CSSMA

Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
Wellington 6140
via email: Radio.Spectrum@mbie.govt.nz

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COMMENTS OF

COMMERCIAL SMALL-SATELLITE SPECTRUM MANAGEMENT ASSOCIATION

RE-PLANNING OPTIONS FOR FREQUENCY BANDS WITHIN 1710-2300 MHZ

Dear Sir/Madam,

The Commercial Smallsat Spectrum Management Association ("CSSMA") respectfully submits these comments in response to the consultation on Re-planning options for frequency bands within 1710-2300 MHz (the "Consultation") issued by the Radio Spectrum Management ("RSM").

CSSMA's membership includes many of the leading operators, ground station service providers, manufacturing and component providers, and other service providers in the small satellite ("smallsat") industry. CSSMA seeks to create the conditions for a coordinated, transparent, and expedited spectrum coordination process among commercial smallsat spectrum users, government users, and other satellite and terrestrial users and to advocate and represent the members' views on spectrum management and other policy matters that affect the smallsat community.

CSSMA thanks RSM for including the space industry in this consultation, and applauds the agency for taking a globally leading position in allocating spectrum for space operations. In

the past fiscal year, the space industry contributed $1.7 billion to the New Zealand economy,[1] and the CSSMA seeks opportunities for greater representation in New Zealand to promote this global investment locally.

In response to the RSM Consultation and specific questions asked, the CSSMA is pleased to provide a consolidated position by smallsat operators below, including a general comment.

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1. Do you agree with the RSM proposal to use the 1800 MHz duplex gap (1785-1805 MHz) for radio microphones? If not, what is a better use of this block of spectrum?

No comment

2. What size guard band would be appropriate for achieving compatibility between radio microphone use and mobile networks operating below 1785 MHz and above1805 MHz?

No comment

3. Do you agree with RSM's proposal to postpone a decision on the Unpaired 2000 MHz band (2010-2025 MHz) until there is clarity on international harmonised use for the band? If not, what is the best value use for this band?

[1]See https://www.beehive.govt.nz/sites/default/files/2019-11/Deloitte%20NZ%20Space%20Economy%20Report.pdf

CSSMA does not support the proposal to postpone a decision on the Unpaired 2000 MHz band. Rather than hold the band closed, an opportunity exists for RSM to contribute to the international determination of the value of the band by inviting MSS operations as envisioned by Agenda 1.18 to conduct short-term licensed trials in the band. Many MSS narrowband services are being rapidly rolled-out in these bands in the coming year, including some by CSSMA members. This makes good use of the band in the interim, and would serve to inform the Agency of the longer term interest in the band's occupation. Such an assignment can then be reconsidered at a later date, when there is further clarity from the results of international efforts on this front. That said, CSSMA is pleased to see RSM's position in potentially supporting the deployment of narrowband MSS, and notes that some members have a keen interest in deploying their narrowband service within New Zealand.

The CSSMA generally supports this allocation of spectrum, and encourages RSM to base their decision on the results of WRC-23 Agenda Item 1.18.[2] However, the CSSMA also cautions against the allocation of the Unpaired 2000 MHz band to traditional MSS services, which have in the past resulted in subleasing the spectrum to terrestrial operators. This subleasing benefits neither the public or the funding of government initiatives through spectrum auctions.

CSSMA suggests that RSM, as an interim measure, make a portion of this spectrum available to MSS narrowband services that are likely to deploy in the coming year. Longer term licenses have proven to be ineffective in motivating productive use. For instance, in 2009 the European Commission awarded two operators exclusive rights to S-Band spectrum.[3] To this day,

[2] See https://www.itu.int/en/itunews/Documents/2019/2019-06/2019_ITUNews06-en.pdf
[3] See https://op.europa.eu/en/publication-detail/-/publication/8c16d4d9-d6b5-479f-8c45-af1402515fca/language-en

half the spectrum appears stagnant and the other half was used to deploy the European Aviation Network (EAN) in 2018 rather than a MSS.

Furthermore, an interim limit of one (1) year is feasible to deploy MSS narrowband services. The design cycle for smallsats can often be 12 months or less, and with access to spectrum, several operators within the CSSMA could provide service rapidly.

Therefore, the CSSMA proposes that the 2010 – 2025 MHz band be made available, on an interim and temporary basis to bi-directional narrowband MSS services, and not traditional MSS, until the conclusion of the ITU study cycle.

4. Do you agree with RSM's proposal to use the lower portions of the Paired 2200 MHz band (2025-2081.5 MHz and 2200-2256.5 MHz) available for fixed links to enable clearing of the 'L' and 'LL' bands (1427-1524 MHz)?

CSSMA is concerned that the proposal to make the lower sub-band available for fixed link wireless will have a negative impact on critical space operations in New Zealand.

The lower sub-band is heavily used by small satellites for telemetry, tracking, and control (TT&C); in fact, more so than the upper sub-band.[4] CSSMA is concerned whether incumbent space operators will be forced to operate on a non-interference basis. Although satellite-based interference is generally negligible, fixed operations can easily cause or receive interference directly with space operations ground stations.

[4]See Space Network Systems Online, *Frequency distribution for non-geostationary space stations.* URL:https://www.itu.int/online/sns/freqtest.sh?ie=y&plan_id=&categ=N&l1=180&l2=180&jv=18&fr1=2200&fr2=2290&iv=90

If members of CSSMA were forced to operate on a non-interfering basis, regular operations would be severely threatened, and alternative remedies in New Zealand to operating in the sub-band are not tenable.

For instance, it would cause considerable disruption to the operation of satellites if CSSMA members were forced to change frequencies only for ground stations in New Zealand. Not only would every satellite need to be altered to communicate on a different frequency when communicating to New Zealand ground stations, but each satellite would also need to be programmed to change frequencies depending on what ground station was in range.

Moreover, global systems selecting and coordinating their space operation frequencies should not be met with a wall if their mission objectives find that a southernly high-latitude control station in New Zealand is optimal for their circumstances. CSSMA notes that hundreds of systems operate in these bands in the US alone, many of which are (or will be) positioned in highly inclined orbits. Many CSSMA members also have operations in this band, and must work carefully to select ideal sub-bands so as to coordinate with operators around the world. Restricting half of the band in an otherwise ideal location for commanding to highly inclined satellite orbits places great strain on this process.

As discussed by RSA in the Consultation, overall traffic is expected to increase in this band as well. CSSMA notes that such traffic will be dependent not only on the number of new unique networks, but also on the number of deployed satellites in aggregate. A single system with thousands of satellites will need more spectrum and transmission time to conduct TTC operations purely based on the number of links that need to be established on a regular basis.

Use of the 2025-2110 MHz band for fixed wireless links is in line with the ITU allocation table, however, the ITU allocates these bands to space operations on a primary basis and previously recognized the importance of space operations in the band, stipulating that future high-density land systems would cause unacceptable interference.[5] The ITU therefore recommended phasing in only low density land systems into the band in a way that would limit their aggregate interference levels on existing space operations.

Furthermore, the nature of fixed wireless not only means that it is typically used in low density areas, but also that interference patterns are predictable. New operators will have the opportunity to position their operations to minimize the interference caused to existing satellite ground stations, but also protect themselves from interference. One possibility would be the use of exclusion zones around ground stations, as proposed by Great South and Rocket Lab.

CSSMA is therefore concerned about the considerable negative impact of opening the sub-band to fixed wireless, and therefore recommends to RSM that if the lower sub-band is opened, that space operations be granted priority rights. This would preserve the functioning of space operations systems in the local areas they are specifically deployed, yet enable the use of fixed systems elsewhere in the country.

5. Do you agree that the proposed channel plan for fixed links in Figure 1 would be adequate to transition those affected licenses in 'L' and 'LL' fixed link bands? If not, why not?

No comment

[5] See ITU Recommendation SA.1154-0-199510.

6. Do you agree that the proposed channel plan for fixed links could also accommodate short-term licenses that may or may not align with the channel raster on a case-by-case basis and are subject to coordination with fixed links for TV outside broadcasts of major events and for space operation?

CSSMA is concerned with the practicality of short-term licenses in the proposed channel plan for fixed link wireless. Even if an operator wishing to communicate with a satellite applied for a short-term license, they would ultimately not be able to successfully coordinate if the band is too densely occupied by primary users.

As previously mentioned, the ITU maintains a recommendation that the entire 2025-2110 MHz spectrum is allocated to space operations to avoid coordination issues on the lower part of the spectrum.[6]

7. Are there better uses for the lower portions of spectrum in the Paired 2200 MHz band? If so, what?

CSSMA believes that expanding the dedicated band for Space operations to the entire 2025-2110 MHz band would be the best use, considering the long investment and use of the band for space operations, including both government civil and military agencies, as well as commercial companies.

As previously discussed, the lower sub-band is heavily used by small satellites for telemetry, tracking, and control (TT&C), more so than the upper-band.[7] If RSM expanded its

[6] See *Id.*

[7] See *supra*, at note 4.

globally leading dedicated band for space operations to the entire 2025-2110 MHz range, it would increase the incentive for more operators to choose New Zealand over other jurisdictions.

8. Do you agree with RSM's proposal to reserve 2081.5-2110 MHz and 2256.5-2290 MHz exclusively for space operation in New Zealand? If not, why not?

CSSMA applauds RSM's globally leading proposal to create a dedicated band for space operations, nearly always used for critical satellite control functions. However, the exclusive dedication does not make up for the larger issue raised when space operations is excluded from the lower section of these bands. Many global systems, through coordination of their system's frequencies, will be forced to choose between having a well-coordinated sub-band in the lower section that works elsewhere, or having a ground station in such a geographically advantageous location as New Zealand. The Agency prudently observed the rapid recent growth in these bands for space operations and the surge in new satellite deployments around the world when it made its proposal to dedicate the upper portion of these bands to space operations. However, in consideration of the above, good cause is shown to ensure that the proposed dedication to the space operations service in the upper part of the band must not be made as a trade-off for excluding space operations from the lower part of the band. Doing so would unduly harm those systems with operations in the lower part of the band that cannot accompany this restriction globally. CSSMA believes that the most appropriate use of the band is thus a full primary allocation to space operations across 2200 – 2290 MHz, with dedicated operations implemented in the upper half as proposed by RSA. This best ensures the operability of the frequency and attractiveness of New Zealand as an ideal location to establish these essential facilities.

9. Do you agree that the reserved spectrum would be adequate to support the growing demand in space activities?

CSSMA is concerned with any limitation on space operations that is out of sync with ITU allocations. Many countries have followed the ITU in allocating the entire 2025 - 2110 MHz band to space operations. Furthermore, as referenced previously, the lower sub-band is more heavily used by small satellites for telemetry, tracking, and control (TT&C).[8] Therefore, CSSMA reiterates its suggestion to expand dedicated space operations to the entire band on a primary basis.

10. Is there a better use for the spectrum between 2081.5-2110 MHz and 2256.5-2290 MHz? If so, what?

CSSMA values the use of the spectrum in the entire band, both in New Zealand and across the globe. Continued space operation in this band would be in harmony with both ITU and other government allocations.

11. Do you agree with the proposal to use 10 MHz guard bands in the frequency range 2290-2300 MHz?

CSSMA reiterates the general suggestion to keep allocations in sync with ITU recommendations. For instance, the range 2290-2300 MHz is allocated by the ITU for space research and deep space communication. If RSM were to preserve this band, there would be potential for future use by space operators. However, we acknowledge that dense use of the band

[8] See *supra*, at note 4.

above 2300 MHz could plausibly cause interference, and justifies the assignment of the guard band as proposed.

12. What is the best value use for the Paired 2100 MHz band expansion?

The CSSMA sees four potential options that have competing interest in the band. These are traditional MSS service, an aviation network similar to the EAN, terrestrial mobile broadband and narrowband MSS. Traditional MSS, which describes the use of satellites to provide voice or broadband internet services, have long remained underutilized. While operators in North America enjoy a monopoly on this spectrum, operators in Europe have been awarded a duopoly. The argument given in favor of these awards was that they would incentivize greater investment in the deployment of MSS networks.

After years of the spectrum laying stagnant, and the inability of other operators to use it due to licensing restrictions, the general public have seen no material benefit from this highly valuable spectrum. Rather than providing affordable connectivity, the handful of operators that control these bands have only either sublicensed the spectrum to terrestrial mobile operators, built terrestrial networks for servicing aviation, or have done very little aside from launching satellite assets for the purposes of protecting their licenses.

As these satellite licenses are typically awarded at a fraction of the cost of auctions for terrestrial mobile licenses, tax revenue and the general public benefit are circumvented when the satellite operator eventually subleases the spectrum. Sadly, the cost of mobile service to the end user does not reflect the use of this loophole, and the end effect is merely the enrichment of the few. Given

this, the CSSMA would encourage RSM to use the lessons learned from other administrations and steer clear of allocating the band to traditional MSS services. In addition, we further describe RSA's specific alternate proposals for the band below.

Aviation-based networks

The buildout of an aviation network using terrestrial-based stations would not be well suited to New Zealand's geography. The EAN is a technically-viable solution for Europe given the large population density over a relatively large geography. This translates into a high density of aircraft that in turn are always visible to a tower on the ground. Given New Zealand's remote and isolated geography, a large portion of international aircraft would have access to such a network for a fraction of their flight time at best before having to hand over to a satellite-based network. As a result, domestic and international aircraft would be far better served with satellite connectivity alone. It is generally optimal for this connectivity to be provided in Ku- or Ka-band as these ranges allow for greater throughput. Numerous companies already exist that presently provide such services, or that plan to roll out new systems in the near future.

Part of the decision process should also reflect upon the ability of a service to be provided in other portions of the radio spectrum. In this instance the 2100 MHz band is particularly well suited to narrowband MSS, due to the size and power requirements of user terminals envisioned for IoT-type deployments. The same is inherently not true for aircraft-based broadband where the power and terminal size requirements are greater. Given the low adoption rate of the EAN by carriers, the CSSMA would thus discourage RSM from allocating this band to an aviation network and

instead encourage such services to be sought at higher frequencies where passengers could enjoy greater throughput with existing technology.

Mobile broadband

To the extent that the public, particularly in rural areas, should benefit from the outcomes of this proposal, the use of the 2100 MHz Band expansion for mobile broadband does not represent the best use case. The capability of current mobile broadband services to meet the intensive demand in dense urban areas indicates that the complete servicing of lower-traffic rural areas will not require any more spectrum resources than are already assigned. Thus, an expansion of spectrum would not necessarily carry a benefit to the support of rural mobile broadband operations. This spectrum is thus better left for a use case that must inherently operate in rural areas, such as narrowband MSS.

Narrowband MSS

Narrowband MSS is not a new development, however it is seeing renewed interest with the advancements in small satellites. Several of the CSSMA's members are looking to, or have already, deployed satellites capable of efficiently moving small amounts of data on a global scale. All of them do so without having to fully deploy their entire constellations first. In general, they are capable of providing global coverage for delay-tolerant data immediately after the launch of a single satellite.

As it happens, the 2100 MHz band is something of a "Goldilocks" zone for smallsat IoT networks, given the inherent power and antenna size restrictions associated with small portable devices

needing battery lives well in excess of 5 years. In comparison to an aviation network, these devices would be unable to function effectively at higher frequencies such as Ku and Ka-band. Minimal rain fade within the 2100 MHz band also enables the closing of otherwise difficult link budgets, and is imperative after accounting for the limited gain and powers used by narrowband MSS devices.

The narrowband MSS market is readily addressable with little to no terrestrial infrastructure requirements. Market research agency *Northern Sky Research* estimates that 5.8 million satellite IoT devices will be deployed by 2023, and manufacturers will need to leverage existing economies of scale to ensure this demand can be met.[9] Fortunately, existing popularity of the band has resulted in greater commercial-off-the-shelf component availability which in turn has driven down costs.

While this band remains under study at the ITU, the CSSMA suggests that RSM open 5 MHz of paired spectrum for the development of narrowband IoT. This can be made available on an interim basis until further studies or public consultations have been conducted. As any such license would be provided on an interim basis, it would facilitate the development of technology and services within a currently unused band while not locking the RSM into any future commitments. Given all of the above, it is the CSSMA's belief that mobile broadband and narrowband IoT would best serve the needs of New Zealand's public.

Comment

[9] *See* Satellite Evolution Group, *M2M and the IoT: moving towards the IoE*, URL: http://www.satelliteevolutiongroup.com/articles/M2M-IoT.pdf (June 2016). *See also* EMEA Satellite Operators Association, *Internet of Things (IoT) and the Role of Satellites*, URL: https://www.esoa.net/cms-data/positions/1695%20ESOA%20IOT%20%20Sat%20Brochure%20Proof%204.pdf.

CSSMA would also like to take the opportunity to comment on a discrepancy in the original Consultation publication. On page 11, RSM refers to range 2081.5-2110 MHz as space- to-Earth, and 2256.5-2290 MHz as Earth-to-space. These allocations are in reverse assignment from the ITU allocation.

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In conclusion, CSSMA applauds RSM for taking a globally progressive leadership position in proposing a dedicated band for space operations, and suggests the RSM would benefit most by keeping its allocations in sync with ITU recommendations, while moving forward with its proposal to afford the upper half of the band to space operations exclusively to accompany future growth. CSSMA also voices concern about opening up the lower portion of the Paired 2200 MHz sub-band to disruptive use by traditional systems. In addition, actions taken to reserve the Unpaired 2000 MHz band provide no value at a time when such bands are being actively explored for MSS services across the world. CSSMA recommends that for this purpose, and in support of informing the discussion around Agenda item 1.18, that it at least permit short-term trials in the band for services such as narrowband MSS.

Respectfully Submitted

/S/ Nick Spina
Nickolas G. Spina
President - CSSMA