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9th May 2021

710-2300 MHz Discussion Document
Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
Wellington 6140

via email: Radio.Spectrum@mbie.govt.nz

Dear Sir/Madam,

UNCLASSIFIED

Submission: 24 - 30 GHz use in New Zealand Discussion Document

Great South wishes to thank Radio Spectrum Management for the opportunity to submit on the abovementioned document.

We would be pleased to speak in support of our submission.

Background

1. Great South (and Venture Southland before) has customers who have been actively using Ka-Band spectrum at Awarua Satellite Ground Station, and is anticipating significant growth in demand for this spectrum.
2. Great South's space operations forms the basis of a business generating in excess of $NZD 1.5 million per year in "weightless" exports that is forecast to continue to grow in coming years.
3. Great South continues to make efforts to establish a satellite ground station in the Far North of New Zealand, which we anticipate will also use 24 – 30 GHz spectrum, amongst others.
4. Uncongested and easy access to spectrum for space operations provides a remarkable strategic advantage to New Zealand in providing telecommunications to the space industry for space operations that is envied around the world. We appreciate efforts by RSM to facilitate this.
5. We have always found that the amateur radio service provides important and useful benefits, even though they are hard to quantify. We support any and all efforts to preserve and enhance that service.
6. Since 2008 we have taken an active interest in exploiting Southland's natural advantages for radio astronomy, and were actively involved in the Australasian bid for the Square Kilometre Array project.

Outcomes sought

Great South seeks:

1. That the satellite services are accommodated to be completely aligned with the ITU Radio Regulations.

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2. That an area of 10 km radius and preferable 40 km radius be established around Awarua Satellite Ground Station so that activities supporting all space telecommunications in Ka-Band Satellite Service bands are (1) primary service for uplink and downlink, (2) enjoy receive protection
3. Likewise for our proposed Far North station, once we have confirmed the site.
4. That radio astronomy receive protection be established in the vicinity of Otahu Flat, in the Waiau Valley (north of Tuatapere).
5. We very strongly support the retention of the current amateur radio usage in the 24 GHz band as it stands.

Background

Great South

Great South is the trading name for Southland Regional Development Agency Ltd, a council controlled organisation owned primarily by Invercargill City Council, Southland District Council, Gore District Council and Environment Southland. It replaces Venture Southland, which was a Joint Committee of Invercargill City Council and the Southland and Gore District Councils.

Amongst other things, Great South operates and hosts third-party satellite ground stations at Awarua, Invercargill and Lochiel in Southland for overseas customers, and is currently in the process of establishing other stations in Southland and in Northland. The Awarua station transmits and receives in Ka-Band (amongst other bands), and we expect the proposed Northland station to also use Ka-Band. We host a Starlink gateway at Awarua Satellite Ground Station.

Great South's space obligations

Venture Southland is the implementing authority on the New Zealand Government side of the *Arrangement between the European Space Agency and the Government of New Zealand on the Setting Up and Use of Telemetry and Tracking Facilities for the Purpose of the Agency's Launcher Programmes and Activities*, (Paris, 23 May 2007). Venture Southland's role is to be novated to Great South.

Venture Southland has entered into a number of International Trade in Arms Restrictions (ITAR) agreements with United States customers relating to space related technologies.

Great South's interest in the space sector

In conjunction with the French Space Agency (CNES), Venture Southland established the Awarua Satellite Ground station—between Invercargill and Bluff—between 2004 and 2008 to support the European Space Agency's (ESA) Ariane 5 ATV missions to resupply the International Space Agency from 2008 to 2014. ESA gifted the facilities to Venture Southland in 2008 as a way to encourage space development in New Zealand and since 2014 Venture Southland has hosted ground stations (antennas and electronics) for, amongst others, the world's best-known small-sat satellite operators.

In 2015 Venture Southland established a second ground station facility at Lochiel, between Invercargill and Winton, and then a UHF station in Invercargill to support Rocket Lab's launches. The disparate stations are required to resolve spectrum management issues in the UHF band.

All our customers are overseas based and our revenue will exceed $1.5 million in the coming financial year, noting that all our revenue comes from "weightless" exports. We have a full order book and expansion continues. To meet demand, we have begun further development of the Awarua Satellite Ground Station for which we have resource consent to erect 23 antennas.

Currently we have nine antennas of 2.7 metre or more aperture on the Awarua site, with another three 6 metre antennas under preparation and two antennas to be installed by the end of the year. We estimate that the value of the equipment at Awarua Satellite Ground Station exceeds $NZD 6 million, which would have contributed around $NZD 900,000 in GST collection as it entered the country.

In 2019 Great South was successful with the University of Auckland to gain Catalyst-Strategic funding to establish a Multi-mission Operations Centre in Invercargill. This will further enhance Great South's and New Zealand's space capability.

Great South holds the radio licences for our customers where appropriate.

Great South's relationship with Radio Spectrum Management

Venture Southland and then Great South has enjoyed a very cordial relationship with Radio Spectrum Management ever since 2004 when engineering work for the ESA ATV launch campaigns began. We have always found RSM to be helpful, friendly and accommodating; we are not surprised to find that this happy view is shared by those of our overseas colleagues who have also dealt with RSM.

Views represented

In preparing this submission we have conferred with our colleagues in Deutsche Zentrum für Luft- und Raumfahrt e.V (DLR), Kongsberg Satellite (KSAT), and Planet Lab. Each has significant and useful experience to share in space operations around the world.

Some (if not all) of these organisations are independently submitting on this discussion document.

Great South has also taken an interest in, and attended occasional meetings of the Commercial Smallsat Spectrum Management Association (CSSMA), which has helped shape our thinking.

Submission

Q1. What are the most likely use cases in New Zealand for mmWave based 5G services?

The limited reliable propagation range of millimetre wavelength microwaves means that it is unlikely to be deployed by network operators in rural (farmed) areas, other than at specific work areas with limited range. For example, an opencast mine would likely find mmWave 5G very useful to communicate around the site; we would likely find mmWave 5G useful for visiting engineers and our own engineers at our ground stations. That said, new generations of WiFi may be easier to use for these purposes as they will have less limitations imposed on their use by cellular network providers.

Q2. What are the likely use cases for Ka band satellite services in New Zealand in the short and long term?

Radio spectrum to communicate with LEO satellites is currently unstressed in New Zealand, with X-Band providing the mainstay for downloading payload data. However, it is clear from the IAF Space Operations Committee (in-person and more recently on-line) meetings we have been attending that Europe and USA are finding that X-Band is congested for space use and for this reason they are already beginning to migrate to Ka-Band for EO payload downloading. Also, new instruments on board Earth Observation spacecraft are generating ever more data to the point that it is becoming problematic to download in X-Band with its relatively restricted bandwidth. We envisage that over the next 5 to 10 years that Ka-Band will become very popular with satellite operators and we intend to support them from our stations. As for the terrestrial uses for this band, we see growth to the point that demand may well exceed supply for bandwidth. We see optical ground

stations to communicate with space craft to be sufficiently unreliable due to weather conditions to replace X- and Ka-Band for this use.

In addition, the upcoming Lunar Gateway, Artemis and Mars missions will use Ka-Band. We are in early discussions to support Lunar Gateway, so supporting deep-space missions is not an academic matter for us. Relatively weak signals likely to be received will need protection at ground stations.

As is already available in the public domain, we host a Starlink gateway and a Starlink TT&C ground station at Awarua SGS. Both use Ka-Band. This is not under any exclusivity arrangement and we envisage hosting other high-speed satellite gateways and ground stations, at Awarua and also at our proposed Far North station.

We expect that demand for using the Ka-Band bands for radio astronomy and amateur use will noticeably grow in coming years. As we have experienced—most noticeably in S-Band—as consumer products become available that operate at higher and higher frequencies, the prices of RF components are driven strongly down through commodification and strong competition. In particular, high performance Low Noise Amplifiers in S- and X-Band that were once prohibitively expensive have become relatively cheap and easy to use as the 3G and 4G consumer markets commoditised the components. There is still much to be learnt about propagation and anomalous behaviour of radio paths over longer distances at Ka-Band and amateur use will likely assist research in this area. We can expect the radio astronomers to likewise exploit Ka-Band for these reasons.

We are not experts in Earth Observation, but we do anticipate that with increased satellite use of radiometric and other imaging at Ka-Band, we can expect to see terrestrial use of the same frequencies to obtain *a priori* and reference data for calibration and supplementary services.

Because the developments in the space industry are now progressing very fast and because we are ourselves struggling somewhat to keep abreast of the developments in Ka-Band, in order to protect ourselves and our customers, our very strong preference for managing radio spectrum in Ka-Band for satellite services is that it is completely aligned with the ITU Radio Regulations for space services as primary services:

Satellite service	Frequency bands
Sensors	
Earth exploration-satellite (passive)[1]	22.21 – 22.5 GHz 23.6 – 24 GHz
Space research (passive)	22.21 – 22.5 GHz 23.6 – 24 GHz
Earth exploration-satellite (active)[2]	24.05 – 24.25 GHz
Uplinks	
Fixed-satellite (Earth-to-space)	24.65 – 25.25 GHz 27 – 27.5 GHz
Time signal-satellite (Earth-to-space)	25.25 – 27 GHz
Space Research (Earth-to-space)	22.55 – 23.15 GHz
Downlinks	
Earth exploration-satellite (space-to-Earth)	25.5 – 27 GHz
Space Research (space-to-Earth)	25.5 – 27 GHz

[1] Passive = passive sensors to monitor the Earth

[2] Active = active sensors like radars to monitor the Earth

others	
Inter-satellite	22.55 – 23.55 GHz 24.45 – 24.75 GHz 25.25 – 27.5 GHz
Amateur satellite	24 – 24.05 GHz

Q5. If not, do you think the existing fixed services should be allowed in the 26 GHz?

Only as a secondary, non-interfering service to space activities.

Q6. Do you agree New Zealand should allocate 24.25 - 27.5 GHz primarily for IMT use?

Space Services should be the primary service in this spectrum within 40 km of Awarua SGS. We believe it may be acceptable to allocate the frequency band 24.25 – 27.5 GHz to IMT on a primary basis, but IMT should not get a preferential treatment compared to the other primary services in this band, e.g. Earth exploration-satellite service which also should be a primary status.

Q7. How should RSM accommodate other use in this band such as space services

RSM should develop national regulation to allow coexistence between the different services. For example, RSM could implement the ITU-R recommendation SA.[IMT-EESS/SRS COORDINATION] which is currently under review at ITU-R Study Group7. Also, RSM could investigate solutions from other areas, for example CEPT/Europe developed a regulatory framework to support the development of 5G and also to protect existing services.

Q8. How do you see our proposal of the 28 GHz band allocation?

We strongly agree with your proposal to allocate the whole of 28 GHz for satellite use as a primary service.

Q9. Which option do you prefer for allocating 28 GHz band? Or is there any other option for managing the shared use of IMT, ESIMs and FSS in the 28 GHz band?

We have no preference for how the 28 GHz band is allocated other than we seek that a protection zone be provided at our ground stations to protect the spectrum for space services. For obvious reasons, we seek that one protection zone be centred on Awarua Satellite Ground Station. We anticipate that our proposed Far North station site location will be confirmed before a decision on this consultation is made and we seek that we be allowed to protect this site also when we are able to provide the location.

Q10. If you prefer option 1, do you agree with the proposed sharing mechanism (defining satellite coordination zones) between IMT use and FSS ground stations?

Yes, see above.

Q11. If you prefer option 2, how much spectrum do you think RSM should allocate to ESIM, IMT private network/FWA? And what's the preferred spectrum placement?

No view

Q12. Are there any other issues of sharing use between satellite earth stations and ESIMs that you would like to bring to our attention?

No view

Q13. Do you agree that the current satellite allocation and licensing regime for 29.5 - 30 GHz should remain?

Yes.

Q14. What's your preferred licensing option in 26/28 GHz spectrum?

From our perspective, Options 2 and 3 seems to be the best. This allows RSM to control who is using the frequency range and where. The main idea behind ITU-R Rec. SA.[IMT-EESS/SRS COORDINATION] is that a zone can be drawn around an earth station in which the usage of 5G in the 26 GHz band is limited. Therefore, it is important to know where the 5G base stations are or who is owning the devices.

Q15. Do you see any need for general user licence spectrum for IMT? If so, what use case might there be?

We see that perhaps localised 5G service could be provided by local communities or industries to provide IMT services to their workers or communities where national network providers may not hold any interest. If experience is anything to go by, local nodes could well become quite inexpensive and with good Internet backhaul, able to be accommodated by national telcos. This would enable people to use their cellphones seamlessly in places where service would otherwise be unobtainable.

Q16. If there is a need for general use spectrum for IMT and ESIM, how much spectrum should we set aside for it? Should RSM mandate technical conditions on the general use licence?

Possibly answered for Q15.

Q20. Do you agree RSM should mandate equivalent ETSI harmonised standards for radio licences in Radio Standards Notices and review these standards regularly?

Q21. Which option do you prefer to set the unwanted emissions?

Q22. If we use a TRP option for setting AFEL and UEL, do you have any recommended solutions on TRP measurement in field?

Q23. Do you agree that RSM should set unwanted emissions limits (in UELs and AFELs) base on 3GPP category B requirements? If no, please explain the reasons and provide your suggestions?

Q20 - Q23 are focussed on cellular use. It is important to note that cellular and space operations use different out of band limits when dealing with interference, and they take some effort to harmonise. We found it particularly difficult in S-Band for satellite TT&C when we were using cellular spectrum rights. Whatever interference rules are developed, they need to easily accommodate both users.

Q24. Do you agree that we should we implement (e.g. through UELs and AFELs) the ITU Radio Regulations, Resolution 750 limits, including the 1 September 2027 transition date and grandfathering clause for the protection of the EESS (Passive) Band? If not, please explain what limits and transition dates you consider to be more appropriate.

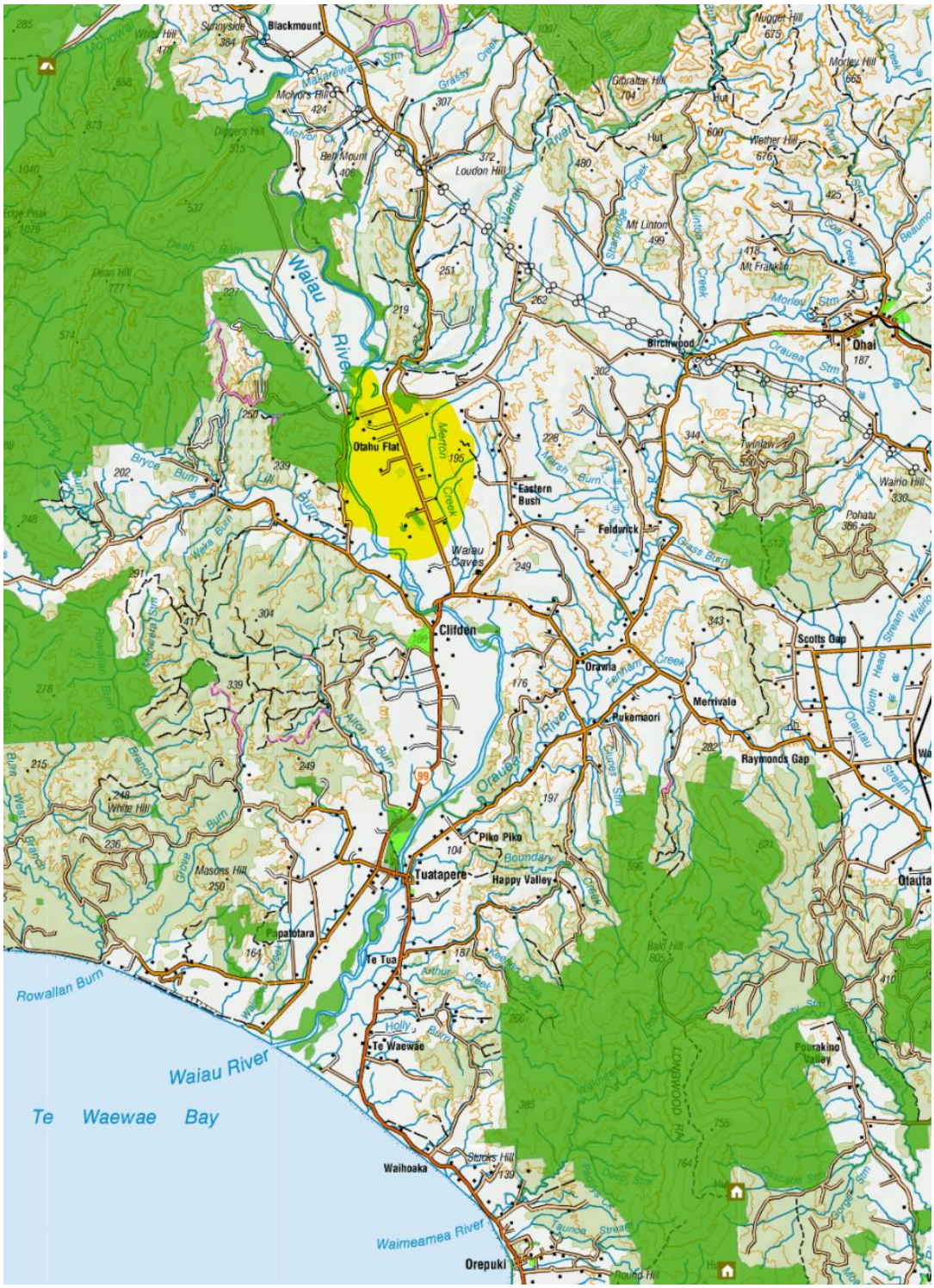
From our standpoint, it would be beneficial to implement the European standards which better protects the EESS (passive) from 5G. At the end of the WRC-19 conference, the

WMO stated that the regulation of 5G in the band 26 GHz to protect the EESS (passive) are not sufficient and the WMO is very disappointed. So, it would be highly appreciated by the EESS community if New Zealand could review the European regulation in this context. If this is not possible, the ITU regulation should be implemented.

Q25. Do you have any insights on equipment availability at, or close to, the edge of 24.25 GHz that can meet both pre-1 September 2027 and post-1 September 2027 unwanted emission limits? Is there any additional technical solution such as frequency separation or filtering required for some equipment types?

Q26. Do you agree with RSM's position to not establish a framework for coordination zones for RAS?

We have investigated using the upper Waiau Valley in the vicinity of Otahu Flat as a very low noise site for radio astronomy. The area is never going to be intensively inhabited and is surrounded by hilly Public Conservation Land that will block most if not all interfering signals. We would like to keep this area as an option for radio astronomy. Indeed, the area offers almost unique opportunities New Zealand as an ideal radio-quiet area over a wide range of radio frequencies for radio astronomy at no real disadvantage to locals. If this area could be identified as a co-ordination zone for radio astronomy, this option can be held open and, indeed, would help identify the area for such use.



Q27. Do you see a need for RSM to allow EESS and SRS earth stations to operate in the band?

To protect our ground station from 5G and to allow the reception of EESS data in Ka-band, we recommend to allow EESS and SRS earth stations in this band, or at least EESS stations.
Awarua is some distance from Invercargill and Bluff, so the impact on 5G should be very small. As a guideline, RSM could implement the ITU-R recommendation SA.[IMT-EESS/SRS COORDINATION] which is currently under review at ITU-R Study Group 7 or ECC decision ECC(19)01 which is very similar to the ITU recommendation.

Q31. Do you agree that think RSM should implement ITU Radio Regulations, Resolution 242, resolves 2.1 in the management rights and licences conditions? If not please explain why or propose an alternative?

Whatever decision is made, we seek that space services are not restricted by management rights as the nature of the services do not allow them to be used in this way.

Q32. Do you see a need for RSM to allow continued FSS gateway access to 27.0 - 27.5 GHz on a case by case basis? If so, how should we coordinate FSS Earth stations and IMT?

Yes. This is going to be interesting and I don't know how to achieve it.

Q33. Do you have any comments regarding the spectrum sharing approach proposed by RSM between FSS and IMT FWA in the 28 GHz band?

None, other than FSS should be a primary service and our current and future stations be protected.

Q34. If RSM were to apply an EIRP limit on horizontal plane for FSS, what is the maximum EIRP value we should assume?

Taking the Starlink SES as a starting point, the EIRP directed horizontally assuming a minimum elevation of 5° is 20dBW EIRP using the radiation pattern envelope (RPE) supplied by Starlink.

The minimum requirements for SES antenna RPE is given in ITU-R S.465 which specifies the gain at 14.5 dBi for 5° off the boresight for any antenna where dish diameter/wavelength is ≥50, which condition is true for all the antennas we use and envisage. On this basis the maximum EIRP should be 31.5 dBW.

We note Inmarsat have Ka-Band services to their GSO satellites: based on their gateway site which uses a 13.2m antenna, the 31.5 dBW corresponds to a minimum elevation angle of 10° which is probably about right for GSO operation.

When considering the issue of coordination zones around the Ka-Band SES locations our 'back of the envelope" calculations indicate a least a 40 km zone is required.

We trust that the points raised in our submission are helpful in guiding RSM's policy development and we would be happy to provide any clarification or further thoughts to RSM.

Yours faithfully

Robin McNeill
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