RADIO SPECTRUM MANAGEMENT

# The New Zealand Spectrum Outlook 2023–2027
## A forward looking view of radio spectrum management

SEPTEMBER 2023

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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Te Kāwanatanga o Aotearoa
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## Ministry of Business, Innovation and Employment (MBIE)
## Hīkina Whakatutuki – Lifting to make successful

MBIE develops and delivers policy, services, advice and regulation to support economic growth and the prosperity and wellbeing of New Zealanders.

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Information, examples and answers to your questions about the topics covered here can be found on our website: **www.rsm.govt.nz.**

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# Introduction

Radio spectrum is a vital resource that enables wireless digital connectivity. It underlies and supports a vast array of economic activities, contributing to our economic growth, innovation and global competitiveness.

New Zealanders aspire to stay ahead of the technology curve, increasing productivity and sustainability while supporting market development and protecting consumer interests. Creating an enabling environment for digital transformation using radiocommunications technologies and radio spectrum resources is a high priority.

The speed of technological development in telecommunications requires us to monitor emerging wireless technologies, their use of radio spectrum and to anticipate the areas of growth and development in spectrum management.

Radio Spectrum Management (RSM) is part of the Ministry of Business, Innovation and Employment (MBIE) and is responsible for the regulation, administration and investigation of radio spectrum in Aotearoa New Zealand. Our three teams (Policy and Planning, Licensing and Investigations) work closely with local industry, other government agencies, foreign governments and international bodies.

Our policy function is funded through taxpayers and our administrative functions through cost recovery on licensing fees and charges. Revenue from spectrum sales goes into the Crown account and is not used directly for administration. It is therefore important that we make opportunities to provide feedback on our approach to the stewardship of spectrum resources.

This is our third Spectrum Outlook. Publishing an 'Outlook' helps us to communicate our strategic direction in terms of responding to trends that affect access to and use of radio spectrum — and how we will prioritise activities in our day-to-day work.

## About the Spectrum Outlook 2023–2027

To give you an idea of the scope of spectrum management in New Zealand, Section 1 provides a summary of the legal and operational framework that guides our work and illustrates some of the projects and programmes that we have been involved in since the previous Outlook.

The rest of this Outlook takes a closer look at the direction that digital transformation might take, noting the international context and implications for New Zealand. It also highlights our potential work programme and the extent to which we might need to adapt our regulatory frameworks to fully enable new technologies.

**Section 2** – Looking forward – technologies driving change

**Section 3** – Looking forward – trends in spectrum management

**Section 4** – Upcoming spectrum projects.

Please note that, while this Outlook sets out a potential work plan for 2023-2027, based on trends in technology and spectrum management radio spectrum policy decisions are made by the Government and are subject to change based on Government priorities.

# 1 Our Spectrum Management Framework

The radio frequency spectrum is regulated under the **Radiocommunications Act 1989** (the Act), which sets out the rights and obligations of spectrum users and prescribes the basic structure of national radio spectrum management. The Act also recognises the international treaties, relating to radio spectrum management, to which we are a signatory, through the International Telecommunication Union (ITU) Constitution, Convention and the ITU Radio Regulations. Administratively, the Chief Executive of MBIE is responsible for the regime.

Along with the Act, there are a range of regulatory tools through the **Radiocommunications Regulations 2001** and other documents that include public information brochures (PIBs). These documents establish licencing regimes as well as guide investigations and enforcement.

Transmissions of radio waves must be licenced and recorded on the Register of Radio Frequencies (RRF). The legislation provides three approaches to licensing:

**Administrative licensing** – used where spectrum supply is sufficient to meet demand. In these cases, RSM makes spectrum available for licensing of specified services and issues radio licences to applicants on a first-come, first-served basis. Each licence is for a given geographic area. These licences may be revoked by RSM and are not tradable.

**Spectrum rights** – often used for spectrum where demand exceeds supply, in particular the frequencies suitable for cellular and broadcasting services. Rights are created by RSM, enabling the holder to assign licences within a particular frequency range, at any location in the country. These rights are known as "Management Rights". They have a maximum duration of 20 years. Management Rights are treated as business assets, and can be traded and mortgaged. The spectrum licences assigned within a Management Right are similarly tradable.

**General user licences (GULs)** – created to cover spectrum bands allocated for wide spread consumer technology, for example, Wi-Fi, wireless microphones, and remote-controlled devices. Lack of global harmonisation (in some bands) means that not all consumer devices from other countries are suitable for use here. The GUL regime alongside the product compliance framework controls the import, distribution and supply of these products.

Other legislative requirements relevant to radiocommunications include the Commerce Act 1986, which supports the competition aspects of wireless markets; and the Telecommunications Act 2001, which establishes the legal frameworks for telecommunication services provision.

In general, regulating radio spectrum:

- Supports public policy objectives, including providing for Te Reo Māori and public broadcasting
- Supports economic growth by enabling information and communications technology innovation, and competitive broadcasting and communications sectors
- Meets the growing demand for wireless services
- Facilitates non-commercial spectrum uses that benefit New Zealand, including public safety, aeronautical, maritime, defence communications and short-range devices (such as Wi-Fi)

## 1.1 Our continued role in international harmonisation

It is important to keep in mind the importance of New Zealand's continued international engagement to ensure that it makes the best radio frequency spectrum decisions. Radio equipment is generally made for large markets which support economies of scale. Global and regional harmonisation of radio spectrum is important so that radio equipment is available, affordable and interoperable. We are mindful that New Zealand has a small-scale market which cannot achieve economies of scale on its own. We need to make spectrum management decisions that recognise the international context and how other jurisdictions are managing issues, especially aligning with our closest neighbour and trading partner, Australia. As such, decisions that affect vendors and the long-term availability of equipment internationally can have significant impacts on radiocommunications sector participants domestically. Broadly, the drivers of harmonisation and spectrum management decisions include:

1. Technology developments and standardisation (for example, initiatives led by the ITU, the Third Generation Partnership Project (3GPP), the Institute of Electrical and Electronics Engineers (IEEE) and the European Telecommunications Standards Institute (ETSI)).
2. Countries or regions with large populations making spectrum available for a particular use (Europe, Americas, and larger jurisdictions in the Asia-Pacific).
3. Development and update of international regulatory frameworks on spectrum allocation and allotment (for example updates to the ITU Radio Regulations).

These drivers are often iterative and one or more of these may influence harmonisation and spectrum management decisions.

Radio Spectrum Management (RSM) closely monitors international developments and engages with other administrations, regions and the broader industry on issues. In our role as a member state of the ITU, we contribute to shaping international use of radio frequency spectrum, and the benefits of standardisation and harmonisation. We take part in international study groups and World Radiocommunication Conferences (WRCs). In the Asia-Pacific Telecommunity (APT), New Zealand plays an active role in developing proposals to help support spectrum management. As part of this we host the New Zealand Radio Sector Group, a national forum of government agencies, industry, licensees and stakeholders to discuss, debate, and provide input on issues affecting spectrum use.

## 1.2 Our spectrum management activities

The activities of RSM in spectrum management, allocation and assignment can be considered in the four broad areas shown in Figure 1: input and engagement internationally; technical assessment and advice; commercial and competition; and delivering government outcomes through policy development and decision-making. Compliance monitoring and enforcement activities fall within the technical and commercial and competition areas.

***Figure 1: RSM Spectrum Management and Allocation***


Since the previous Outlook, the activities of the three RSM teams (Licensing, Investigation, and Policy and Planning) have included creating licences, carrying out investigation activities, resolving interference problems, and generating policy to support Government decisions. In terms of spectrum rights, along with managing Crown spectrum holdings, RSM has undertaken a review of expiring rights, technical consultations, engagement with Māori on interests in radio spectrum, and making spectrum available for 5G.

Table 1 provides a snapshot of some of the projects RSM has been involved in between 2017 and 2023. These projects illustrate the range of activities that have made a significant contribution to enabling connectivity that supports all aspects of New Zealanders' lives.

*Table 1: Key RSM projects 2017–2023*

| | |
|---|---|
| **RSM Licensing**<br>Developing the new Registry | RSM is required to maintain a Register of Radio Frequencies (RRF). In late 2022, RSM launched an updated Register of Radio Frequencies (RRF). We have worked towards replacing the RRF since 2019 and are now seeing the results of this project. The new RRF will make licence applications and spectrum management more efficient. It will also modernise and transform licence administration by using cloud computing, enhanced API support and GIS capabilities. Integration of the RRF with other New Zealand government digital platforms like RealMe Authentication, Quick Pay and NZBN will help make RSM services more user-friendly. |
| **RSM Investigations**<br>Support for major events<br>Resolving interference complaints | The investigations team is responsible for much of the day-to-day work of RSM in the field.<br><br>Throughout 2020 and into 2021, we worked with the America's Cup project team to ensure interference issues were minimised during America's Cup races. We also worked closely with the Ministry of Foreign Affairs and Trade (MFAT) to prepare for the Asia-Pacific Economic Cooperation (APEC) conference (which due to COVID-19 was switched to a virtual platform). Additionally, together with colleagues in MBIE's Major Events team, RSM Investigations worked to ensure fans were able to enjoy the FIFA Women's World Cup held in 2023.<br><br>Interference complaints and supplier auditing are a large part of the work of the investigation team. Since 2010 the complexity of cases has increased. This has largely been driven by an increase in different types of radio devices operating in close proximity to each other. |
| **RSM Policy and Planning**<br>International engagement<br>Enabling access to spectrum, including 5G<br>Government Policy Statement<br>Maori Spectrum Working Group | RSM has continued to engage with trading partners, regional groups and relevant international organisations on a wide variety of radio spectrum issues including through the Asia Pacific Telecommunity (APT) and ITU-R study groups. This culminates in representing New Zealand at the World Radiocommunications Conference (WRC) negotiations. The outcome of WRC-19 has been implemented through treaty processes. Work continues to finalise preparations for WRC-23, taking place November – December 2023.<br><br>We reached an important milestone in our delivery of spectrum for 5G in 2023 with the allocation of spectrum in the 3.5 GHz band. RSM was directed by Cabinet to coordinate access for mobile networks, Māori interests as well as regional and private networks. In 2023, New Zealand's three national mobile network operators received rights in the 3.5 GHz band in exchange for accelerated 5G deployments and investment in rural connectivity through the Rural Connectivity Group. Additionally, the Interim Māori Spectrum Commission received rights in the 3.5GHz band to manage on behalf of Māori.<br><br>In terms of other spectrum allocations, we have provided a new period of rights to the 1800 and 2100 MHz bands; and consulted on the 1700 MHz, 2300 MHz and 24 - 30 GHz bands. We have continued to manage licensing in Crown spectrum including opening licencing in 3.30 - 3.34 for regional broadband, operating the Crown Managed Spectrum Park (2575 - 2620 MHz), and auctioning sound broadcasting licenses. |

| | |
|---|---|
| **RSM Policy and Planning**<br>International engagement<br>Enabling access to spectrum, including 5G<br>Government Policy Statement<br>Maori Spectrum Working Group | Since 2019, RSM has worked closely with the Māori Spectrum Working Group to progress discussions about spectrum interests with the Crown on behalf of Māori. In 2022 the Crown signed a Memorandum of Understanding with Māori to establish an enduring relationship on radio spectrum. In line with this agreement, we have transferred Management Rights to the Interim Māori Spectrum Commission in the 2100 MHz, 2300 MHz and 3.5 GHz bands.<br><br>One of the responsibilities that the Radiocommunications Act 1989 gives to the Minister responsible for radiocommunications is the ability to issue a 'Statement of Government Policy and Directions' to guide administration of the radio licensing regime. The 2021 Policy Statement directed RSM to reserve the 1427 MHz – 1525 MHz frequency range that has been internationally identified for mobile broadband development (4G and 5G). Subsequent updates have also set aside spectrum in the 1800 MHz and 1900 MHz bands, pending future government decisions, that may be suitable for the Emergency Services, rail communications or Māori interests[1]. |

In the next sections, we look forward and highlight the trends we think are likely to affect how we regulate radio spectrum in New Zealand. The trends identified are grouped into two broad categories:

› technologies driving change (Section 2)

› trends in spectrum management (Section 3).

While there are obvious interrelationships between these trends, collectively we expect they will drive future changes in business models, and service arrangements, along with adaptations to our regulatory frameworks, our planning, allocation and licensing activities.

1 www.mbie.govt.nz/dmsdocument/18702-memorandum-of-understanding-maori-spectrum-agreement

# 2 Looking Forward – Technologies Driving Change

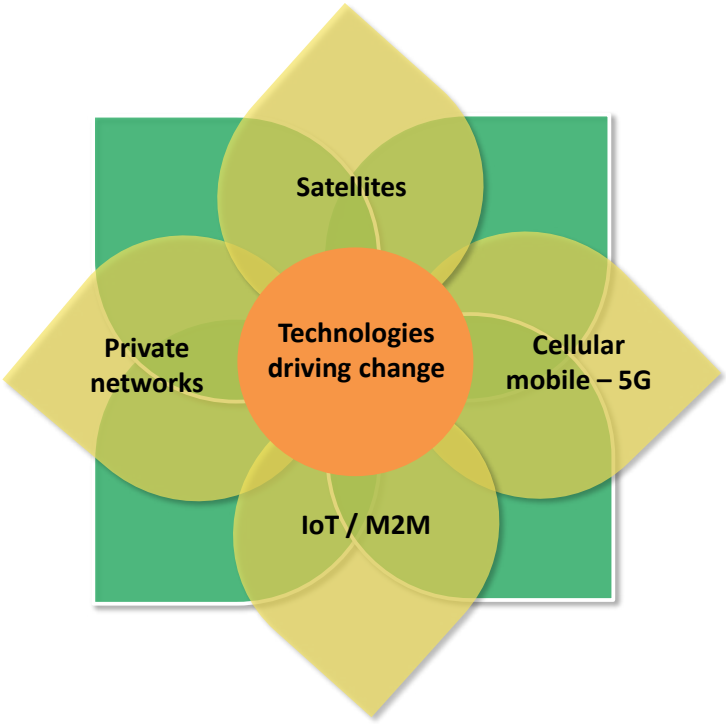
We wish to understand the technology trends driving change in New Zealand and their potential to support digital transformation, while achieving effective and efficient use of spectrum as well as policy and regulatory objectives.

Each generation of technology brings its challenges. Technological advancements in radiocommunications are no different. The speed of development means regulators, industry and consumers have to constantly navigate a range of complex technological matters. As industry and consumers adapt, regulators need flexibility to respond.

The roll-out of 5G networks worldwide is underway and is an example of a new wave of technological development which will continue to grow and evolve to 6G, which is expected towards the end of this decade. The ongoing development of satellite technologies providing more ubiquitous connectivity and broadband is an example of a new wave technological development. Another example is the miniaturisation of devices and equipment, along with the development of internet of things and private networks. New technologies will create an environment of digital transformation that will influence many industries and will continue to challenge the way we think about radio spectrum management.

In this section, we comment on four key trends as shown in Figure 2.

***Figure 2 – Technologies driving change***



## 2.1 Satellites and space – evolving technologies and use cases

In the last decade or so there has been significant investment by governments and the private sector in the space industry which has stimulated development of new satellite technologies. These developments relate to size, function, payload capacity, power storage and launching. This has enabled a degree of mass production that has driven down the price of satellites, and vastly reduced the cost of launching, further pushing technological advancement.

We are seeing the results of these investments through the emergence of new Low-Earth-Orbit (LEO) satellites, mega satellite constellations, low-latency satellite networks, short duration satellites and further development of existing satellite networks. We have seen increased delivery of satellite broadband services to the New Zealand consumer in recent years. We have also seen new use cases emerge such as Non Terrestrial Networks (NTN), Direct to Device, IoT and sensor networks.

The success of new satellite technologies and the relative explosion of satellite projects is putting pressure on the international frequency coordination regime. It is also influencing application and uptake in non-space sectors. This is stimulating interest in new use cases that satellites can support, such as more ubiquitous connectivity and consumer broadband, particularly to locations not currently well served by traditional service providers (e.g. rural and remote areas).

**Example box: Mega Satellite Constellations and Satellite Broadband**

LEO satellites converged into low-latency satellite networks can provide consumer broadband using phased array antennas and a significant network of ground stations. These low-latency networks are powered by large constellations of LEO satellites. Phased array antennas can be steered electronically to track these satellites, even while moving. This means they can be placed on an aircraft, marine vessels or automobiles, as well as covering areas that are not economically viable to cover with terrestrial infrastructure. These networks have many more LEO satellites in a constellation than you would need geostationary satellites (eg tens of thousands versus less than six).

These new use cases are challenging traditional business models. For example, it could be necessary to adapt international regulation of satellites to capture these new use cases and to address technical, commercial and regulatory considerations. This would also ensure that international regulation does not constrain the development of new use cases.

### *Implications for New Zealand*

Our strategic advantage in the space industry includes our location for launch sites, and for tracking, telemetry and control (TT&C), and earth station facilities in the southern pacific. This has stimulated a domestic space economy around the launching of small satellites and increased TT&C and Earth Station facilities. It has also stimulated further investment into the New Zealand space sector. In turn, growth in the space sector increases the volume of ITU-R satellite filings, coordination requests, notifications and recordings in the master international frequency register as well as increasing the co-existence considerations

RSM is responsible for the administration of satellite filings submitted to the ITU-R on behalf of New Zealand businesses. RSM expects to continue processing filings, coordination requests, notifications, and registrations in the space service bands.

In light of the rapid technological development and the range of satellite services available to industry and consumers, our regulatory responses will need to take into account changing market dynamics. New Zealand's Space economy is 'New Space' driven, characterised by a mix of start-up and well-established, small and large entrepreneur-driven and privately funded space companies that service both government and non-government customers. This is in contrast to 'Traditional Space' economies where large-scale government activity has been a major driver (such as in US and Europe). International space economies are now expanding from Traditional Space models and developing their New Space activities.

RSM will continue to monitor developments in satellite technology and use of new satellite bands (including developments on telemetry, short messaging, low-data-rate IoT satellites, Non Terrestrial Networks and Direct to Device) and evolving market structures. Satellite technologies may support future connectivity work programs which seek to ensure that New Zealand continues to have world standard connectivity to meet the current and future needs of New Zealand's businesses and people.

We will also continue to assist the NZ Space Agency on issues as they arise and provide information on regulatory settings for satellite operators.

***Upcoming Projects***

*Progress work on the future use of the 24 - 30 GHz frequency band.*

*Consider 1980 - 2010 MHz and 2170 - 2200 MHz S band and 40/50 GHz QV band.*

*Monitor MSS developments in 1518 - 1525 MHz and E band Satellite systems in 70 /80 GHz*

## 2.2 Growth in wireless broadband traffic

One of the most significant trends of the last decade is the uptake and growth of fixed wireless and mobile broadband. With a growing range of new mobile applications and services, there has been a dramatic increase in mobile data use. The drivers behind this growth are video usage, device proliferation and application uptake, along with the emergence of higher definition video (4-8K) and Virtual Reality. The growing use of applications to stream content is particularly noteworthy.

***Figure 3: Drivers of mobile traffic increase 2020-2030 (source: ITU Report M.2370-0 (07/2015))***

The trends that are expected to increase overall mobile telecommunications traffic over the next decade are shown in Figure 4.

Internationally, the radiocommunications industry is adapting to this growing demand in different ways. New and innovative types of technology are being developed to help manage this demand and allow the uptake of new use-cases from different types of service providers. Services such as fixed wireless and mobile broadband are now part of a wider package that also includes other capabilities. Use cases like internet of things (IoT), ultra-reliable services, ultra-low latency and customised networks provide services tailored to customer requirements.

The member states of the International Telecommunications Union (ITU) have achieved agreements in the last two decades on international allocations and identifications to support the development of mobile broadband. The last three World Radiocommunication Conferences (WRC-12, 15 and 19) have focused on addressing growing mobile broadband access requirements through the harmonised identifications of spectrum for International Mobile Telecommunications[2] (IMT).

Various wireless technologies, including 5G and 6G in the future, are likely to demonstrate growth in parallel to traditional service providers and network operators. Businesses and sectors which might not typically invest in IMT infrastructure may look to build their own networks to provide services that are customised to their needs. In many countries where spectrum has become scarce, this is also driving interest in spectrum sharing models including more advanced methods such as dynamic spectrum access.

### *Implications for New Zealand*

The challenge we face is finding ways to make spectrum available in key bands to accommodate new wireless applications while maximising growth and investment in these services. Spectrum allocations have formed the basis for developing mobile data networks including for 5G (IMT-2020) and in the future 6G (IMT-2030). However, spectrum identified for IMT at an ITU level, almost always has incumbent users. With potential increases in spectrum users and service providers, RSM will need to actively manage challenges such as sharing, compatibility and user conflicts. We will need to work with the sector to create a positive investment environment for mobile infrastructure and services.

We are seeking ways to support the roll-out of 5G services alongside other broadband technologies and in the future 6G services. By enabling these technologies, we aim to support increasing broadband connectivity through offering a greater range of options by which greater rural capacity and coverage can be provided, as well as supporting an increase in innovation and productivity in urban areas.

While there has been a focus to enhance coverage and connectivity, the emphasis will increasingly shift to:

- Addressing capacity constraints, including ensuring there is sufficient capacity to cater for future growth, and
- Supporting different use cases (for example for industry verticals), developing capacity, and enabling uptake of new wireless technologies including addressing interoperability needs.

RSM will continue to proactively engage in the WRC, ITU, APT and international matters relating to spectrum, including monitoring and responding to developments. RSM will also monitor developments in new emerging 6G mobile technology and standards, particularly relating to use cases, spectrum sharing, and tiered and dynamic access mechanisms.

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2 IMT, IMT-Advanced and IMT-2020 are the ITU-defined technical requirements to be met by 3G, 4G and 5G mobile broadband equipment.

***Upcoming Projects***

*Consider: 600 MHz, 1980 - 2010 MHz, 2170 - 2200 MHz, 3.34 - 3.4 GHz, 3.4 - 3.46 GHz, 3.8 - 4.2 GHz, 6.425 - 7.125 GHz, 24 - 30 GHz, and 40 GHz bands for 5G / 6G and associated technologies.*

*Monitor 1427 - 1518 MHz and 5.925 - 6.425 GHz.*

## 2.3 Massive internet of things

The global growth in connectivity (also driven by global broadband uptake) has encouraged the development of wireless applications for enabling the automated and seamless day-to-day interaction between machines, portable devices, objects, infrastructure and people. These applications range from personal wearable devices such as tracking bands, to automated smart homes, assisted transportation systems and in targeted systems in a "smart city". A common thread between these use cases is they revolve around large numbers of devices sending low amounts of data.

**Internet of Things (IoT)** is a concept for internet connectivity of objects, devices, appliances and sensors. The definition of IoT is still evolving, but it is widely understood as an application integrating multiple existing technologies rather than a class of radiocommunication technology. The types of applications and purpose vary widely, and the connectivity aspect of these emerging wireless applications does not point to any specific spectrum band as a sole access solution.

**Machine-to-Machine (M2M)** applications are widely used for transmitting low bit-rate data between devices and systems.

Use cases for IoT & M2M wireless applications will develop rapidly with the roll out of other wireless technology like 5G services, development of 6G, satellite connectivity and generally authorised short-range devices (for example, the increasing connectivity of agricultural machinery for operation and monitoring). The potential of IoT and M2M for health and safety monitoring and sustainability measures has also been widely researched but is yet to be implemented at scale.

The standardisation of wireless technology is creating a trend of convergence around wireless 3GPP and IEEE standardised technologies to replace proprietary technologies and land mobile systems in some sectors.

### *Implications for New Zealand*

IoT and M2M wireless applications operate currently across generally authorised or licenced spectrum (also known as licence-exempt or unlicensed) as well as licenced mobile spectrum e.g. 5G NR and 4G LTE, allowing commercial mobile carriers to offer dedicated bandwidth and coverage to M2M and IoT customers.

We are now seeing IoT use cases in industry and domestically for gathering data, monitoring and reporting (utilities monitoring smart meters for example). Having a coherent system for applications in a particular sector (for example, utilities) provides for economies of scale and interoperability of devices nationally.

RSM will continue to monitor IoT business models and use-cases internationally. Many of these business models are integrating IoT with private networks and spectrum sharing to provide customised services that use spectrum efficiently. The extent to which the Radiocommunications Act 1989, and other legislation might form barriers to the development of these business models is an ongoing focus.

RSM will also monitor the need for spectrum for critical infrastructure in New Zealand (see 'Smart transport in New Zealand' example).

***Upcoming Projects***

*Review and re-plan appropriate spectrum bands, including technical consultation.*

*Scope issues and develop proposals to modernise the administration of the Radio-communications Act 1989 to keep pace with new technologies and market developments.*

**Example box: Smart transport in New Zealand**

Transportation systems are becoming increasingly reliant on wireless connections for essential safety applications to operate. The absence of, or interference to, wireless connections will render some systems inoperable. KiwiRail has systems deployed in Auckland that are capable of running increased safety and signalling features if they have radios connected between the electric train fleet and trackside infrastructure. For its Wellington metro operations, KiwiRail is at the start of a multi-year business case process to procure a new signalling system for the metro network, to enhance its capacity.

In other countries, dedicated ranges of spectrum have been set aside for rail applications. In New Zealand, we have a number of land mobile channels for rail use (typically 12.5 or 25 KHz wide). However, the newer systems available employ LTE-based technologies, with bandwidth requirements of 3-5MHz. This is a large increase in the spectrum required. This also reflects the increasing trend of the broader radio sector to move towards standardised cellular based systems. The Government Policy Statement has set aside 1900–1910 MHz for potential rail use pending a business case by KiwiRail.

## 2.4 Private networks and Industry verticals

There has been increased interest in private wireless networks for different industry sectors like manufacturing, agriculture, and logistics, often referred to as 'verticals'. In general the idea is to improve connectivity for these industries which will lead to greater productivity gains from automation in industrial practices ("Industry 4.0"). While use cases for verticals do not exclusively use mobile spectrum, there are implications for using multiple cellular technologies (e.g. 4G LTE and 5G NR) in terms of licensing models and spectrum sharing.

Private networks are those owned and operated by a business or sector for their exclusive use and are not available for retail services to the public. Private networks feature network infrastructure that is used exclusively by devices authorised by the end user organisation. The roll-out of low-latency 5G networks and developing IoT use cases will lead to further integration of these technologies to create private networks. For example, overseas, several large manufacturers have licences to develop private networks.

### *Implications for New Zealand*

Spectrum for International Mobile Telecommunications (IMT) has generally been made available on a nation-wide basis to ensure that a cell phone can receive and send data anywhere in the country. Private networks will create high demand in some IMT spectrum bands and may challenge this model. Making spectrum available for 5G or 6G across different bands (e.g. 3.3 - 3.4 GHz and 3.8 - 4.2 GHz) has the potential to provide spectrum to industry sectors to develop private networks. Where there are multiple users in the same band, for example through private networks, interference management can become more complicated and administratively burdensome. Detailed technical criteria or rules may be needed to manage interference risks in some cases.

Different frequency bands are suitable for different use cases, so having spectrum available in high, mid and low frequency bands will allow for a variety of use cases and industry verticals. Significant investment in private infrastructure and the capability to build and operate these sorts of networks will be necessary. Agricultural and horticultural businesses for example, will likely need to source capability or services from existing operators or consulting firms.

The evolution of Radio Access Network (RAN) for cellular technologies including increased flexibility, decreased costs, RAN virtualisation and Open RAN may help drive increasing development and deployments of private networks and industry verticals. We are monitoring these developments.

A related issue is the role of Licencing for such services which is currently restricted by the Radiocommunications Act 1989. This issue will be discussed further in section 4 of this outlook. RSM is also monitoring developments in spectrum sharing models including static, tiered and dynamic access mechanisms for 5G and other allocations (how they might be applied here).

***Upcoming Projects***

*Consider 600 MHz, 1980 - 2010 MHz, 2170 - 2200 MHz, 3.34 - 3.4 GHz, 3.4 - 3.46 GHz, 3.8 - 4.2 GHz, 6.425 - 7.125 GHz, 24 - 30 GHz and 40 GHz frequency bands.*

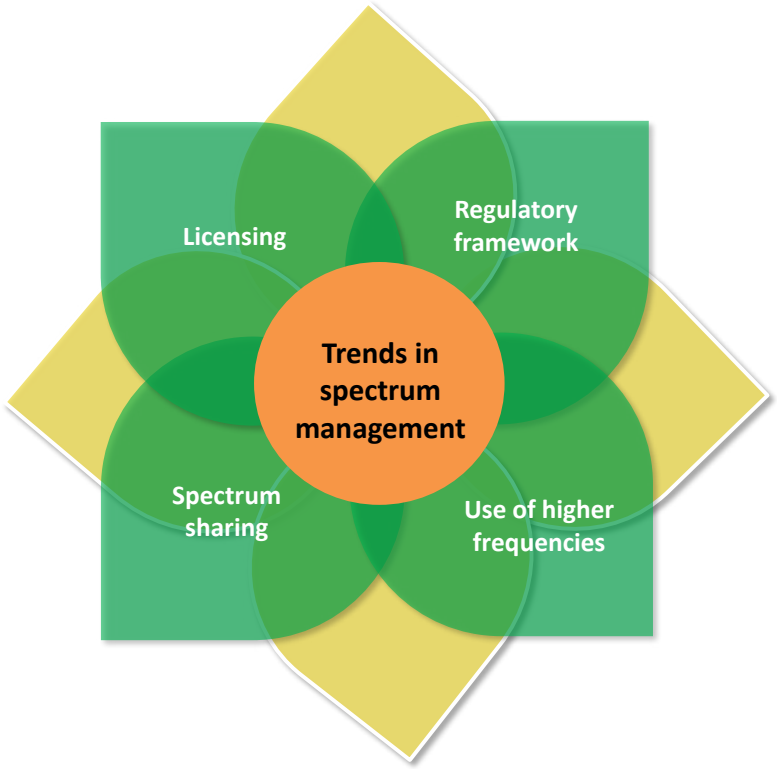
*Monitor 1427 - 1518 MHz.*

*Develop and implement revised operational approach to small cell network licensing.*

# 3 Looking Forward – Trends in Spectrum Management

Spectrum management approaches are changing to adapt to technological developments. Internationally, regulators are considering different and new approaches in spectrum management. We expect that industry's approach to commercial structures and operating models will also change.

***Figure 4 – Trends in spectrum management***




With reference to four aspects shown in Figure 4, this section highlights the trends that we think will be influential in how we regulate radio spectrum in New Zealand.

We are seeing an ever growing number of technologies and proliferation of devices driving increasing demands for access to spectrum. This will require tighter spectrum management, and technologies will need to use the spectrum more efficiently. Regulators will have to continue to look for ways to get increasing use out of the radio spectrum to enable sustained improvements in efficiency over time. Generally radio frequency spectrum is managed with respect to three technical dimensions:

1. **Frequency** (different users or applications on separate frequencies).
2. **Spatial** (different users or applications separated by distance, geography, or obstructions).
3. **Time** (different users or applications access the spectrum at different times).

Traditionally, spectrum management has been based on conservative approaches, primarily on frequency, where frequency ranges have been allocated to a single service (such as fixed, mobile, broadcasting, satellite) and assignment to exclusive use for one particular purpose or technology in a particular frequency range ('spectrum silo' approach). In addition, frequency separation (guard bands) has been used to compensate for transmitter and receiver performance. There is a growing need for regulators to minimise guard-bands and make more use of spatial and time dimensions to enable more spectrum use.

Policy and planning interventions, market forces, and technological development are three aspects that regulators in many jurisdictions are considering. Policy and planning levers used to increase efficiency could include a combination of: undertaking tighter co-existence analysis using improved assumptions; setting of tighter rules on licensing; requiring better equipment performance; allowing spectrum sharing among different types of users; using different authorisation mechanisms; re-farming and recycling spectrum; and allocating use of higher frequency ranges.

Use of market mechanisms to incentivise the highest benefit and most efficient use of spectrum will continue to be important. This may require spectrum regulators to identify opportunities to take action where required and appropriate to support these outcomes. It would be necessary to have the appropriate tools and data to enable an analysis of this type. There are a range of technologies that will help to achieve greater efficiency. These include the use of more spectrally efficient equipment that achieves more data through a given bandwidth (bits per second per Hertz), greater frequency reuse, and use of equipment that is more tolerant to interference. Changing expectations of spectrum users where they are required to operate in an environment with other users and some level of degradation (no longer a noise limited environment) will also be relevant.

## 3.1 Spectrum re-farming, recycling and sharing

### *3.1.1 Re-farming and recycling*

Spectrum re-farming is a tool that could increase the efficient use of spectrum. Spectrum re-farming and recycling allows the use of existing spectrum to support newer generation technologies. Often the transition from one technology to another technology can be complex and requires detailed technical management so that old and new networks can continue to operate with minimal interruptions. We have seen examples of this through the transition from analogue to digital television in New Zealand and through the transition through 1st, 2nd, 3rd , 4th and 5th generation cellular technologies. Transition from current cellular technologies to 6th generation is likely to happen towards the end of the decade. With 5G there are technology options to ease transition allowing coexistence with 4G in the same band such as using dedicated carriers or Dynamic Spectrum Sharing. In the case of cellular, this transition has happened with limited regulatory intervention as the radio frequency spectrum was in private management rights, where the MNOs managed their own transition.

*Implications for New Zealand*

Investigations into the efficient use of spectrum are largely due to a growing number of technologies and the proliferation of devices. The dwindling availability of spectrum in key frequency bands is also a factor, vital to ensuring the long-term sustainability of wireless infrastructure. While this has not yet become a significant issue for New Zealand, RSM maintains a watching brief on developments in this area.

Historically, we have taken a band-by-band approach, requiring use of licencing and technical conditions to fulfil regulatory and wider government outcomes. We see a need for a technology neutral approach to support flexibility in equipment upgrades as technology evolves. However, many factors will shape this approach moving forward. When we undertake spectrum planning there is always a band plan involved (for example duplex spacing, uplink and down link frequencies) which is inevitably suitable to particular technologies. With growing spectrum use and the need for tighter spectrum management, this may require specific technical conditions.

Where possible, we will continue to use a technology-neutral approach with least restrictive technical conditions as this provides flexibility for spectrum users. We have been using this approach when assigning spectrum to MNOs to enable a transition to different technologies over time. While we will continue to apply this as a principle, tighter management of the radio frequency spectrum may require RSM to be more specific in some areas to enable new use while managing interference risks.

***Upcoming Projects***

*Investigate ways to get more use out of radio frequency spectrum and adopt tighter spectrum practices.*

*Consider the effect of spectrum sharing frameworks on market dynamics and competition and whether the current regulatory framework enables or constrains access arrangements and spectrum sharing.*

*Consider sharing models when developing future spectrum bands.*

### *3.1.2 Spectrum sharing*

Spectrum sharing is where a radio frequency spectrum band can be authorised and used by multiple different users that may be operating different technologies. Regulators are now finding it increasingly challenging to give different users their own frequency bands (spectrum silo approach) and have to look at different users in the same band. Regulators are also finding that many existing bands are not used ubiquitously over an entire country and there are often frequencies or location gaps where another use can be enabled.

Internationally there has been ongoing work on dynamic spectrum access, under a few models. This uses a database to automatically find unused frequencies and occupy them with mixed success but this is further maturing. Dynamic spectrum access is not widely used except in Northern America so far. Static forms of sharing are more common globally. Despite this, spectrum sharing is maturing and is beginning to factor into strategic thinking for many regulators who are starting to see such methods able to drive more efficient spectrum use in the long term.

*Implications for New Zealand*

Along with other regulators, we are changing the way we are thinking about how we can make spectrum available. Traditionally management rights have included long-term exclusive rights on a frequency band, with a set of accompanying commercial terms, technical requirements and sometimes implementation obligations. Responding to changing business models and technological developments, and competing demands for spectrum rights, requires us to look more closely at the merits of sharing methods and what might work in New Zealand.

Spectrum sharing can be implemented through both of the traditional static licensing mechanisms (radio licensing and general user licensing). This already happens in some cases through prescribed licensing rules but is normally for particular technology types (for example fixed to fixed, land mobile to land mobile). A recent database approach called Automated Frequency Coordination (AFC) is being implemented in North America to enable more flexibility with Wi-Fi 6E while coexisting with fixed links. We are continuing to monitor this approach.

We will continue to monitor the demand for different tools and levers to allow more innovative approaches to spectrum sharing.

***Upcoming Projects***

*Consider the effect of spectrum sharing frameworks on market dynamics and competition and whether the current regulatory framework enables or constrains access arrangements and spectrum sharing.*

*Monitor developments in Automated Frequency Coordination (AFC) systems for the 5.925 - 6.425 GHz frequency band for this region.*

## 3.2 Use of higher frequencies

As technology advances, higher and higher frequency ranges become feasible and more equipment becomes available. Higher frequencies offer higher bandwidths but come with increased propagation losses. Frequency ranges that did not seem feasible decades ago now have widespread use. This includes the frequency ranges recently identified for mmWave 5G in the 26 GHz, 40 GHz and 66 - 71 GHz bands and satellite bands 40 - 50 GHz (Q/V band) 70 - 80 GHz (E band).

There is growing interest in the use of even higher frequency ranges (eg above 100 GHz) with the latest technological advancements. Higher frequency ranges can offer very wide bandwidths, much higher data throughput and network capacity for fixed and mobile applications. These high bandwidths can also offer high resolution for radio determination applications.

International work, research and development are considering the 100 - 1000 GHz frequency range as a possibility for providing large bandwidths to provide very high data rates, high resolution imaging and industrial applications.

Other regulators have recognised the potential for technology innovations in higher frequency bands. Both the US and the UK have provided frameworks to increase access to frequencies above 100 GHz to promote technological innovations.

Higher frequency ranges can be shared more readily than lower frequency ranges, mainly due to their propagation characteristics. In addition technologies can utilise spectrum access techniques to minimise the risk of interference to other users. How spectrum is made available in these higher frequency ranges may need further investigation where shared models may be the default.

### *Implications for New Zealand*

We will need to consider the most appropriate time to make higher frequencies available, noting that this will be driven through the development of international activities and available equipment. Because higher frequency ranges can be shared more readily this could favour non-exclusive licensing approaches that maximise the number of users that can access spectrum. There are models of spectrum sharing that RSM currently use that could be applied to higher frequency ranges, such as General User Licences (GUL).

***Upcoming Projects***

*Consider the future use of the 24 - 30 GHz band and 40 GHz mmWave, particularly 40.5 - 43.5 GHz and 40 - 50 GHz QV band.*

*Monitor E band Satellite systems in 70 - 80 GHz.*

## 3.3 Licensing approaches enabling new technologies

With the development of new technologies, commercial models are changing and more complex service arrangements are emerging. Regulators will need to look at the merits of licensing approaches and the extent that they constrain or incentivise use of new technologies and applications. In some cases, a new approach to allocation and licensing will be necessary.

Regulators are looking more closely at new licensing approaches including spectrum sharing, small cells and short range devices (SRDs). Currently, where individual licensing would be impractical (like for SRDs and Wi-Fi connectivity). With the proliferation of such devices and the continuing development of technologies, we are likely to see a reassessment of technical conditions and other regulatory requirements. This is because traditional licensing approaches did not anticipate the current and emerging commercial models, which means traditional licensing approaches may prevent the uptake or success of new technologies. In future, there is likely to be a greater emphasis on more flexible spectrum sharing techniques.

### *Implications for New Zealand*

RSM is actively considering ways to address issues from the regulator and operator perspectives. There are a range of potential approaches such as in the current GUL regime (traditionally used in New Zealand for spectrum sharing), radio licensing and management rights. Finding a balance between protecting consumers and supporting innovation is an ongoing focus.

We are interested in exploring ways the licensing framework might work better for the deployment of indoor small-cells for private networks. We will monitor international developments to consider if GULs are appropriate when developing future spectrum bands (for example higher frequency bands like mmWave bands).

In 2021, we commenced a review of rules for the 2575 MHz – 2620 MHz Managed Spectrum Park for the remaining years on the management right.

A number of management rights are due to expire in the 2028 – 2031 period. We aim to start review of management rights around 5 - 6 years before expiry, to allow lead in time to undertake the planning work required. Considerable planning effort on rights reviews will be needed in this Outlook period.

Implementation of the Crown-Māori Memorandum of Understanding on Radio Spectrum (MOU) is underway (discussed in section 4.2). The MOU applies to the allocation of new Management Rights and the renewal of expiring Management Rights.

***Upcoming Projects***

*Consider updates to General User Licences, particularly for short-range devices.*

*Commence planning work for spectrum bands where management rights are due to expire from 2028 – 2031, including:*

- 2500 and 2600 MHz, expires 31 December 2028 review commences around 2023 - 2024 review commences around 2024
- AM and FM, expires 2 April 2031 review commences around Q1 2025
- 700, 850, and 900 MHz, expires 28 November 2031 review commences around Q4 2025.

*Complete a review of the current Managed Spectrum Park rules.*

## 3.4 Regulatory frameworks

We have identified three priority work programme areas needed to enable our regulatory framework to respond to technology trends and innovations in spectrum management. These relate to:

- our regulatory settings under the Radiocommunications Act
- how we fund spectrum management services
- how we sustain the pool of engineering expertise needed to support spectrum use.

### *3.4.1 Adapting the New Zealand Spectrum Management Framework*

The Radiocommunications Act has not been substantially amended since its introduction in 1989. Many provisions are outdated and are affecting administration of the Act. In addition, specific provisions are unnecessarily constraining new technologies from being authorised within the regime. This is preventing deployment of key tools for law enforcement and border controls by government agencies.

Operational workarounds have progressively been used for some law enforcement activities and in administering rights to spectrum. If this continues, it will significantly impact spectrum management in the medium and long-term in two areas: allocation of spectrum, particularly spectrum for 5G technologies; and inhibit developing innovative forms of licencing to reflect changing commercial models, as highlighted throughout this outlook.

Each of these broader issues have more specific implications for items of work that are planned for the 2023 - 2027 period or have an effect on the levers that are available to RSM in authorising new technologies.

- The Act was drafted at a time when systems were paper based and online transactions were not envisaged. Modernising the provisions will ensure the Act reflects changes in trade, technology, equipment and industry best practice.
- There are inconsistencies in how technical requirements and reference standards are authorised under the Act and regulations. This is apparent for both radio and spectrum licensing regimes, and has led to constraints over adapting and responding to new technologies (including responding to the ITU Radio Regulations, changing business models and network evolution). This creates serious implications for compliance monitoring and enforcement.
- The current approach to competition in the Act creates duplication, uncertainty and may not always result in outcomes that are in the public interest. Reliance on deeds and commercial contracts to impose conditions on spectrum use and holdings creates uncertainties for spectrum right holders and difficulties for enforcement.
- The radiocommunications regime was originally designed with the intent that all spectrum would be transferred to the management rights regime, and spectrum use and allocation decided by the market – very little regulatory role for government was anticipated. However, current practice and the outcomes sought from spectrum management do not reflect the initial regime design.

#### *Implications for New Zealand spectrum management framework*

We are considering ways in which to support law enforcement by providing for approved agencies to deal effectively with security and safety threats that cause potential or actual harm such as those arising from drones or improvised explosive devices (IEDs). Law enforcement should be able, in appropriate circumstances, to use wireless technologies to detect, monitor, disrupt, use, intervene and prevent communications.

RSM will seek to continue to modernise the approach to and administration of the radiocommunications regime under the Radiocommunications Act 1989 so that it is fit-for-purpose for current and future needs.

This includes ensuring the regulatory framework can meet desired objectives including:

- Supporting public policy objectives, including providing for Te Reo Māori and public broadcasting
- Supporting economic growth by enabling information and communications technology innovation, and competitive broadcasting and communications sectors
- Meeting the growing demand for wireless services
- Facilitating non-commercial spectrum uses that benefit New Zealand, including public safety and defence communications, and industrial, scientific and medicinal applications.

We will also need to ensure that there are adequate tools available across government agencies to manage security threats (for example, ability to deploy a range of devices to monitor, intercept and disrupt telecommunications). Any changes to the regulatory frameworks will need to ensure New Zealand can meet obligations under international agreements, treaties and conventions relating to radiocommunications and the radio spectrum.

***Upcoming Project***

*Investigate issues and develop proposals to modernise the Radiocommunications Act 1989 covering: supporting law enforcement, keeping pace with new technologies and market developments, streamlining consideration of competition issues in spectrum allocations, modernising radiocommunications administration.*

### *3.4.2 Radio Spectrum Fees Review*

Holders of radio and spectrum licences must pay an annual fee to cover the administrative costs of registering their licences. This fee covers the costs of technical planning, licence registration and compliance activities to protect the rights of licence holders. Spectrum policy work is funded by the tax-payer. Revenue from spectrum sales goes to the Crown account and is not used for administrative costs. A memorandum account is used to hold fee revenue and pay relevant expenses. This means that fee revenue can be held to the credit of fee payers over multiple years and allows for the smoothing of fees over time.

Treasury guidelines require that government-imposed fees, such as those for radio and spectrum licences, be reviewed every three years. Radio licence fees are mandated by the Radiocommunications Regulations – Schedule 6: Annual Admin Fees. Following the 2017 review, the vast majority of users pay a fee of $150 (including GST) per licence.

We are currently in a phase of planned under-recovery of fees to reduce the positive balance in the memorandum account. The aim of the 2017 review was to reduce the memorandum account gradually so that a sudden, large reversal in fees is not required. A high-level fees review was also conducted in 2020 which found that a more detailed review was unnecessary. Additionally, based on this 2020 review, ongoing monitoring would be prudent and it appeared that the next regular fees review would be the appropriate time for a fees reset.

***Upcoming Project***

*Review the radio spectrum licensing fees regime.*

### *3.4.3 Building Certification Capability*

Approved Radio Engineers (AREs) and Approved Radio Certifiers (ARCs) are a critical component of the radio licensing regime in New Zealand. The effectiveness of the radiocommunications regulatory regime is reliant on the expertise of these authorised experts.

The Radiocommunications Act 1989 and the Radiocommunications Regulations 2001 were updated in 2004 and 2005 to provide processes and certification of authorised persons. Authorised persons include Radio Engineers, Radio Certifiers and Radio Examiners. The amendments were specifically to allow people that are not employed by the Ministry to certify radio and spectrum licences and issue certificates of competency.

Since 2006, MBIE and industry sectors have progressively increased their reliance on authorised persons to provide efficient and technically compatible assignment of radio spectrum. This is particularly apparent in key industries where there is growing demand for radio spectrum such as the telecommunications, maritime and aeronautical industry sectors, as well as the growing space industry. These industry sectors are vital for New Zealand's economic prosperity.

*Implications for New Zealand*

We have mapped the environment to understand the demand versus the availability of AREs and ARCs. This work points to the lack of radio engineering training and qualifications in New Zealand. We expect that in the coming years, there will be a significant shortage of skills and capability in the radio sector.

To sustain the pool of expertise to adequately service key industries, an increase in support of the authorised persons regime is needed to meet current and future projected industry demands.

▶ ***Upcoming Project***

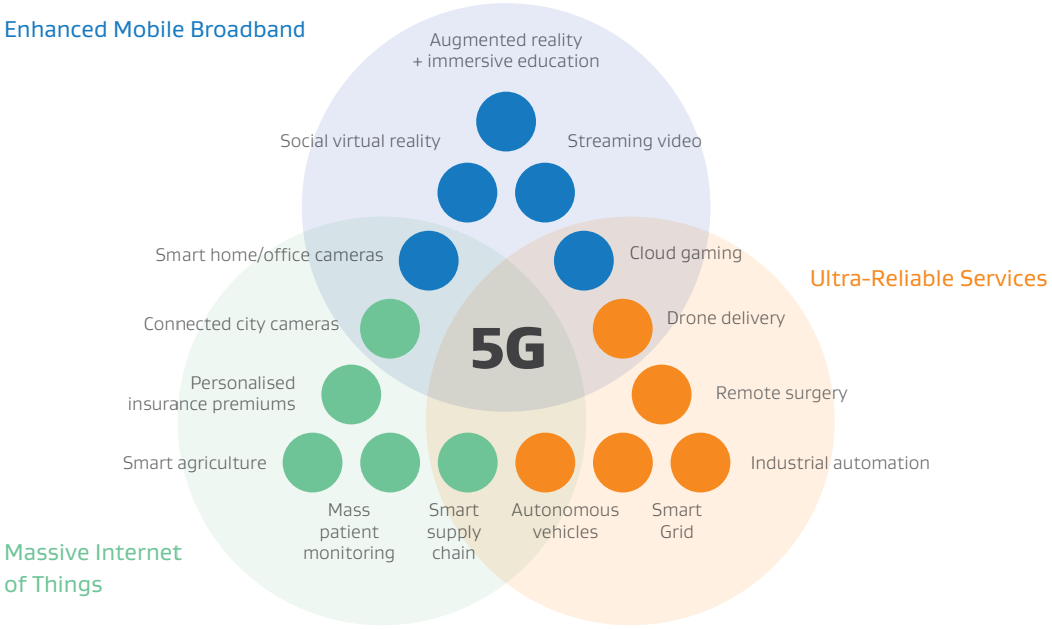
*Monitor sector needs, including for training and qualifications for radio spectrum management specialists.*

# 4 Upcoming Projects 2023–2027

While the RSM work programme for 2023–2027 is subject to government direction, the potential projects below have been raised in response to ongoing regulatory responsibilities and the action points arising from industry trends and sector developments outlined in Section 3.

There are two overriding factors influencing the period 2023–2027 that are geared towards leveraging the radiocommunications sector and the digital economy to grow New Zealand for all. Notably, enabling nationwide roll-out of 5G services and implementing the Crown's agreement with Māori regarding spectrum interests.

***Figure 5 – 5G Spectrum Strategy***




**3.5 GHz**
10 km² coverage per cell site
CBD/urban areas
Global

**600 MHz**
100 km² coverage per cell site
Rural/peri-urban areas
USA, Canada, NZ

**26 GHz**
500 m² coverage per cell site
Localised, high capacity data
satellite, fixed + cellular
Global

## 4.1 Enabling the nationwide roll-out of 5G services

Digital technologies are evolving rapidly and have wide-ranging impacts across economic, social and public sector domains. It is therefore important for government to respond in a timely and coordinated way in order to create an environment for digital transformation. Additional spectrum bands identified for IMT 5G services will further facilitate roll-out of 5G services. As shown in Figure 5 some of these frequency bands may also facilitate a future a transition to 6G.

## 4.2 Implementing the enduring agreement between Māori and the Crown

In February 2022 the Government signed a Memorandum of Understanding on Radio Spectrum (MOU) with the Māori Spectrum Working Group. The MOU establishes a long-term, enduring agreement that recognises Māori interests in radio spectrum. These interests include digital enterprise and jobs, healthcare, rural economy and connectivity, education, broadcasting, and revitalisation of te reo Māori. The MOU was developed in partnership with the Māori Spectrum Working Group. It is an opportunity to build Māori capability in spectrum-related industries and see Māori participating more prominently in this growing sector. The Māori Spectrum Working Group was established by Māori in 2019 to lead this work with the Government. The details of the agreement include an ongoing allocation of national spectrum, a role for Māori in spectrum policy-making, and the establishment of a permanent Māori spectrum entity to hold and manage the spectrum allocation on behalf of Māori. The full MOU can be found on MBIE's website[3].

## 4.3 Upcoming spectrum projects 2023–2027

Taking the upcoming spectrum projects from Section 4, Table 2 outlines our major activities and projects over the upcoming outlook period. A brief description is provided of each activity and how it relates to each of the trends identified in this Spectrum Outlook.

We note that flexibility is required in responding to emerging issues in radio spectrum as new technologies and issues emerge. Hence, this indicative work programme is designed to be flexible and responsive to issues over time.

Additionally, note that radio spectrum policy is subject to Ministerial direction. Priorities can and do change over time to reflect the direction of the relevant Minister and Government, consequently this list should not be read as a definitive list of projects.

3 www.mbie.govt.nz/dmsdocument/18702-memorandum-of-understanding-maori-spectrum-agreement

*Table 2: Summary of RSM's Potential Work Plan*

| | Satellites and space | Mobile data traffic | Massive IoT | Private networks + industry verticals | Use of higher frequencies | Spectrum sharing + efficient use of spectrum | General user licensing | Spectrum management and administration |
|---|---|---|---|---|---|---|---|---|
| **Band planning, technical studies, making spectrum available and implementation** | | | | | | | | |
| Future use of the 24 - 30 GHz band including technical considerations, consultation and making spectrum available | ● | ● | | | ● | | | ● |
| Review and re-plan 600 MHz spectrum, including technical consultation | | ● | ● | | | | | ● |
| Review and replan 1980 - 2010 MHz and 2170 - 2200 MHz | ● | | ● | ● | | ● | | ● |
| Consider the remaining spectrum in the 3.3 - 3.8 GHz band including 3.34 - 3.4 GHz frequency band (intended for regional broadband and private networks) and the 3.4 - 3.46 GHz frequency band (intended for national use) | | ● | ● | ● | | | | ● |
| Start initial work on reviewing and re-planning the 3.8 - 4.2 GHz frequency band bands, potentially including technical consultation | | ● | ● | ● | | ● | | ● |
| Investigate future use of the 6.425 - 7.125 GHz frequency band taking into account international and regional developments, including Wi-Fi, Mobile (IMT) and shared models | | ● | | | | | ● | ● |
| Commence review and planning work for frequency bands where management rights are due to expire from 2028–2031. This includes:<br>› 2500 and 2600 MHz, expires 31 December 2028 review commences around 2023-2024<br>› 2300 MHz, expires 25 November 2030 review commences around 2024<br>› AM and FM, expires 2 April 2031 review commences around Q1 2025<br>› 700, 850, and 900 MHz expires 28 November 2031 review commences around Q4 2025 | | ● | ● | ● | | ● | | ● |
| Investigate ways to get more use out of the radio spectrum and adopt tighter spectrum practice including spectrum sharing, tiered and dynamic access mechanisms | ● | ● | ● | ● | ● | ● | ● | ● |
| Complete the review the 2575 – 2620 MHz Managed Spectrum Park | | ● | ● | ● | | ● | | ● |
| Investigate and plan for 40 GHz mmWave, particularly 40.5 - 43.5 GHz and 40 - 50 GHz QV band satellite | | | | | ● | | | ● |
| Continue implementation of Crown agreement on radio spectrum with Māori | | | | | | | | ● |

| | Satellites and space | Mobile data traffic | Massive IoT | Private networks + industry verticals | Use of higher frequencies | Spectrum sharing + efficient use of spectrum | General user licensing | Spectrum management and administration |
|---|---|---|---|---|---|---|---|---|
| **Regulatory management and administration** | | | | | | | | |
| Assisting New Zealand Space Agency on issues as they arise | ● | | | | | | | ● |
| Continue to run the ITU-R Satellite Co-ordination process and keep PIBs up to date (e.g. PIB 60) and engage space and satellite service providers on on New Zealand regulatory settings as they arise | ● | | | | | | ● | ● |
| Adapt and update licensing frameworks and processes as required for both space and terrestrial systems | | | | | | | ● | ● |
| Scope issues and develop proposals to modernise the Radiocommunications Act 1989 including relating to spectrum sharing | | | | | | | | ● |
| Continue to proactively engage in the APT ITU, WRC and international issues relating to radio spectrum | | | | | | | | ● |
| Develop and implement revised operational approach to small cell network licensing | | ● | ● | ● | | ● | ● | ● |
| Develop options for law enforcement agencies regarding use of wireless electronic counter measures and associated technologies | ● | ● | | ● | | | | ● |
| Keep the government policy statement for radio licencing updated as required | | | | | | | ● | ● |
| Keep the PIBs updated as required | ● | ● | ● | ● | ● | ● | ● | ● |
| Consider updates to General User Licences, particularly for short-range devices | | | | | | | ● | ● |
| Start the review the Radio Spectrum Licensing Fees regime in 2023 | | | | | | | | ● |
| Continue managing licencing within Crown spectrum holdings | | ● | ● | ● | | ● | | ● |
| Continue implementation of the new RRF | | | | | | | | ● |
| Continue investigations work | | | | | | | | ● |
| Investigate ways to build capability in the Radiocommunications sector including through the training of Approved Radio Engineers and Certifiers | | | | | | | | ● |

| | Satellites and space | Mobile data traffic | Massive IoT | Private networks + industry verticals | Use of higher frequencies | Spectrum sharing + efficient use of spectrum | General user licensing | Spectrum management and administration |
|---|---|---|---|---|---|---|---|---|
| **Monitoring items** | | | | | | | | |
| Monitor international developments on telemetry, short messaging, and low-data-rate IoT satellites | ● | ● | ● | | | | ● | ● |
| Monitor developments and sharing arrangements in 3.8 – 4.2 GHz | | ● | ● | ● | | ● | | ● |
| Monitor developments for mobile in 1427 - 1518 MHz and mobile satellite services in 1518 - 1525 MHz | ● | ● | | | | | | ● |
| Monitor 5.875 - 5.925 GHz for Intelligent Transportation Systems (ITS) | | ● | ● | | | ● | | ● |
| Monitor potential developments in 1880 - 1920 MHz including spectrum for rail | | ● | ● | ● | | | | ● |
| Monitor developments Automated Frequency Coordination (AFC) systems in the 5.925 - 6.425 GHz frequency range for this region | | | | | | ● | | ● |
| Monitor developments in E band Satellite systems in 70 / 80 GHz | ● | | | | ● | | | ● |
| Monitor developments in new 6G mobile technology and next generation mobile technologies and standards | | ● | | | | ● | | ● |
| Monitor developments in Non-Terrestrial Networks and Direct to Device and other space sector developments | ● | ● | | | | | | ● |
| Monitor international developments in spectrum sharing, tiered and dynamic access mechanisms | | | | | | ● | | ● |
| Monitoring sector needs, training and qualifications for radio specialists | | | | | | | | ● |

Te Kāwanatanga o Aotearoa
New Zealand Government

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