RADIO SPECTRUM MANAGEMENT

NOT GOVERNMENT POLICY

Fixed Services in New Zealand Discussion Document:

Ensuring efficiency in the backbone of the digital economy

January 2015

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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Interested parties are invited to comment on the content of this document, in particular the questions posed in the text boxes, and on any related issues. Written submissions should be sent no later than 15 March 2015 to:

by email: *(preferred option)*

radio.spectrum@mbie.govt.nz

Subject line: "Fixed Service Discussion Document Submission"

or

by post:

Fixed Service Discussion Document Submission
Radio Spectrum Management: Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
WELLINGTON

Any party wishing to discuss the proposals with Ministry officials should email, in the first instance, radio.spectrum@mbie.govt.nz.

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Glossary of terms used in this document

Where abbreviations or other terms are used in this document, they have the following meanings:

Abbreviation	Meaning
ARC	Approved Radio Certifier
ARE	Approved Radio Engineer
DMA	Defined Metropolitan Area
EHF	Extra High Frequency, 3 GHz – 30 GHz
GHz	Gigahertz
ITU-R	International Telecommunications Union, Radiocommunications Sector
kHz	kilohertz
km	kilometre
Ministry	Ministry of Business, Innovation and Employment
MHz	Megahertz
PIB	Public Information Brochure
RSM	Radio Spectrum Management
SHF	Super High Frequency, 30 GHz – 300 GHz
STL	Studio to transmitter link
UHF	Ultra High Frequency, 300 MHz – 3 GHz

1. Introduction

1.1. Purpose

The key goal for spectrum management is to ensure efficient use of the radio spectrum. This comprises both technical efficiency and economic efficiency. In some cases, trade-offs may be made between the two; in all cases, careful planning is necessary.

Fixed services are widely used for backhaul, broadcasting, and other large-scale data transmissions. They can be thought of as the backbone of the digital economy. Ensuring efficient use of fixed service bands can help achieve the Ministry's overarching goal to grow New Zealand for all.

In the *Radio Spectrum Five Year Outlook: 2012-2016*[1] ('the Spectrum Outlook'), the Ministry of Business, Innovation and Employment (the Ministry) proposed to carry out work to ensure the efficient use of the fixed service bands in New Zealand. The review

> *"is expected to identify current usage of New Zealand allocations and identify any opportunities and potential efficiency gains in the bands. It will consider international trends and allocation practices and compare these with current New Zealand practices."*

This discussion document forms a key part of the fixed services review and seeks industry input on options to increase efficiency in the fixed service bands.

1.2. Fixed service bands

Typically, fixed service bands provide point-to-point and point-to-multipoint links up to 100 km apart, either intra metropolitan, inter metropolitan, or between rural high sites to provide long distance radio links. These bands are in the frequency ranges 162.2 MHz to 86 GHz. Some bands have been allocated for specific purposes due their characteristics and the availability of equipment.

The Ministry has published a number of Public Information Brochures (PIBs) covering fixed services in New Zealand. These are targeted at licence seekers, Approved Radio Engineers (AREs) and Approved Radio Certifiers (ARCs). The four key PIBs are:

- PIB 21 "*Table of Radio Spectrum Usage in New Zealand*", detailing the New Zealand allocations of spectrum
- PIB 22 "*Fixed service bands in New Zealand*", detailing the allotment of bands and giving channel plans for all fixed service bands
- PIB 38 "*Radio Licence Certification Rules*", containing engineering rules and information necessary for licence assignments to be made
- PIB 58 "*Radio Licence Policy Rules*", containing the policy rules any application for a radio licence must comply with before an assignment can be made or a licence granted.

When changes are made to the Ministry's rules and policies, these PIBs are updated to reflect Government or Ministry decisions.

[1] Radio Spectrum Five Year Outlook 2012-2016: consultation draft – http://www.rsm.govt.nz/cms/policy-and-planning/consultation/radio-spectrum-five-year-outlook-2012-2016

1.3. Review process

The Ministry initiated the current review of fixed services in 2012. Consultation with stakeholders as part of the review is being undertaken in two stages.

The first stage was undertaken in late 2012 when a targeted consultation sought the views of 30 AREs and ARCs who had certified fixed service licences in the previous 12 months. This consultation sought views on whether

> *"any fixed service bands are at present congested, or if the demand for use is likely to present challenges in the next five years."*

The Ministry received eight responses ranging from the very broad, to the detailed and specific. These initial submissions have fed into this broader discussion paper.

In this second stage, the Ministry seeks wider input on fixed services issues from industry. This discussion document outlines a number of issues that are either band-specific or relevant across the wider fixed service links arena. The document also identifies the Ministry's position on some bands and / or issues where the Ministry does not wish to make any further change. The Ministry is seeking views on a number of questions. A summary of all questions is provided in Section 4 of this discussion document.

1.4. Review scope

After considering the submissions from the targeted consultation, the Ministry has identified a number of key areas of work. These align with the issues raised in the Spectrum Outlook and include the following:

- The use of assignment policies to increase spectral efficiency – demand for spectrum continues to grow for multiple reasons including greater proliferation of wireless services, reducing equipment costs, flat licence fees and continuous demand for more data throughput.
- The reconfiguration of existing fixed service bands – to harmonise with ITU-R channel plans. Harmonisation increases the availability of 'off-the-shelf' equipment that can be used in New Zealand, potentially reducing costs to fixed service operators and users.
- The congestion at certain metropolitan sites – Sky Tower, Sugarloaf, Kaukau and Mount Cargill were highlighted as sites with heavy demand for licences. The Ministry notes that licences at these sites are likely to always be in demand due to their proximity to major population centres.

The review also considers whether some bands used for fixed services should be moved from the radio licencing regime to the management rights regime.

2. General fixed service proposals

The Ministry has identified a number of generic fixed service issues relating to licencing, engineering, and implementation of services in fixed service bands in New Zealand. These are discussed further below.

2.1. Digitisation

Digital modulation techniques provide benefits over analogue modulation due to their increased data throughput and options for different modulation schemes. All fixed service bands above 1 GHz are restricted to digital modulation only. Under 1 GHz, some bands are digital only, some allow both digital and analogue modulation, and some services (such as studio to transmitter links (STLs)) are restricted to analogue only.

Table 1 below summarises the different uses for sub 1 GHz bands.

Table 1: Summary of existing use for sub 1 GHz bands

Band	Frequency range	Allocated use
EE (inc EEW 25 kHz) channels)	162.2 – 170.31 MHz	Point-to-point & point-to-multipoint Analogue and digital services
I	420 – 430 MHz	Point-to-point & point-to-multipoint Analogue and digital services
I_{STL}	404 – 413.8 MHz (I1 – I18 & I1# -I15#)	Point-to-point uni-directional Studio to transmitter links Analogue services only
JL	440 – 449 MHz	Point-to-point & point-to-multipoint Digital only
JL_{STL}	444 – 444.9 MHz	Point-to-point uni-directional Studio to transmitter links Analogue services only
J	450 – 470 MHz	Point-to-point & point-to-multipoint Analogue and digital services
KK	806 – 812 MHz 851 – 857 MHz	Point-to-point Digital only
KL	841 – 851 MHz	Point-to-point uni-directional Studio to transmitter links (analogue only services) Analogue and digital services
K	915 – 921 MHz 928 – 935 MHz	Point-to-point uni-directional Studio-to-transmitter links (analogue only services) Analogue and digital services

The bands below 800 MHz were originally designed for linking analogue land mobile sites together. Many of these bands are now used for low data rate digital services which have arisen in part from the demand for automation, telemetry, telecommand and control systems.

Most bands include a range of services, with channel widths ranging from 12.5 kHz to 75 kHz. Where STLs are permitted in the band, channel widths are up to 500 kHz.

Transitioning to digital only services may increase the spectral efficiency of the sub 1 GHz bands. Permitting digital services in STL bands is discussed further in Section 3.1. The Ministry is keen to hear views on whether some or all of the fixed service bands below 1 GHz should be transitioned to digital only services. If so, how the transition should be phased in, and over what timeframe.

What are the options?

There are a number of possible options for future use of sub 1GHz bands, these include:

1. Do nothing – leave the current rules as they are, allowing licensing for both analogue and digital and allowing the current mix of analogue and digital services to continue.

   Given that analogue is an old technology and is not as spectrally efficient as digital, the Ministry does not consider that doing nothing is a good option.

2. Require all new licences to be for digital services only so that in time all bands will transition to digital. Existing analogue services will be able to continue until the licensee chooses to transition to digital.

3. Transition some or all bands to digital services only and require both existing and new licences to be for digital services only, with existing licensees given a deadline to make the transition. Typically the transition period is set at no less than 5 years in accordance with Regulation 15D of the Radiocommunications Regulations 2001.

1. ***Should all or some sub 1 GHz fixed service bands be digital only? If so, are there particular bands that should be given priority to change to digital only services?***
2. ***Should any requirement for digital services apply to new licences only or should existing analogue services be required to transition to digital? If all licences are required to transition to digital services, over what time period should analogue licences be phased out?***

2.2. Spectral efficiency

The increase of data consumption in both private and public networks is creating demand for increased connectivity using fixed radio links. Digital services provide for greater spectral efficiency over analogue services. Current licencing rules require digital links to have a minimum spectral efficiency of one bit per second per Hertz. All 56 MHz channels across all bands are required to meet a minimum spectral efficiency of four bits per second per Hertz.

The Ministry is keen to hear views on whether the minimum spectral efficiency should be set at four bits per second per Hertz for all new digital services in all fixed service bands.

3. ***Should the Ministry increase the minimum spectral efficiency of digital services from one bit to four bits per second per Hertz? If so, should this apply to some (please identify which ones) or all bands?***
4. ***Should any requirement for increased spectral efficiency apply to new licences only or should existing licences be required to transition to this standard? If so, over what time period should the lower standard be phased out?***

2.3. Metropolitan site congestion

There are a number of elevated sites that serve major urban areas that offer good coverage of the local area and therefore act as major hubs in New Zealand's radiocommunications infrastructure. Sites serving metropolitan areas such as the Sky Tower in Auckland, Te Aroha in the Waikato, Wharite in the Manawatu, Kaukau in Wellington, Sugarloaf in Christchurch and Mount Cargill in Dunedin are all well used. Sky Tower in Auckland is the busiest site in New Zealand with high demand from all users of spectrum.

Industry feedback indicates that congestion may be limiting the ability to engineer new licences at these sites.

The Ministry has rules which set minimum antenna performance within seven Defined Metropolitan Areas (DMAs) in PIB 38 and PIB 58. DMAs are established for Auckland, Hamilton, Tauranga, Palmerston North, Wellington, Christchurch, and Dunedin.

We are considering whether the number of DMAs should be increased from the seven already identified and whether additional rules for the DMAs are necessary to manage the identified congestion issues.

The Ministry is not yet convinced that congestion is sufficient outside the identified DMAs for the number of DMAs to be increased. The Ministry is interested in hearing feedback on whether other potential locations should be identified as DMAs.

Additional rules to apply within the DMAs could include:

- Specifying more stringent minimum antenna performance requirements, such as:
    - narrower beam widths and better side lobe performance
    - minimum radiation pattern envelope (RPE) masks, or
    - minimum performance formulas based on the ITU-R Recommendations.
- Setting a more stringent minimum level of spectral efficiency for services within the DMA , potentially through requiring compliance with specified equipment standards.
- Increasing the minimum path length requirements for fixed links that are within the DMA, or cross the DMA boundary. Additional rules could also encourage users to select an appropriate frequency band for their radio link, preventing lower frequency bands being used for short links.

In any of these options, the reduction in congestion in these areas may be slow to achieve if new rules are applied only to new licences. The reduction may be more rapid if any new performance requirements were applied to existing licences. However, retrospective application could have significant cost implications for industry. This could be mitigated by progressively applying the rules to different bands and / or progressively applying the rules to highly congested DMAs.

The Ministry welcomes feedback on the potential mechanisms to reduce congestion in particular DMAs identified in the options above or any alternative mechanisms to reduce congestion. Feedback is also sought on whether any new rule(s) should be applied to new licences only or also be applied retrospectively to existing licences. If the rules were applied retrospectively, the Ministry is interested in feedback on which bands and sites should be given priority for change.

5. ***Should further areas be added to the designated DMAs and if so which areas?***
6. ***Should further DMA rules be introduced? If so, what should the rules specify? Should these be tailored to each particular DMA?***
7. ***Should any DMA specific rules be applied to new licences only or also apply to existing licences? If existing licences become subject to the new rules, how should the transition be managed?***

2.4. Interference evaluation method for Digital Microwave Radio (DMR)

Submissions from the targeted consultation in late 2012 suggested the current interference evaluation method for digital microwave radio, '1 dB threshold degradation method' (1dB method) be changed to a carrier to interference (C/I) method.

The interference evaluation method is prescribed in section 4.3 'Co-channel interference threshold' of PIB 38: Radio Licence Certification Rules. The 1 dB threshold degradation method is required for the KK, LL, L, EHF and SHF digital microwave radio bands. Section 2.4.2 *'Receiver noise floor'* of PIB 38 sets out the interference threshold calculation method and sets a fixed interference threshold of -110 dBm for other VHF and UHF fixed services.

Under the 1dB method, the noise floor of a victim receiver must not be increased by more than 1 dB by any interfering signal. Effectively this means that any interfering signals must be at least 6 dB below the thermal noise floor of the victim receiver. The advantages of the 1 dB method are that it:

- is simple
- is well proven
- does not require detailed knowledge of the fixed service or specific details of the receiver that interference is being assessed against (victim receiver).

The carrier to interference (C/I) method is based on the protection ratio of a victim receiver. The protection ratio is the minimum ratio (dB) of the wanted signal to the unwanted signal to ensure the system is able to operate with satisfactory reception. Unlike the 1 dB threshold degradation method, the C/I method

- requires detailed knowledge of the victim receiver and the expected level of wanted signal.
- involves more calculations and work by the ARC / ARE.

The Ministry notes that the C/I method is the prescribed method by the Australian Communications and Media Authority through its RALI FX3 microwave fixed services frequency coordination document.

What are the options?

1. No change, continue to require the use 1 dB threshold degradation method.

2. Change the rules in PIB 38 to require the use of the C/I method for KK, LL, L and SHF bands.

The information recorded against licences in SMART is currently sufficient to support a 1 dB threshold degradation interference assessment method, however it may not be sufficient for effective use of the C/I method. If the Ministry required a C/I method to be used, generic protection ratios would be needed so that the method could be used against existing licences. The setting of these generic protection ratios may have some challenges. In addition, ratios may need to be set at a

worst case receiver performance to protect existing licensees from harmful interference which may impact on the efficient use of spectrum.

Figure one shows an on channel scenario of interference to a victim receiver. The left shows an interference scenario where the 1 dB threshold degradation method is used where an interfering signal must be 6 dB below the noise floor of the receiver. The right shows an interference scenario there the C/I method is used and the interfering signal is limited to a minimum ratio below the wanted signal. For the same piece of equipment, the minimum ratio in the C/I method will be similar to the ratio in the 1dB method of the receiver threshold to the noise floor. In both methodologies, fade margins are normally added into the link budget and when assessing interference, the faded signal is considered for the worst case scenario for the victim receiver.

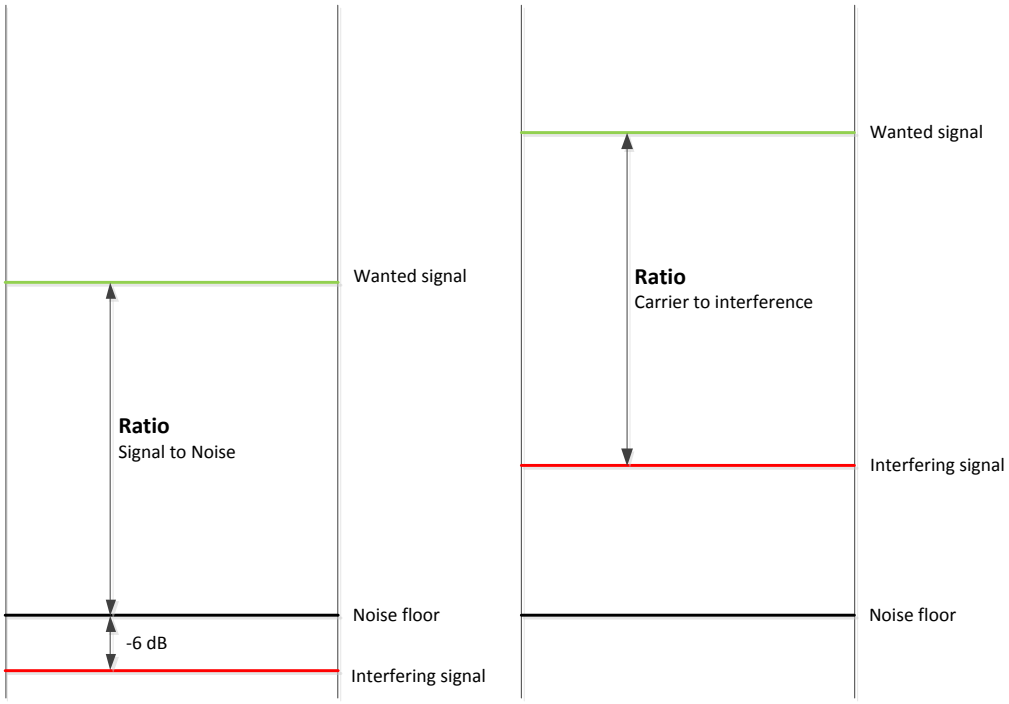


Figure 1: 1dB threshold degradation vs C/I method

In theory the C/I method may be more spectrally efficient than the 1 dB method as it may allow licence engineering closer to the margins of receiver performance. In practice due to the limitations on the information on existing licences, worst case receiver performance may need to be assumed. Initially in some locations, use of the C/I method may provide some spectrum efficiency gains allowing fixed links to be certified that may not be able to certified under the current 1dB method. However, in time the C/I method may result in a general increasing in the power (EIRP) of fixed links to overcome interferers. This may limit the ability to certify new licences.

The 1dB method is the Ministry's preferred method as:

- it is simple to use and perform the required calculations and AREs / ARCs are familiar with this method;
- it is non-specific to individual fixed link system design where details of the receive system and expected receive signal levels are not required;

- it is a proven method where interference is unlikely, this gives licensees certainty that they will not be interfered with by the granting of new licences;
- the information currently recorded in SMART supports this method; and
- it is uncertain if the C/I method will provide a spectrum efficiency gain in practice.

If the methodology is changed, the Ministry will need to do further work to define the details of how a C/I method would be implemented. It is likely that:

- a set of generic protection ratios would need to be prescribed.
- new requirements would need to be added so that additional information is recorded in SMART on new licences to allow better use of the C/I method.
- new rules would need to be developed to allow an ARE / ARC to use the protection ratios defined on the equipment manufactures datasheets, where the information can be sourced.

8. ***Should the current '1 dB interference threshold degradation' method prescribed in Section 4.3 'Co-channel interference threshold' of PIB 38 be retained or replaced with a carrier to interference method? Please provide information on why the method should be changed and the increased spectral efficiency over the current 1 dB threshold degradation method expected to result from the change.***

9. ***If the method is changed to a carrier to interference method, how should this be implemented?***

2.5. Adjacent channel interference criteria

Section 4.4 *'Adjacent channel interference criteria'* of the *'Radio Licence Certification Rules'* (PIB 38) sets out rules on assessing adjacent channel interference. The section sets out generic Frequency Dependent Rejection values to be used in the absence of more specific information from manufactures equipment data sheets. These values are:

Table 2: Frequency Dependent Rejection

Channel offset	Frequency Dependent Rejection (FDR)
Co-Channel	0 dB
1st Adj Channel	30 dB
2nd Adj Channel	50 dB
> 2nd Adj Channel	Consideration not required

The Ministry is interested in hearing views on whether these values are appropriate or should be amended.

10. ***Are the Frequency Dependent Rejection values in PIB 38 appropriate? If not, what should these values be? Should there be different values for different bands?***

2.6. Equipment standards

There are currently no equipment standards specified in the Radiocommunications (Radio Standards) Notice 2010 for fixed service equipment in the microwave bands above 1 GHz. Above

1 GHz, the ITU standards apply and equipment is required to comply with Recommendation ITU-R SM.1541-5 *'Unwanted emissions in the out-of-band domain'*.

Below 1 GHz, AS/NZ Standard 4768.1 (2010): '*Digital radio equipment operating in land mobile and fixed services bands in the frequency range 29.7 MHz to 1 GHz - Radiofrequency requirements'* applies for fixed services that use 12.5 and 25 kHz channel devices.

During our initial discussions with industry, some concerns were raised about equipment performance of some newer equipment. In some cases, equipment does not comply with the prescribed standards or operates in frequencies above 1 GHz where the Radio Standards Notice does not specify a standard. In other cases, digital emissions in the microwave bands are wider than the prescribed channel width and do not comply with the published New Zealand band plans.

Specifying minimum equipment performance standards may reduce the risk of interference from poor performing equipment going on the market.

What are the options?

There are a number of options to manage the performance of transmitting equipment. These include:

1. Do nothing. This relies on equipment supplied from developed markets and overseas suppliers having to meet international standards required by other jurisdictions.

2. Implement New Zealand standards for microwave equipment[2]. This could be met through adopting a relevant international standard (for example European standard EN 302 217-2[3] covers transmitters operating fixed service links from 1.4 GHz to 86 GHz). This could limit the supply of equipment to end users if compliance costs increase for suppliers.

11. Should the Ministry implement equipment standards for fixed services above 1 GHz? If so, what standard should be specified?

2.7. Necessary bandwidth and channel widths for digital services

For some digital microwave bands services, the occupied bandwidth may be greater than the channel width prescribed on the licence. This creates a potential compliance issue where emissions may not be strictly in accordance with licences. The issue of the occupied bandwidth being greater than channel bandwidth is recognised in Recommendation ITU-R F.1191 (5/11) *'Necessary and occupied bandwidths and unwanted emissions of digital fixed service systems'.* This recommendation offers commentary around out of band emissions such as;

> *"it is relatively unlikely that out-of-band emissions from [fixed services] will cause significant interference into systems operating in adjacent bands, because:*
>
> - *the power spectrum of a deployed fixed service link decays rapidly outside the occupied bandwidth; and*
> - *the e.i.r.p. of line-of-sight [fixed services] is low or medium."*

[2] The Ministry would need to notify the World Trade Organisation and MFAT that new standards apply. MFAT

[3] Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas

In additional the recommendation further notes

> *"that from the viewpoint of interference into other systems sharing the same frequency band, interference due to out of band emissions will be, in general, less significant than that due to emissions within the necessary bandwidth*".

and

> *"that intra-system interference related problems, which may be caused by unwanted emissions, are normally taken into account by [fixed service] designers".*

If any changes were required to existing fixed service licences, then an update of the general licence conditions for all radio licences would be required. PIBs are guidance notes for new access seekers rather than current licence holders.

The Ministry is seeking views on whether further prescription of the occupied bandwidth on licences for fixed services is required. In addition, the Ministry seeks view on whether there is a need to provide further guidance to AREs and ARCs for licence engineering.

What are the options

There are a number of options to this including:

1. Do nothing. The Ministry would rely on the general requirements under the Act for compliance with the International Radio Regulations

2. Emphasise the relevant parts of the International Radio Regulations by adding references to specific recommendations in the general licence conditions.

   In this case, all transmissions would be required to comply with reference ITU-R F.1191 (5/11). Most equipment sourced internationally should already meet this standard so it is unlikely that this would cause unnecessary burden on licence holders.

12. Should the Ministry adjust the general licencing conditions for digital services to ensure licences better reflect occupied bandwidth in the microwave bands?

2.8. Information on licence records

The licencing rules in PIB 38 require accurate information to be recorded in SMART. These requirements are currently not heavily enforced. As a result, AREs and ARCs may have difficulties engineering licences and have to carry out additional work to find a suitable channel for new transmissions. Some submitters to the Five year Spectrum Outlook raised concerns regarding the quality of the information in SMART.

The inaccuracy or lack of information in SMART may be a result of poor information recorded on licences and / or changes to equipment after the licence is granted not being reflected in SMART. During the licence engineering process, the Ministry considers it is the responsibility of AREs and ARCs to ensure recorded licence details are satisfactory. However, once a licence is granted, there is a responsibility on the licence holder to ensure that the installed equipment is correctly recorded against the licence information held by the Ministry.

Inaccurate licence information may become more significant if the interference calculation methodology is changed from the current 1 dB threshold degradation method to the C/I

methodology as discussed in section 2.4 of this document. For efficient outcomes the latter methodology would require greater accuracy and potentially more information to be recorded in SMART.

What are the options?

The Ministry seeks views on whether AREs and ARCs consider inaccurate information on licences a significant issue and, if so, how should the Ministry respond to the issue. Options for Ministry action include:

1. Increasing in the number of licence audits being carried out on AREs and ARCs

2. Increasing in the number of site audits by the compliance team, to ensure that installed equipment is accurately reflected in the details held in SMART

3. Requiring additional professional development for AREs and ARCs on the licencing requirements.

13. Is inaccurate information on licences a significant issue for AREs and ARCs and licensees? If so, how should the Ministry respond to the issue?

2.9. Transition of spectrum to the management rights regime

Use of some fixed service bands is predominantly by a single licensee. An example of this is the 5 GHz band which is predominantly used by Kordia for a national network to provide carrier grade backhaul. The Ministry currently does not have any policy on when frequencies should be moved from the radio licencing regime to the management rights regime. To date, only high value spectrum mainly used for cellular mobile communications and broadcasting purposes are within the management rights regime.

The advantages of the management rights regime are:

- a defined term up to a maximum of 20 years - rights may expire earlier if the Crown chooses to create rights for a shorter period at the outset. The long tenure is intended to give the management right owner greater certainty in decision-making about their investments. There is no obligation on a management right owner to grant licences to other parties. This may create competition concerns, but there is also an economic incentive to maximise revenues from the asset.
- Encouraging the efficient use of spectrum - owners and rightholders factor resource charges into decision-making about the appropriate technology to use.
- the ability to change or upgrade the technology used - with no need to involve the Ministry. However this may increase the risk of disparate technologies being used between management rights and less than optimal channel reuse, resulting in less technical efficiency. Coordination between management right owners and rightholders may resolve any issues.

The Ministry is interested to hear feedback on whether bands predominantly used by a single licensee should be transferred to the management rights regime. If so, should the Crown retain ownership of the management rights or the right be transferred to a private manager.

14. ***Should the Crown consider creating management rights for bands where there is predominantly a single licensee? If so, are there other criteria that should be met before a management right is created for fixed service bands?***

15. ***If spectrum is transferred into the management rights regime, should it be managed by the Crown or allocated to a private manager? If allocated to a private manager, should the allocation be by contestable means or to the predominant user?***

2.10. Channel widths

The ITU-R recommendations provide for a range of channel widths for fixed service bands. Jurisdictions may elect to use any combination of the recommended channel widths. Industry trends indicate that there is increased demand for larger channels in the higher frequencies from licence holders. Newer licences in the Register of Radio Frequencies for bands above than 7.1 GHz indicate that 28 and 56 MHz channels are increasingly being used. The Ministry seeks feedback on whether, as a matter of policy, fixed service bands should be based on the following channel sizes where a range of channel widths are provided for under the ITU:

Table 3: Preferred Channel Widths

Frequency	Preferred channel width	Comments
Below 800 MHz	Multiples of 12.5 kHz	I band starts out with 25 kHz channel widths.
800 MHz to 1 GHz	Multiples of 250 kHz	
1 to 2 GHz	Multiples of 25 kHz and 2 MHz	For LL and L Band use respectively
2.7 GHz and above	Multiples of either 3.5 or 10 MHz	The 80 GHz band however has significant larger channel sizes due to its operational characterises and equipment availability

The ITU-R Recommendations may not include an option for these channel widths for all bands. An example is the W band where the current channel width in use is 29.65 MHz, which was based on United States band plans that was initially drawn up to meet demand for voice circuits. A number of proposed rechanneling options for individual bands are discussed in section 3 of this document.

16. ***Should the Ministry apply consistent channel sizes across specified frequency ranges in fixed service bands? If so, what should be the basis for these channel sizes? Should channel sizes be based on the preferred channel width shown in Table 3?***

2.11. Band renaming

At present, a substantial number of the lower frequencies – UHF and EHF bands use a letter to represent the band. To minimise confusion between other international band notations, e.g. X band radar, should the Ministry rename to numbers only? Table 4 offers some potential options (note not all bands shown):

Table 4: Potential band renaming

Frequency	Current band designator Preferred	Potential new band designator
450 – 470 MHz	J Band	460 MHz band
3600 – 4200 MHz	P Band	4 GHz band
7425 – 7730 MHz	U band	7.5 GHz band
14.5 – 15.35 GHz	G band	15 GHz band

17. Should the Ministry rename bands that are currently prefixed with letters, by numbers representing their approximate frequency of operation?

3. Band specific proposals

The following section proposes changes to a number of specific fixed service bands.

3.1. I_{STL}, JK_{STL}, KL and K STL bands

Studio to transmitter links (STL) are a type of fixed service used for linking an urban sound broadcasting studio to a sound broadcasting transmit site. Some bands have been set aside solely for STL use and there are specific rules applying to all STL services.

The Ministry notes that the frequency ranges used for STL links are highly desirable for other services such as cellular mobile and some bands currently used by STLs have are included in 3GPP[4] specifications. The STL bands (KL and K bands) have recently been re-planned through the review of the 806 – 960 MHz bands and the Ministry intends to retain the current bands allocated for STLs.

There is however a tension between broadcasters desires to have dedicated links and overall efficient use of spectrum for fixed services. The Ministry also notes that many radio programmes are broadcast nationwide through a network. The Ministry is considering whether there are opportunities to increase the efficient use of STL bands.

Table 5 below shows the different sub 1 GHz STL bands.

Table 5: Summary of STL bands below 1 GHz

Band	Frequency range	Allocated use
I_{STL}	404 – 413.8 MHz (I1 – I18 & I1# -I15#)	Point-to-point uni-directional Studio to transmitter links
JL_{STL}	444 – 444.9 MHz	Point-to-point uni-directional Studio to transmitter links
KL	841 – 851 MHz	Point-to-point uni-directional Studio to transmitter links
K	915 – 921 MHz 928 – 935 MHz	Point-to-point uni-directional Studio-to-transmitter links

What are the options?

A number of potential changes could be made to the STL bands to increase the spectral efficiency of STL bands which are outlined below. Not all of these are mutually exclusive.

Do nothing

If industry considers here are no issues with the current STL bands, then an option would be for the Ministry to make no changes to these bands.

[4] 3GPP is group that was initially set up to build the specifications for 3G cellular operations but has continued on with work on the 4G LTE specifications on a collaborative basis with industry organisation partners.

Digitisation

PIB 38 currently restricts all STL services to analogue transmission only. Analogue links are spectrally inefficient compared to digital links. A digital 500 kHz licence can carry three stereo programmes while an analogue service can only carry one. The Ministry is interested in views on whether digital links should be allowed in STL bands.

If changes are made to allow digital links in STL bands, the Ministry could allow both digital and analogue services in the same bands or require some or all STL bands to be transitioned to digital only services.

Minimum link distance

The frequency ranges that the STLs use are suitable for medium to long distance or obstructed services. However, many STLs are used for short distances, with 25 % of links are less than 5 km and 50 % of links are less than 10 km.

Recognising the fact that STLs are primarily used to link urban broadcast facilities with their local transmitters, other parts of the spectrum may be used for provide for these links. For example, SHF and EHF microwave links are more suited for short distance links. Most of the major studios already have SHF or EHF microwave links between their studios and the major broadcast transmission sites. The Ministry is seeking views on whether a minimum link distance should be specified for some bands.

Dual mono links

Some STL links are licenced and operated with 2 separate links providing stereo links for a single sound broadcasting programme. With the changes in available technology, a single 500 kHz composite channel can be used to provide stereo STLs. Whilst dual mono links using 2 x 250 kHz channels do not use more spectrum than a single 500 kHz channel, they have the potential to deny access to 500 kHz channels, making their use more spectrally inefficient. The Ministry would like to cease any further dual mono links being licensed.

Channel widths

Particular transmission locations have high demand for STLs due to their proximity to major urban centres. Where excess demand is an issue, one option to manage demand would be to require broadcasters that presently have multiple programmes from the same studio to the same transmission site to use a 500 kHz channel digital STL to carry three programmes to the transmitter. Where broadcasters have a single programme being transmitted via a STL, a 250 kHz digital channel would have to be used.

This would increase spectral efficiency by increasing the number of digital services with the ability to carry more information over the same path.

This option provides a different methodology for the digitisation of services, with the same resulting benefits of greater spectral efficiency resulting from a single digital service instead of dual analogue services.

STLs at congested sites

As noted in section 2.3, there are a number of elevated sites that serve the major metropolitan areas which offer good coverage of the local area. These sites act as major hubs in New Zealand's radiocommunications infrastructure.

The Ministry is keen to hear views on whether a limit should be placed on the number of STLs any one user[5] may have at specified congested sites, and if so, what that limit should be.

Limiting the number of STLs a licensee could have would increase efficient use of STLs at high density sites. Where there are three or more programmes going over the same path from a studio to transmit site, users could look to other solutions such as a SHF, EHF microwave link or wireline connection.

Time frames for change

Any change to currently operating services brings challenges to those licence holders using those services. The Ministry seeks views on when changes should be made to STL services on the five proposals laid out in this section. The Ministry has two main options to manage the transition to new licencing rules, if any changes are adopted. Either all potential changes could apply to existing as well as new services, requiring existing licence holders to transition to comply with the new licence rules within a set timeframe. If existing services have to change, how long a period notice period should be given for the change? Alternatively changes could be applied only to new access seekers immediately and existing licensees could remain on their existing licence arrangements until any changes to the licence are required. Changing the licencing rules would require some industry operators to purchase new equipment to meet the new rules. However, phasing the transition in over a number of years would give operators time to make the appropriate arrangements for investment. The Ministry seeks views on what would be appropriate method to apply the potential changes for the various topics identified above and when these proposed changes should be implemented. The Ministry is open to the two different implementation methods applying to the proposals.

18. ***Should digital services be permitted in STL bands? If so, should digital and analogue services be permitted or should all existing analogue services be required to transition to digital?***
19. ***Should a minimum link distance be specified for STLs in some bands for current and / or future links? If so, which bands should have the minimum link distance specified?***
20. ***Should no new dual mono STL services be allowed? If not, should the Ministry transition users from dual mono services to digital links?***
21. ***If the Ministry allows digital licences in the STL bands, should any broadcaster that transmits more than 3 programmes between a studio and broadcasting site be required to use a 500 kHz channel digital STL and those broadcasting a single programme be required to use a 250 kHz channel digital STL?***
22. ***Should a limit of three STL licences (via a combination of analogue and digital transmissions) at any single location be introduced for any single licensee? If so, should this be limited to congested sites only? If so, which ones? Should these limits apply retrospectively to current licences or should they only apply for new licences. Should the limits apply once any licence holder applies to make a change to any one licence at a site?***
23. ***How should the Ministry manage the timing and introduction of any changes to STL services? How should each of the five proposals above be managed?***

[5] Any revised rules will include non-association rules to ensure that a single user cannot use a number of different legal entities or licensees to hold more than the permitted number of licences.

3.2. EE Band

The current usage and allocation of the EE band (162.2 – 170.31 MHz) appears to meet present and future demands. The Ministry has no plans for change in these bands, however is interested to hear views on the channel plan for the EE band.

24. Are there any issues with the current band plan, use of, or future demands for the EE band?

3.3. I Band

I band (404 – 430 MHz) is one of the busier fixed service bands in use in New Zealand. The lower half of band is assigned to STLs (discussed above), and the upper half of the band has 25 and 50 kHz channels (groups F and G) for fixed services. The Ministry is aware of some demand for increased channel sizes to allow for increased data throughput in the band. If 100 kHz channelling were permitted in the band, a minimum spectral efficiency may need to be specified. The nearby JL band already has minimum spectral efficiency rules in place to ensure that efficiency in the band is maintained.

What are the options?

There are two possible options for the I band.

1. Do nothing. No changes to the I band plan.

2. Introduce 100 kHz channels into the band plan, by overlaying them on top of the existing 50 kHz channelling. This could be achieved by overlaying 100 kHz channelling on top of the 'G' group for 50 kHz channels numbered I603 through I699. The proposal is illustrated in Table 14 of Appendix 1. 100 kHz channelling gives more options to spectrum users by allowing for medium data rates to be deployed in this band. For instance, should two adjacent 50 kHz channels be joined together in a single 100 kHz transmission at the present time, it would be non-compliant as each licence needs a stand alone emission.

   This proposal enables 100 kHz channelling to be offered for assignment in the I band. However overlaying the 100 kHz and 50 kHz channelling may not be the most efficient use of the band as a single 50 kHz channel may remove the option of the overlaid 100 kHz channel being used in an area if a single 50 kHz channel blocks reuse of that channel in certifying a 100 kHz licence.

25. Should the Ministry offer 100 kHz channels in the I band (Group G) which interleave with the current 50 kHz channel plan? If not, how should the channel plan be amended, if at all?

3.4. J Band

This is the busiest fixed service band (450 MHz – 470 MHz) in use in New Zealand in terms of the most number of licences operating in the band. No congestion issues have been raised-in the main due to the narrow channels employed in the band. J band is primarily used for backhauling land mobile services and has a large number of licence holders across the country linking sites for private network use. With the emerging demand from industry for higher data throughput across the fixed service bands, there is an opportunity to reconsider the channelling in this band.

What are the options?

1. Do nothing. No changes to the J band plan.

2. Introduce 100 kHz channels into the band plan, by overlaying them on top of the existing 50 kHz channelling (Group D block of 50 kHz channels).

   Offering 100 kHz channelling would allow further options for fixed service users in the J band for services that require increased bandwidth. The proposal is illustrated in Table 15 of Appendix 1. As J band is the busiest fixed service band in terms of number of licences, adding 100 kHz channelling may have an impact on spectrum availability making it more difficult to engineer licences in the band.

26. Should the Ministry offer 100 kHz channels in the J band (Group D) which interleave with the current 50 kHz channel plan? If not, how should the channel plan be amended, if at all?

3.5. JL band

The JL band is a smaller UHF digital only band adjacent to the J band, using the frequency range of 440 – 449 MHz. It is at present lightly used compared to the neighbouring J band. PIB 38 requires a minimum spectral efficiency of two bits per second per Hertz for all services in this band. Increasing the spectral efficiency of fixed service bands in general is discussed in section 2.2 and would potentially raise the level of efficiency to four bits per second per Hertz. Given the light use of this band, the Ministry is seeking feedback on the potential reasons for the light use and whether there is a need for any changes to the channel plan or licencing requirements.

27. Are there any issues with the current band plan, use of, or future demands for the JL band?

3.6. KK Band

The KK band (806 – 812 MHz / 851 – 857 MHz) is designated for use with digital point-to-point links only. It is used to provide connectivity for land mobile radio, transport, and utility networks. All new licences must be for links with a minimum path length of 5 km, however some older licences created prior to this being implemented are for shorter links.

Currently KK band has a one bit per second per Hertz minimum throughput. As discussed in section 2.2, the Ministry is interested in views on whether the spectral efficiency should be raised to four bits per second per Hertz.

28. Are there any issues with the current band plan, use of, or future demands for the KK band?

3.7. L Band

L band (1427 – 1525 MHz) is mainly used to provide telephone services using customer multi access radio systems (CMAR), as part of the Telecommunications Service Obligation (TSO) to rural customers. The Ministry is currently undertaking a review of the TSO and expects to report at the start of 2015.

The L band is heavily used and it is difficult to certify new licences in the band. However, the largest licence holder is currently reviewing its long term use of this band. If the largest licence holder migrates their services away from the L band, the number of licences would reduce significantly.

Digital radio broadcasting services, if implemented, are expected to use the centre band gap of L band (1461.5 MHz to 1490 MHz). The Government policy statement[6] states that 1461.5 MHz to 1490 MHz may not be used for granting new radio licences except for

(i) maintaining the coverage of services provided by existing licensees; or

(ii) facilitating, by means of short-term licences, the transition of existing licensed services to alternative frequencies; or

(iii) demonstrating, by means of short-term licences and subject to the protection of existing licensed services, the operation of new technologies.

As digital radio has not yet eventuated in this band, the spectrum remains clear.

L band will also be part of the discussion of long term International Mobile Telecommunications (IMT) spectrum allocation at the forthcoming World Radio Conference (WRC) in 2015. There is presently a great deal of interest and debate around the allocation of spectrum for IMT purposes. Any allocation is subject to the WRC processes which typically take a number of years before the final allocation is made. New Zealand would then have to decide whether to follow the WRC recommendations for this part of the spectrum. As a result, it may be many years before for new services could be implemented or equipment becomes available from vendors for these frequencies.

With the current TSO review and international discussions around an IMT identification for L band, the Ministry considers that the any review of L band should be deferred until the future of the band become clearer. However should you have any views on the use of L band, the Ministry welcomes comment.

29. What services should L band be used for in the future? Why?

3.8. 5 GHz Band

The 5 GHz fixed services band spans the frequency range 4.4 GHz to 5 GHz. There is only one licensee in this band who was moved from the former N band (1800 - 1900 MHz) approximately 15 years ago. Since then, the licensee has invested in new equipment to provide a nationwide network to provide carrier grade backhaul for business telecommunications and broadcasters.

As discussed in section 2.9, where bands are occupied by a single licensee, there may be justification to transfer these frequencies to the management rights regime. The 5 GHz band may be a candidate for such a transfer.

30. Are there any issues with the current band plan, use of, or future demands for the 5 GHz band?

3.9. P Band

P Band is lightly used as there are significant coordination requirements due to the overlap with the C band for satellite use.

[6] http://gazette.govt.nz/notice/id/2008-go3203?year=2008&pageNumber=2213

The Ministry is currently comfortable with the level of use of the P band, however is interested to hear comments from stakeholders on the use of P band, and its coordination requirements with licenced satellite users.

31. Do you have comments on the current coordination process or possible future demands for services in the P band?

3.10. R Band

The R band (5925 – 6420 MHz) is designated for use by digital high capacity fixed point-to-point links. There is demand for services in this band as it provides good medium distance backhaul. It is shared with C band satellite services and there are a number of transmit and receive sites protected for this purpose. For the most part, these protected sites are New Zealand Racing Board (NZRB) uplink sites which have a wide geographic spread but are not in continuous use.

Currently, the band plan comprises offset channel plans (R and RA) each with 29.65 MHz channel bandwidths. ITU-R Recommendation F.383 (02/13) '*Radio-frequency channel arrangements for high-capacity fixed wireless systems operating in the lower 6 GHz (5 925 to 6 425 MHz) band'* provides for a number of different channelling sizes in the R band. These are 28, 29.65, 40 and 80 MHz.

The Ministry considers it is appropriate to review the channelling in the R band to see if the band should be aligned with other fixed service bands in New Zealand.

What are the options?

Rechanneling options for the R band include:

1. Do nothing – retain the current 29.65 MHz channel width with its two groups of channels interleaved.

2. Retain the current 29.65 MHz channels but remove the currently underused alternative offset group of 29.65 MHz channels.

3. Rechanneling to 28 MHz *(preferred option)*. This would make available a wider ecosystem of equipment. It would also allow for derivatives of 28 MHz to be used in the future, as 7 and 14 MHz channels would fit into 28 MHz channelling. 56 MHz channelling would be made available through pairing the 28 MHz channels. Allowing for 56 MHz channelling would improve the capacity of the band and allow higher data-rate equipment to be used

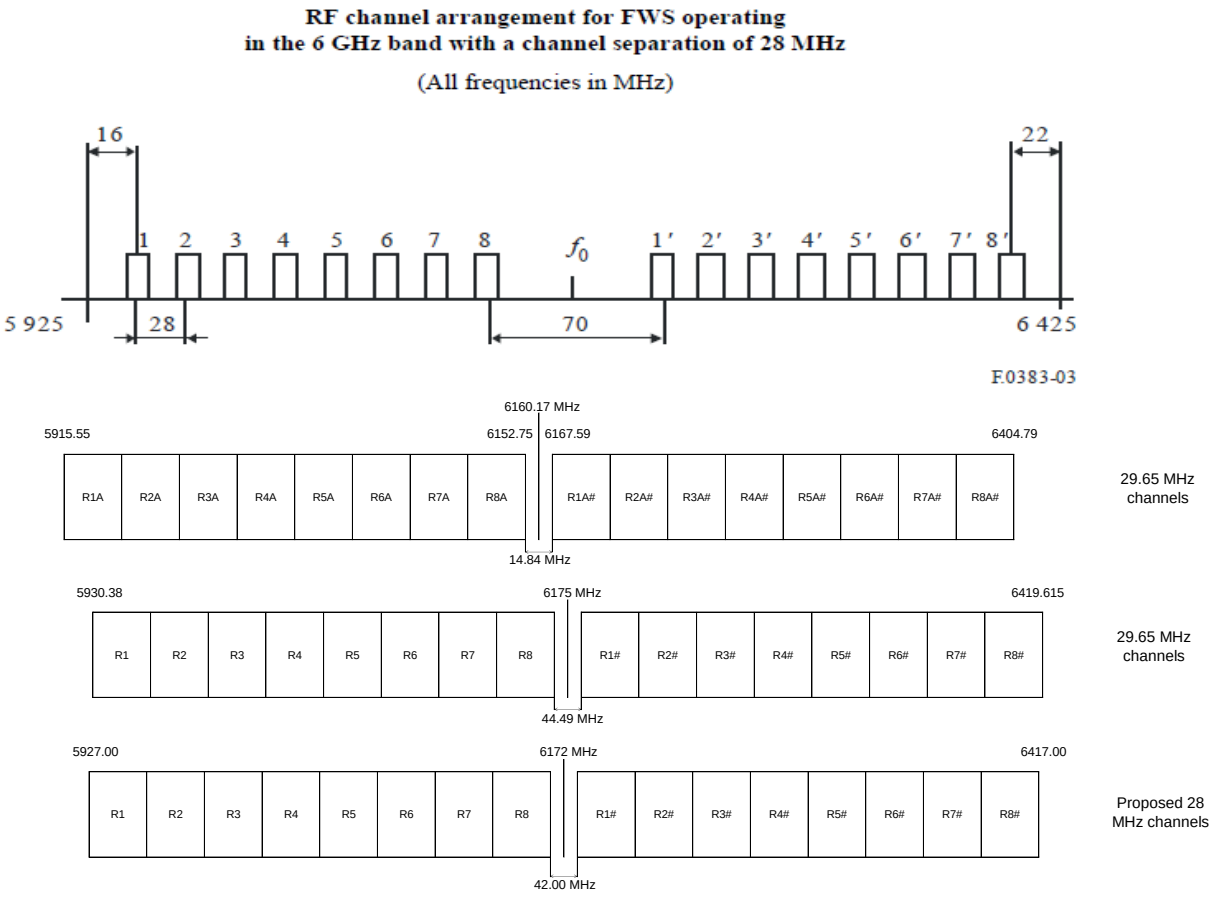
4. Rechanneling to 40 MHz. This would also make available an ecosystem of equipment available and enable other narrower channelling options.

The Ministry's preference for 28 MHz channelling is based on industry trends for 28 MHz channels in other bands and provides a foundation for potential 56 MHz channelling in the band in future, as seen in some of the bands around 8 GHz.

Table 6: Proposed R band 28 MHz rechanneling

Proposed R band rechanneling, based on 266 MHz duplex and 70 MHz spacing			
Channel	**MHz**	**Channel**	**MHz**
1	5,941	1#	6,207
2	5,969	2#	6,235
3	5,997	3#	6,263
4	6,025	4#	6,291
5	6,053	5#	6,319
6	6,081	6#	6,347
7	6,109	7#	6,375
8	6,137	8#	6,403

Figure 2: Proposed R band rechanneling



Managing the transition to new channels

The proposal for 28 MHz channelling in the R band means 'new' channels will be narrower than the existing 29.65 MHz channelling in R band. The Ministry seeks views on whether the new channelling

should apply to new licences only, permitting both 28 MHz and 29.5 MHz channels in the R band or whether all existing licences should be transitioned onto the new channel plan. If so, the Ministry is interested in views on what is the appropriate timeframe for businesses to make the necessary arrangements to accommodate the new channel plan.

32. Should the Ministry adopt 28 MHz channelling for the R band?

33. If the Ministry is to adopt 28 MHz channelling, should this be applied to new licences only or should all existing licences be required to transition to the new channelling? How long a timeframe should be allowed for the transition?

3.11. T Band

T band's (6430 – 7100 MHz) primary user is Chorus, who use it to provide connectivity for the public switched telephone network. It is designated to provide digital point-to-point and high capacity links with N+1 redundancy. The band has a significant number of licences across the country. The Ministry is unaware of any significant congestion issues in the band.

Currently, the band plan comprises offset channel plans (T and TA) each with 50 MHz channel bandwidths. ITU-R Recommendation F.384 (03/12) *'Radio-frequency channel arrangements for medium- and high-capacity digital fixed wireless systems operating in the 6 425-7 125 MHz band'* provides for a small number of different channelling sizes in the T band. These are 3.5, 7 and 14 MHz.

Three potential options have been identified for this band:

1. Removing the N+1 requirements.

   The N+1 requirements were initially used for bearer links with protection for selective fading, but are now infrequently used for new assignments. The removal of the N+1 requirement would increase the utility of the band. However, removal of the requirement could mean that in time the band will become occupied with single links and restrict the ability to certify new N+1 systems and the expansion of existing N+1 systems. T band offers potential fixed link users the ability to implement high availability services with the N + 1 requirements.

2. Rechanneling of the band to 14 MHz channel plan.

   The ITU-R Recommendation F.384 *Radio-frequency channel arrangements for medium- and high-capacity digital fixed wireless systems operating in the 6 425-7 125 MHz band* has no 28 MHz channelling option, however there is a 14 MHz channel plan which could be adopted.

3. Removing of the 'TA' alternative channelling.

   Two offset 40 MHz channel plans are provided in the T band, however removal of the 'TA' alternative channelling is an option. There are no apparent disadvantages to removing the TA channels, as it is not being used with no licences currently on any of these channels.

34. Is the N+1 designation still required for efficient use of T band?

35. Should the redundant TA channels be removed from the channel plan for the T band?

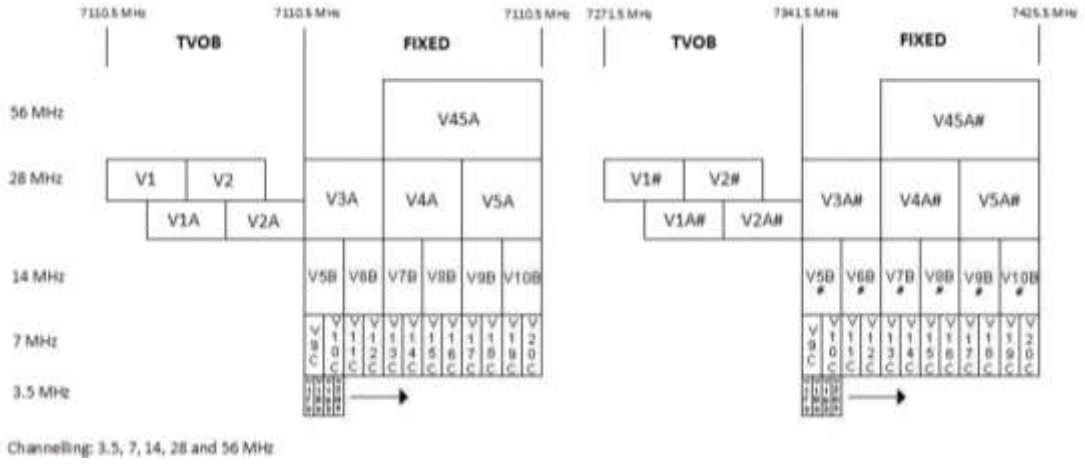
36. Should the Ministry consider rechanneling the T band to 14 MHz channel widths? If not, why not?

3.12. V Band

V band (7100 – 7425 MHz) is currently used for a variety of uses and is heavily licenced across the country. The lower half of the go / return channel plan is dedicated to 28 MHz TVOB channelling. The upper half has various channel sizes available but only one 56 MHz and three 28 MHz channels are available.

The Ministry is considering the future of the band and is seeking feedback on whether there remains demand for the two send and two return channels in the TVOB section of V band. In addition, the Ministry is seeking views on whether any existing demand in these bands can be accommodated in other dedicated TVOB bands.

Figure 3: Illustrating the current Channelling of V band



The Ministry is considering whether an additional 56 MHz channel for fixed services can be accommodated in the TVOB half which would overlap the V2 and V2A and respectively V2# and V2A# TVOB channels. The remaining channels in the upper part of V band would remain unchanged.

Creating another 56 MHz channel for use could work side by side with TVOB. This would mean that there would need to be new requirements created for users of V2A and V2A# to co-ordinate with fixed licences. An alternative could be that the new channel is licenced for use on a non-interference basis with TVOB usage. The Ministry is keen to hear feedback on what an acceptable coordination policy would be if an additional 56 MHz channel be available in the lower part of V band and whether the new 56 MHz channel could be used on a non-interference basis.

37. ***Should new 56 MHz channels V23A (7110.5 MHz) and V23A# (7341.5 MHz) be created? If so, could the new 56 MHz channels coexist with the TVOB channels currently in place? What would be an acceptable coordination policy if this were to occur? Should the new 56 MHz channels be available only on a non-interference basis?***

38. ***Can existing demand for the TVOB channels in V band be accommodated on other TVOB channels?***

3.13. U, W and Y bands

U band

U band's (7425 – 7730 MHz) predominate users are telecommunications services along with some land mobile backhaul. It is in high use across the country.

U Band has a large number of channel options with 56 MHz channels currently included in the band plan. These channels are restricted for DMR links with a minimum spectral efficiency of four bits per second per Hertz. Eight percent of licences in this band use 56 MHz channels.

Whilst U band is busy, the Ministry is unaware of any significant congestion issues or need for alternative channel widths. Consequently the Ministry is not considering any changes to this band.

W band

W Band (7730 – 8290 MHz) is used mainly for telecommunications links by a number of companies, with cellular licences being the majority of in the band. Channel widths in W band are currently 29.65 MHz.

The Ministry is considering amending the channel plan for W band. Rechanneling options are 28 MHz channelling or 40 MHz channelling which are shown below.

28 MHz channelling would increase the available channel count to nine and is consistent with other channel width suggestions (see section 2.10) to rechannel bands using multiples of 3.5 MHz wherever possible. With nine channels available using 28 MHz channel spacing, this offers 252 MHz of spectrum to be available for assignment. 28 MHz channelling in the W band would also allow use of industry standard equipment.

Based on the channelling in Annex 2 paragraph 1.1 of ITU R- F.386 '*Radio-frequency channel arrangements for fixed wireless systems operating in the 8 GHz (7 725 to 8 500 MHz) band*', 28 MHz channelling in the W band could enable 56 MHz channelling as well. This enables 224 MHz of spectrum to be allocated with larger channels for assignment. This is shown in Table 8 below. However, 56 MHz channel widths are not currently specified in the ITU-recommendation.

40 MHz channelling reduces the channel count to six, but enables more bandwidth per channel to be available for use and uses more of the spectrum. Using 40 MHz channelling in the W band enables 240 MHz of spectrum available for assignment. This contrasts with only 207 MHz available with 29.65 MHz channelling in the W band. 40 MHz channelling in the W band would allow for larger channelling and is defined in the ITR-recommendations.

Table 7: Potential W band 28 MHz rechanneling

Potential W band rechanneling, based on 283.5 MHz duplexer spacing			
Channel	**MHz**	**Channel**	**MHz**
1	7747.0	1#	8030.5
2	7775.0	2#	8058.5
3	7803.0	3#	8086.5
4	7831.0	4#	8114.5
5	7859.0	5#	8142.5
6	7887.0	6#	8170.5
7	7915.0	7#	8198.5
8	7943.0	8#	8226.5
9	7971.0	9#	8254.5

Figure 4: Potential W band 28 MHz rechanneling

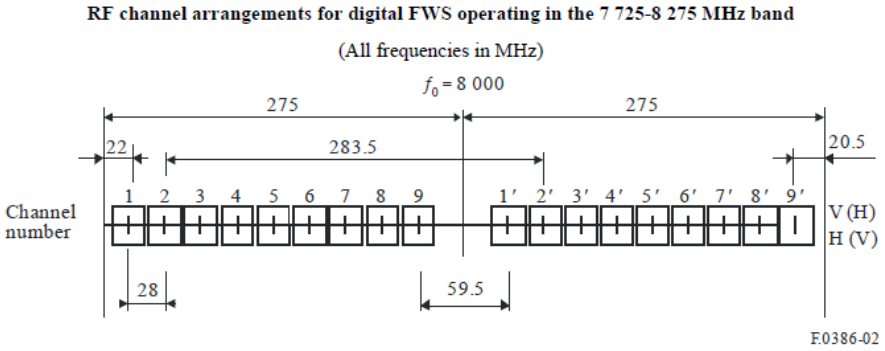


Table 8: Potential W band 56 MHz channelling

Potential W band rechanneling, based on 28 MHz channelling			
Channel	**MHz**	**Channel**	**MHz**
1	7761.0	1#	8044.5
2	7817.0	2#	8100.5
3	7873.0	3#	8156.5
4	7929.0	4#	8212.5

Table 9: Potential W band 40 MHz rechanneling

Potential W band rechanneling, based on 310 MHz duplexer spacing			
Channel	**MHz**	**Channel**	**MHz**
1	7745	1#	8055
2	7785	2#	8095
3	7825	3#	8135
4	7865	4#	8175
5	7905	5#	8215
6	7945	6#	8255

As with all rechanneling proposals, the Ministry is interested to hear whether any new band plan should apply to new licences only or whether existing licences should be transitioned onto the new channel plan. If migration of existing 29.65 MHz licences was required, licensees would need to modify or replace existing equipment. In the ideal, current 29.65 MHz licences would be allowed to continue until equipment reaches end of life. However old and new channel plans would need to run side by side within the band. This may not be feasible and the Ministry will undertake further work to assess the impact of retaining the two band plans over the longer term.

Y band

Y band (8290 – 8500 MHz) is mainly use for broadcast links and currently has 28 MHz channelling. In this band, only three licences are allocated in the Y channels and these three licences are to a single licence holder. Therefore the Ministry could end the practice of having two channel plans in the Y band running side by side by transitioning that licence holder to YA channels or other suitable 28 MHz channels in other bands.

In addition for Y band, a 56 MHz channel could be added to the channel plan for assignment around the current 28 MHz plan, using the YA channels.

Table 10: 56 MHz channelling option for Y band

Potential Y band 56 MHz rechanneling, based on 119 MHz duplexer spacing			
Channel	**MHz**	**Channel**	**MHz**
1	8321.0	1#	8440.0

56 MHz channelling in the Y band would mean that one channel would be available for allocation. This would need to be assigned in conjunction with the current 28 MHz channelling.

Aligning proposed U, W and Y bands

To align with a number of ITU recommendations for fixed services, some adjustments to the boundaries the U, W, and Y bands are proposed. This would allow New Zealand to, in the future, manage any changes to these bands in terms of plans or complete changes in use. Table 11 illustrates the proposed changes.

Table 11: Aligning U, W and Y band channelling

Band	Current (MHz)	Proposed (MHz)
U	7425 – 7730	7425 - 7725
W	7730 – 8290	7725 - 8275
Y	8290 - 8500	8275 - 8500

The alignment of the 8 GHz bands would bring them, into line with those recommendations set out in ITU R- F.386. However, this would change the boundaries from those currently in use in New Zealand. Current channels that are in operation would not be affected in any way, for instance the bottom of the Y band would continue to overlap with the upper part of channel W8#. It would provide a cleaner long term set of boundaries if the W band were to be rechanneled.

39. Do you have comments on the current coordination process or possible future demands for services in the U band?

40. Should W band be rechanneled to enable either 28 MHz, 40 MHz, or 56 MHz channelling to enable new services? Which channel size is preferred? Why?

41. Should the Yx channels be disestablished from the Y band channel plan, enabling the current dominant channel plan (YxA) to become the single channel plan for Y band?

42. Should the Y band have an additional 56 MHz allocation added to the current YxA 28 MHz channel plan?

43. Should the band boundaries be realigned to match ITU-R F.386, by adjusting the U / W boundary at 7.730 GHz down to 7.725 GHz, and by adjusting the W / Y boundary from 8.290 GHz to 8.275 GHz?

3.14. H band

The licensees in H band (10.5 – 10.68 GHz) are a small number of utilities providers with few licences.

The current channel plan is taken from ITU – R Recommendation F.747 '*Radio-frequency channel arrangements for fixed wireless systems operating in the 10 GHz band'.* At present, the H band channel plan is set up for 21 MHz channels, which are not optimal in terms of equipment supply. The Ministry is considering alternative options for channelling or use of the band.

What are the options?

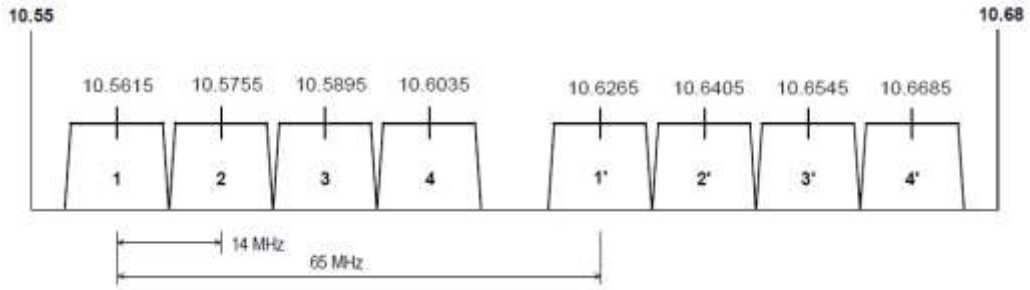
There are a number of options available for channelling H band. These include:

1. Do nothing. Retain the current channelling of the band.

2. Rechannel the band. At present in the H band, there are both 7 and 21 MHz channels in the channel plan. The Ministry is considering which would be the most efficient, both in terms of spectral efficiency and economic efficiency. Consistent with the policy decision to move to channel sizes with multiples of 3.5 MHz, a 7 MHz or 14 MHz channel width would be more appropriate.

Australia has 14 MHz plans listed in their Radiocommunications Assignment and Licensing Instruction (RALI) FX3 '*Microwave fixed services frequency coordination'*. Adopting this channel plan would remove 50 MHz at the bottom of H band, which could then be reallocated. Existing users would need to migrate away from the 21 MHz channels over a specified transition period. Aligning with the Australian channel plan would provide trans-Tasman consistency, which could provide economies of scale for equipment supply.

Figure 5: 14 MHz channelling as taken from Australian FX3 10GHz assignment



3. H band could be reallocated to a non-fixed service use, as at present it is very lightly used.

   H band's allocation in the International Radio Regulations (2012) shows that fixed services has primary or secondary allocation in this part of the radio spectrum. However there are no obvious alternative uses for H band.

   Reallocation of H band to other uses is attractive from a perspective of efficient use of spectrum. Only a small number of licence holders would be affected. However, licence holders would need to be relocated to alternative bands and there is a cost of equipment and time in carrying out the refarming.

44. Should the Ministry offer a 14 MHz channel plan for H band and migrate users away from 21 MHz channelling?

45. Should the band be reallocated to a different service or use? If so, what other services or uses should be allocated to the H band?

3.15. Z band

Z band (10.7 – 11.7 GHz) is predominantly used by cellular mobile and land mobile radio operators, to provide backhaul data to non-fibre connected transmission sites. Z band is a busy band.

A number of licences in the band have narrower emissions recorded in SMART than the current 40 MHz channelling. This indicates that the 40 MHz channelling is not well suited to this band or the equipment available for use in the band.

What are the options?

There are a number of options, based on using a 530 MHz duplexer spacing, as presently used for the 40 MHz channel plan:

1. Do nothing. This leaves the present 40 MHz channel plan in place;

2. Rechannel the band to either:

   a) offer a 28 MHz channel plan for the band; or

   b) offer a 28 MHz channel plan and interleaved 56 MHz channels *(preferred option)*.

Table 12: Proposed Z band 28 MHz channelling

Proposed Z band rechanneling, based on 530 MHz duplexer spacing			
Channel	**MHz**	**Channel**	**MHz**
Z1C	10,723	Z1C#	11,253
Z2C	10,751	Z2C#	11,281
Z3C	10,779	Z3C#	11,309
Z4C	10,807	Z4C#	11,337
Z5C	10,835	Z5C#	11,365
Z6C	10,863	Z6C#	11,393
Z7C	10,891	Z7C#	11,421
Z8C	10,919	Z8C#	11,449
Z9C	10,947	Z9C#	11,477
Z10C	10,975	Z10C#	11,505
Z11C	11,003	Z11C#	11,533
Z12C	11,031	Z12C#	11,561
Z13C	11,059	Z13C#	11,589
Z14C	11,087	Z14C#	11,617
Z15C	11,115	Z15C#	11,645
Z16C	11,143	Z16C#	11,673

Table 13: Proposed Z band 56 MHz channelling

Potential Z band rechanneling, based on 530 MHz duplexer spacing			
Channel	**MHz**	**Channel**	**MHz**
Z1B	10,737	Z1B#	11,267
Z2B	10,793	Z2B#	11,323
Z3B	10,849	Z3B#	11,379
Z4B	10,905	Z4B#	11,435
Z5B	10,961	Z5B#	11,491
Z6B	11,017	Z6B#	11,547
Z7B	11,073	Z7B#	11,603
Z8B	11,129	Z8B#	11,659

Allocating 28 MHz channels in the Z band would offer more channels, allowing greater reuse. However, 28 MHz channelling would offer smaller allocations than the present 40 MHz channelling. Overlaying 56 MHz channelling over the 28 MHz channelling would enable larger channels to be assigned. However, at present, this channelling is not an official annex of ITU-R Recommendation F.387 *'Radio-frequency channel arrangements for radio-relay systems operating in the 11 GHz band'*.

The Ministry's preferred option is to implement the 28 MHz channelling in the Z band, with the option of 56 MHz channels being available if demand occurs from users.

The new band plan could be introduced through requiring all new licences to comply with the 28 MHz channelling, allowing incumbent licences using the 40 MHz channel plan to remain. This would not solve the issue of current spectrum inefficiencies in the short term. Alternatively, all users could be migrated to the new channelling over a specified transition period. The Ministry seeks feedback on the impacts of rechanneling and what is the most appropriate mechanism to introduce the new channel widths.

46. Should the Z band channel plan be changed to 28 MHz channels? If not, why not?

47. If a 28 MHz channel is adopted, should the Ministry also adopt a 56 MHz channel plan?

48. If the band is rechanneled, should incumbent licensees be required to transition to the new band plan?

3.16. G band

The Ministry sees no significant issues with the G band and does not propose any changes at this time. However the Ministry invites any comments on the current use or future demands in the G band

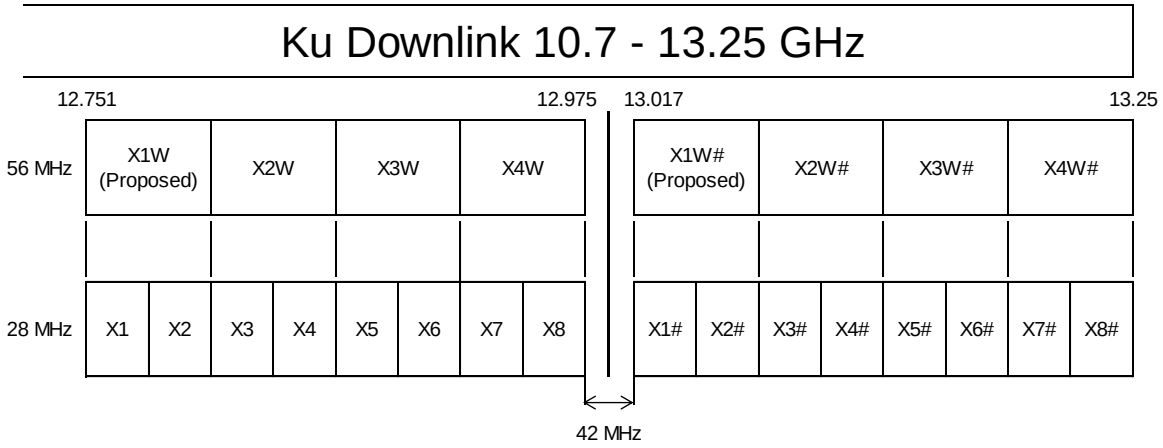
49. Are there any issues with the current band plan, use of, or future demands for the G band?

3.17. X band

X band is presently used for high capacity fixed services, primarily for providing backhaul for cellular services across New Zealand.

The Ministry recently proposed a 56 MHz channel plan in line with the pre-existing 28 MHz channel plan. These channels were implemented with the exception of the proposed X1W (and X1W#) channel which was withdrawn after concerns regarding Ku satellite downlink receiver performance at the lower end of the X band. The issue was based on the out of band emissions resulting from the wider in band emissions from the 56 MHz channel potentially affecting the satellite Ku band downlink (terrestrial receive).

Figure 6: X band verses Ku (Satellite) downlink



What are the options?

The options for X band include:

1. Do nothing.

2. Introduce the previously proposed additional 56 MHz channel to the X band.

The Ministry is seeking feedback on whether or not to introduce an additional 56 MHz channel into the X band channel plan.

50. Should the Ministry introduce an additional 56 MHz channel to the X band, or should it remain unavailable for assignment?

3.18. 18 and 23 GHz bands

The 18 and 23 GHz bands are used to typically provide backhaul for telecommunications providers. Due to their high frequencies, the antennas in these frequency bands perform very well with highly focused beams. This means that there is a significant reuse available of channels within both these bands.

Satellite / terrestrial coordination

A key issue for these bands is that they share the same frequency ranges as the space to earth segment of the Ka satellite band. Figure 7 shows an overview of the 18 and 23 GHz terrestrial fixed service bands, along with the Ka satellite band.

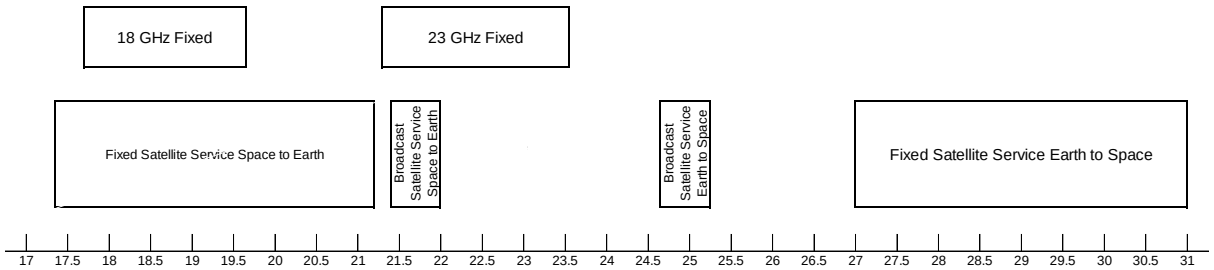


Figure 7: Ka band

There is growing international interest in the Ka band for both direct to home broadcast satellite services (BSS) and fixed satellite services (FSS) for Very Small Aperture Terminals (VSAT) and satellite news gathering (SNG) applications. This interest is due to the high levels of use and increasing congestion in the C and Ku satellite bands.

The FSS allocation, as outlined by the ITU, coincides with the whole of the 18 GHz band, whereas use for BSS is limited to the lower part of the 23 GHz band. A reservation for satellite is currently set aside at the bottom of the 18 GHz band, consisting of 330 MHz paired spectrum.

BSS receivers in New Zealand do not have individual receive protection due to the potentially large number of receivers across the country sharing with a large number of 23 GHz fixed links. In contrast, satellite downlinks in the C band have receive protection due to their small number and use. These downlinks require coordination with the P fixed service band, however there are presently no licenced fixed services in this band. In the Ku band, there is currently no requirement for terrestrial / satellite coordination as the BSS space to earth segment has no terrestrial services.

PIB 58 sets out protection conditions for some satellite services in the 18 GHz band, which were initially put in place for the now redundant Teledesic satellite constellation.

The Ministry is considering if satellite Ka band (18 – 28 GHz) use is foreseen in New Zealand and if so, whether the 18 GHz and 23 GHz fixed service bands should be pre-emptively refarmed for Ka satellite use. The Ministry is cautious about clearing any fixed service bands before a longer term view becomes clearer, particularly given the long lead in time for satellites to be built and launched into their desired orbital position.

Rechanneling of the 23 GHz channel plan

Preliminary feedback from industry indicated a need to reconsider the 23 GHz band channel plan. There are a significant number of licences in the 23 GHz band however only 60 licences use the 56 MHz band plan and 112 MHz band plan (only three per cent of the band total). There are also a significant number of 28 MHz licences (over 50 per cent of the licences in the band) in use at present.

The recommendations in ITU-R F.637 '*Radio-frequency channel arrangements for fixed wireless systems operating in the 21.2-23.6 GHz band*' have the band subdivided above 22.4 GHz. However if the 23 GHz allocation is reduced significantly, it will impact on available allocations and the receiver input of deployed fixed service links. A level of sharing between fixed service and terrestrial satellite receivers will be required.

In the current plan for 23 GHz band, there are a number of 3.5, 7 and 14 MHz channels. The Ministry seeks feedback on whether there is any user demand for such small channel sizes? Demand exists

for 14 MHz channels with 16 per cent of licences for these channels. However there appears to be little current demand for 3.5 and 7 MHz licences. Typically the trend is for larger channels across the wider fixed service bands. Removing smaller channel allocations from the 23 GHz channel plan would clean up the channel plan, however a handful of users may need to use larger channels when engineering new 23 GHz licences.

51. Should the Ministry facilitate in any specific way the development of satellite services in the Ka band? For example, should the Ministry consider early clearances of some fixed services in either the 18 or 23 GHz bands?

52. Should the Ministry remove the underutilised 3.5 and 7 MHz channels from the 23 GHz channel plan?

3.19. 38 GHz band

No issues have been identified to date with the 38GHz band and the Ministry has not formulated proposals for the future of this band. Suggestions are welcome on its future demands and uses.

53. Are there any issues with the current band plan, use of, or future demands for the 38 GHz band?

3.20. 70 – 80 GHz band

There is currently low uptake of licences in this band and the Ministry is aware that licensing is seen as a potential barrier to use of this band.

The band is currently administered by the Ministry under the radio licensing regime similar to other fixed service bands. A General User Radio Licence (GURL) may be an option for this band. A GURL offers no protection from interference from other fixed service users and any co-ordination is among the users at their discretion. The properties of fixed links in this band include a narrow beam width, and short distance use (1km maximum). Therefore the frequency reuse of the band is high and the likelihood of interference between uncoordinated systems would be low.

Changing the licencing regime to a general user licence would remove the need to licence individual services or pay licence fees, but current licence holders would have no protection from other fixed links nor will there be any recording of users in the band.

OFCOM in the UK recently consulted with industry in regards to a split regime in the 70 – 80 GHz band and whether it would be appropriate. After considering feedback, OFCOM intends to split the band with one part continuing on a self-co-ordination process and the other half moving to a coordinated licence approach by the band manager, which offers protection to users of the band. The Ministry seeks feedback on whether a combined GURL and administrative system would be appropriate for this band in New Zealand.

What are the options?

There are two options for this band:

1. Do nothing.

2. Create a General User Radio Licence to enable particular uses within the band without the need for individual licencing.

54. Should the Ministry move the licencing regime for the 70 – 80 GHz band from administrative licencing to a New Zealand general user radio licence?

4. Summary of Questions

Appendix 1: Tables of proposed rechanneling for I and J bands

Table 14: I band Proposal – Group G: 100 kHz rechanneling

Current 50 kHz channels – I Band (Group G)				Proposed 100 kHz Channels – I Band (Group G)			
Channel	**MHz**	**Channel**	**MHz**	**Channel**	**MHz**	**Channel**	**MHz**
I603	422.56250	I603#	427.57500	I700	422.58750	I700#	427.60000
I605	422.61250	I605#	427.62500				
I607	422.66250	I607#	427.67500	I704	422.68750	I704#	427.70000
I609	422.71250	I609#	427.72500				
I611	422.76250	I611#	427.77500	I708	422.78750	I708#	427.80000
I613	422.81250	I613#	427.82500				
I615	422.86250	I615#	427.87500	I712	422.88750	I712#	427.90000
I617	422.91250	I617#	427.92500				
I619	422.96250	I619#	427.97500	I716	422.98750	I716#	428.00000
I621	423.01250	I621#	428.02500				
I623	423.06250	I623#	428.07500	I720	423.08750	I720#	428.10000
I625	423.11250	I625#	428.12500				
I627	423.16250	I627#	428.17500	I724	423.18750	I724#	428.20000
I629	423.21250	I629#	428.22500				
I631	423.26250	I631#	428.27500	I728	423.28750	I728#	428.30000
I633	423.31250	I633#	428.32500				
I635	423.36250	I635#	428.37500	I732	423.38750	I732#	428.40000
I637	423.41250	I637#	428.42500				
I639	423.46250	I639#	428.47500	I736	423.48750	I736#	428.50000
I641	423.51250	I641#	428.52500				
I643	423.56250	I643#	428.57500	I740	423.58750	I740#	428.60000
I645	423.61250	I645#	428.62500				
I647	423.66250	I647#	428.67500	I744	423.68750	I744#	428.70000
I649	423.71250	I649#	428.72500				
I651	423.76250	I651#	428.77500	I748	423.78750	I748#	428.80000
I653	423.81250	I653#	428.82500				
I655	423.86250	I655#	428.87500	I752	423.88750	I752#	428.90000
I657	423.91250	I657#	428.92500				
I659	423.96250	I659#	428.97500	I756	423.98750	I756#	429.00000
I661	424.01250	I661#	429.02500				

Current 50 kHz channels – I Band (Group G)				Proposed 100 kHz Channels – I Band (Group G)			
Channel	**MHz**	**Channel**	**MHz**	**Channel**	**MHz**	**Channel**	**MHz**
I663	424.06250	I663#	429.07500	I760	424.08750	I760#	429.10000
I665	424.11250	I665#	429.12500				
I667	424.16250	I667#	429.17500	I764	424.18750	I764#	429.20000
I669	424.21250	I669#	429.22500				
I671	424.26250	I671#	429.27500	I768	424.28750	I768#	429.30000
I673	424.31250	I673#	429.32500				
I675	424.36250	I675#	429.37500	I772	424.38750	I772#	429.40000
I677	424.41250	I677#	429.42500				
I679	424.46250	I679#	429.47500	I776	424.48750	I776#	429.50000
I681	424.51250	I681#	429.52500				
I683	424.56250	I683#	429.57500	I780	424.58750	I780#	429.60000
I685	424.61250	I685#	429.62500				
I687	424.66250	I687#	429.67500	I784	424.68750	I784#	429.70000
I689	424.71250	I689#	429.72500				
I691	424.76250	I691#	429.77500	I788	424.78750	I788#	429.80000
I693	424.81250	I693#	429.82500				
I695	424.86250	I695#	429.87500	I792	424.88750	I792#	429.90000
I697	424.91250	I697#	429.92500				
I699	424.96250	I699#	429.97500				

Table 15: J Band Proposal – Group D: 100 kHz rechanneling

Current 50 kHz channels – J Band (Group D)				Proposed 100 kHz Channels – J Band (Group D)			
Channel	**MHz**	**Channel**	**MHz**	**Channel**	**MHz**	**Channel**	**MHz**
J101D	460.050000	J101D#	465.26250	J150G	460.07500	J150G#	465.28750
J102D	460.100000	J102D#	465.31250				
J103D	460.150000	J103D#	465.36250	J151G	460.17500	J151G#	465.38750
J104D	460.200000	J104D#	465.41250				
J105D	460.250000	J105D#	465.46250	J152G	460.27500	J152G#	465.48750
J106D	460.300000	J106D#	465.51250				
J107D	460.350000	J107D#	465.56250	J153G	460.37500	J153G#	465.58750
J108D	460.400000	J108D#	465.61250				
J109D	460.450000	J109D#	465.66250	J154G	460.47500	J154G#	465.68750
J110D	460.500000	J110D#	465.71250				
J111D	460.550000	J111D#	465.76250	J155G	460.57500	J155G#	465.78750
J112D	460.600000	J112D#	465.81250				
J113D	460.650000	J113D#	465.86250	J156G	460.67500	J156G#	465.88750
J114D	460.700000	J114D#	465.91250				
J115D	460.750000	J115D#	465.96250	J157G	460.77500	J157G#	465.98750
J116D	460.800000	J116D#	466.01250				
J117D	460.850000	J117D#	466.06250	J158G	460.87500	J158G#	466.08750
J118D	460.900000	J118D#	466.11250				
J119D	460.950000	J119D#	466.16250	J159G	460.97500	J159G#	466.18750
J120D	461.000000	J120D#	466.21250				
J121D	461.050000	J121D#	466.26250	J160G	461.07500	J160G#	466.28750
J122D	461.100000	J122D#	466.31250				
J123D	461.150000	J123D#	466.36250	J161G	461.17500	J161G#	466.38750
J124D	461.200000	J124D#	466.41250				
J125D	461.250000	J125D#	466.46250	J162G	461.27500	J162G#	466.48750
J126D	461.300000	J126D#	466.51250				
J127D	461.350000	J127D#	466.56250	J163G	461.37500	J163G#	466.58750
J128D	461.400000	J128D#	466.61250				