RADIO SPECTRUM MANAGEMENT

NOT GOVERNMENT POLICY

174 to 184 MHz:

Land Mobile Radio technical consultation

October 2017

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

New Zealand Government

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Glossary

Abbreviation/Term	Meaning
ARE /ARC	Approved radio engineer / Approved radio certifier
Band III	The former television VHF Band III, with frequencies between 174-230 MHz
IoT	Internet of Things
LMR	Land Mobile Radio
PIB 22	Public Information Brochure 22: Fixed Service Bands in New Zealand
PIB 23	Public Information Brochure 23: Mobile Service Bands in New Zealand
PIB 38	Public Information Brochure 38: Radio Licence Certification Rules
PIB 39	Public Information Brochure 39: Spectrum Licence Certification Rules for Crown Management Rights
PIB 58	Public Information Brochure 58: Radio Licence Policy Rules
PIB 59	Public Information Brochure 59: Policy Rules for Crown Management Rights
The Act	Radiocommunications Act 1989
The Crown	Her Majesty the Queen, acting through the Chief Executive of the Ministry of Business, Innovation and Employment
The Ministry	The Ministry of Business, Innovation and Employment
The Regulations	Radiocommunications Regulations 2001

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Invitation for submissions

Interested parties are invited to comment on the content of this document, in particular the questions posed, and on any related issues. Comments should be submitted in writing, no later than **5pm** on **Wednesday 13 December 2017** to:

By email: *(preferred option)*

Radio.Spectrum@mbie.govt.nz

Subject line: "174 MHz to 184 MHz: Land Mobile Radio technical consultation"

Or

By post:

174 MHz to 184 MHz: Land Mobile Radio technical consultation
Radio Spectrum Management Policy and Planning
Ministry of Business, Innovation and Employment
PO Box 2847
WELLINGTON 6140

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

Publication and public release of submissions

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Submissions are also subject to the Official Information Act 1982. If you have any objection to the release of any information in your submission, please set this out clearly with your submission. In particular, identify which part(s) you consider should be withheld, and explain the reasons(s) for withholding the information. The Ministry will take such objections into account when responding to requests under the Official Information Act 1982.

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174 to 184 MHz: LMR technical consultation

1 Introduction

Since the end of analogue television broadcasting in New Zealand, the former television Band III (174-230 MHz) block has been largely unused. In April 2016, Radio Spectrum Management in the Ministry of Business, Innovation and Employment (the Ministry) issued a consultation document asking for views on possible future uses. Based on the submissions received (see Annex 1 for summary of submissions), the Minister of Communications decided that 10 MHz of spectrum between 174 and 184 MHz would be allocated for land mobile radio (LMR) services. This was announced in April 2017. At the same time, the Minister announced an allocation of 10 MHz (210 - 220 MHz) for Internet of Things (IoT) technology and a reservation for Digital Audio Broadcasting. (See Annex 2 for the 174 – 230 MHz band plan).

This consultation document seeks views from industry and individuals on a mix of allocation and technical issues for the 10 MHz in Band III allocated to LMR.

1.1 Land mobile bands in New Zealand

LMR refers to the operation of land-based simplex or duplex transmitting equipment communicating between mobiles and/or portable sets, either direct or through a repeater.

Currently, LMR uses a range of frequencies including VHF spectrum between 136–174 MHz and UHF spectrum. Within the existing LMR bands, there are a number of frequencies reserved for particular services (such as wide area paging), and blocks of channels set aside for specific users (such as government agencies) and critical communications (such as crane control and logging operations).

The VHF LMR spectrum is used extensively across New Zealand. There are over 2000 licensees operating in the bands. In repeater channels about two percent of licensees hold licences nationwide and 80 percent operate in only one region. In simplex channels about 20 percent of licensees hold licences nationwide and 60 percent operate in only one region.

There is significant demand for VHF channels in the major centres (Auckland, Hamilton, Wellington, Christchurch and Dunedin). Industry feedback is that engineers are struggling to licence services in their preferred VHF channel.

1.2 Allocation of 10 MHz for land mobile radio

On the basis that there is congestion in the VHF bands, 10 MHz of spectrum between 174 MHz and 184 MHz has been allocated to land mobile radio. This is contiguous with frequencies already allocated to LMR.

The Ministry envisages that equipment (both passive and active elements) that currently operates in the EE band[1] just below 174 MHz, can be re-engineered to operate above 174 MHz. The Ministry is aware of equipment manufacturers selling equipment, aimed at both the US and UK markets, that is frequency agile and can operate the whole of the former Band III (i.e. 174 – 230 MHz).

[1] The EE band runs from 162 – 173 MHz. It is used for LMR services with both analogue and digital services being permitted. The maximum bandwidth for a service is 12.5 kHz.

2 Allocation design

We consider that to reflect both the feedback from the April 2017 consultation on Band III and the Ministry's overall spectrum management aims for New Zealand, the allocation of 174 MHz to 184 MHz to LMR should:

- Encourage efficient use of spectrum (spectral efficiency)
- Promote the economic use of spectrum (allocative efficiency)
- Provide opportunities for a range of users to access the spectrum
- Support innovation and new uses of LMR technology to emerge
- Address congestion in LMR bands.

Q1. Should any other objectives apply to the allocation of 174 MHz to 184 MHz for LMR services?

2.1 Licensing regime

All current LMR frequencies are managed under the radio licensing regime. The licensing policy and certification rules are set out in PIBs 58 (Radio Licence Policy Rules) and 38 (Radio Licence Certification Rules) respectively. Frequencies and licences are allocated on a "first come first served" basis. Unless specifically identified in PIB 23, channels are shared on a geographic basis with no nationwide exclusivity provided to licensees except by fortuitous channel availability.

The additional 10 MHz of VHF spectrum is being allocated to LMR on the basis that there is congestion in other LMR bands and industry is finding it difficult to engineer new licences in some areas. Where there is excess demand for particular frequencies, those frequencies are typically managed under the management rights regime rather than radio licensing.

With the new licence fee structure and lower fees, there is little incentive on licensees to prevent spectrum hoarding. The policy tool generally used to manage demand and ensure the best economic use of a scarce resource is to apply a charge to those using the resource (a resource charge). Resource charges discourage non-productive use of a resource such as spectrum. Under the Radiocommunications Act, resource charges cannot be applied to spectrum in the radio licensing regime. However, the ability to sell management rights or spectrum licences provides an alternative route to applying a resource charge for spectrum use. The sale price for the rights can (in most circumstances) be considered equivalent to a resource charge for the use of the spectrum.

For these reasons, the Ministry is proposing that this spectrum is managed under the management rights regime. (See Annex 3 for a brief description of the licensing regimes)

There are two consequences of this proposal. Firstly, spectrum licences in management rights must be certified by approved radio engineers (AREs). At present, the majority of LMR radio licences are certified by approved radio certifiers (ARCs). Any ARC wishing to certify LMR spectrum licences must meet the requirements for AREs and apply to the Ministry for approval to be an ARE. For some ARCs, this may require further training to upskill to the technical requirements to be an ARE.

Secondly, the Radiocommunications Act and Radiocommunications Regulations restrict spectrum licences to a single transmitter on a single frequency. As a result all fixed transmitters in these bands will need to be individually licensed. Multiple location licences

typically used for repeaters on a single channel will not be available for LMR services in 174 MHz to 184 MHz.

Q2.	***Do you have any comments on the proposal to manage 174 - 184 MHz under the management rights regime?***
Q3.	***Do you agree that a resource charge (set through the sale price) be applied to spectrum rights in the LMR frequencies between 174 MHz to 184 MHz? If not, how should the Ministry manage demand for spectrum?***

2.2 Channel Plan

In late 2015, VHF LMR users completed the migration from 25 kHz to 12.5 kHz channels. Almost all licences now have a width of 12.5 kHz. We expect that use of the narrow channel widths to be reflected in the new channel plan. Channel widths are proposed to be based on a 6.25 kHz building block with aggregation of channels permitted up to a prescribed maximum. For LMR voice channels, we are proposing to set this maximum at 12.5 kHz consistent with the current radio licensing rules. We are interested in industry views on whether wider data channels should be allowed (see section 2.4).

We anticipate that we will have simplex and duplex channels in the channel plan for 174 MHz to 184 MHz. Duplex channels could be based on a 4.5 MHz, 4.6 MHz or 5 MHz duplexer. Submitters preferred a 4.5 MHz duplexer spacing. However, the Ministry proposes a 4.6 MHz duplexer spacing as this is similar to the equipment operating in the EE band (162 MHz to 173 MHz). A mid-band gap of 1.4 MHz would be available for simplex channels with the duplex and simplex channels separated by a guard band of approximately 250 kHz, allowing:

- 512 paired 6.25 kHz duplex channels,
- 146 x 6.25 kHz simplex channels in the mid-band gap, and
- 272 x 6.25 kHz simplex channels at the top of the channel plan.

Given the configuration of the repeater and mobile channels in the 162 MHz to 173 MHz LMR bands we propose that the repeater base transmit channels will be in the upper portion of the duplex.

The proposed band plan is shown below:

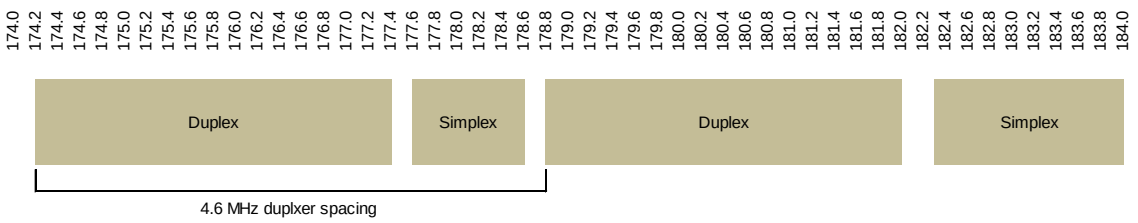


Figure 1: Proposed band plan for LMR in 174 MHz to 184 MHz

This gives the low and high frequencies of the duplex and simplex bands (rounded to two decimal places) as:

	Lower frequency (MHz)	**Upper frequency (MHz)**
Lower duplexer	174.25	177.45
Mid band simplex	177.70	178.60
Upper duplexer	178.85	182.05

	Lower frequency (MHz)	Upper frequency (MHz)
Upper simplex	182.29	183.99

The channel plan could interleave the various channel sizes as typically set for other LMR bands. An alternative approach would be to group the different channel sizes across the duplex and simplex bands. This latter option has the potential to be more spectrally efficient as use of narrow channels would no longer prevent the use of a wider channel.

Q4. Do you agree that 6.25 kHz is an appropriate channel bandwidth as the basic building block for the channel plan in 174-184 MHz?

Q5. Do you agree the maximum channel width should be 12.5 kHz for voice services?

Q6. Do you agree that 4.6 MHz is an appropriate duplexer spacing for this band?

Q7. What should be the balance between simplex and duplex channels? Should more simplex channels be provided for?

Q8. Should the duplex repeater base transmit channels be in the upper or lower portion of the band?

Q9. Should the different channel sizes be interleaved in the channel plan or grouped according to size?

Q10. Do you have any other comments on the configuration of duplex and simplex channels?

2.3 National or regional allocations

When transferring the 174 - 184 MHz band to the management rights regime, the Crown is able to either

- allocate the management rights or
- retain the management rights and allocate spectrum licences in the bands.

Management rights give the rights owner the autonomy to decide who may hold spectrum licences and where the transmitters are located. If, as in the cellular bands, the management right owner decides to allocate all spectrum licences to themselves, management rights provide exclusive use of the frequencies covered by the right.

At this stage, the Ministry considers that management rights could be allocated to industry in both the simplex and duplex bands. This would provide for exclusive nationwide duplex and simplex channels to be available.

For the duplex frequencies, channels could be offered on a single basis or with the 'natural' pair. Our preference is to offer duplex frequencies as paired channels.

If the Crown retains ownership of the management right, spectrum licences can be allocated on an individual basis or paired for duplex services. This would support the regional services which appear to dominate the LMR VHF bands.

In other LMR bands, simplex licences are generally issued on a shared use basis. The Ministry is interested in industry views on whether simplex licences in 174 MHz to 184 MHz should also be on a shared use basis or exclusive to the licensee within the coverage area of the spectrum licence.

The Ministry is particularly interested in hearing from industry whether there is any interest in owning management rights enabling exclusive access to one or more channels nationwide.

Q11. Would you or your organisation be interested in purchasing management rights (nationwide access) in 174 MHz to 184 MHz? If so, would this be for duplex channels, simplex channels or both?

Q12. Do you have any comments on whether simplex licences should be issued on a shared use basis or for exclusive use in the coverage area?

Q13. Do you have any comments on whether the duplex channels should be offered as paired rights or as 'single channel' rights?

2.4 Use restrictions

LMR is typically a mobile voice service. However some data services are allowed in other VHF LMR bands which are not strictly LMR services. Typically, the Ministry is much less restrictive over the types of services that can operate in private management rights. In Crown management rights, the Ministry tends to set rules similar to those used in radio licensing.

The Ministry is interested to hear industry views on whether other types of services should be allowed in 174 MHz to 184 MHz. In particular we want to understand industries' views on and demand for the following services in these frequencies:

- Larger bandwidth duplex or simplex data channels
- Point to multipoint services such as SCADA
- Mesh networks.

There is the potential to accommodate some uses such as mesh networks in another part of the 174 – 230 MHz range, such as the proposed IoT allocation between 210 MHz to 220 MHz. The Ministry is anticipating that it will carry out further consultation on the frequencies allocated to IoT in 2018.

Q14. Do you have any comments on what services should be allowed in 174 MHz to 184 MHz and how management rights could be configured for these services?

Q15. What, if any, maximum channel width should be set for the different duplex and simplex services? Please provide reasons for why you propose any particular maximum.

Q16. Should some fixed to multipoint services be permitted in 174 MHz to 184 MHz? If so, what types of service and what other restrictions, if any, should be applied to these services?

Q17. Should mesh networks be permitted in 174 MHz to 184 MHz?

2.5 Term of management rights and licences

The maximum term of any management right (and hence spectrum licence) is set in the Radiocommunications Act at 20 years. However rights may be created for any lesser duration, for example 1, 5, 10 or 15 years. A spectrum licence cannot have an expiry date beyond that of the relevant management right.

A shorter duration for management rights allows adjustments to be made as demand grows. However, too short a period becomes administratively burdensome and creates uncertainty for industry. Rights need to be of sufficient duration to provide certainty for users to invest in technology for this band.

Our preference is to create management rights with a 10 year term. Allocated management rights would be subject to review approximately two or three years prior to the expiry of the management right. The outcome of this review will form part of the process to decide whether the rights will be renewed.

Spectrum licences in Crown management right would have a term limited by the expiry of the management right. The duration would be dependent on when the licence is applied for.

Q18. What term is appropriate for the LMR management rights between 174 MHz to 184 MHz?

2.6 Allocation mechanism

2.6.1 Allocating management rights

The Ministry is proposing that, if there is sufficient demand for management rights giving exclusive nationwide use, the rights will be auctioned. However, if this consultation results in only one expression of interest for management rights, the party may be offered the opportunity to purchase management rights up to a maximum bandwidth. If no expressions of interest are received, all management rights will be retained by the Crown.

If an auction is held, we propose each lot would be a nationwide management right of 6.25 kHz nominal band width.

The auction process would be:

Stage 1: Bidders will be able to bid for a number of lots at the reserve price. If bids are received for more lots than that being offered, the price per lot will be increased by a predetermined increment. Bidders may bid again for the number of lots wanted at the new price. This process will be followed until the number of lots bid for is less than or equal to the number of lots offered.

Stage 2: Bidders will be able to identify the channels they prefer and whether they prefer contiguous channels or spaced channels suitable for, for example, a trunked dispatch service.

Management rights will be transferred to their new owners once all fees and charges are received by the Ministry. The manager may then issue spectrum licences that comply with the terms and conditions of the management right.

2.6.2 Allocating Crown spectrum licences

The Ministry is proposing that users will be able to engineer licences and apply for a spectrum licence in Crown owned management rights in 174 MHz to 184 MHz on a first come first served basis as with the current radio licensing regime. Blocks of channels will be gradually released to maximise efficient use of spectrum. Spectrum licences will be granted by the Ministry provided they meet the relevant technical requirements and all fees and charges (if any) are received by the Ministry.

Q19. Do you have any comments on the proposed allocation method for management rights and/or spectrum licences?

2.7 Pricing and payment terms

2.7.1 Management rights

Under the management rights regime, where there is excess demand for frequencies, the rights are competitively allocated (except where there are public good uses). The successful party in a competitive allocation is assumed to be the party with the highest economic value use for the spectrum. The Crown's role is to set the reserve price for the spectrum.

There are a number of mechanisms used to establish the reserve price including benchmarking, deprival valuation or other econometric modelling. For cellular mobile spectrum sales, the Ministry uses all three methodologies to set the reserve price. For broadcasting, the Ministry has used an econometric model which is scaled relative to the population covered. There are no existing econometric models for LMR services, nor any similar competitive allocations for LMR here or elsewhere to benchmark against. We are not convinced the complexity of developing an econometric or deprival value model for LMR is justified for this allocation.

The reserve price for management rights is likely to be set after consideration of the level of demand, duration of the management right and price set for spectrum licences in 174 MHz to 184 MHz. As a minimum, this could be the administrative cost of creating and allocating the management rights.

We anticipate that the prices paid for LMR management rights would be significantly lower than that those paid for cellular mobile spectrum. On this basis, the Ministry proposes that payment for the management rights would be upfront with a single lump sum payment. No payment terms will be offered.

Annual licence fees for spectrum licences created in the management rights will also be payable in addition to purchasing the management right.

The Ministry is keen to hear views on how the reserve price / resource charge be set.

Q20. Do you have any comments on how the reserve price for a management right should be set?

Q21. Do you have any comments on payment terms for management rights?

2.7.2 Spectrum licences in Crown management rights

For spectrum licences, the Ministry is not proposing a competitive allocation. This then requires the Ministry to set an offer price for the licences. We could use a simplified approach and set a charge based on geographic coverage area or population covered. Given that LMR services tend not to be consumer focused, a population based approach may not be relevant to the value of the licence. Our preference would be to set a charge based on geographic coverage area of a licence.

PIB 38 establishes the coverage area of the mobile service component of LMR as being the continuous coverage area of the paired transmitter to the -95 dBm contour. The Ministry is also interested in hearing views on whether this or other signal strength contours could be used to set the coverage area of the spectrum licence.

The charge for each spectrum licence could be paid

a. on an annual basis for the duration of the licence, or
b. as a single up front lump sum.

Without any commonly used methodology to set a price for access to LMR spectrum, there is a risk that the Ministry could set the price too high or too low in either of these options. Allowing for the spectrum licence resource charge to be paid on an annual basis would allow the charge for access to the spectrum to be amended in response to changes in demand for licences.

Setting the resource charge as a single up front lump sum would provide greater certainty for industry on the cost of holding licences in the band. However, there would be no opportunity for the Ministry to adjust the charge for a particular licence once is has been granted. If the resource charge were adjusted in response to changes in demand (as well as duration), this could create inequities between licensees who obtained their spectrum licences at different times.

Our preference is for the resource charge to be set on an annual basis allowing for adjustments to be made as demand changes. If a licensee decides not to retain a licence, it can be cancelled at any time by the licensee on application to the Ministry.

At present, there is higher demand for LMR duplex licences in the metropolitan areas causing congestion in LMR bands in these areas. Demand for LMR spectrum licences in 174 MHz to 184 MHz may also be higher in these areas. The Ministry has three options open to it to deal with regional variations in demand. These are to

1. have no differentiation between high and low demand areas
2. set a higher spectral efficiency requirement (such as narrower bandwidths) for equipment operating in high demand areas, or
3. set a higher resource charge for access to the frequencies in high demand areas.

If the Ministry were to set a resource charge on a nationwide basis, licensees operating in low demand areas may experience a rise in the annual resource charges to deal with demand elsewhere. This may negatively impact on the use of the spectrum in low demand areas.

The second option (requiring higher spectral efficiency) is used in fixed services, where there is similar higher demand in the metropolitan areas. Appendix B in PIB 38 has defined metropolitan areas (DMAs) (see Annex 4) where higher spectral efficiency equipment is required. This would require the high demand areas to be determined based on existing use of LMR bands. The fixed services DMAs are similar areas to where other VHF LMR bands have higher demand and could be used for LMR services in 174 MHz to 184 MHz.

The third option provides for the Ministry to amend the annual resource charge according to demand on a regional basis. Given that the Ministry's preference is to use the resource charge to manage demand, this option is most consistent with the policy proposal.

All licensees will be required to pay the annual licence fees in addition to any resource charge identified in the options above.

The Ministry is keen to hear views on the options for setting any resource charge.

Q22. Do you have any comments on how to set the resource charge for spectrum licences in Crown management rights in 174 MHz to 184 MHz?

Q23. If geographic coverage is used to set the resource charge, what signal strength contour should be used to set the coverage extent? Should the coverage be limited to continuous coverage or also include fortuitous coverage? Why?

Q24. Should any resource charge be set and imposed annually or as a single upfront payment?

Q25. Which option is preferred to manage regional variations in demand and how should the regions be identified? Do you have an alternative mechanism to manage regional variations in demand?

2.8 Competition considerations

A risk with opening up a new band is that a small number of licensees could dominate holdings in the band, excluding others and stifling competition in downstream markets. In order to address this matter, acquisitions of management rights and spectrum licences are already subject to the prohibition on anti-competitive acquisitions in the Commerce Act 1986. For some allocations for cellular mobile services, the government has also elected to impose spectrum acquisition caps on management rights as part of the sale process where competition is a particular concern.

No formal analysis of the competition in the LMR market has been carried out. Land mobile licences are held by over 2000 entities or individuals. The majority of the licensees operate on a regional basis with only a few national network providers. Compared to the cellular mobile market, equipment costs and spectrum availability do not appear to be barriers to entry to the market and the majority of licensees hold licences for their own or other commercial operators use rather than providing a consumer service.

If the Ministry were to impose competition related spectrum caps for 174 MHz to 184 MHz spectrum rights, the options include:

1. Setting no acquisition limits
2. Limiting a single entity (or associated entity) to holding no more than a fixed percentage of the nationwide rights in 174 MHz to 184 MHz
3. Excluding a single entity (or associated entity) from holding both national management rights and regional licences in the 174 MHz to 184 MHz duplex and simplex channels

The Ministry is not convinced that spectrum caps are required for the reasons identified above.

Q26. Do you consider that allocation of LMR spectrum rights between 174 MHz to 184 MHz should be subject to acquisition caps? If so, why and what should these caps be?

2.9 Implementation requirements

A key objective of spectrum regulation is to ensure spectrum is put to its highest economic use. Whilst market allocation of spectrum contributes to this objective, there is a risk that spectrum is purchased for its foreclosure value (i.e. for its value in excluding competitors) rather than economic use. Implementation requirements are designed ensure that spectrum is put to economic use. However, a difficulty with implementation requirements is the compliance testing, particularly when services are transient and / or intermittent. With the potential number of users and nationwide use of rights in 174 MHz to 184 MHz, compliance monitoring of any implementation requirement will be challenging.

Implementation requirements for other bands require that a service be implemented within a defined number of years. Failure to meet the implementation requirement results in loss of the right to use the spectrum or the management right.

At this stage the Ministry is not convinced that implementation requirements are needed if the price for spectrum licences is able to be adjusted to match demand. We are interested in

hearing views on whether implementation requirements are necessary for rights for LMR between 174 MHz to 184 MHz.

Q27. Do you consider that implementation requirements should be imposed on LMR management rights and / or spectrum licences in 174 MHz to 184 MHz? If so, why and what should these be?

Q28. Do you consider there should be any requirement regarding access to or use of other LMR frequencies if an entity holds licences in 174 MHz to 184 MHz and other LMR frequencies managed under the radio licensing regime?

3 Management rights

Management rights must specify the range of frequencies covered by the right. In addition, the management right may specify

- the protection limits from unwanted emissions in adjacent rights
- limits on unwanted emissions from emissions on frequencies within the management right (the adjacent frequency emission limit (AFEL). The AFEL must not exceed the protection limit on an adjacent management right
- the power floor. This sets the maximum power of unwanted emissions outside a protection limit[2].

A spectrum licence gives the holder the right to transmit (and /or received protection) on the frequencies specified on the licence. A spectrum licence must specify the unwanted emissions from a transmitter. These unwanted emissions must not exceed the AFEL on the management right.

We propose that the AFELs for 6.25 kHz and 12.5 kHz management rights be based on the unwanted emissions in the digital LMR radio standards (see section 4.7 for further details). These assume a maximum transmitter power of 15.2 dBW (see section 4.2 for discussion on power limits). The AFELs are shown in Figures 2 and 3 below for a 6.25 kHz and 12.5 kHz management right respectively. Details of the frequency and power levels for the AFELs are included as Annex 5.

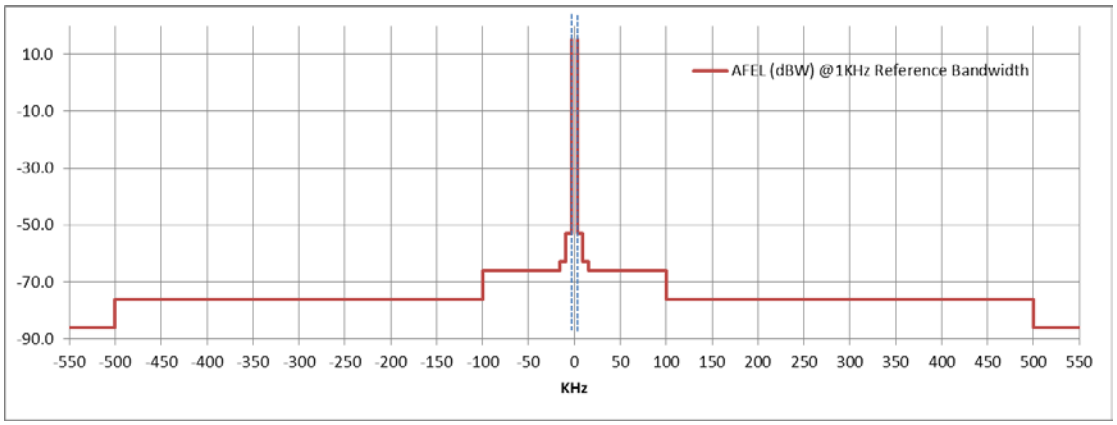


Figure 2: AFEL for a 6.25 kHz management right

[2] If no power floor is specified, the Act sets the power floor at -50 dBW. Below the power floor, the Ministry may issue radio licences.

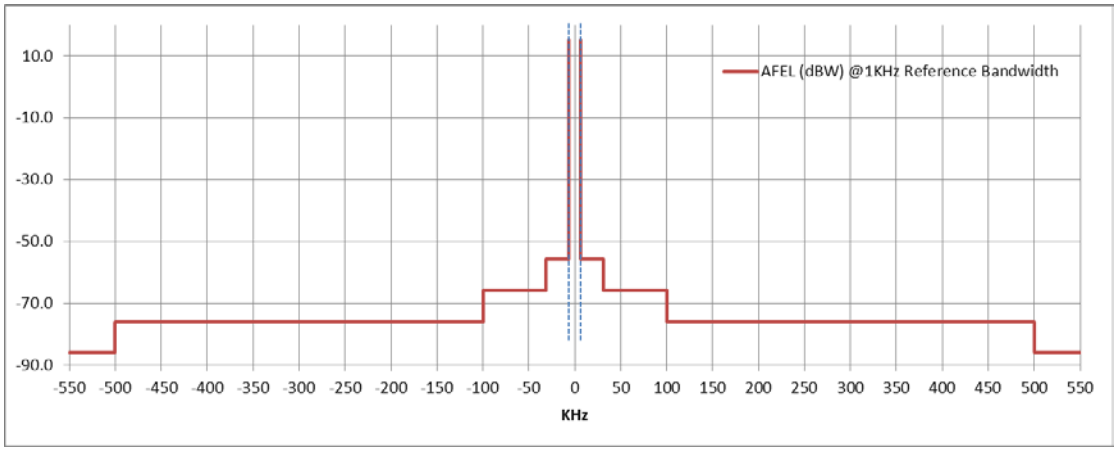


Figure 3: AFEL for a 12.5 kHz management right

The Ministry proposes to set the power floor for management rights at -86 dBW for 1 kHz reference bandwidth

The protection limit could mimic the AFEL of an adjacent channel and would therefore be -52.8 dBW and -55.8 dBW (1 kHz reference bandwidth) for 6.25 kHz and 12.5 kHz management right as shown in Figures 4 and 5 below.

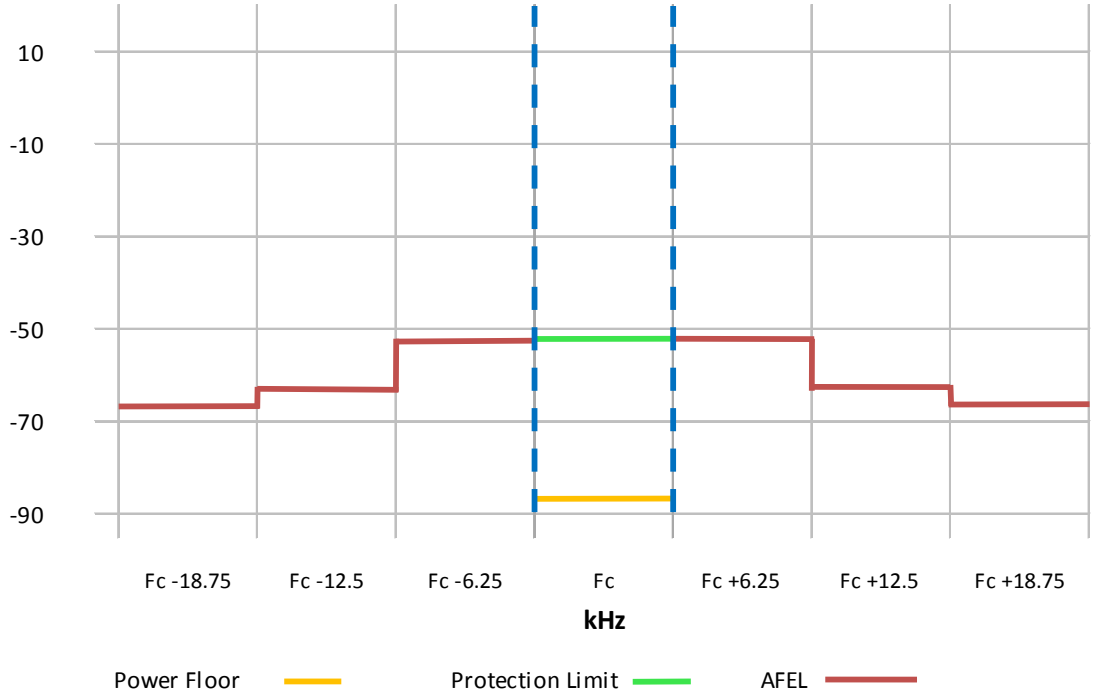


Figure 4: Proposed protection limit and power floor for a 6.25 kHz management right

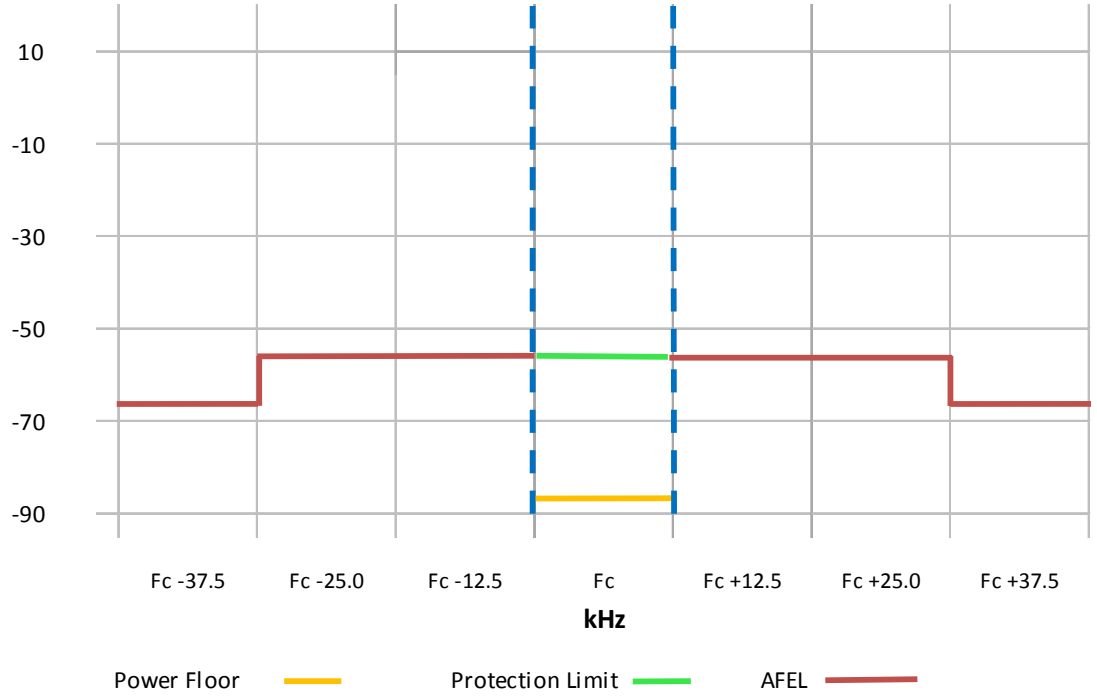


Figure 5: Proposed protection limit and power floor for a 12.5 kHz management right

Management rights could be created covering a single or multiple channel widths. The maximum channel width could be specified as a condition on the management right. However, if the management rights cover multiple channels, the management right would set no out of band / unwanted emissions for the immediately adjacent channels within the same management right. Unwanted emissions would be managed through the conditions on the relevant spectrum licence or though equipment standards (see sections 4.2 and 4.7 for related issues).

The Ministry is interested in hearing industries views on the proposed out of band emissions and whether the management rights should be limited to a single channel width or cover multiple channels which are specified on the management right.

Q29. What Adjacent Frequency Emission Limits and protection limits should apply to management rights for LMR in 174 MHz to 184 MHz? Should these align with the out of band emissions in the equipment standards? Why or why not?

Q30. Should management rights be created (and retained) at one channel wide or be able to be amalgamated? If amalgamated, should restrictions on the maximum channel width and number channels be specified on the management right?

Q31. What level should the power floor be set at?

4 Technical requirements

4.1 Approach to technical requirements

In the radio licensing regime, the Ministry sets out detailed policy and licensing guidance for land mobile as well as setting equipment standards. In private management rights, the Ministry typically does not specify equipment standards nor do we set out licensing guidance for owners. In Crown management rights, the Ministry issues licensing policy and certification guidance similar to radio licensing.

The following sections ask questions on the details of the technical requirements. However, we are also interested in industries' general views on whether a similar approach to radio licensing should be applied to LMR management rights and spectrum licences in 174 MHz to 184 MHz. In particular, we are would like your views whether the Ministry should devolve decisions on use and technical specifications in private management rights to industry as has been done in the cellular bands.

Q32. Should the Ministry approach the technical specifications for these bands similarly to radio licensing? If so, why?

Q33. Are there particular technical specifications which you consider must be identified?

4.2 Maximum transmitter power

Typically, no power limit for the wanted emissions is specified on the management rights. However, to some extent, the limits on out of band emissions (the AFELs) set the maximum transmitter power possible in the management right.

PIB 23 sets the maximum wanted emission power limit for LMR transmitters in the adjacent EE and bush winch bands at 14 dBW for mobile transmit and in the EE band, 15.2 dBW for the base transmit. Arguably, if management rights are created to cover a single channel, and no amalgamations are permitted, the management right would set the channel width and the AFEL would act as a limit on the wanted transmission power. However if the Ministry allowed management rights to be created or amalgamated to cover more than one channel, then the AFEL is less capable of managing the maximum power of emissions in channels towards the centre of the management right.

The Ministry is interested to hear industry views on whether wanted emission power limits should be specified for spectrum licences in this band or whether the AFELs and protection limits on the management rights are sufficient to limit the maximum power of the LMR transmissions. The Ministry is also interested to know whether industry considers private management rights for nationwide deployment should be treated differently to Crown management rights for regional LMR services.

Q34. Should the management rights set the maximum power for wanted emissions or the AFELs be relied on to manage adjacent channel emissions? Why or why not?

Q35. Should private and Crown management rights be treated differently? If so, how and why?

4.3 Minimum field strength

The minimum field strength sets the level of the wanted signal that needs to be present at a receiver to justify compliance action for protection from harmful interference. It is based on the service and the typical sensitivity of the receivers being used.

PIB 38 defines -95 dBm as the minimum received power for the continuous coverage contour. For repeater channels, this contour line also is used to identify the area where a service can reasonably expect interference protection. When channels are used on a shared (non-interference) basis or are exclusive to a single user, no minimum field strength is specified.

Private management rights used solely by the manager would be in similar situation to exclusive channels in other LMR bands. Minimum field strength would not be necessary as the licensee is able to fully manage interference themselves. However interference between users may arise in Crown management rights where several licensees are operating on the same channel.

The Ministry is keen to hear whether the minimum field strength should be applied to the Crown management rights in 174 MHz to 184 MHz.

Q36. Should a minimum field strength be specified for simplex and/or duplex LMR services between 174 MHz to 184 MHz? If so, why?

Q37. Should private and Crown management rights be treated differently or have different minimum field strengths specified? If so, why?

4.4 Coverage

PIB 38 establishes the coverage area of the mobile service component of LMR as being the continuous coverage area of the paired transmitter to the -95 dBm contour. This allows new users to identify the operational area of a particular transmitter.

The Ministry is interested in hearing views on whether the coverage area of the mobile service should be identified for this band in Crown management rights and if so, to what extent should this apply.

Q38. Should a maximum coverage area be specified for simplex and/or duplex LMR services for Crown management rights in 174 – 184 MHz? If so, how and what should this be? Please give reasons for your views

4.5 Maximum permitted interfering signal

Under section 48 of the Act, all applications to register a spectrum licence must be on the prescribed form. Form 7 in Schedule 7 of the Regulations sets out the information required before a spectrum licence can be registered. Form 7 requires a value for the maximum permitted interfering signal (MPIS) in the protection area. PIB 38 sets the harmful interference thresholds for LMR repeaters as -106 dBm at the wanted receiver. However this protection limit does not extend to the whole protection area as an MPIS would do (Note: -106dBm at 174 MHz at unity antenna gain is equal to 16 dBuV/m).

The Ministry is interested in industries' views on what is an appropriate MPIS for LMR services in 174 MHz to 184 MHz.

Q39. What should the Maximum Permitted Interfering Signal be set at on LMR spectrum licences in 174 MHz to 184 MHz? Why?

Q40. Should there be any consideration made to the difference between the MPIS being set over the entire protection area and the interference threshold in PIB 38 being set at the receiver?

4.6 Analogue or Digital services

Most LMR bands in the VHF frequencies allow both digital and analogue services. However the Ministry encourages new LMR services to be more spectrally efficient using narrower channels and digital technology.

We are interested in industry's views on whether we should allow only digital LMR to operate in the band and exclude analogue services in both the simplex or duplex bands.

Q41. Should only digital LMR services be permitted in the duplex and / or simplex frequencies between 174 MHz to 184 MHz? If so, why or why not?

4.7 Equipment standards

The Radiocommunications (Radio Standards) Notice 2016 sets out the performance standards required to be met by different classes of radio equipment. These equipment standards only apply to equipment operating under a radio licence. The Radio Standards notice also prescribes the unwanted emission power limit for any transmitter not covered by the equipment standards including equipment operating under a spectrum licence.

The equipment standards for LMR are set as:

Applicable Standards		Level of Conformity
APCO P25 land mobile – 12.5 kHz channels (30 – 1000 MHz and 800 MHz trunked radio)	ANSI/TIA-102.CAAB-C	A2
Digital land mobile – 6.25 kHz channels (30 – 1000 MHz)	EN 301 166-1 V1.3.2	
Digital land mobile – 12.5/25 kHz channels (30 – 1000 MHz)	AS/NZ 4768	
Digital land mobile – ETSI DMR (30 – 1000 MHz)	EN 300 113-1 V1.7.1	

The Ministry is able to prescribe the above standards for LMR equipment operating under the management rights regime or to rely on the unwanted emission limits set on the management rights and in the Radio Standards notice. Setting equipment standards is contrary to current policy for management rights including Crown management rights[3]. However the use of equipment standards is well understood by the LMR industry.

The Ministry wants to hear from industry whether these standards (or others) should be applied to the LMR management rights.

Q42. What equipment standards, if any, should be applied to the use of LMR services in 174 MHz to 184 MHz? Please provide reasons for your views

[3] The Crown's FM broadcasting management rights are subject to a reference standard for transmission field strength but not for equipment operating in the band

4.8 Digital Mobile Radio (DMR) Access Codes

Under the radio licensing rules for LMR (section 3.2 of PIB 38), all new simplex LMR must use unique access codes and these must be included on the relevant licence. This is primarily to manage the shared use of these channels. If simplex licences are issued on an exclusive basis, there is an argument that these may not be required, or at least not mandated.

The Ministry is interested in industry's views on whether access codes require specification on Crown management right terms and conditions.

Q43. Should access codes be required on LMR licences in 174 MHz to 184 MHz? If so, why or why not?

5 ‘Non-standard’ LMR service configurations

Some LMR service providers use ‘non-standard’ service configurations to extend the coverage of the land mobile service or to use LMR frequencies to create a networked service. Some of these are discouraged in LMR radio licensing bands, but may be able to be accommodated in this band.

5.1 Trunked dispatch

Specific LMR bands are reserved for trunked dispatch services due to the nature of the channel spacing required. There is a possibility that some channels in 174 MHz to 184 MHz could be identified for trunked dispatch services.

The Ministry is interested in industry views on whether this band should be planned to include trunked dispatch services.

Q44. Should some channels between 174 MHz to 184 MHz be reserved for trunked dispatch services? If so, should this be provided for in private management rights and / or Crown management rights? Why?

5.2 Linear repeaters

To date, linear repeaters are only permitted to ensure full coverage within the primary coverage area in LMR bands and are not permitted for extending coverage. Linear repeater equipment must comply with similar licence conditions as LMR repeaters and will be channel specific. Given the nature of linear repeater equipment, we are aware that their use can be problematic.

The Ministry is interested in hearing industry views on whether linear repeaters should be allowed in the 174 MHz to 184 MHz.

Q45. Should linear repeaters be allowed in the LMR channels between 174 MHz to 184 MHz? If so, should this be provided for in private management rights and / or Crown management rights? Why?

5.3 Back to back linking

Back-to-back linking is where a fixed location receiver re-transmits the received signal from one mobile channel on the mobile transmit frequency of another channel.

This configuration is not supported in other LMR bands as it can cause spectrum denial on a radio site. PIB 58 requires that fixed links or wired backhaul is used to connect repeaters to form wide-area networks.

The Ministry is keen to hear industry views on whether a similar restriction should apply to 174 MHz to 184 MHz and whether the fixed and mobile transmit channels should be strictly enforced.

Q46. Should back to back linking be restricted in the LMR channels between 174 MHz to 184 MHz? If so, should this be provided for in private management rights and / or Crown management rights? Why?

Q47. Should the fixed and mobile transmit channels be strictly enforced? If so, why?

6 Other matters

6.1 Timing of release of 174 MHz to 184 MHz frequencies for LMR

As noted earlier, the Ministry understands that LMR equipment that is tuneable across the whole of the 174 – 230 MHz is available in other markets. This means that 174 MHz to 184 MHz can be released in the near future.

Based on feedback from this consultation, we anticipate that decisions on the allocation of 174 MHz to 184 MHz for LMR will occur in the first half of 2018 with allocation in late 2018.

Q48. Do you have any comments on the proposed timing of the allocation of these frequencies?

6.2 Implementation and effectiveness review

The allocation of LMR licences in the management rights regime is novel. We are proposing that the implementation and use of the management rights be reviewed early in the management right term.

We propose to review the effectiveness and use of these frequencies three years after the first rights are allocated.

Q49. Do you have any comments on the proposal to review the implementation and effectiveness, and / or the timing of the proposed review?

Q50. Do you have any other comments?

7 Summary of questions posed

Annex One: Summary of submissions on Band III replanning relating to Land Mobile Radio

We received 21 submissions on the replanning of Band III. Submitters came from a range of sectors, including broadcasting, telecommunications, amateur radio, land mobile radio, critical communications and utilities companies.

Submissions on the Band III consultation have been published on the Radio Spectrum Management website. These can be found at https://www.rsm.govt.nz/projects-auctions/current-projects/review-of-options-for-174-230-mhz/submissions.

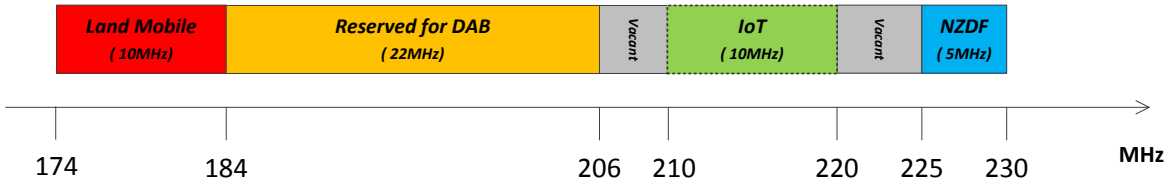
Twelve submissions explicitly supported an allocation to land mobile radio in Band III. Only one submitter disagreed with an allocation for land mobile, while two believed more work needed to be undertaken to assess current levels of congestion. Generally, submitters who supported an allocation for land mobile did so on the basis of congestion in other LMR bands.

Key themes in the submissions were:

- Any allocation should require the most efficient technology to be used, including allowing only digital technology in the band. RFUANZ suggested that there should be separate 12.5 kHz and 6.25 kHz channels rather than interleaved channels to manage any potential spectrum denial issues in the band.
- There should be separate allocations for LMR voice services in the lower part and for wideband simplex and duplex services in the upper part of Band III. A number of submitters supported accommodation for point to point and point to multipoint telemetry, SCADA and other M2M networks. RFUANZ also suggested a small trunking band be created.
- There was a need for dedicated spectrum for emergency services and / or utility companies

Most submitters preferred the spectrum to remain in radio licensing. However submitters who commented were split over whether there should be a charge associated with use of the spectrum.

Annex Two: Band plan for 174-230 MHz



Annex Three: The licensing regimes

The Radiocommunications Act 1989 and Radiocommunications Regulations 2001 set out the two licensing regimes for spectrum use in New Zealand.

Radio licensing regime

To date, all LMR services have been managed under the radio licensing regime administered by the Ministry. The Ministry sets out the licensing policy and rules in the Public Information Brochures (PIBs) and has the discretion to apply terms and conditions to the licences in addition to those in the Act and regulations.

Licences are issued on a first come first served basis. Anyone wishing to obtain a licence must identify

- an appropriate frequency and
- location or area for the
    - transmissions or
    - protection from harmful interference.

Before the Ministry issues a radio licence, an approved radio certifier must confirm that the radiocommunication service for which the radio licence is required is technically compatible with existing licences.

Unwanted and out of band emissions are managed by setting equipment standards identified in the Radio Standards Notice.

An annual licence fee must be paid prior to the radio licence being issued. These fees cover the administrative costs of managing radio spectrum in New Zealand and are currently set at $150 including GST for the majority of licences.

The Regulations allow the Ministry to cancel a radio licence at any time if, amongst other things:

- the radio licence is deemed to be in insufficient use
- the transmissions under the radio licence may cause harmful interference, or
- the annual licence fee is not paid.

Management rights regime

Management rights are tradeable, nationwide rights which permit the manager or owner to create and register spectrum licences in the frequencies covered by the management right. On creation, management rights are owned by the Crown acting by and through the Ministry of Business Innovation and Employment. The Crown may decide to retain or allocate the management rights to others. If the Crown retains ownership of the management right, this is referred to as a Crown management right. If the management right is allocated to another owner (including another government department or agency), this is known as a private management right.

Spectrum licences may be issued by the manager to themselves or third parties. Before the manager can grant a spectrum licence, an approved radio engineer must certify, amongst other things, that the proposed transmissions are technically compatible with, and will not cause harmful interference to, existing licenced radio services. The spectrum licence application and manager approval is sent to the Registrar of Radio Frequencies (employed by the Ministry) who then registers the spectrum licence in the Register of Radio Frequencies. The spectrum licence is only valid once it is registered. It is the spectrum licence that

establishes the right to transmit and/or receive protection from harmful interference from co-channel emissions.

Management rights have a maximum term of 20 years. Any spectrum licence created in a management right expires at the same time as the management right.

Unwanted and out of band emissions are managed by the conditions on the management right and spectrum licence. Generally, the Ministry does not set equipment standards for frequencies managed under the management rights regime. However the Radio Standards Notice does set unwanted emission limits for all spectrum licences outside those prescribed on the licence.

Generally, the Crown management rights and Crown spectrum licences are allocated competitively. The Crown will set a reserve price and the market determines the purchase price. It is this purchase price that is equivalent to a resource charge.

Before a spectrum licence is registered by the Ministry, an annual licence fee must be paid. This fee covers the administrative costs of managing radio spectrum in New Zealand and is currently set at $150 including GST for all spectrum licences.

Annex Four: Defined Metropolitan Areas

These Defined Metropolitan Areas are used in PIB 38 for fixed services.

Location	NZTopo50	NZTM2000		Radius (km)
		Easting	Northing	
Auckland	BA32 576 203	1757564	5920302	40
Wellington	BQ32 580 353	1757978	5435286	30
Christchurch	BX24 710 804	1570999	5180388	15
Dunedin	CE17 062 174	1406208	4917351	15
Hamilton	BD33 008 154	1800755	5815371	15
Palmerston North	BM34 220 293	1821988	5529295	15
Tauranga	BD37 788 235	1878779	5823498	15

Annex Five: Adjacent Frequency Emission Limits for 6.25kHz and 12.5kHz management rights

In the tables below, "fc" refers to the centre frequency of the management right and the e.i.r.p. has a reference bandwidth of 1kHz.

AFEL for a 6.25 kHz management right	
Frequency	**Maximum level (e.i.r.p.)**
<fc-500 kHz	-86 dBW
fc-500 kHz < f < fc-100 kHz	-76 dBW
fc-100 kHz < f < fc-15.625 kHz	-66 dBW
fc-15.625 kHz < fc < fc-9.375 kHz	-62.8 dBW
fc-9.375 kHz < f < fc-3.125 kHz	-52.8 dBW
fc-3.125 kHz < f < fc+3.125 kHz	6.25 kHz management right
fc+3.125 kHz < f < fc+9.375 kHz	-52.8 dBW
fc+9.375 kHz < f < fc+15.625 kHz	-62.8 dBW
fc+15.625 kHz < f < fc+100 kHz	-66 dBW
fc+100 kHz < f < fc+500 kHz	-76 dBW
>fc+500 kHz	-86 dBW

AFEL for a 12.5 kHz management right	
Frequency	**Maximum level (e.i.r.p.)**
<fc-500 kHz	-86 dBW
fc-500 kHz < f < fc-100 kHz	-76 dBW
fc-100 kHz < f < fc-31.25 kHz	-66 dBW
fc-31.25 kHz < f < fc – 6.25 kHz	-55.8 dBW
fc-6.25 kHz < f < fc+6.25 kHz	12.5 kHz management right
fc+6.25 kHz < f < fc+31.25 kHz	-55.8 dBW
fc+31.25 kHz < f < fc+100 kHz	-66 dBW
fc+100 kHz < f < fc+500 kHz	-76 dBW
>fc+500 kHz	-86 dBW