ITU-R SM.329? If not, what do you propose for the necessary protect EESS (passive) receivers in 50.2 – 50.4 GHz and 52.6 – 54.25 GHz from the second harmonic of mobile BS emissions within 24.25 – 27.5 GHz?

Viasat supports RSM's proposal to restrict the spurious emission of IMT Base stations ("**BSs**") within 24.25 – 27.5 GHz to be at least -60 dBW/MHz or lower accordance with Category B of ITU-R recommendation SM.329. This will ensure adequate protection of FSS receivers operating in the adjacent band 27.5 – 29.5 GHz.

Q11. Do you agree with our 5% quantification for the use of the terms "very limited" number of BSs operating in 24.25 – 27.5 GHz that are expected to communicate with a positive elevation angle towards indoor mobile UEs? If not, what technical modifications would you suggest to this quantification?

Viasat understands and appreciates the methodological approach taken by RSM to characterise the terms "very limited" number of IMT BSs in 24.25 – 27.5 GHz. While Viasat is in agreement with RSM on the methodology used to quantify "very limited", the value of 5% as the upper bound should be adjusted to 1% to cover almost all possible cases where there could be potential grating lobes from IMT BSs pointing towards the GSO arc that impact satellite receivers operating in the adjacent band 27.5 – 29.5 GHz. In particular, it is the coherent addition of all grating lobes at a given time instant across the footprint of the receive beam which is a concern from an interference point of view in the adjacent band, recognising that the IMT BS array will continue to radiate gain in the adjacent band. Therefore, Viasat considers 1% to be sufficient as $\Pr[\mu - 3\sigma \leq X(t) \leq \mu + 3\sigma] \approx 0.99$ (= 99%) and obtaining the complement of 0.99 yields 1 − 0.99 = 0.01 (= 1%). This provides higher degree of certainty for a "very limited" number of BSs with a positive elevation angle or any BS creating a grating lobe towards GSO arc resulting in possible inference events.

Q13. How would you mathematically characterise the term "normally" pointing the BS below the horizon, as quoted in "resolves 2.1" of Resolution 242 (WRC-19)?

Viasat agrees with RSM's proposal for the use of the terms "practical measures" to imply electrical and mechanical down tilting of the BS antenna below the horizon. The outdoor BSs must not direct antenna beams (via electrical steering) to elevation angles greater than 0 degree above the horizon (where horizon is defined in footnote 41 of Consultation paper).

Q14. What would be your mobile BS's typical elevation beam steering range and would the composition of the BS antenna array cause grating lobes to occur? If so, would you be able to quantify the direction and magnitude of these grating lobes?

IMT BS deployments should take all practical measures to avoid formulation of grating lobes and cause interference on the satellite receivers operating in the adjacent frequency band 27.5 – 29.5 GHz. According to the physics of phased arrays, the BSs elevation beam steering range and inter-element spacing should be constrained to avoid the occurrence of grating lobes. In general, a grating lobe would appear when the inter-element spacing in the array would exceed $d_{\max} = \lambda/[1 + \sin(\theta_{\max})]$ for $\theta_{\max} \in [0, \pi/2]$[16].

[16] λ is the wavelength corresponding to the carrier centre frequency.

<u>Viasat's response on specific questions relating to 27.5 – 29.5 GHz</u>

Q19. Do you agree with RSM's proposed new spectrum uses within 27.5 – 28.35 GHz, noting the growing demand for FSS (Earth-to-space) GSO and NGSO gateways and user terminals?

Viasat agrees with RSM's proposed new spectrum uses within 27.5 – 28.35 GHz for FSS but strongly recommends making FSS the primary service in this band. Any terrestrial mobile use (MS) of this band should be secondary. Not doing so would create a significant imbalance in spectrum resources, causing economic, technical, and operational burdens for the New Zealand ESIM ecosystem.

As mentioned in our cover letter above, we strongly recommend:

1. Making FSS, including ESIM, primary service in the band 27.5 – 28.35 GHz
2. Any terrestrial Mobile Service (i.e. FWA, 5G hotspots) sharing with FSS in this band should be made a secondary service, to avoid unnecessary technical complexities and detrimental economic, technical and operational effects on the New Zealand FSS/ ESIM ecosystem.
3. ITU-R Resolution 169 be interpreted as intended – a cross-border framework
4. Maintaining a GURL (General User Radio Licence) framework for FSS/ ESIM user terminals
5. Issue compulsory directives in the licensing regime for NGSO systems (explained in detail in the cover letter above) to comply with the ITU Radio Regulations EPFD limits of Article 22 in this band, and across the spectrum bands where these limits apply, as to:
    - 5.1 Protect GSO/ Multi-Orbit networks from unacceptable interference generated by NGSO systems
    - 5.2 Ensure large NGSO constellations share FSS frequencies and orbital resources effectively with other NGSOs
6. FSS gateway elevation angles should not be constrained by secondary MS use or MS use in bands adjacent to FSS primary use.

There is growing demand for the use of Ka-band (27.5 – 30 GHz and 17.7 – 20.2 GHz), which includes 27.5 – 28.35 GHz for FSS, primarily for the need of high-speed, broadband satellite communications, particularly for ESIM on aircraft and ships, as well as government operations, including ESIM on land vehicles.

Further, there is growing demand for accessing the internet onboard aircraft and ships, driven by passengers and crew who expect to stay connected while travelling. This demand is fuelled by the increasing reliance on digital devices and the desire to maintain productivity and communication during travel. Airlines and shipping companies are responding by investing in onboard Wi-Fi solutions to enhance passenger satisfaction and potentially improve business operations.

As per previous responses, we highlighted that we provide inflight connectivity to multiple commercial airlines, including Air New Zealand, using our Ka-band satellite network, as well as providing Ka-band satcom systems to New Zealand Defence Forces. We also provide maritime services for both commercial and government agencies. Land-based Ka-band Satcom systems can be used by multiple New Zealand Government Departments, the New Zealand military, and visiting military. The spectrum within 27.5 – 28.35 GHz enable us to utilise our existing GX satellites and upcoming Viasat-3 satellites covering New Zealand to provide higher capacity to address the increasing demand for ESIM services. Therefore, Viasat agrees that this band should be made available for FSS user terminals, including ESIM terminals for aviation, maritime and land use.

Viasat also agrees with RSM that satellite receivers need to be protected from potential interference produced by Mobile Service transmitters operating in the 27.5 – 28.35 GHz band and from the adjacent 26 GHz band.

Q20. Do you agree with RSM's assessment of the impact on existing users, including the sharing and compatibility scenarios, considerations and overall conclusions in the form of conditions to be met for the protection of existing users such as individually licenced FSS GSO and NGSO Earth stations, as well as FSS satellite receivers operating within 27.5 – 28.35 GHz? If not, please provide further specific technical details and rationale.

We do not support a sharing framework that fails to maximise economic benefit from this spectrum and impacts the development of the New Zealand FSS/ ESIM ecosystem. FSS should be made primary service in this band.

Further, we note that condition 1 in the Consultation Paper (refer to page 29 of the Consultation Paper) may not be applicable to all GSO FSS gateways. There are situations where we would need to operate an FSS gateway with a lower elevation angle. Therefore, we propose for RSM to remove this condition since what matters is the EIRP density towards the horizon.

The assumption stipulated in the Consultation Paper (refer to page 31) about the maximum satellite peak gain of 46.6 dBi may not be applicable to all satellites. GX satellites may just meet this condition. There are concrete scenarios and requirements where operation below 20 degrees of elevation is necessary for gateways; therefore, RSM should not constrain FSS operators' operational requirements by mandating an elevation threshold. Furthermore, it would not be feasible to replicate such limitations in the band 29.5-30 GHz, because gateways do operate below 20 degrees of elevation angle in this band.

In summary, we strongly recommend that FSS be made primary in this band, and MS secondary service to avoid all unnecessary technical burdens on FSS/ ESIM, noting that MS will have an exclusive and unrestricted operational environment in the 26 GHz band in relation to FSS systems.

Q21. Is there any further application/system details you wish to provide which qualifies as an existing user? If so, please provide the details, including any relevant technical information.

Besides the gateways at Warkworth and Albany communicating with GX satellites, Inmarsat New Zealand also operates gateway services at Albany with the Hylas-3 satellites in the 27.5 – 28 GHz, 29 – 29.5 GHz and 19.2 – 19.7 GHz.

Q22. Do you agree with RSM's understanding of the spectrum requirements for enabling different services and applications, e.g., FSS (Earth-to-space) and Mobile Service in 27.5 – 28.35 GHz?

Viasat recommends that the 27.5 – 28.35 GHz frequency band be made available for FSS operation on a primary basis, in line with the globally harmonised use of the band.

Viasat does not support the comments made by the Ministry in Section 2.3.2 that: "*The same use cases for mobile services as those described in the 26 GHz frequency band (e.g., FWA,* *and private networks) apply in 27.5 – 28.35 GHz band*." This is misleading as the assessment made in considering the 26 GHz band was that the spectrum use requirements for mobile services could be fully met in the 24.45 – 27.5 GHz frequency band and that rules would be developed restricting access to the band above 27.5 GHz. It is accepted that there may be some other minor use cases; however, such use cases cannot be considered the same for mobile services in the bands above 27.5 GHz.

Further, the Ministry has taken a coarse approach in its overall proposals, and this has resulted in proposals for licensing that will have unnecessarily high compliance costs for satellite operators and will restrict access for some satellite applications. A more nuanced policy is required to ensure satellite services above 27.5 GHz are not undermined in their ability to build a full-fledged New Zealand FSS/ ESIM ecosystem and not constrained by the, numerous, ample and exclusive spectrum options enjoyed by the MS.

Q23. What are your spectrum estimates for FSS (Earth-to-space) and Mobile Services (including their applications) which you wish to implement or use in the 27.5 – 28.35 GHz range?

The spectrum in the 27.5 – 28.35 GHz and 28.35 – 30 GHz frequency ranges are global bands that were planned at the ITU level based on global demand estimates to meet current and future demand for FSS/ESIM services. Therefore, our spectrum estimate is, of course, fully aligned with the international estimates reflected in the ITU allocation plan for the band 27.5 - 30 GHz.

The market demand for higher data throughput for satellite broadband in both the aviation and maritime industries is skyrocketing. The 27.5 – 30 GHz spectrum will allow significantly higher throughputs to be delivered on board aircraft and ships. For example, a 4 x 500 MHz bandwidth in the 28 GHz band would allow a wider transponder frequency reuse pattern, with a multiplicative effect on capacity, enabling many aircraft, ships, or land vehicles to take advantage of this throughput.

Viasat's use of the internationally planned FSS Ka-band is necessary as Viasat uses this spectrum today to provide hundreds of millions of high-speed broadband connections every year to passengers across the regions, using innovative antenna designs for ESIM on aircraft, ships and land-based vehicles. The current and future GX and Viasat-3 satellites covering New Zealand will extend user link operations to the full 27.5 – 29.5 GHz frequency band.

Viasat will also be utilising the entire 28 GHz, including the 27.5 – 28.35 GHz for FSS gateways operation. GX3 uses the full 27.5 – 29.5 GHz frequency band for feeder links at Auckland and Warkworth.

As noted by the Ministry, the ability for satellite operators to share the spectrum means that individual operators are not seeking sole access for their own use. Multiple satellite operators are able to utilise the spectrum without creating interference with each other.

Q26. Do you agree with the geography-based by area type option of sharing the 27.5 – 28.35 GHz frequency range between FSS (Earth-to-space) and Mobile Services, as detailed in Option 1?
If not, please propose alternatives with the required details for RSM's consideration.

Viasat recommends RSM to implement FSS as the primary service, while Mobile Service as the secondary service. We do not agree with geographical restrictions being placed upon FSS/ ESIM systems.

Due to the higher frequencies, Ka-band antennas can achieve an equivalent power output with a smaller dish size than lower frequency bands. GSO/ Multi-Orbit (FSS/ ESIM) have evolved to user terminal sizes smaller than 45cm, hence the interference environment is a lot more complex for such small GSO/ Multi-Orbit terminals. There is no justifiable reason for adding further complexities to that environment by mixing a terrestrial MS service which isn't secondary to FSS.

The Consultation Paper provides no analysis of ESIM operation or consideration of how MS may be deployed. As a result, conclusions are drawn without full consideration of important issues. Viasat believes that there is little or no risk to the operation of mobile stations in adjacent bands (below 27.5 GHz) or secondary Fixed Wireless Access ("FWA") stations in the same bands (above 27.5 GHz) due to the itinerant operation of the different services as well as the varied antenna pointing.

Q27. Do you agree to divide Option 1 by Part A and Part B by using the Statistics New Zealand defined area accessibility criteria? If not, please suggest an alternative criterion which RSM could use?

Viasat recommends RSM to implement FSS as the primary service, while Mobile Service as the secondary service.

Q28. In accordance with Part A of Option 1, do you agree that L-ESIMs should not be permitted inside major, large, medium, small urban areas and high urban accessibility areas? If not, please provide an alternative with a detailed explanation.

L-ESIM is critically important for trains and land vehicles for providing satellite broadband for passengers and enabling essential operational data transmission, such as engine diagnostics and real-time tracking. It also enables worker safety in forestry and agriculture, and satellite-based devices provide a lifeline for check-ins and SOS capabilities in areas with no mobile coverage.

Therefore, not permitting the deployment of L-ESIM in these areas would restrict future satellite solutions/applications in the Ka-band from bridging coverage gaps, which are critical for New Zealand, a nation with significant geographical challenges. L-ESIMs support the 'always-on' connectivity for vehicles such as cars, trucks, trains, and even agricultural equipment as they move through major/medium/small urban areas to remote areas. Again, the use of the 27.5 – 30 GHz for FSS on a primary basis represents the best operational option to enable the growth of the New Zealand L-ESIM ecosystem.

Q30. In accordance with Part B of Option 1, do you agree that Mobile Service (and its applications) should not be allowed to operate inside medium and low urban accessibility areas, as well as remote and very remote areas? If not, please provide an alternative with a detailed explanation.

With FSS as primary and Mobile Service as secondary, the cumbersome coordination approach proposed is resolved. We note that the 26 GHz band (24.25 -27.5 GHz) is being proposed for exclusive and unincumbered use by the Mobile Service.

Q31. Would you like to propose any modifications for Option 1? If so, please provide modifications with relevant associated details.

Viasat proposes the following modifications to Option 1:

1. FSS is allocated nationwide on a primary basis.
2. Continue the operation of FSS gateway earth stations at existing licensed sites as per RSM's current policy in accordance with the licensing framework established in PIB 38 and PIB 58.
3. To allow expansion of services at existing licensed sites, RSM should consider applications to expand current FSS gateway Earth station licences within these areas, in accordance with the licensing framework established in PIB 38 and 58.
4. The establishment of new GSO FSS gateways should be allowed, to enable the expansion of GSO/ Multi-Orbit systems.
5. L-ESIM, A-ESIM, M-ESIM user terminals should be permitted on a nationwide basis under GURL. ITU-R Resolution 169 only applies where there is a cross-border coordination requirement. A-ESIM gate-to-gate should be permitted. M-ESIM pier-to-pier should also be permitted.
6. VSAT terminals should be permitted under GURL as current practice.
7. RSM should allow the use of Mobile Services on a secondary basis in the band 27.5 – 28.35 GHz
8. To co-exist with FSS (Earth-to-space), mobile BSs should take practical measures to ensure that transmitting antennas are mechanically pointed below the horizon.
9. To protect GSO/ Multi-Orbit networks from unacceptable interference generated by large-scale NGSO satellite systems, refer to our our recommedations in the cover the letter and in question 19.

Q32. Do you agree with the geography-based by priority of service type option of sharing the 27.5 – 28.35 GHz frequency range between FSS (Earth-to-space) and Mobile Services, as detailed in Option 2? If not, please propose alternatives with the required details for RSM's consideration.

Viasat does not support this approach. Viasat recommends that a simplified operational implementation of the Cabinet decision on the shared use of this band should allocate it to FSS on a primary basis and to the Mobile Service on a secondary basis.

Q33. Which areas would you like FSS to have priority over Mobile Services, and vice versa, and why?

FSS is primary service on a nationwide basis.

With FSS as primary and Mobile Service as secondary, the cumbersome coordination approach proposed is resolved. Viasat notes that the 26 GHz band (24.25 -27.5 GHz) is being proposed for exclusive and unincumbered use by the Mobile Service.

Q35. Are there any other suggestions for licencing conditions which you wish to see included as part of Option 2? RSM encourages details of specific conditions for different types of FSS user terminals, e.g., fixed terminals vs. A-ESIMs and M-ESIMs.

Viasat recommends RSM to allow gate-to-gate A-ESIM and pier-to-pier M-ESIM operations in New Zealand, as mentioned in Q31.

Q37. Do you agree with our approach of ESIM use in 27.5 – 28.35 GHz?

Viasat respectfully does not support RSM's interpretation of ITU Resolution 169, as explained in the cover letter above. If the allocation of the band 27.5 – 28.35 GHz, as per Cabinet decision, is implemented to:

a. Achieve the highest economic value of the spectrum
b. Enable the unhindered growth of the New Zealand ESIM ecosystem
c. Mitigate regulatory asymmetries that could harm FSS/ ESIM investments in New Zealand,

Then, the implementation of the Cabinet decision on the shared use of this band must be carried out by RSM with FSS as the primary service. In this case, Res. 169 must be applied as intended (cross-border framework), without a national-level variation to its intended purpose, and allowing ESIMs to be operated in their full range of operational capabilities (i.e., gate-to-gate, pier-to-pier, and L-ESIM). These principles also apply to the band 28.35 - 30 GHz.

Q38. Do you wish to offer, implement or use pier-to-pier or gate-to-gate M-ESIM and A-ESIM applications in 27.5 – 28.35 GHz?

Yes, Viasat would like to offer pier-to-pier and gate-to-gate M-ESIM and A-ESIM applications in the 27.5 – 28.35 GHz as well as in 28.35 – 30 GHz.

Q39. Is there any other change which you wish to see in our approach for using A-ESIM and M-ESIM? If so, provide the relevant details.

See Q37.

Q41. What is the likelihood of interference from land ESIM terminals operating in 28.35 – 29.5 GHz to Mobile Service receivers (BSs and UEs) operating in 27.5 – 28.35 GHz under possible shared use of FSS (Earth-to-space) and Mobile Services in 27.5 – 28.35 GHz?

See Q37.

Q42. What technical conditions may be required to ensure that future L-ESIM use is not constrained in 28.35 – 29.5 GHz while protecting possible Mobile Service receivers in 27.5 – 28.35 GHz. Provide necessary technical justification to support your answer.

See Q37.

Q43. To not constrain future use of A-ESIMs and L-ESIMs, do you propose any changes to the technical conditions for operating A-ESIMs and L-ESIMs within 28.35 – 29.5 GHz? If so, what would these be and what assumptions as well as processes did you use to derive these changes?

See Q37.

Q44. Do you agree with RSM's proposed licencing arrangement to licence FSS (Earth-to-space) GSO or NGSO gateways operating in 28.35 – 29.5 GHz? If not, what changes would you recommend?

Viasat supports the current licensing regime with an annual administrative fee of $150 for a licence to operate FSS gateways.

Viasat recommends RSM to allow existing licensee(s), including Inmarsat NZ Ltd, to renew their licences in the 27.5 – 28.35 and 28.35 – 29.5 GHz frequency range before their licences expire in May 2026. This would allow for continuous operation of FSS gateway(s) without service interruption to New Zealand and Trans-Tasman users.

Q45. Which licensing option would you prefer for licensing FSS GSO and NGSO fixed user terminals and moving user terminals (ESIMs), respectively? RSM requests for appropriate justification to support your answer.

Viasat does not support RSM's proposal for the satellite operators to obtain a radio licence for user terminals and ESIM user terminals. The use of user terminals in the 27.5 – 28.35 GHz and 28.35 – 29.5 GHz bands should be allowed under the GURL with common EIRP.

Viasat notes that some years ago, the Ministry created a system for licensing that requires Approved Radio Engineers ("AREs") to undertake certification as part of the licensing process. This adds costs to the licence fees and has not been considered in the consultation document. The current proposal to require individual user terminal licensing as well as individual licensing of ESIM use is onerous as:

- Terminal costs need to be kept low to enable a cost-efficient product.
- Licences need to be available promptly.
- Licence modifications need to be made promptly
- Addressing the movement of the user terminal changes would adds more costs.

Even a modest number of 1,000 user terminals would create a huge cost and complexity. In addition, the Ministry provides access to satellite bands for other satellite operators that would not face the same costs. i.e. there would not be a level playing field for the provision of the same services by different satellite operators (albeit operators are offering services in different bands). This is a major economic issue that has not been addressed in the consultation document.

Should RSM require operators to obtain a radio licence in order to use ESIM terminals, Viasat proposes that RSM implement a single radio licence for nationwide deployment of ESIM terminals with the same technical specification and the same satellite operator's network. Viasat does not recommend a radio licence per user terminal per satellite as this would increase the operational costs and does not support the deployment of ubiquitous end-user terminals.

Q46. Do you agree with RSM's proposed approach to 29.5 – 30 GHz? If not, what modifications would you suggest to our proposal?

Viasat recommends RSM to allow Inmarsat NZ Ltd to renew its licences in the 29.5 – 30 GHz band before they expire in May 2026. This would allow us to continue operating gateway(s) in New Zealand without any service interruption.

We have significant concerns about RSM's intentions to replicate the 27.5-28.35 GHz conditions of sharing with terrestrial Mobile Service in this band. There are concrete scenarios and requirements where operation below 20 degrees of elevation is necessary for gateways; therefore, RSM should not constrain FSS operators' operational requirements by mandating an elevation threshold. Furthermore, it would not be feasible to replicate such limitations in the band 29.5-30 GHz, because gateways do operate below 20 degrees of elevation angle in this band.

Since there is no change to the licensing arrangement for gateway operations, existing licensees should be allowed to retain their licences.

Viasat strongly recommends that RSM realign its interpretation of Res. 169 to avoid harming ESIM investments in New Zealand and to enable the New Zealand ESIM ecosystem to flourish without regulatory asymmetry. Viasat does not support removing the 29.5–30 GHz frequency band from the GURL framework.