28 February 2022

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

Email: Radio.Spectrum@mbie.govt.nz

Re: 5 Year Spectrum Outlook

Dear Sir/Madam,

Omnispace LLC ("Omnispace") sincerely appreciates the opportunity to submit a response to the Radio Spectrum Management Policy and Planning's, "Draft Five Year Spectrum Outlook 2022-2026" (5 Year Spectrum Outlook). Although it addresses other matters identified by RSM, Omnispace primary objective is to advocate for the licensing of the 1980-2010 MHz / 2170-2200 MHz band for Mobile Satellite Services (MSS) with an optional hybrid Complementary Ground Component (CGC). In addition, we would like to update the RSM on technological advancements within 3GPP as regards 5G Non-Terrestrial Network (NTN) developments.

Background on Omnispace

Omnispace operates a MEO global non-geostationary orbit ("NGSO") satellite system in the 2 GHz S-band (1980-2025 MHz Earth-to-space / 2170-2200 MHz space-to-Earth) with feeder links in the 5/6 GHz band. Omnispace's NGSO system has been brought into use in accordance with applicable International Telecommunication Union ("ITU") regulations. Omnispace is leveraging over NZD$1 billion of assets that the company acquired to deploy its NGSO system in order to provide Mobile Satellite Services (MSS) and hybrid connectivity via a complementary ground component (CGC).

Omnispace is managed by veteran satellite industry executives and has investments from leading private equity firms and strategic partners with a successful track record in the wireless and satellite domains. Omnispace's shareholders include Columbia Capital LLC, Telcom Ventures LLC, Greenspring Associates, Fortress Investment Group, and Intelsat S.A.

Omnispace currently offers MSS capacity in various markets through its existing operational on-orbit F2 satellite network. The F2 satellite network is the first element of the NGSO constellation that will be capable of providing 24 x 7 coverage and connectivity around the globe ("Omnispace System"). Omnispace plans to launch two additional satellites into space the first half of this year, leading to the significant expansion of the Omnispace System.

Omnispace is investing in new technology and infrastructure as part of its next generation global constellation designed to provide hybrid 5G connectivity. The Omnispace network will power critical global communications, including 5G NTN (5G Non-Terrestrial Network) and Internet of Things (IoT) connectivity, directly from its satellites in space to mobile devices around the world. Omnispace is building upon the investments it has already made to validate 3GPP standards-based 5G products and technologies and to demonstrate 5G connectivity from space.

Omnispace's hybrid MSS system can provide a broad range of services of interest to New Zealand, including a wide array of possible commercial and government communications:

- **Industries**: Commercial MSS services to enterprises in agriculture, mining, fishing, etc.;
- **Hybrid**: In areas that are lacking in coverage or capacity due to blockage or density;
- **Connectivity**: Internet connectivity in rural and remote areas;
- **Emergencies/Public Safety**: Communications during natural and man-made emergencies, as well as disaster warnings to the public and government agencies;
- **Defence**: Increased capacity and resiliency for mobile defence applications;
- **Internet of Things (IoT)**: Connected car applications, smart city (urban and rural), transportation and logistics (on-shore and off-shore);
- **Unmanned Aerial Vehicles**: situational awareness for disasters such as fires, damage caused by weather events, delivery, insurance inspections; and
- **Aviation Networks:** hybrid network that utilises both satellite and terrestrial networks to provide Internet access to airline flights.

Built around globally harmonised spectrum in the 2 GHz band and 5G NTN advanced technologies, the Omnispace System is ideally positioned to provide a wide array of commercial and government communications needs, subject to requisite licences and approvals.

Thank you again for the opportunity to provide comments on the "Draft Five Year Spectrum Outlook 2022-2026."

Please do not hesitate to contact me should there be a need for clarification or additional information.

Sincerely,

Mindel De La Torre
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ATTACHMENT 1

<u>Introduction</u>

Omnispace is pleased to have the opportunity to provide the following comments on the Radio Spectrum Management Policy and Planning's "Draft Five Year Spectrum Outlook 2022-2026."

Omnispace has an operational MEO non-geostationary orbit ("NGSO") satellite system in the 2 GHz S-band (1980-2025 MHz Earth-to-space/2170-2200 MHz space-to-Earth) and is interested in pursuing a trial to provide MSS service with the intent, subject to RSM's requirements, of acquiring a nationwide licence to provide MSS/CGC service throughout New Zealand.

In line with the questions asked in the draft document regarding the main trends and implications for spectrum management over the next five years, Omnispace wishes to focus its comments on the benefits of licencing the globally harmonised 1980-2010 MHz /2170-2200 MHz band for MSS/CGC as well as the technological advancements in the band which is increasingly being utilised for MSS services, including 5G Non-Terrestrial Networks (NTN) that are being standardised in 3GPP Release 17 and the Internet of Things (IoT), both of which can be of great geographic and economic value to New Zealand. The developments regarding satellite inclusion within 3GPP for Release 17 are an important difference between the RSM's last *Draft Five Year Spectrum Outlook 2017-2021* and this year's Spectrum Outlook, therefore the RSM should keep in mind these 5G NTN developments in 3GPP as it develops its regulatory frameworks for 5G and for the complementary ground component (CGC) recommended by Omnispace. Omnispace also reiterates its position on the 6 GHz band, the band in which Omnispace has its satellite gateway feeder links.

1) Licencing the 2 GHz S-band in Line with Regulatory Trends

Omnispace is pleased that one of RSM top work plan priorities is to progress the implementation of decisions made in 2020 on the 1700-2300 MHz band. We encourage the RSM to look specifically at licencing the S-band (1980-2010 MHz / 2170-2200 MHz) because the time is ripe to achieve the best value use for the globally harmonised band by adopting a regime consisting of the mobile satellite service (MSS) with a complementary ground component (CGC) also known as an ancillary terrestrial component. MSS connects the unconnected in remote and isolated areas, which is extremely beneficial for a country like New Zealand with its expansive rural areas and often challenging terrain. In addition, MSS IoT applications create unprecedented connectivity and innovation for agricultural and logistical sectors, which are important for New Zealand's productivity. However, MSS is not widely utilised in urban areas and thus to combine MSS with a CGC component allows for terrestrial mobile services to exist in conjunction with MSS. The result is a highly efficient use of spectrum: a two-for-one application consisting of both satellite and terrestrial services in a common spectrum band that has a global ITU allocation for both MSS and Mobile Service (MS). This hybrid MSS/CGC approach provides exceptional value, efficiency, innovation and flexibility by allowing the market to determine the most relevant service offerings.

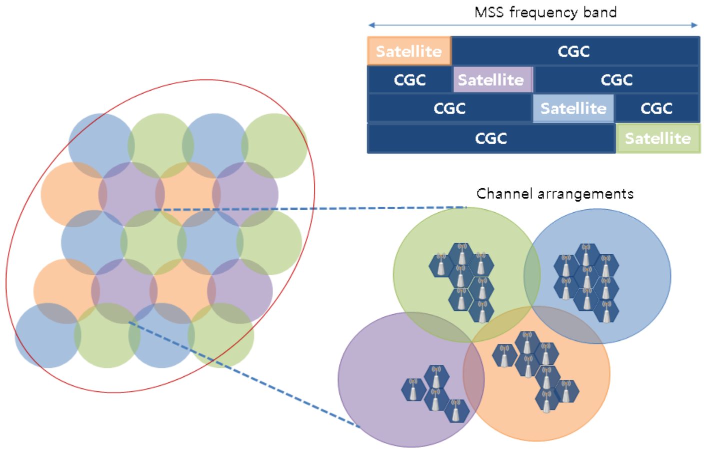
MSS/CGC is intentionally broad in the services it enables and allows market demand to determine what might be the best services for a country like New Zealand. As mentioned previously, because the 1980-2010 MHz/ 2170-2200 MHz band is one of the few allocated for both MSS and MS and identified for IMT, it is an optimum band for global 5G NTN, which is discussed in detail below, as well as IoT so that devices can seamlessly move from one destination to another using MSS and terrestrial technologies in the same spectrum. For instance, animals on a farm or wool packaged for export at the source of a sheep farm are equipped with a small IoT sensor. The farm is in a rural area without terrestrial coverage, so the IoT sensor is connected via a satellite signal. Satellite coverage tracks the shipment from the farm via truck until it enters an urban area or shipping port covered by a terrestrial network, at which point, the signal is seamlessly handed off to the terrestrial service. When the shipment heads out to sea and away from the terrestrial networks, the sensor signal again seamlessly switches back to a satellite that tracks the shipment across the ocean to its destination (where it switches back to a terrestrial signal when available, and so on). Throughout the life of this shipment chain, the IoT sensor monitors the goods in real-time, alternating between satellite and terrestrial coverage using the same spectrum band. This hybrid process – enabled by a MSS/CGC regime – increases security, efficiency, and the flow of information all while seamlessly using the same frequencies in the 2 GHz S-band.

New Zealand exporters of high value products, such as merino wool, already leverage sales based on tracking products from specific points of origin. This type of application may be expanded for use with any products exported by New Zealand industries as the use cases are unlimited because they can adapt to any specific need.

While 2 GHz MSS/CGC deployments are just beginning, the growth and ubiquity of IoT provide a new business case in the S-band that has not existed before. As the demand for IoT continues to grow exponentially, we respectfully suggest RSM should keep in mind that IoT is just one of many types of customer services that MSS can provide, so the S-band should not be limited to satellite IoT given the long development cycle and expense involved in launching a global MSS system.

Under suitable technical sharing conditions with MSS managing the spectrum usage of the terrestrial mobile services component, the 1980-2010 MHz/ 2170-2200 MHz band could easily be shared between MSS/CGC. While band segmentation can allow the shared use of the MSS spectrum, frequency reuse is a more spectrally efficient use of the MSS band. In this case, the MSS/CGC permits not only multiple MSS satellite spot beams (each with a larger bandwidth than possible under band segmentation), but also for MSS/CGC within each MSS spot beam. The ITU has shown this sharing mechanism in the graphic which follows.

Graphic 1: Frequency Reuse



Source: ITU, Working Party 4B

Authorising the Complementary Ground Component for MSS systems:

- Increases the efficiency of spectrum use through satellite network integration and increased frequency reuse;
- Improves coverage in urban areas and other areas that satellite providers could not otherwise serve;
- Reduces costs, eliminates inefficiencies and enhances the operational ability of satellite systems to offer service to users;
- Provides additional communications services and functionalities that can enhance public protection; and
- Strengthens competition in the national markets.

Countries that have adopted MSS CGC include the United States, Canada, European Union countries and Mexico. If New Zealand were to choose a CGC model consistent with the European Union, New Zealand could take advantage of economies of scale for equipment and other services, as MSS and terrestrial services can coexist when the directionality of the mobile service uses 3GPP Bands 1 and 65 that are already in operation in New Zealand. Suitable modems for the 1980-2010 MHz/ 2170-2200 MHz band are already available and more are under development.

Other countries are also examining the 1980-2010 MHz/ 2170-2200 MHz band to determine its best utilisation. In 2019, Mexico became the first country to use a public auction to award CGC licenses to the MSS operators in the 2 GHz S-band. Australia and Brazil have advanced regulatory proceedings to determine how to license the 2 GHz S-band for MSS/CGC over the next year. Saudi Arabia's auction for the S-band is expected to occur later this year.

Administrations are aware that the implementation of MSS/CGC allows an expansion of coverage areas with a highly efficient use of spectrum. Incumbent local terrestrial mobile operators may partner with MSS operators to expand coverage nationwide without further deploying costly wire infrastructure. The dual benefit of connecting the unconnected in isolated communities through MSS with the possibility of partnering with terrestrial mobile operators is a highly valuable use of a scarce resource.

Omnispace is interested in having the opportunity to provide the same services in New Zealand that it provides in other countries and, therefore, would urge RSM to prioritise planning of this band to facilitate the timely introduction of important new services. Omnispace has extensive experience working with regulators designing the MSS/CGC regime, including auctions if appropriate, and would welcome an opportunity to work with and share insights with RSM as they see fit.

MSS/CGC represents great potential value to the 1980-2010 MHz/ 2170-2200 MHz for New Zealand with its efficiency and flexibility, proffering a dual satellite-terrestrial approach that enables a breadth of service options which the market determines. Omnispace has multiple MSS/CGC pilot projects around the world with its existing MEO satellite and looks forward to exploring the possibility of a similar trial in New Zealand and sharing the results with RSM.

In summary, Omnispace recommends that RSM preserve the global S-band allocation for mobile satellite service, mobile service and fixed service, streamline the licensing of hybrid systems in general and 5G NTN in particular and permit the deployment of ATC/CGC to satellite systems.

2) 5G NTN: Technological Developments in 3GPP

In the RSM's 5 Year Spectrum Outlook diagram of Technologies Driving Change, three of the four key trends are 5G, satellite and IoT/M2M.[1] It is, therefore, extremely relevant to highlight the efforts ongoing within the 3rd Generation Partnership Project (3GPP) with respect to 5G Non-Terrestrial Networks (5G NTN) as it involves the convergence of these three trends. 3GPP is the leading global standards-setting body for wireless communications and the primary force behind the development of 5G.

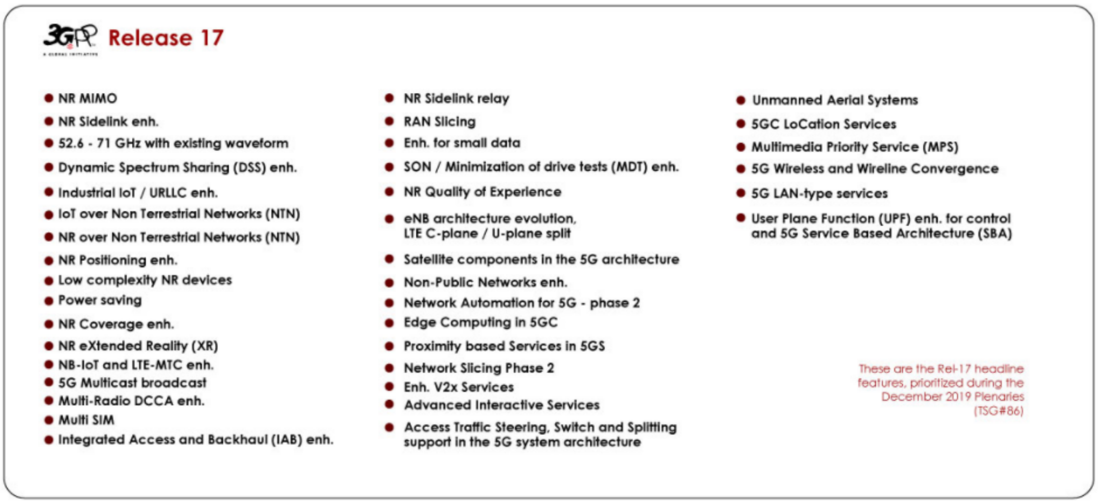
While technical work has been ongoing within 3GPP on satellites for many years, 2022 marks a major milestone for satellite and 5G convergence because 3GPP Release 17 will be finalised in mid-2022 and there are several important parts of the standard which incorporate 5G NTN including at the radio level, RF and co-existence aspects, architecture aspects and integrated satellite components in a 5G network. 3GPP also addresses narrow-band IoT and enhanced machine type communication support for 5G NTN. Omnispace lists below relevant documents in 3GPP Release 17 related to 5G NTN and satellite in 5G:[2]

1) Technical Report 23.737, "Study on architecture aspects for using satellite access in 5G," March 31, 2021.
2) Technical Report 24.821, "Study on Public Landline Mobile Network (PLMN) selection for satellite access," August 9, 2021.
3) Technical Report 28.808, "Study on management and orchestration aspects of integrated satellite components in a 5G network," March 29, 2021.
4) Technical Report 36.763, "Study on Narrow-Band Internet of Things (NB-IoT) / enhanced Machine Type Communication (eMTC) support for Non-Terrestrial Networks (NTN)," June 29,2021.
5) Technical Report 38.821, "Solutions for New Radio (NR) to support Non-Terrestrial Networks (NTN)," June 30, 2021.
6) Technical Report 38.863, "Non-terrestrial networks (NTN) related RF and co-existence aspects," July 21, 2021.

As noted, 5G NTN is being standardised in Release 17 of 3GPP which will be finalised for equipment vendors in the middle of this year, with equipment becoming available in 2023 depending on the vendor and market demand. The 1980-2010 MHz / 2170-2200 MHz band is one of the bands supported globally for 5G NTN by countries, operators and manufacturers and which benefits greatly from having a standardised band plan and user equipment available. The developments regarding satellite inclusion within 3GPP for Release 17 are an important difference between the RSM's last *Draft Five Year Spectrum Outlook 2017-2021* and this year's Spectrum Outlook, therefore the RSM should keep in mind these 5G NTN developments in 3GPP as it develops its regulatory frameworks for 5G and for the complementary ground component (CGC) recommended by Omnispace above. MSS operators will be able to provide 5G NTN services such as those in Graphic 2 directly to 5G devices working in cooperation with mobile operators to areas previously not reachable by mobile networks.

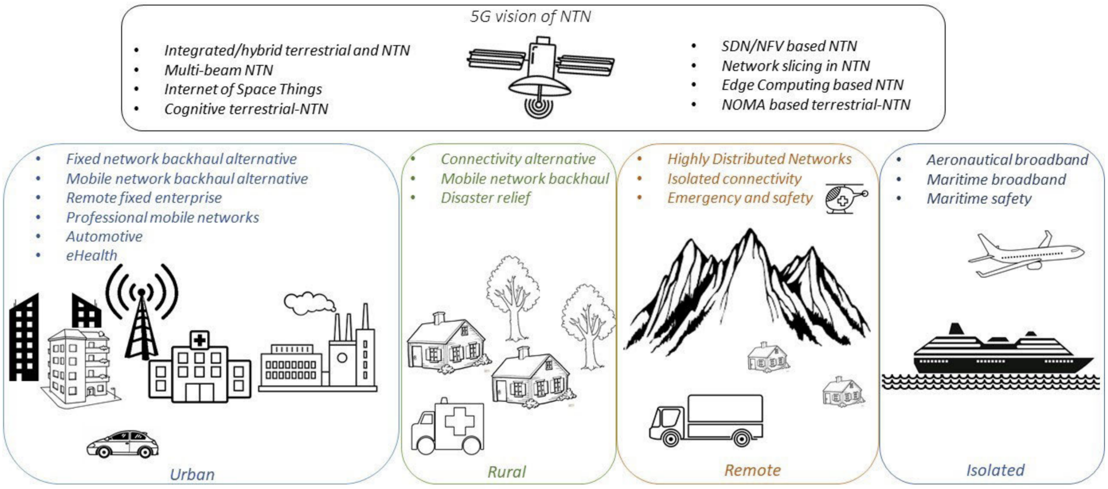
[1] See p. 12, *Draft Five Year Spectrum Outlook 2022-2026*, Radio Spectrum Management Policy and Planning, at https://www.rsm.govt.nz/assets/Uploads/documents/consultations/2021-draft-five-year-spectrum-outlook-2022-2026/draft-five-year-spectrum-outlook-2022-2026.pdf, December 2021.
[2] This list is not exhaustive as there are many additional documents on satellite from earlier releases of 3GPP as well as new studies initiated for Release 18.

Graphic 2: Key Features of 3GPP Release 17



Source: https://www.3gpp.org/release-17

Graphic 3: Use Cases for 5G NTN



Source: IEEE Non-Terrestrial Networks in 5G & Beyond: A Survey (Figure 1)

3GPP member companies have strongly supported S-band NTN standardisation to achieve the following, which will be relevant for the geographic and economic realities of New Zealand:

- Coverage: offer more cost-effective and available support for high-value mobility services in remote, isolated, unserved, and underserved markets to help bridge the digital divide;
- Service Continuity: reinforce 5G reliability for consumers and devices on trains, planes, ships, automobiles and other mobile platforms;
- Resiliency: exhibit less vulnerability to outages due to physical attacks or natural disasters

- Service Augmentation: create new economic opportunities in sectors such as agriculture, mining and logistics through ubiquitous, geographically agnostic connectivity;
- Scalability: ensure attractively priced, mass-market focused products and services through global standardisation and globally harmonised frequency allocations; and,
- Wide-Area IoT: support powerful new business cases for Internet of Things uses in widely distributed vertical markets, such as, for example, energy, transportation and agriculture.
    - Longstanding demand-side and supply-side trends promise to make NTN a reality
    - Demand side factors include the commercial imperative for universal connectivity, enterprise need for IoT, lower-cost devices, and pressures among terrestrial networks to enhance reliability and performance.
    - Supply-side factors include new technologies, such as enhanced beamforming, superior edge processing, lower cost of accessing space, and better antenna processing.

With respect to the CGC component of MSS, NTN optimises such deployments, reflects the regulatory trend toward globally harmonised standards and globally scaled software and hardware production and will increase CGC capabilities and lower CGC expenses in ways that make the service more functional, more cost effective, and more likely to succeed in the marketplace.

The ITU-R Working Party 4B also has been tasked with developing the radio air interface(s) for the satellite component of IMT-2020 and has initiated work on various items in its subworking group on Next Generation Access Technologies (NGAT) including the vision and requirements, guidelines for the evaluation of and the timeline for this activity.[3]

3) Satellite connectivity and low-cost terminals play a key role in making seamless global IoT a reality

Given the ubiquitous coverage of satellites, their connectivity will play a critical role in expanding the reach of IoT applications. Mobile satellite services support IoT today and various standards bodies, such as 3GPP, are incorporating IoT into their 5G NTN standards as growing demand from enterprises, governments, and consumers has created a tremendous market for the wide variety of data-driven results that can be obtained from IoT applications.

IoT applications are already widely deployed in both licensed and unlicensed spectrum bands allocated for satellite, fixed, and mobile uses. Omnispace respectfully recommends the regulatory environment be designed to nurture the evolution of IoT services in both licensed and unlicensed spectrum to allow the market to decide which solutions thrive. Now more than ever, governments must provide a flexible regulatory framework for spectrum that promotes the development and growth of IoT and refrains from imposing service or technological restrictions on innovation.

[3] Additionally, liaison statements have been sent from 3GPP to ITU-R WP 4B regarding efforts in Release 17 related to 5G NTN such as the 3GPP Technical Report, "Study on Narrow-Band Internet of Things (NB-IoT) / enhanced Machine Type Communication (eMTC) support for Non-Terrestrial Networks (NTN)." Within ITU-R Working Party 4B, there is a Correspondence Group has met to continue to work on satellite radio interface technologies for the satellite component of IMT-2020. The next meeting of Working Party 4B is in May 2022. While efforts are ongoing in ITU WP 4B, the standards work at 3GPP continues to move forward at a rapid pace.

Hybrid satellite systems with a complementary ground component will be an ideal way to extend IoT coverage in New Zealand as they can deliver IoT to areas that are not covered by terrestrial networks such as in the sheep farm example given above. Satellite IoT ensures digital equity and inclusion of those who are or have been historically underserved, or adversely affected by inequality as all those communities also benefit tremendously from IoT applications.

For example, an IoT sensor that measures the amount of snowmelt in isolated mountain regions cannot relay vital information regarding possible flooding downriver unless it is connected to a satellite or if someone goes to the remote location to collect the data. The use case for satellite-based IoT across many types of remote data collection is equally fundamental, such as measuring changing glacier or water levels at sea or inland lakes; tracking deforestation, and other climate change related events in temperate rain forests; and estimating crop production, soil moisture data and monitoring water quality in communities dependent upon agriculture. Other examples include connecting public safety transport systems after natural disasters where terrestrial systems have been knocked out and providing telemedicine to rural and remote communities. Satellite connectivity for IoT will help communities globally meet the United Nations Sustainable Development Goals.

4) **Position on 6.425-7.125 GHz**

As Omnispace articulated in its response to RSM's Consultation on WLAN use in the 6 GHz Band in June 2021, Omnispace agrees with the RSM's view that the additional 500 MHz from 5925-6425 MHz will provide sufficient spectrum for WLAN or WiFi at this time. Given the ongoing studies and preparations for WRC-23 on Agenda Item 1.2, Omnispace agrees that consideration of the upper part of the 6 GHz band for new applications is premature at this time.

Omnispace is particularly interested in the future of the 6425-7125 MHz band because the gateways for our current NGSO constellation utilise this band (5175-5250 MHz uplink/7010-7075 MHz downlink). Omnispace believes that extensive studies on sharing and compatibility will need to be undertaken at the international level to ensure protection of incumbent services such as the FSS from WLANs in the relevant parts of the band, particularly to determine if additional constraints may be necessary to protect NGSO MSS feeder links.

Omnispace, however, does not support consideration of the use of the 6 GHz band for IMT, as it implies exclusive, primary use of the band for mobile services. Compatibility between high-powered outdoor IMT deployments and both FSS uplinks and downlinks in the same band will be impractical and difficult to achieve. As an NGSO system, our receivers utilise tracking antennas that operate from near horizon to horizon during each satellite pass, making them particularly susceptible to interference from other sources, particularly at low elevation angles. Moreover, in addition to the large amount of IMT spectrum currently available, WRC-19 identified over 17 GHz of high-band spectrum for IMT. There is no indication that additional encumbered spectrum is required for IMT and the current spectrum available for 5G services should be more than enough to accommodate the 5G demand in New Zealand.