Ministry of Economic Development Manatu Ohanga | Radio Spectrum Management

Discussion paper

Contents

Summary
Invitation for submissions
Posting and release of submissions
Privacy Act 1993
Glossary of terms and acronyms
1. Introduction
2. Frequency allocations
2.1 ITU and proposed New Zealand allocations
2.2 Proposed New Zealand allocation
2.3 Coordination with the space science services
2.4 Recommendation
3. Usage of the 70-90 GHz band for high capacity fixed linking in other countries
4. Technology and standards
4.1 Channeling arrangements
4.2 Power levels
4.3 Summary
4.4 Antenna Off-axis performance
4.5 Recommended technical standards for New Zealand
5. Licensing
5.1 The current New Zealand licensing arrangements for the fixed service
5.2 Licensing procedures adopted in other countries for this spectrum
5.3 Options for licensing
6. Consultation
Appendix 1: Possible implementation framework for option 2 - Non exclusive licensing
Appendix 2: Comparison of key features of band management options

Summary

Over the last two decades there has been a marked increase in the demand for connection to high speed data networks and this has resulted in an unprecedented expansion of the use of optical fibre. However many localities requiring high speed access are still not connected and this has led to major development programmes being contemplated within industry and supported by government.

Whilst optical fibre is a good solution where economic, often radio linking is preferred as it does not require the laying of cables and can be carried out relatively quickly. At the same time demand for high capacity cost effective radio linking is increasing technological development has resulted in linking equipment operating in the millimeter bands (bands above 30 GHz) becoming available. In particular there are now a number of manufacturers providing high capacity point-to-point linking equipment in the 70-90 GHz band.

The purpose of this paper is to seek the views of those with an interest on options for future regulatory arrangements for high capacity short haul point to point linking in the 70-90 GHz band.

At millimeter wavelengths relatively small antennas (about 30 cm) can provide very high antenna gains. Such antennas have very narrow beam-widths (less than 1.2º), and there is an opportunity to re-use the frequency very often. Propagation at these frequencies is strictly line-of-sight. Careful antenna placement using local shielding can lead to even higher frequency re-use. It is expected that dozens of such point-to-point links could traverse most cities. Typical data sheets indicate that this technology can support applications requiring throughputs of up to 10 Gbps over path lengths of up to 8 km.

Because of the relatively high degree of frequency re-use, most spectrum management authorities overseas that have already provided access to this band have opted for very simple licensing arrangements that places the responsibility for path planning and any interference resolution onto the licensee. This is called ‘self co-ordination’ in Australia and the UK.

In the New Zealand context it is expected that access to this band would provide for a range of short-haul point-to-point links that would compliment development of the optical fibre network. For example, there are a number of buildings not yet connected by fibre and this technology could provide a cost-effective approach to bring connectivity to these buildings.

This paper examines the regulatory regimes in place in other nations and outlines three options for high-capacity short haul point to point links in New Zealand.

Invitation for submissions

Comments are invited on the questions in Section 6 “Consultation” or on any other related issues are invited. Written submissions should be sent no later than 1 October 2008 to:

70-90 GHz Fixed Links

Radio Spectrum Policy and Planning

Ministry of Economic Development

PO Box 1473

WELLINGTON

or emailed to radiospectrum@med.govt.nz (preferred option).

Posting and release of submissions

The Ministry of Economic Development (MED) intends to publish all submissions on its website at http://med.govt.nz. The MED will consider you to have consented to the publication of your submission, unless you clearly specified otherwise.

Please advise the MED if you do not consent to the release of any information contained in your submission, and in particular, which parts should be withheld, together with the reasons for withholding them. MED will take into account all such objections when responding to requests for information on submissions to this document under the Official Information Act 1982

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The Privacy Act 1993 establishes certain principles with respect to the collection, use and disclosure by various agencies including MED, of information relating to individuals and access by individuals to information relating to them held by such agencies. Any personal information you supply to the MED in the course of making a submission will be used by MED in conjunction with considerations of matters covered by this document only. Please clearly indicate in your submission if you do not wish your name to be included in any summary the MED may prepare for public release on submissions received.

Glossary of terms and acronyms

ACMA	Australian Communications and Media Authority
Administration	The arm of government responsible for meeting the obligations under the ITU Convention and Constitution.
AUT	Auckland University of Technology
CEPT	European Conference of Postal and Telecommunications
dBm	Power in decibels relative to 1 milliwatt
dBw	Power in decibels relative to 1 watt
ECC	European Electronic Communications Commission

EIRP	Equivalent isotropic radiated power
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission of the USA
Gbps	The rate of data in gigabits per second
GHz	The frequency in gigahertz
ITU	International Telecommunication Union
MED	Ministry of Economic Development
OFCOM	The UK Office of Communications
POP	Point of Presence access point to an Internet Service Provider

1. Introduction

The purpose of this paper identify options for the introduction of access to the 70 90 GHz band for short haul point to point linking in New Zealand.[1]

There is growing demand for high-capacity digital connectivity to facilitate applications such as broadband and streaming video. The growth of broadband services is recognized as a national priority.[2] Connectivity is the keystone of New Zealand Digital Strategy. This is giving rise to exploration of new and better ways of providing transmission paths in both the private and public sectors, in conjunction with major developments in optical fibre.

One of the problems facing all countries is the need to provide optical fibre to the many points that need high speed connectivity. A number of radio solutions have been identified to provide timely high speed connection but all have limitations.[3]

A recent development that may be worthy of consideration in the New Zealand context is the use of the so-called ‘millimeter wave’ bands. Europe, North America and Australia have already put arrangements in place for access to the 71-76 and 81 86 GHz bands for short haul high capacity point-to-point linking.

There are a number of manufacturers now producing equipment in these bands that will support up to 10 Gbps full duplex services over line-of-sight paths up to about 8 km in length.[4]

At these frequency ranges very small antennas of 30 cm or less can give high antenna gains and produce very narrow beams. Because of the very narrow beams and the requirement for strict line-of-sight paths, careful path planning and the use of local shielding for strategic antenna placement can lead to even higher frequency re-use. Dozens of such links could traverse a city providing short range point to point links to compliment the deployment of optical fibre networks.

Because of the possibilities for significant geographic re-use of these frequencies, very little inter-system coordination is required. Most countries that have opened these bands for use have done so by the adoption of ‘minimal’ licensing regimes where the licensee is responsible for overcoming any inter-system interference. In the UK and Australia this has been termed ‘self coordination’.

Unlike with most other technologies there are very few detailed specifications for fixed-links operating in these bands. Most administrations have adopted requirements that are limited to specifying maximum transmitter and radiated powers, minimum antenna gain and the frequency band to be used. Other technological choices (e.g. the mode of modulation) are left to the developers and the end users to determine.

Use of technology in the 70-90 GHz band range is desirable because of lower atmospheric absorption. Within the 60 GHz [5] band the oxygen in the air is highly absorptive. With atmospheric absorption peaking at some 10dB per km at 60 GHz only very short range communication (typically less than 2km) is possible. In the 70-90 GHz bands the atmospheric absorption is less than 1 dB per km, hence the communications range is increased making it a more cost effective approach for longer paths.

Typical applications identified by the Australian Communications Media Authority (ACMA)[6] are:

- Fibre (Backbone) POP access
- redundant access – network diversity
- enterprise campus connectivity
- local area network extension

- local loop
- metropolitan area network
- wide area network access
- central office bypass
- storage access
- wireless backhaul
- high definition video

A search of the New Zealand Register of Radio Frequencies[7] indicates that there is currently a licensed trial of 70-90 GHz technology underway in New Zealand.

The Auckland University of Technology, Centre for Radiophysics and Space Research confirm that they are not carrying out any radio astronomy observations in these bands.

Footnotes

[1]For an overview of radio spectrum policies in New Zealand see Review of Radio Spectrum Policy in New Zealand

[2]See the Digital Strategy website http://www.digitalstrategy.govt.nz

[3]For a discussion of the US situation see Cisco 02-146 ExParte FCC WTB of May 18 2003

[4]See www.e-line.com/technolgy.cfm

[5]See www.gigabeam.com/technology.cfm

[6]See ACMA paper “Planning of the 71-76 GHz and 81-86 GHz Bands for Millimetre Wave High Capacity Fixed Link Technology” December 2006 at http://www.acma.gov.au/WEB/STANDARD/pc=PC_310066

[7]SMART data base on www.rsm.med.govt.nz/pls/web/dbssiten.main

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2. Frequency allocations

A scan of the allocations used in most countries indicates regulatory activity in the 71-86 GHz band. Within this frequency range the bands 71-76 GHz and 81-86 GHz have been adopted within Europe and Australia.

The Ministry notes that the band 92-95 GHz is also allocated for point to point linking in the USA[8]. The band is split as the segment 94-94.1 GHz is not available to the fixed service. This coupled with the fact that the band is also shared with space science services and radiolocation means that it is less useful than the lower bands for fixed linking purposes. It is therefore not proposed to consider licensing point to point links in this band in the USA at this stage.

Footnote

[8]See FCC 03-248 “Allocation and Service rules for the 71-76 GHz, 81-86 GHz and 92-95 GHz Bands November 2003 see www.fcc.gov

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2.1 ITU and proposed New Zealand allocations

71-76 GHz

GHz	ITU[9] Allocation	Proposed NZ Allocation

71-74	Fixed	Fixed
	Fixed-satellite (space to earth)	
	Mobile	
	Mobile-satellite (space to earth	
74-76	Fixed	Fixed
	Fixed-satellite (space to earth)	Space research (space to earth)
	Mobile	
	Broadcasting	
	Broadcasting satellite	
	Space research (space to earth)	
	5.561	

81-86 GHz

GHz	ITU Allocation	Proposed NZ Allocation
81.84	Fixed	Fixed
	Fixed-satellite (space to earth)	Space research (space to earth)
	Mobile	5.149, 5.561A
	Broadcasting	
	Broadcasting-satellite	
	Space research (space to earth)	
	5.149, 5.561A	
84-86	Fixed	Fixed
	Fixed-satellite (earth to space)	Radioastronomy
	5.561B	5.149
	Mobile	
	Radio Astronomy	
	5.149	

Footnote 5.149 refers to the need to protect Radio Astronomy

Footnote 5.561 refers to the need to respect the decisions of a future Broadcasting Satellite Service planning conference.

Footnote 5.561A provides for a secondary allocation to the Amateur and Amateur- Satellite services

Footnote 5.561B relates to the Administration of Japan only

Footnote

[9] Article 5 of the International Radio Regulations.

2.2 Proposed New Zealand allocation

Currently there are no specific New Zealand allocations to services in these frequency bands. [10] It is noted that the use of these bands for satellite services is not likely as the relatively high atmospheric absorption makes space to Earth propagation difficult.

To use these bands for fixed point to point services requires the deployment of high gain narrow beam antennas. Without such high gain antennas communications with the current transmitter technology would be limited to a few metres. This would suggest that the use of these frequency bands for practical mobile or broadcasting use is not likely at this stage in the development of the technology.

The Auckland University of Technology Centre for Radiophysics and Space Research has confirmed that these bands are not used now and are unlikely to be used in the near future for space science services in New Zealand. If it is later decided to use the bands for space science then the compatibility with the fixed service is likely to be high due to the very narrow beams employed and propagation being strictly limited to line of sight paths. As the future New Zealand space science needs are not well defined, Radio Astronomy and Space Research services would remain with their existing allocation status.

The Amateur and Amateur Satellite service allowed under footnote 5.561A and Space Research services are of a secondary status in the ITU allocations and no change to its application in New Zealand is proposed.

Footnote

[10]Reference to the MED publication PIB 21 see www.med.govt.nz/rsm . There is a New Zealand allocation is in the band 81-84 GHz for vehicle collision avoidance radar. It is assumed that this entry should have been placed against the adjacent band 79-81 MHz which is the international band used for this purpose.

2.3 Coordination with the space science services

In Australia the radio telescopes at the Paul Wild and Mopra observatories carry out observations in 70-90 GHz frequency range. Coordination has been effected by the notification of an area around the observatories where coordination between the proposed fixed-link and the radio telescopes is required.

In radio astronomy, observations are often on fixed spectral lines and therefore radio telescopes wanting to carry out such observations do not have the latitude to change frequency. For this reason the radio astronomy allocation in the band 84-86 GHz is left as a primary allocation and coordination arrangements will be needed with the fixed service should radio astronomy require use of this band in future.

2.4 Recommendation

It is proposed that New Zealand allocate the bands 71-76 GHz and 81-86 GHz on a primary basis to the fixed service. It is further proposed that the band 84-86 GHz also be available for Radio Astronomy on a primary basis.

3. Usage of the 70-90 GHz band for high capacity fixed linking in other countries

In Europe, the 47 countries that comprise the European Conference of Postal and Telecommunications Administrations (CEPT) have formed the European Radio Office (ERO) to coordinate areas of common interest between members. The ERO has developed a decision based on the ETSI specification ETSI TS 102 524 which has been taken up by 5 of its 47 members. Other European countries such as the UK have adopted

part of the specification only. The Australian standard appears to be based on the UK standard but has drawn on the US antenna standard, as that is the only reference currently available.

4. Technology and standards

This paper draws upon and summarises the findings of other administrations on technology and standards, for example the Australian Communications and Media Authority (ACMA).[11] The main elements of the technical standards adopted elsewhere are limited to the spectrum to be used, the maximum power of the transmitter, the minimum antenna gain and the maximum overall radiated power. No attempt has been made to define the mode of modulation for example and a number of different approaches have been developed and are on offer by manufacturers.

Footnote

[11]ACMA Publication ”Planning of the 71-76 & 81-86 GHz Bands for Millimetre-Wave High Capacity Fixed Link Technology” Dec 2006

4.1 Channeling arrangements

There are a number of arrangements in common use. The US has adopted a plan based on the use of the total spectrum available in 8 x 1.25 GHz channels. Emissions are not restricted to individual channels and a number of adjacent channels can be amalgamated to support relatively wide emissions up to 5GHz in bandwidth.

4.1.1 US Channeling arrangements in GHz

70 GHz Band	80 GHz Band
71.00-72.25	81.00-82.25
72.25-73.50	82.25-83.50
73.50-74.75	83.50-84.75
74.75-76.00	84.75-86.00

4.1.2 ECC Channeling arrangements

The ERO has drafted a standard for these frequency bands[12] and stipulated this in Recommendation ECC/REC (05) 07. It consists of a plan where each 5 GHz block has a guard band of 125 MHz at each end and contains 19 x 250 MHz channels.

Of the 47 members of the ERO only five have indicated that they have adopted this standard. These are Croatia, Denmark, Estonia, Netherlands and Slovenia.

The rest of Europe appears to have adopted variations on the ECC Recommendation.

4.1.3 Australia and UK channeling arrangements

Both the UK[13] and Australia [14] have decided that detailed channeling of the band is unnecessary and in fact may be counterproductive as the modulation schemes are not regulated. In the UK and Australia, a guard band of 125 MHz is provided at each end of the bands giving an available bandwidth of 4.75 GHz. This is in accordance with the ECC recommendation ECC/REC (05) 07.

70 GHz Band	80 GHz Band
71.000 -71.125 Guard Band	81.000-81,125 Guard Band
71.125-75.875	81.125-85.875
75.875-76.000 Guard Band	85.875-86.000 Guard Band

4.1.4 The case for a guard band

Europe and Australia have opted for a 125 MHz guard band at each band edge. The USA has not adopted any guard bands.

Immediately adjacent to these bands are a number of evolving spectrum uses like vehicle collision avoidance radar and the Road Transport and Traffic Telematics (RTTT). The timing of development of some of the applications in the adjacent bands is some way in the future.

It is expected that the uptake of high capacity point to point links in New Zealand will reflect trends in other similar countries and in the future there may be many such links in service. The introduction of guard bands from the outset minimises the potential for interference caused by unwanted emissions from the fixed service and from the services in the bands immediately adjacent.

Footnotes

[12]The document can be found on the ERO Website at www.ero.dk
[13]See OFCOM Document OfW 369 March 2007 see www.ofcom.org.uk
[14]See ACMA RALI FX 20 of 13 December 2007 see www.acma.gov.au

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4.2 Power levels

The ERO and Australia provide a maximum total EIRP of +45 dBw and a maximum transmitter output power of +30 dBm. They also stipulate a minimum antenna gain of 43 dBi. The minimum antenna gain is necessary to ensure the high degree of frequency reuse as an antenna with this gain would have a beam width at the -3dB points of less than 1.2 degrees

The US regulator[15] takes a slightly different approach inasmuch as the power supplied to the antenna has a spectral density limit of 150 mW/100 MHz with a maximum of 3 watts. The minimum antenna gain is specified at the same level as the ERO at 43 dBi as well as a maximum beam width at the -3 dB points of less than 1.2 degrees.

The UK regulator, the Office of Communications (Ofcom)[16] specifies a maximum power output of the transmitter as +30 dBm and a maximum EIRP of +55 dBw. OFCOM does not stipulate a minimum antenna gain.

Footnotes

[15]See FCC Document WT Docket No 02-146 of 3 March 2005 www.fcc.gov
[16]See OFCOM Document OfW369 March 2007 www.ofcom.org.uk

4.3 Summary

The table below summarizes basic technical arrangements in key overseas markets.

Country	Maximum Transmitter power/Spectral Density	Minimum Antenna Gain	Maximum EIRP	Maximum -3dB Beam width
USA	+5 dBW and 150 mW/100 MHz	43 dBi	+55 dBW	1.2º
Europe ERO	+30 dBm	43 dBi	+45 dBW	1.2º

United Kingdom	+30 dBm		+55 dBW	
Australia	+30 dBm	43 dBi	+45 dBW	1.2º

4.4 Antenna Off-axis performance

There is little data available on antenna off-axis performance however the US regulator[17] stipulates antenna masks which could be used. In Australia the ACMA[18] has adopted the US masks as follows:

- the minimum front to back performance should exceed the forward gain by at least 12 dB; and
- the cross polar discrimination up 5º from the beam centre should offer at least a 25 dB reduction in gain.

Off Axis angle	Minimum radiation suppression	Minimum Cross-polar suppression
5 to 10 degrees	35 dB	45 dB
10 to 15 degrees	40 dB	50 dB
15 to 20 degrees	45 dB	50 dB
20 to 100 degrees	50 dB	55 dB
100 to 180 degrees	55 dB	55 dB

Footnotes

[17]See Appendix B of FCC document FCC Final Decision 05-45 0f Docket No 02-146

[18]See Appendix 1 of ACMA RALIFX 20 December 2007

4.5 Recommended technical standards for New Zealand

It should be noted that measurements at this frequency order are difficult to carry out and tend to be confined to laboratory testing only. Taking into account that New Zealand users will probably want to be able to source equipment from as wide a range of suppliers as possible throughout the world, the MED is of the view that the technical standards adopted should not be unnecessarily restrictive.

4.5.1 Frequency Bands

It is recommended that New Zealand adopt the same frequency plan as Australia and the UK. That is that the frequency bands 71.125-75.575 GHz and 81.125-85.875 GHz be allocated on a primary basis for point to point fixed linking in New Zealand.

4.5.2 Transmitter Power

The difference between the US (3 watts) and the UK/Australia (1 watt) limits is small, hence it is proposed that New Zealand adopt the US transmitter power standards of 3 watts with a maximum spectral density of 150 mW/100 MHz as this would give slightly better performance and provide for a wider range of equipment.

4.5.3 Antenna characteristics.

There is merit in having a minimum gain specified as it ensures only very narrow beam widths are used. The figure of 43 dBi is generally accepted in both North America and Europe for this standard. The directivity pattern adopted by Australia and the US would appear to be relevant to New Zealand to ensure a high level of frequency re-use.

4.5.4 Maximum Radiated Power

The higher limit adopted by the UK and the USA of +55 dBW e.i.r.p. would appear to be appropriate to enable the introduction of equipment from a wider range of sources.

5. Licensing

New Zealand as a signatory to the ITU Constitution and Convention is obligated to issue Licences under provision 18.1 of the ITU Radio Regulations that states:

> '18.1 § 1 1) No transmitting station may be established or operated by a private person or by any enterprise without a licence issued in an appropriate form and in conformity with the provisions of these Regulations by or on behalf of the government of the country to which the station in question is subject…'

The licensing of transmitting stations in New Zealand is regulated under two regimes. In parts of the spectrum that have been transferred into Management Rights a Spectrum Licence is the authorising instrument.

In all other parts of the radio frequency spectrum, licences are granted under administrative processes. The authority for the MED to issue licences to transmitting stations, arises from enacting section 111(2) of the Radiocommunications Act 1989 as amended.

There are three possibilities for Administrative licensing:

- a radio licence granted under Section 8 of the Radiocommunications Regulations which takes the form of a individual station licence;
- a General User Licence granted under Part 9 of the Regulations which covers all stations within the technical description on the licence; and
- an exemption to licensing granted under Part 10 of the Regulations.[19]

Footnote

[19]Generally this applies in cases were no interference can be caused to other users.

5.1 The current New Zealand licensing arrangements for the fixed service

Most of the bands allocated to the fixed services have an approved channelling plan already developed.[20] An Approved Radio Engineer selects the appropriate channel from the relevant band plan and carries out an investigation to ensure that no unacceptable interference will be caused by the issue of the new licence. The Approved Radio Engineer certifies the licence application and upon receipt of that application the MED issues the licence on payment of the appropriate fee.

Each transmitter is then individually licensed under Part 8 of the Regulations and the data entered into the Register of Radio Frequencies. When new stations are being planned the Approved Radio Engineer consults the Register of Radio Frequencies to carry out the spectrum engineering so as to ensure that there is no unacceptable interference to or from, existing networks.

Footnote

[20] See MED Document PIB 22 "Fixed Services in New Zealand"

5.2 Licensing procedures adopted in other countries for this spectrum

Australia, USA and UK authorities all provide a licensing regime where parties wishing to establish and operate stations within the 70-90 GHz frequency bands receive a non exclusive nationwide licence (or authority).

The holders of a non exclusive nationwide licence are required to enter the basic individual station data into the centralized data base of the administration concerned. An annually renewable licence is then issued by the respective spectrum management authority after a fee is paid. The data consists mainly of the location of both ends of the link with the minimum of technical details.

The purpose of this somewhat different approach of 'self coordination' adopted in Australia and the UK is to minimise the transaction costs by making use of the inherent high degree of frequency reuse of equipment operating at these frequencies.

In general interference can only be caused to those stations within sight and pointing in the direction of the new transmitter/receiver.

To carry out the necessary interference evaluation studies, a holder of a non- exclusive nationwide licence needs access to the site data of the other licensed stations in these bands. Without access to such records, this process would not be possible and the number of stations that could use this band before interference occurred would be much less.

On the other hand, the issue of individual licensing has costs attached to it. The current annual fee levied for fixed links in New Zealand is $200 per station per year. In the UK the cost for stations operating in these bands is £50 (currently around NZ$131) per station per year while in Australia the cost is A$ 187 (currently around NZ$236) per pair of stations per year.

Whilst taking into account the importance of access to the 70-90 GHz band for fixed-links in support of the national broadband delivery objective and protecting existing stations consideration has been to how licensing could be further simplified and reducing cost to both the Government and to the end user.

As indicated earlier, the concept of self-coordination as applied overseas also prevents licensing these stations by a General User Licence issued under Part 9 of the Radiocommunications Regulations. This is because site data from the existing stations would not be captured.

Currently there are no other applications using these bands in New Zealand, although there could be in the future. Radio Astronomy, for example, could be introduced and this would require protection against interference. Coordination with existing stations would not be possible without detailed location records. This supports the case for the issue of individual station licences where such data is recorded in the Register of Radio Frequencies, or an option where such data is held by the licensee and subject to audit.

The MED currently regulates the OX band (2.700-2.900 GHz) using self-coordination between licensees. The OX band is used extensively for itinerant microwave linking in support of outside broadcasting purposes as well as other temporary linking requirements. OX band licensees know who the other licensees are and can quickly and effectively coordinate band usage amongst themselves. This self-coordination concept has been operationally proven as an effective form of shared spectrum access.

If a process to that used within the OX band could be developed for the 70-90 GHz bands, then the requirement for individual licensing of each station may be able to be avoided, thus reducing the costs to both the MED and the end user.

One possible approach would be for the MED to follow the UK and Australian example of issuing non-exclusive nationwide licenses to the interested parties. The MED would only record the names and contact details of the licensees, and these would be publicly available on the MED website via the SMART interface to the Register of Radio Frequencies.

As inter-station coordination will be required if interference is to be avoided, a condition of the proposed non-exclusive nationwide licenses would be that each licensee keeps records of the stations that they have installed and that this data be made available when requested by another holder of a similar non-exclusive nationwide licensee. The obligation to keep records and make information available would lie with the non-exclusive nationwide licensee rather than the MED. This would remove the need for the MED to keep such records and licence individual stations.

Non-exclusive nationwide licenses would contain a condition to the effect that: 'the holder of this licence shall maintain records as detailed in an attached schedule and these records shall be made available at no charge on request by other holders of non exclusive nationwide licences for the bands 71-76 GHz and 81-86 GHz, as well as to the MED'.

In order to ensure that the MED records of the holders of non-exclusive nationwide licenses and their contact details is current, the non-exclusive nationwide license would be annually renewable and subject to a nominal administrative fee to cover administration costs. This minimises the direct compliance costs of access whilst ensures that the necessary licensee contact details for inter-station and inter-service coordination are maintained should they be needed due to the development of future services.

The UK and Australia have adopted a ‘first in time’ rule for the mitigation of interference and dispute resolution. This means that when resolving interference issues radio links licensed first have priority over those licensed later. This concept is enshrined in Part 12 of the Radiocommunications Act 1989, and necessitates the recording of a date from which licence priority can be measured

5.3 Options for licensing

Option 1 - Individual Licensing

License applications are be prepared and certified by an Approved Radio Engineer or Certifier for each fixed point to point link. If the licence application is in accordance with licensing policies a licence would be granted by the Ministry and an annual administrative fee of $200 per fixed link transmitter would be incurred.

The details of each link would be recorded on the register of radio frequencies, and this enables robust interference mitigation when subsequent links are being engineered and certified. Engineering and certification is mandatory and this incurs an additional cost for the licence applicant.

The information on the Register of Radio Frequencies also enables a robust compliance and audit regime to ensure maximal utility of the radio spectrum resource.

Maintenance of band usage information ensures that future options for managing or re-farming the 70-90 GHz band are not curtailed.

The first in time’ priority is easily established using Part 12 of the Radiocommunications Act 1989 and the date of recording of the radio licence as captured in the Register of Radio Frequencies.

Option 2 – Non-exclusive Licensing

The MED would issue interested parties with an annually renewable non-exclusive nationwide licence at a cost of $300 per annum. This would apply to the user as licensee irrespective of the number of transmitters operated by the licensee. There would also be no requirement for links to be certified.

The MED would keep a record of all holders of the non-exclusive nationwide licence and this is information would be publicly available on the register of radio frequencies.

Each non-exclusive nationwide licensee would be required to keep and maintain technical data on the links that they have installed. This data might include transmitter and receiver pair make, model, location, date of installation, and period of operation. The licensee would be obliged to provide this data to other non-exclusive nationwide licence holders and the Ministry on request and at no charge.

The maintenance and provision of data ensures that:

- there is an ability for interference mitigation when planning and operating high-capacity radio links;
- there is the basis for dispute resolution should interference between links occur; and
- band usage information is available to assist the future management of the band should it be required.

Appendix 1 contains details of a possible implementation framework for this option. Within the mandatory regulatory framework, licensees could implement measures to streamline the coordination of new and existing high-capacity fixed links in the 70 – 90 GHz range. For example, licensees may chose to establish a voluntary code of practice, form an industry group, or to electronically publish the technical data relating to their links at a common internet location.

In the first instance interference is avoided via the licensee coordination process. However, should interference occur after the licensee coordination stage, then the avoidance, mitigation and/or resolution of that interference should be attempted directly by the affected parties using any and all technical means.

In the event that the affected parties can not manage interference then the Ministry of Economic Development would play an active role to resolve the situation.

Option 3 – General User Radio Licence

The MED would issue a General User Radio Licence to be utilised by transmitters of point to point services in the 70-90 GHz bands without them incurring an annual fee.

As band usage information is not easily available after a General User Radio Licence is implemented, there can be no guarantee of interference protection, nor can interference dispute resolution be pursued should it occur. Furthermore future options for band management are more difficult to implement.

An unlimited number of links would be able to be operated and there is no requirement to have links certified.

There is no basis for interference resolution within this type of licensing regime.

Preferred option: the Ministry's view

Noting that initially the risk of inter-system interference will be low, the Ministry is of the opinion that Option 2 represents a suitable balance between the level of regulation required to mitigate or resolve interference, and the need to preserve future band planning and management options.

A comparison of the key features of the three licensing options is contained in Appendix 2.

6. Consultation

The MED invites specific comment from the industry on the following questions.

1. Should provisions for short haul high-capacity fixed point-to-point links in the 70/80 GHz bands be introduced in New Zealand, and why?
2. What are the appropriate frequency allocations to be applied for this service in New Zealand – either:
1. The Australian, and European allocations incorporating guard bands being 71.125-75.875 GHz and 81.125-85.875 GHz; or
2. The US allocations without guard bands being 71-76 GHz, 81-86 GHz and 92-95 GHz?
1. What is the appropriate transmitter power limitation to be applied in New Zealand – either:
1. that adopted in Australia and Europe, being a maximum power of 1 watt; or
2. that adopted in USA, being a power spectral density of 150 mW/100 MHz coupled with maximum power of 3 watts?
1. Should a Minimum Antenna Gain or 43 dBi as used in Europe, the US and Australia be applied in New Zealand?
2. What is the most appropriate Maximum Radiated power for emissions to be applied in New Zealand – either:
    1. +55 dBw e.i.r.p. as used in the US and UK; or
    2. +45 dBw e.i.r.p. as used in Europe and Australia?
1. Is option 2, non-exclusive licensing the most appropriate licensing mechanism to be introduced in New Zealand, if not what is your favoured licensing mechanism and why is this so?
2. If your answer to question 6 supports licensing option 2, should this licensing mechanism be introduced on a national basis as in the UK or USA, or on a regional basis?
3. If your answer to question 6 supports licensing option 2, what mechanisms to streamline the sharing of technical information and self-coordination process would you suggest?
4. If your answer to question 6 supports licensing option 2, should Approved Radio Engineers and Certifiers be required to date and sign-off each technical record to ensure that record is accurate?\

Appendix 1: Possible implementation framework for option 2 - Non exclusive licensing

The MED would issue interested parties with an annually renewable non-exclusive radio licence at an administrative cost of $300 per annum. The licence class implemented would be the 'miscellaneous (radio and spectrum') licence for Radio transmitters emitting 30dBW e.i.r.p. or more (class of licence code OZ3).

The MED, in accordance with Section 5 and 6 of the Radiocommunications Act 1989, maintains a record of all licenses granted in the Register of Radio Frequencies. This information would be used to;

1. ensure licensee information is available to assist effective management and long term planning of the 70 – 90 GHz band;
2. enable licensees to contact one another for the purpose of radio coordination (i.e. self regulate);
3. enable interference management and resolution; and
4. enable the MED to conduct radio licence audits.

Effective Management and Long-term Planning

Effective management and long-term planning is supported as follows.

In accordance with Regulation 8 of the Radiocommunications Regulations 2001, every radio licence must specify: the name and address of the licensee, the frequencies of operation, the commencement date of the licence, and the class of radio licence.

Following from section 111 (3) of the Radiocommunications Act 1989, Regulation 14 of the Radiocommunications Regulations 2001, gives the Chief Executive of the MED the power to include in any radio licence any terms or conditions and restrictions he/she sees fit. Schedule 1 of the Regulations specifies as a general condition of licence the compliance of any directions given by the Chief Executive for the use of the radio transmitter operating under the radio licence.

Each non-exclusive licence would contain the minimum terms and conditions to ensure the effective management of the 70-90 GHz band. These terms and conditions would specify the basic technical parameters applicable to all radio transmitters operating under the licence e.g. effective isotropic radiated power, transmitter power, power spectral density, antenna gain, emission type and/or bandwidth.

Licensee Contact for Radio Coordination

Licensee radio link coordination would be effected as follows.

The Register of Radio Frequencies is publicly accessible online (at URL http://www.rsm.med.govt.nz/pls/web/dbssiten.main). Hence, licence holders contact information would publicly available on the register of radio frequencies.

Each non-exclusive licence would also contain a condition or direction from the Chief Executive instructing the licensee to keep accurate technical records of each fixed link operating under the licence. These records would include as a minimum; the frequencies of operation, the transmitter and receiver locations and heights, the make, model and serial number of the equipment and the service start and stop date.

To ensure that technical records are available for the purpose of coordinating fixed links each non-exclusive licence would contain a condition or direction that the technical records be made available (at no charge and within a specified timeframe, say 15 working days) to other licensees in the 70-90 GHz range. The process of coordination would involve the licensee introducing a new fixed link to:

- obtain relevant technical records from other licensees;
- examine all technical records to ensure that placement of a new fixed links does not cause interference to existing fixed links; and
- update its own technical records.

The licensees would be at liberty to streamline the process outlined above, for example by forming a co-ordination of community group for this purpose (as licensees within the OX band, and users of the LPFM General User Radio Licence have done). Use of electronic files, internet web pages, and communication by Email would also streamline this activity.

To ensure that records are accurate each non-exclusive licence would include a condition that each technical record be dated and endorsed by an Approved Radio Engineers or Approved Radio Certifier.

To ensure that records are kept up to date each non-exclusive licence would include a condition that the complete technical records would be provided annually to the MED [electronically]. A non-exclusive licence would not be renewed annually until the records and licence fee had been received by the Ministry.

Interference Management And Resolution

Because of the technical characteristics of point to point linking in the 70-90 GHz range, should interference require management technical measures (such as antenna shielding, and careful receiver and transmitter placement) can be simply and cheaply effected. Thus, in the first instance interference mitigation and resolution would be addressed directly by the affected parties.

In the event that the affected parties could not manage interference the MED would need to play a more active role. Examination of the licensee’s technical records, or those records deposited with the Ministry at annual renewal could be used to ascertain first in time priority for the interfered with or interfering transmission.

Licence Auditing

Licence and licensee auditing is required to ensure compliance with the Radiocommunications Act, Regulations and licence conditions.

It is usual practice of MED to audit licenses and licensees annually. An audit to ensure that each licensee is keeping records and that these records are accurate would provide incentives for licensees to adhere to this condition of licence. Failure to adhere to the conditions of licence is equivalent to operating a radio transmitter without a licence and this is an infringement Section 37, clause 1 (f).

Furthermore, failure of a licensee to provide suitably detailed and accurate technical records to other licensees within the specified time frame could be reported to the MED and appropriate remedial action could be undertaken.

This system of licensee self-regulation, and audit is analogous to that used within the regulatory framework for Electromagnetic Compatibility, where an electronic equipment supplier:

- registers their status as a supplier with the MED;
- is required to ensure equipment supplied to market meets all relevant standards;
- is required to keep detailed records and documentation verifying that their equipment meets all regulatory standards, and
- must provide those detailed records to the Ministry for the purposes of audit.

The main difference between the EMC regime and with licensee self-coordination is that licensees may also need to communicate amongst themselves.

Appendix 2: Comparison of key features of band management options

	Option 1: Individual licences	Option 2: Non-exclusive licence	Option 3: General User Licence
Interference protection	Yes.	Yes.	No.
Record in Register of Radio Frequencies	Yes,	Yes LIMITED Name and contact details only Transmitter and receiver location & period of operation data held by licensee and subject to audit	No.
Certification required (at additional cost to the user)	Yes. Mandatory	No. Not required	No. Not required
Interference resolution	Yes. Compliance based on information held in the Register of Radio Frequencies	Yes. Remedial action based on information held by the user	No.
Fee	$200 per transmitter per year	$300 per user per year irrespective of the number of transmitters	No fee
Future proofing	Yes.	Yes. Information held by licensee could be transferred into the Register of Radio Frequencies in future if necessary	No. No information available to enable implementation of increased regulation should risk increase

Optimum regulation	No. 'Gold-plated' regulation Would impose higher costs of regulation on business than necessary	Yes. Would manage risk at minimum cost to business	No. Does not manage risk adequately. Because it does not provide a guarantee of viability of future service, and hence undermines investor confidence to develop broadband services