Commercial-in-Confidence

Via Electronic Submission
Radio.Spectrum@mbie.govt.nz

Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
Wellington 6140

Amazon Kuiper New Zealand Limited
Response to Consultation on Allocation of 24-30 GHz Radio Spectrum

December 12, 2025

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Amazon Leo appreciates the opportunity to participate in the Radio Spectrum Management's consultation regarding the allocation of radio spectrum between 24-30 GHz. We are grateful for RSM's collaborative approach and the opportunities we have had to actively participate in the 24-30 GHz Technical Working Group. Amazon Leo's response focuses on three key recommendations that will maximize spectrum efficiency while ensuring robust protection for all services operating in the Upper and Lower 28 GHz band:

1. Support Option 2 with Approved Regulatory Engineer Coordination

Amazon Leo supports Option 2's geography-based priority approach for sharing the 27.5-28.35 GHz band between FSS and Mobile Services. This approach maximizes spectrum efficiency by enabling FSS gateway deployment in areas with optimal fiber infrastructure—most readily available in metropolitan areas—while ensuring coexistence through technical coordination procedures. Critically, we recommend that coordination feasibility be assessed by Approved Regulatory Engineers rather than requiring protracted operator-to-operator coordination. This streamlines the licensing process by focusing purely on technical compliance with established protection criteria (such as ΔT/T thresholds for FSS gateways and PFD limits for Mobile Services), eliminating unnecessary delays associated with commercial negotiations between operators.

2. Do Not Apply ITU-R Resolution 123 Technical Conditions to ESIM Above 28.35 GHz

We urge RSM to clarify that Annex 1 technical conditions from ITU-R Resolution 123 (WRC-23) apply only to ESIM operations in the 27.5-28.35 GHz band and not to operations above 28.35 GHz. Resolution 123's technical conditions were specifically designed to protect cross-border interference to co-frequency terrestrial service operations. Since New Zealand has no land-bordering neighbors and the Cabinet's August 2023 decision allocated 28.35-29.5 GHz primarily for satellite services within New Zealand, these constraints are unnecessary and would inappropriately limit satellite service deployment. Adjacent band coexistence is adequately achieved by applying PFD limits only to ESIM out-of-band emission limits.

3. Allow G2G A-ESIM, P2P M-ESIM, and L-ESIM Above 28.35 GHz

Finally, Amazon Leo recommends that RSM authorize the full range of ESIM operations in the 28.35-29.5 GHz band, including gate-to-gate aeronautical ESIM, port-to-port maritime ESIM, and land-based ESIM. This approach aligns with the Cabinet's decision to allocate this spectrum primarily for satellite services. Technical safeguards established through out-of-band emission limits and minimum elevation angle requirements provide adequate protection for adjacent band terrestrial services while facilitating innovative mobility applications throughout the country.

These recommendations will position New Zealand to enable the rapid deployment of next-generation satellite broadband services, and ensure efficient use of this valuable spectrum resource while maintaining appropriate protections for all services.

Commercial-in-Confidence

Via Electronic Submission
Radio.Spectrum@mbie.govt.nz

December 12, 2025

Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
Wellington 6140

RE: Consultation on Allocation of 24-30 GHz Radio Spectrum

Amazon Kuiper New Zealand Limited, a wholly owned subsidiary of Amazon.com Services LLC (hereinafter, "Amazon Leo"), appreciates the opportunity to provide comments in response to the Radio Spectrum Management's ("RSM") consultation regarding the allocation of radio spectrum between 24-30 GHz. Amazon Leo appreciates the collaborative approach RSM has taken in developing technical options for spectrum sharing in these important frequency bands, and is grateful for the opportunities we have had to actively participate in RSM's 24-30 GHz Technical Working Group ("TWG"). Amazon Leo's comments below focus on the 28 GHz band, as well as the allocation of FSS spectrum in the 17.3-17.7 GHz band.

I. Background

Amazon Leo, formally Project Kuiper,[1] will bring high-speed, affordable broadband to unserved and underserved communities around the world. Amazon Leo began launching its constellation of non-geostationary satellite orbit ("NGSO"), Fixed-Satellite Service ("FSS") satellites in low Earth orbit ("Amazon Leo System") in April 2025.[2] Since committing to invest over 10 billion U.S. dollars in the Amazon Leo System, Amazon Leo has made significant strides toward further deployment, including the continued expansion of its terrestrial infrastructure and the unveiling of innovative customer terminals that will offer high performance in small form factors and at affordable price points. Amazon Leo's goal is to deliver service to select

[1] On November 13, 2025, Amazon replaced the Project Kuiper code name with Amazon Leo, its permanent brand for its satellite broadband network.

[2] Amazon Leo successfully launched our first 27 satellites on April 28, 2025. That mission was the first of more than 80 to deploy Amazon Leo's initial constellation. *See Amazon Leo mission updates: 150+ satellites in orbit following sixth successful launch*, Amazon (October 14, 2025), https://www.aboutamazon.com/news/innovation-at-amazon/project-kuiper-satellite-rocket-launch-progress-updates. Amazon Leo has now successfully launched over 150 satellites, with additional launches planned in the coming weeks and months.

customers later this year as part of a commercial beta, and to roll out more widely as we launch more satellites and add coverage and capacity to the system.

II. Response to Questions Regarding the Lower 28 GHz Band (27.5-28.35 GHz)

A. Impact on Existing Spectrum Users (Questions 19-21)

19. 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?

Amazon Leo agrees with RSM's recognition of the growing demand for FSS (Earth-to-space) GSO and NGSO gateways and user terminals, and welcomes opportunities in the 27.5-28.35 GHz band ("Lower 28 GHz band") to address this increasing need. The growing demand for FSS broadband connectivity services in New Zealand is evidenced by Amazon LEO's expanding gateway infrastructure, with multiple sites deployed or planned in areas including Auckland, Hamilton, Nelson, and Pahiatua utilizing the Lower 28 GHz band.

Amazon Leo therefore supports RSM's approach to enable shared use of the Lower 28 GHz band between FSS and Mobile Services, while also suggesting that RSM allow land-based FSS Earth stations in motion ("L-ESIM") outside Urban and High Urban Accessibility areas. With appropriate technical conditions and coordination mechanisms, both services can coexist successfully in this spectrum, maximizing the efficient use of this valuable resource while enabling innovation and competition among both satellite and terrestrial operators.

20. 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.

Amazon Leo agrees with RSM's assessment of the impact on existing users in the 27.5-28.35 GHz band, including the sharing and compatibility scenarios and overall conclusions regarding the technical conditions necessary to protect existing FSS gateway earth stations and satellite receivers. Amazon Leo also generally agrees that the technical conditions identified by RSM, including minimum elevation angles, e.i.r.p. density limits, and coordination mechanisms, provide an appropriate framework for enabling both FSS and Mobile Services to coexist while protecting existing licensed operations.

Amazon Leo offers the two following recommendations to ensure the most effective implementation of these protection measures:

- **ITU-R P.452 Propagation Model Flexibility**: Amazon Leo agrees with the application of ITU-R P.452 for calculation of propagation loss between earth stations and mobile base station receivers. However, Amazon Leo urges RSM to allow flexibility in the version of ITU-R P.452 used, rather than mandating a specific version. There are benefits to allowing use of ITU-R P.452-16, for example, which incorporates clutter loss directly with clutter height and distance parameters, whereas ITU-R P.452-18 adds clutter height to Above Mean Sea Level (AMSL) elevation along the great circle path profile,

excluding areas within 50 meters of endpoint terminals. Given that ITU-R P.452-18 requires very high-fidelity local clutter height data for accurate implementation, Amazon LEO urges RSM to provide operators with flexibility to select the most appropriate version based on available data and specific deployment scenarios.

- **I/N Protection Criteria Bandwidth Specification**: Amazon Leo agrees with RSM's deterministic approach to use I/N = -6 dB as a starting protection criterion for mobile base station receivers, as defined in Report ITU-R M.2292. To ensure consistent and predictable coordination outcomes between FSS and Mobile Service operators, we recommend that RSM specify the victim receiver bandwidth over which this criterion is applied.

21. *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.*

Amazon Leo has no further details to provide at this time.

B. Spectrum Requirements (Questions 22-25)

22. *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?*

Amazon Leo agrees with RSM that access to the Lower 28 GHz band is crucial for meeting the increasing performance demands of FSS uplinks for enabling High Throughput Satellite ("HTS") systems currently deployed and under development in GSO and NGSO orbits. Shared access to this spectrum supports higher data rates and lower latency for data-intensive satellite applications while preserving spectrum requirements for International Mobile Telecommunications ("IMT") systems like those defined for the adjacent 26 GHz band.

23. *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?*

Amazon Leo intends to use the full 27.5 – 28.35 GHz shared band for gateway operations.

24. Can you provide a link budget of systems which you plan to operate in 27.5 – 28.35 GHz, which will assist RSM to better plan, allocate and assign this frequency range?

Commercial Information

[redacted]

25. *Can you provide further insights into the typical metrics and calculation methodologies often used for GSO to GSO, GSO to NGSO and NGSO to NGSO FSS coordination? In doing so, given an application, how can we ultimately determine the amount of spectrum an FSS operator can ultimately use relative to another, while respecting the provisions contained in Article 9 of the ITU RR? RSM encourages you to share as much detail as possible.*

GSO and NGSO Sharing. For frequency bands subject to equivalent power flux-density ("EPFD") limits as described in Article 22 of the ITU Radio Regulations, spectrum is shared between GSO and NGSO systems by complying with the applicable EPFD limits. Specifically, Article 22.5C addresses the downlink in the 17.8-18.6 GHz and 19.7-20.2 GHz bands, Article 22.5D addresses the uplink in the 27.5-28.6 GHz and 29.5-30 GHz bands, and Article 22.5F addresses the space-to-space direction in the 17.8-18.4 GHz band. Compliance with these EPFD limits ensures that NGSO FSS systems do not cause unacceptable interference to GSO FSS networks.

For frequency bands not subject to Article 22 EPFD limits, spectrum sharing between GSO and NGSO FSS operators is coordinated through inter-operator coordination procedures. NGSO FSS downlink operations in the 18.8-19.3 GHz band and uplink operations in the 28.6-29.1 GHz band coordinate with GSO FSS networks under ITU Radio Regulations provisions 9.12A and 9.13. These provisions establish the framework for coordination between satellite networks to ensure compatible operations and efficient spectrum use while respecting the rights of all operators under Article 9 of the ITU Radio Regulations.

It is worth noting that technical studies have demonstrated that there is ample margin between current EPFD limits and actual GSO protection requirements to lower these limits while maintaining robust GSO protections.[3] Current limits were established over 25 years ago based on GSO operations from 1998. Consideration of modern spectrum-sharing methods and protection criteria show that NGSO and GSO systems can efficiently coexist with less restrictive EPFD limits through techniques including beamforming and adaptive filtering, adaptive coding

[3] *See* Comments of Kuiper Systems LLC, Modernizing Spectrum Sharing for Satellite Broadband, U.S. Federal Communications Commission Space Bureau Docket No. 25-157 (filed July 28, 2025), https://www.fcc.gov/ecfs/document/1082385155174/2.

and modulation, and application of modern protection criteria. Over-protection of GSO systems restricts unnecessarily the capacity of NGSO systems like Amazon Leo and increases operational costs. We therefore welcome the opportunity to work with RSM to explore modernization of EPFD at the ITU, unlocking the vast position of NGSO systems while continuing to protect GSO operations.

NGSO and NGSO Sharing: NGSO FSS systems share spectrum with other NGSO FSS systems through good-faith coordination as required under Article 9.12 of the ITU Radio Regulations. NGSO operators typically employ technical mitigation strategies including dynamic beam steering, adaptive coding and modulation, frequency coordination, and spatial diversity to minimize interference between systems. The coordination priority between NGSO systems is generally established by the date of ITU filing receipt, following a first-come, first-served principle, though bilateral coordination agreements between operators often establish mutually acceptable sharing arrangements that account for the specific technical characteristics of each system.

C. Technical Options for Sharing - Option 1 (Questions 26-31)

26. 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.

Amazon LEO recognizes the benefits of Option 1's geography-based approach in minimizing coordination complexity and enabling both FSS and Mobile Services to deploy and operate quickly with clear geographic separation. The drawback of Option 1, however, is that it does not maximize spectrum efficiency, as it precludes the deployment of new FSS gateway sites in Urban Areas and High Urban Accessibility areas, which could potentially coexist in those areas with IMT under appropriate technical conditions. FSS gateway earth stations require robust, high-capacity fiber connectivity to the internet backbone and core network infrastructure, which are most readily available in metropolitan areas, making urban deployment essential for optimal network performance and service quality.

For this reason, and as discussed further below in response to Questions 32-36, Amazon Leo supports Option 2 with the recommendation that coordination feasibility be assessed by the Approved Regulatory Engineer. This approach would enable more efficient spectrum use, maintaining appropriate protections for both FSS and Mobile Services through technical coordination procedures, and minimize coordination complexity.

27. 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?

Amazon Leo does not object to using the Statistics New Zealand area accessibility criteria to delineate Part A and Part B, as it is a national standard used by government bodies for regional planning and resource allocation. Use of this existing, clearly-defined governmental boundary database would reduce RSM's administrative burden and eliminate uncertainty for both FSS and IMT operators.

28. 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.

Amazon Leo does not oppose RSM's proposal to not allow L-ESIMs in Part A of Option 1 in the Lower 28 GHz band (*i.e.*, 27.5-28.35 GHz).

29. To facilitate the use of the Mobile Service in accordance with Option 1, do you have any suggestions on how RSM could implement coordination of mobile BSs with FSS (Earth-to-space) GSO and NGSO gateways and user terminals? In particular, which coordination trigger and methodology should RSM use (including any relevant reasons)?

Amazon Leo supports Option 2 for coordination between FSS and Mobile Services in the Lower 28 GHz band. This approach maximizes spectrum efficiency while maintaining appropriate protections for both services through technical coordination procedures.

Under Option 1's geographic separation approach, coordination would be necessary in Part A areas to ensure Mobile Service does not interfere with grandfathered FSS gateways and vice versa.

Protecting FSS Gateways. To protect FSS gateways, we recommend using a coordination contour based on an interference power threshold. An example coordination methodology includes ITU-R Recommendations S.1586/S.1587, designed specifically for this coordination scenario between FSS earth stations and terrestrial services. The protection criteria can be the minimum required Carrier-to-Interference Ratio (C/I) or permissible interference level at the FSS gateway receiver.

Additionally:

- The coordination contour can be defined as an area where a new Mobile Service base station interference exceeds an agreed-upon protection level (*i.e.*, the coordination trigger). A Mobile Service base station outside this contour is licensed without coordination, while one inside requires coordination with the FSS gateway operator to demonstrate compliance.

- For the coordination trigger, the change in the noise temperature of the FSS receiver ΔT/T is an established metric (*see* ITU-R S.748). ΔT is calculated as the equivalent noise temperature rise at the FSS gateway receiver due to Mobile Service interference, and T is the FSS gateway system noise temperature. This trigger helps calculate the coordination distance to protect FSS gateways.

- The coordination calculation must use the highest gateway gain towards the horizon. Standard ITU-R patterns such as ITU-R S.465 or an operator value towards the horizon can be used.

- Since L-ESIMs are excluded from the Lower 28 GHz band and A-ESIM and M-ESIM are subject to Resolution 123, coordination is not required for these terminals under Option 1.

- The Mobile Service average value antenna pattern should be used in coordination to account for gain fluctuations of the phased array. For instance, the average value from ITU-R M.2101 can be used when the Mobile Service base station serves a user equipment in an off-axis direction not co-located with the gateway.

Protecting Mobile Services. To protect Mobile Services, we recommend calculating Power Flux Density ("PFD") contours using in-band horizon Effective Isotropic Radiated Power ("EIRP") from the FSS gateway, considering ITU-R P.452 and applicable clutter, and whether the site has shielding or not, with a PFD contour threshold of -91 dBW/m²/MHz (ACMA RALI MS 46).

Additionally:

- Should the PFD contour intersect with any Mobile Service base station in an area where an FSS gateway needs to coordinate with a Mobile Service that has service priority and must be protected, the FSS operator must enter coordination with the Mobile Service operator to demonstrate compliance.

- Should the Mobile Service and FSS gateway not be in-band, an off-axis EIRP such as the ETSI 303 699 value (-35 dBW/MHz) can be used to compute the PFD threshold.

- The Mobile Service average value antenna pattern should be used in coordination to account for gain fluctuations of the phased array. For instance, the average value from ITU-R M.2101 can be used when the Mobile Service base station serves a user equipment in an off-axis direction not co-located with the gateway.

30. *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.*

Amazon Leo supports Option 2 to maximize spectrum utilization in the 27.5-28.35 GHz band. This approach enables more efficient use of spectrum resources while maintaining appropriate protections for both FSS and Mobile Services through technical coordination procedures.

If Option 1 is selected, we agree with not allowing Mobile Service in Part B areas, as this approach honors RSM's intent to preserve use of this band for FSS uplink outside of Urban Areas and High Urban Accessibility Areas.

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

Should Option 1 be selected, Amazon Leo urges the RSM to include a "Critical Infrastructure Exception" for Part A areas that would allow for the grant of pending, but not-yet-approved, applications for FSS gateway licenses subject to an ultra-stringent coordination trigger of $\Delta T/T \leq 1\%$.

FSS operators have made significant investments in site planning, infrastructure development, and network architecture around these pending sites. Precluding these pending applications

would result in substantial sunk costs and force FSS operators to redesign their networks with potentially suboptimal site locations that may lack the necessary fiber infrastructure.

An exceptionally high coordination trigger of ΔT/T ≤1%—compared to the typical 4-6% threshold—means the FSS operator assumes nearly the entire burden of ensuring coexistence with Mobile Services, while also retaining a pathway for the RSM to grant pending applications for FSS gateway infrastructure in Part A areas.

D. Technical Options for Sharing - Option 2 (Questions 32-36)

32. 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.

Amazon Leo agrees 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. This approach maximizes spectrum efficiency while maintaining appropriate protections for both services through technical coordination procedures.

Option 2 enables FSS gateway deployment in areas with optimal fiber infrastructure—which are most readily available in metropolitan areas—while ensuring coexistence with Mobile Services through established coordination methodologies. This approach is superior to Option 1's geographic exclusivity, which would preclude deployment of new FSS gateway sites in Urban Areas and High Urban Accessibility areas, even where coexistence is technically feasible.

Amazon Leo recommends that coordination feasibility be assessed by the Approved Regulatory Engineer, as discussed in our response to Question 29. This approach maintains appropriate protections for both FSS and Mobile Services while enabling more efficient spectrum use and minimizing coordination complexity.

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

Amazon Leo recommends that FSS and Mobile Service operate co-primary in Major and Large Urban Areas, and that FSS receive priority in Medium and Small Urban Areas, as well as all Urban Accessibility Areas.

This approach ensures adequate protection for Mobile Service where user demand for high-capacity 5G services is the highest, while providing critical FSS gateway infrastructure sites priority access to Medium and Small Urban Areas with high-capacity fiber connectivity to the internet backbone and core network infrastructure, as well as priority access to Urban Accessibility Areas. FSS exclusivity (or near-exclusivity) in these areas drastically simplifies the licensing process for new FSS gateways. Coordination in Major and Large Urban Areas where Mobile Service and FSS operate on a co-primary basis could simplified by allowing coordination feasibility to be assessed by the Approved Regulatory Engineer, eliminating complex continuous coordination with Mobile Service operators.

34. How would you recommend RSM to calculate the coordination zones described in Part A and Part B of Option 2?

Amazon Leo recommends the following methodology for RSM to calculate coordination zones in Part A and Part B of Option 2:

Protecting FSS Gateways. We recommend using ΔT/T (4-6%) as the coordination trigger, representing the noise temperature rise at the FSS gateway receiver due to unwanted emissions from Mobile Service interference, consistent with ITU-R S.748. The coordination zone calculation should use ITU-R P.452 propagation models to account for terrain, tropospheric scatter, and clutter loss, apply the off-axis antenna pattern of the FSS gateway toward the horizon (such as ITU-R S.465), and use the ITU-R M.2101 average pattern value for Mobile Service antennas to account for gain fluctuations in phased arrays.

In Part A areas where Mobile Service and FSS have equal priority, Amazon Leo recommends calculating the coordination contour for every grandfathered and new FSS gateway. A Mobile Service base station should demonstrate it will not exceed the ΔT/T threshold, and both services must coordinate to ensure mutual protection.

In Part B areas where FSS has priority, Amazon Leo recommends calculating the exclusion zone around FSS gateways. A Mobile Service operator in Part B must demonstrate its base station is outside the FSS coordination contour; otherwise, it must enter technical coordination with the FSS operator (or Approved Regulatory Engineer, as Amazon Leo proposes) to meet protection criteria.

Protecting Mobile Services. In Part A areas, we recommend calculating PFD contours using in-band horizon EIRP from the gateway, considering ITU-R P.452 propagation models and applicable clutter, and whether the site has shielding or not, with a PFD contour threshold of -91 dBW/m²/MHz (ACMA RALI MS 46). Should the PFD contour intersect with any Mobile Service base station in an area where a gateway needs to coordinate with Mobile Service that has service priority and must be protected, the FSS operator (or its Approved Regulatory Engineer, as Amazon Leo proposes) should be required to coordinate with the Mobile Service operator to demonstrate compliance.

For non-in-band scenarios, an off-axis EIRP such as the ETSI 303 699 value (-35 dBW/MHz) could be used to compute the PFD threshold. The Mobile Service average value antenna pattern (ITU-R M.2101) should be used in coordination to account for gain fluctuations of the phased array, particularly when the Mobile Service base station serves user equipment in an off-axis direction not co-located with the gateway.

In Part B areas, Amazon Leo agrees with RSM's proposal to allow Mobile Service on a secondary basis, operating at its own risk and accepting any future interference.

35. *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.*

Amazon Leo recommends the following licensing conditions be included as part of Option 2 to facilitate efficient spectrum sharing between FSS and Mobile Services in the Lower 28 Ghz band:

Commercial Information

Simplified Renewal and Certification Process. The licensing process should include an automatic renewal mechanism (*e.g.*, every five years) provided no technical changes are made to the terminal specifications. Additionally, the licensing condition should be shifted from individual terminal operation to a "License to Import/Supply" model, so once the terminal model is licensed, the operator simply records the number of terminals supplied under the blanket license. This approach aligns with international best practices and enables rapid deployment while maintaining regulatory oversight.

Technical Compliance Requirements. The license should require that A-ESIM/M-ESIM terminals are compliant with ITU-R Resolution 123 when operating in the Lower 28 GHz band (*i.e.*, 27.5-28.35 GHz). This ensures that aeronautical and maritime ESIM terminals meet internationally recognized technical standards for coexistence with terrestrial services.

Coordination Exemption for A/M-ESIMs. RSM should explicitly state that A/M-ESIM are exempt from site-by-site coordination with terrestrial services. Given the transient nature of these terminals, their compliance with ITU-R Resolution 123, and their adherence to PFD limits in the Lower 28 GHz band, requiring individual coordination would be impractical and unnecessary. The dynamic mobility of A-ESIM and M-ESIM, combined with their adherence to international technical standards, ensures minimal interference risk to terrestrial Mobile Services.

36. *Would you like to see any additional technical conditions which facilitate sharing for Parts A and B of Option 2? Describe in detail, the changes you would want to make to this proposal.*

Amazon Leo strongly recommends that coordination be assessed by the Approved Regulatory Engineers rather than requiring direct operator-to-operator coordination. This approach would significantly facilitate spectrum sharing in both Part A and Part B of Option 2.

Operator-level coordination can be protracted and complex, often involving business negotiations that extend well beyond technical feasibility assessments. By contrast,

coordination conducted by qualified Approved Regulatory Engineers focuses purely on technical compliance with established protection criteria (such as ΔT/T thresholds for FSS gateways and PFD limits for Mobile Services).

An Approved Regulatory Engineer can independently assess whether a proposed FSS gateway or Mobile Service base station meets the technical coordination requirements outlined in our response to Question 34, calculate coordination contours using standardized methodologies (ITU-R S.1586/S.1587, ITU-R P.452, etc.), and certify compliance with protection criteria. This streamlines the licensing process and removes unnecessary delays associated with commercial negotiations between operators.

E. ESIM Use in Lower 28 GHz (Questions 37-39)

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

Amazon Leo supports the application of ITU-R Resolution 123 (WRC-23) to A-ESIM and M-ESIM operations in the Lower 28 GHz band. Resolution 123 provides a comprehensive technical framework that enables ESIM operations while protecting terrestrial services.

Importantly, Resolution 123 allows for gate-to-gate ("G2G") and port-to-port ("P2P") operations when complying with specified technical and operational requirements. Annex 1, Part 2 of Resolution 123 establishes separate PFD limits for Ka-band A-ESIM operations above and below 3 km altitude, with stricter limits for operations at lower altitudes. This altitude-based approach enables A-ESIM to operate throughout all phases of flight, including takeoff, landing, and ground operations, provided they comply with the applicable PFD limits for their operational altitude.

Similarly, for M-ESIM operations, Resolution 123 allows for operation 70 km or greater from the coast in compliance with EIRP limits set in Annex 1, Part 1 of Resolution 123, as well as operation within 70 km of the cost with the prior agreement of the State(s) concerned. New Zealand has the option therefore under Resolution 123 to allow P2P service and can apply the M-ESIM EIRP limits specified in Annex 1 to such operations to protect co-frequency terrestrial services.

Amazon Leo accordingly recommends RSM enable the full flexibility provided by Resolution 123, including authorization of G2G A-ESIM operations and P2P M-ESIM operations. The technical safeguards established in Resolution 123 provide adequate protection for terrestrial Mobile Services while enabling essential connectivity services for aviation and maritime sectors.

38. 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?

Commercial Information

39. 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.

Amazon Leo does not have additional recommendations at this time.

III. Response to Questions Regarding Upper 28 GHz Band (28.35-29.5 GHz)

A. Proposed Spectrum Uses and Interference Considerations (Questions 40-43)

40. Do you agree with RSM's proposed new spectrum uses outlined in Section 3.1? If not, provide details on the modifications you wish to seek with appropriate reasoning.

Amazon Leo agrees with RSM's proposed new spectrum uses for the 28.35-29.5 GHz ("Upper 28 GHz") band as outlined in Section 3.1. We particularly commend RSM for its forward-looking approach in enabling L-ESIM operations throughout New Zealand. This will facilitate the deployment of innovative mobility applications, including connectivity for vehicles, trains, and other land-based platforms, bringing the benefits of ubiquitous satellite broadband to customers across the country.

For the reasons explained in response to Question 43, below, Amazon Leo urges RSM to clarify that Annex 1 to Resolution 123 does applies only to ESIM operations in the Lower 28 GHz band—and not to ESIM operations above 28.35 GHz.

41. 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?

Simulations demonstrate that adjacent channel harmful interference from NGSO L-ESIM operating in 28.35-29.5 GHz to Mobile Services operating in 27.5-28.35 GHz is inconsequential.

Representative simulation scenarios depict Mobile Service typical capacity loss of less than 0.3%, with a very small percentage of links observing up to 1.15% capacity loss. Typical signal-to-interference-plus-noise ratio ("SINR") loss due to adjacent band L-ESIM interference is very small, with most links experiencing close to 0.03 dB SINR loss.

These simulation results demonstrate that L-ESIM operations in the Upper 28 GHz band (28.35-29.5 GHz) can coexist with Mobile Service operations in the lower 28 GHz band (27.5-28.35 GHz) without causing harmful interference. The minimal impact on Mobile Service capacity and SINR performance supports the authorization of L-ESIM operations in 28.35-29.5 GHz, particularly in non-urban areas where spectrum sharing conditions are even more favorable.

42. 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.

To ensure that future L-ESIM use is not constrained in 28.35-29.5 GHz while protecting Mobile Service receivers in 27.5-28.35 GHz, Amazon Leo recommends technical conditions consistent with **U.S. 47 C.F.R. § 25.202(f) emission limits, ITU-R SM.1541 out-of-band emission limits,** and **ETSI 303 699 off-axis spurious emission limits**. These standards have been extensively validated and provide appropriate protection mechanisms.

Combined with the minimum 30° elevation angle requirement proposed by RSM, these technical conditions ensure that L-ESIM operations in 28.35-29.5 GHz will not cause harmful interference to Mobile Service receivers in the adjacent 27.5-28.35 GHz band, while allowing L-ESIMs to operate without unnecessary constraints.

43. 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?

New Zealand's Cabinet made the decision in August 2023 to allocate the 28.35-29.5 GHz frequency range primarily for satellite services. P2P M-ESIM should therefore be allowed in the Upper 28 GHz band, in addition to G2G A-ESIM and L-ESIM.

Additionally, RSM should not apply Annex 1 technical conditions from ITU-R Resolution 123 to ESIM operations above 28.35 GHz. Annex 1 technical conditions were specifically designed to protect co-frequency terrestrial service operations. Since there will be minimal, if any, co-frequency terrestrial services operating in the Upper 28 GHz band, these constraints are unnecessary and would inappropriately limit satellite service deployment in New Zealand.

Adjacent band co-existence is achieved by applying the PFD limits only to ESIM unnecessary emissions and not to in-band emissions. We therefore recommend adopting only technical requirements consistent with U.S. 47 C.F.R. § 25.202(f) emission limits, ITU-R SM.1541 out-of-band emission limits, and ETSI 303 699 off-axis spurious emission limits.

B. Licensing Arrangements (Questions 44-45)

44. 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?

Amazon Leo agrees with RSM's proposed licensing arrangement to license FSS (Earth-to-space) NGSO gateways operating in the 28.35-29.5 GHz band through the radio licensing framework with technical and operational policy guidelines similar to those contained in PIB 38 and PIB 58.

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

Commercial Information

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

Amazon Leo agrees with RSM's proposed approach to 29.5 – 30 GHz.

IV. Additional Questions

47. Do you agree with RSM's proposed approach to 17.7 – 20.2 GHz? If not, what modifications would you suggest to our proposal?

Amazon Leo appreciates RSM's recognition of the importance of the 17.7-20.2 GHz band for FSS (space-to-Earth) operations and supports RSM's proposal to update licensing rules to allow receive protection for individually licensed FSS gateway earth stations, fixed user terminals, and ESIM in certain locations, and otherwise permitting use on an opportunistic basis. Amazon Leo encourages RSM to expand its approach to include the adjacent 17.3-17.7 GHz band for FSS (space-to-Earth) use on a co-primary basis, consistent with international allocations in ITU Regions 1 and 2. The 17.3-17.7 GHz band is already allocated to FSS (space-to-Earth) on a primary basis in ITU Regions 1 and 2, and this allocation has proven successful in facilitating satellite broadband services globally without causing harmful interference to terrestrial services.

As part of WRC-27 Agenda Item 1.4, ITU Member States will consider a new primary space-to-Earth allocation to FSS in the 17.3-17.7 GHz band in Region 3. This agenda item reflects growing international recognition of the importance of this spectrum for modern NGSO

satellite systems. For example, in 2024, the Permanent Consultative Committee II (PCC.II) of the Inter-American Telecommunication Commission (CITEL) adopted Recommendation 69, which recommends that Member States "facilitate the regional adoption of the use of the frequency band 17.3-17.7 GHz in the space-to-Earth direction for the operations of geostationary and non-geostationary satellite systems in the FSS." And in Europe, the European Conference of Postal and Telecommunications Administrations (CEPT) has likewise authorized ESIM operations in the 17.3-17.7 GHz band through ECC Decision 15(04), demonstrating that FSS use of this spectrum can coexist with terrestrial services when appropriate technical conditions are applied. Indeed, studies by CEPT have concluded that ESIM operations in this band "should not raise any additional interference concern" beyond that presented by uncoordinated FSS earth stations.

By allocating the 17.3-17.7 GHz band to FSS (space-to-Earth) on a co-primary basis now, RSM would:

- Align with international best practices and facilitate harmonization with ITU Regions 1 and 2;
- Position New Zealand as a leader in advance of WRC-27 discussions on this allocation for Region 3;
- Provide regulatory certainty for satellite operators who are designing systems years in advance of deployment, enabling timely investment and service rollout;
- Expand capacity for NGSO FSS systems to deliver high-speed, affordable broadband to customers in New Zealand, particularly in rural and remote areas; and
- Support innovative services including ESIM applications for land, maritime, and aeronautical use cases.

Amazon Leo respectfully requests that RSM include the 17.3-17.7 GHz band in its FSS allocation framework with similar licensing arrangements as proposed for the 17.7-20.2 GHz band, including the option for receive protection licenses for individually licensed FSS gateway earth stations, fixed user terminals, and ESIMs at specific locations.

V. Conclusion

Amazon Leo is grateful for the opportunity to provide comments in response to this consultation, and welcomes further dialogue with RSM on these important issues.

Respectfully submitted,

/s/ Madeleine M. Lottenbach

Madeleine M. Lottenbach
Senior Lead, Licensing & Regulatory Affairs
Amazon Leo
On behalf of Amazon Kuiper New Zealand Limited