

# SPECTRUM LICENCE CERTIFICATION RULES

for

# CROWN MANAGEMENT RIGHTS

This draft document contains revised information

that has yet to become policy and should not be relied upon for the

certification of new spectrum licences without reference to  
[RSMlicensing@med.govt.nz](mailto:RSMlicensing@med.govt.nz)

## Disclaimer

This document specifies the requirements for the certification of sound broadcasting, television broadcasting and Fixed Wireless Access spectrum licences in Crown management right frequency bands. Such licences must also meet the requirements of the Radiocommunications Act 1989 and its amendments ("The Act").

Approved Radio Engineers are required to comply with these Rules when certifying spectrum licences relating to Crown management rights.

These Rules do not represent the entirety of the knowledge and expertise that an approved person must have when determining technical compatibility.

These Rules will be amended from time to time to reflect evolving policies, technologies and services. It is the responsibility of the approved persons to ensure that they are familiar with the latest edition of these Rules as published on <http://www.rsm.govt.nz/cms>. Changes to this document will be notified through the Ministry of Economic Development 'Business Update' publication that is emailed to radio and spectrum licence holders, management right holders, Approved Radio Engineers, Approved Radio Certifiers and other radio industry participants, and also in the Latest News section on the welcome page at <http://www.rsm.govt.nz/cms>. Those wishing to Subscribe to Business Update may do so by Business Update button on the welcome page at <http://www.rsm.govt.nz/cms>.

No liability is or will be accepted by Ministry, or its officers, servants or agents for any loss suffered, whether arising directly or indirectly, due to sole reliance on the accuracy or contents of these Rules.

Radio Spectrum Management would appreciate receiving suggestions for improvement to or advice relating to inaccuracies or ambiguity to these Spectrum License Certification Rules. Such suggestions and advice should be emailed to [RSMLicensing@med.govt.nz](mailto:RSMLicensing@med.govt.nz). Correspondence received will be acknowledged, investigated and appropriate action taken.

Amendment History		
Issue	Date of effect	Description of Amendment
1	28 Sept 2004	Issue 1
2	5 May 2005	Editorial amendments (non technical)
3	Awaiting Approval	Complete revision

# Contents

• <b>Section One: General</b> .....	<b>4</b>
1.1 Purpose of this Public Information Brochure .....	4
1.2 Introduction .....	4
1.3 Acts, Regulations, Gazette Notices and Forms.....	5
1.4 Interpretation, Terminology and Definitions.....	5
1.5 Crown Management Right Frequency Bands .....	6
1.6 Spectrum Licence Policies for Broadcasting Services .....	6
1.7 Allocation Policies for Commercial Broadcasting Services .....	7
1.8 Allocation Policies for Reserved Broadcasting Services .....	7
1.9 Allocation Policies for Fixed Wireless Access Services .....	8
1.10 RSM Processes for Externally Engineered Spectrum Licences .....	8
1.11 Spectrum Licence Rights .....	8
1.12 Spectrum Licence Certification Requirements .....	8
1.13 Spectrum Licence Contents .....	9
1.14 Spectrum Licence Parameters .....	10
1.15 Spectrum Licence Conditions and Other Content Specified by the Act.....	10
1.16 Spectrum Licence Authorities.....	11
1.17 Simultaneous Certification of Licences .....	11
1.18 Requirements for Certifying Engineers .....	12
1.19 Records of Certification and their Retention .....	13
• <b>Section Two: Compatibility and other Technical Issues</b> .....	<b>14</b>
2.1 Technical Compatibility.....	14
2.2 Distress and Safety Services .....	15
2.3 Aeronautical Navigational Services.....	15
2.4 Compatibility Planning for Broadcasting Services.....	16
2.5 Transmitters in Urban Areas.....	17
2.6 Equipment and Site Issues.....	17
2.7 Adjacent Service Issues .....	18
2.8 Protection Locations .....	18
2.9 Population Counts .....	20
2.10 Maximum Permitted Interfering Signal (MPIS) Level Requirements.....	20
2.12 Parameter and Reference Bandwidths .....	22
2.13 Frequency Offset and Time Delay.....	23
2.14 Antenna Radiation Patterns .....	23
2.15 Site Naming Conventions and Geographic Coordinates .....	23
2.16 Verification of Spectrum Licence Parameters .....	24
• <b>Section Three: Engineering Issues relating to Particular Management Rights</b> .....	<b>25</b>
3.1 Introduction .....	25
3.2 MF-AM Sound Broadcasting Services .....	25
3.3 VHF FM Sound Broadcasting Services .....	29
3.4 Analogue Television Broadcasting .....	33
3.5 Digital Television Broadcasting .....	35
3.6 Fixed Wireless Access (3.5 GHz).....	36
• <b>Appendices</b> .....	<b>38</b>
Appendix 1 Terminology for Management Right Spectrum Parameters.....	38
Appendix 2 Sample Approve Engineer's Certificate .....	39
Appendix 3 Sample Spectrum Licence .....	40
Appendix 4 Unwanted Emission Limits .....	44
Appendix 6 Minimum Usable Field Strengths for Broadcast Services Protection Areas .....	52
Appendix 7 List of Agencies for Band Usage Approval.....	53
Appendix 8 List of Maritime Sites used for Distress and Safety Communications.....	54

## Section One: General

### 1.1 Purpose of this Public Information Brochure

This Public Information Brochure (PIB 39) document, herein after called the rules, provides the rules required by the Manager, the Ministry of Economic Development, to be followed when certifying new and modified radio services in Crown management rights. Those management rights provide for Sound and Television Broadcasting services, and Fixed Wireless Access services as detailed herein.

These rules include discussion on regulatory, policy and engineering aspects that an Approved Radio Engineer (ARE) must consider when undertaking engineering activities associated with the preparation and certification of spectrum licences in Crown management right bands.

These rules also include discussion of regulatory licensing matters and broadcasting processes, and do not purport to provide legal advice on the Radiocommunications Act 1989. Readers should take independent legal advice on such matters.

Where these rules include discussion of policy matters and they should be read in conjunction with policy documents (POLDOC) that are available at <http://www.rsm.govt.nz/cms> (search on POLDOC).

Should there appear to be a conflict between these rules and a POLDOC, or for other matters requiring clarification, please email [RSM Licensing@med.govt.nz](mailto:RSM Licensing@med.govt.nz).

These rules do not include all the engineering knowledge and expertise that an ARE requires for the preparation and certification of spectrum licences in Crown management right bands.

Some of the information provided is relevant to spectrum licences in non Crown management rights. However, these rules are not intended to provide rules or advice in respect of those management rights.

**These rules may change from time to time and any new or modified licence registered shall be certified in accordance with the rules current at the time of registration. Changes to the rules will not apply to spectrum licences certified and registered prior to those changes.**

### 1.2 Introduction

The roles of the Ministry of Economic Development (the Ministry) in relation to the radio spectrum include:

- Identifying social, economic, and technology impacts on the radio spectrum
- Establishing competition policies for spectrum use.
- Establishing and managing the regulatory aspects governing spectrum use.
- Planning spectrum allocation.
- Managing radio and spectrum licensing functions including licence registration;
- Mandating technical planning requirements for spectrum use.
- Managing the New Zealand government's radio spectrum international treaty obligations.
- Managing spectrum management rights reserved for assignment by the Crown.

In relation to these roles, the Ministry requires that a spectrum licence submitted for registration in Crown management rights must be certified in accordance with the requirements of section 25(5) of the Radiocommunications Act 1989 ("the Act"). In particular, a licence submitted must be technically compatible with existing radio licences and spectrum licences recorded in the Register of Radio Frequencies (RRF).

The Ministry provides for the certification of spectrum licences by Approved Radio Engineers (ARE). An ARE can be a Ministry employee or an engineer external to the Ministry (external engineer).

In these Rules;

- Section 1 discusses regulatory, policy and administrative issues common to radio frequency bands allocated for spectrum licences services;
- Section 2 provides technical and related information common to the certification requirements for AM, FM and television broadcast bands, and FWA bands; and,
- Section 3 provides band allocation standards, expected coordination processes and other information specific to certification requirements for the sound and television broadcast services bands; and,
- The Appendices technical details and examples relevant to the content of the Rules.

### 1.3 Acts, Regulations, Gazette Notices and Forms

The Act provides the contents, certification requirements, registration requirements and associated rules for spectrum licences and related matters. The Radiocommunications Regulations (the Regulations) contain requirements prescribed by Order in Council under section 112 (s112) of the Act. Schedule 7 of the Regulations provides the prescribed forms for the purposes of registering new spectrum licences (Form 7), their modification (Form 8), their transfer (Form 9) and cancellation (Form 10). Other Schedule 7 forms relate to matters such as spectrum licence mortgages, caveats and consents.

Gazette Notices are publications prescribed by Order in Council under s112 of the Act that identify Government policies including Ministerial Directives and notices extending the Regulations on such matters as, but not limited to, the promulgation of new, modifications to and revocations of General User Licences (GUL), EMC Standards, Radiocommunications Standards and Reference Standards (s133).

The Radiocommunications Act may be viewed at [Radiocommunications Act 1989](#)

The Radiocommunications Regulations may be viewed at [Radiocommunications Regulations 2001](#)

Current Gazette Notices may be viewed at <http://www.rsm.govt.nz> and searching on Gazette Notices.

### 1.4 Interpretation, Terminology and Definitions

The interpretation, terminology and definitions contained in this document shall have the meanings as identified in the;

- Radiocommunications Act 1989 and its amendments;
- Radio Regulations 2001 and its amendments;
- International Radio Regulations (ITU-R RR) and ITU-R Recommendations; and,
- Convention of International Civil Aviation (ICAO).

For example the term 'necessary bandwidth' has the meaning as defined in Article 1.152 of the International Radio Regulations.

Within these Rules references to sections of the Act are identified s, for example, s133 means section 133 and s57C(1)(a)(i) means section 57, subsection C, clause 1, sub-clause (a), item (i).

Terminology commonly used in this document and for which legal definitions are included in s1 of the Act, include;

- Interference, harmful Interference and interfering equipment;
- Protection Areas (which includes Protection Locations);
- Protection Level (PL);
- Power Floor (PF);
- Unwanted emissions and unwanted emission limit (UEL);
- Adjacent Frequency Emission Limit (AFEL);
- Co-channel emissions;
- E.i.r.p.

Some of these terms are shown diagrammatically in Appendix 1, Terminology for Management Right Spectrum Parameters and discussed as necessary below.

It should be noted that where the Act refers to Protection Area of a licence, it is accepted practice to include Protection Locations to adequately define the Protection Area of a licence. See section

[2.8 Protection Locations](#) ..... 18 for further discussion

MED acronyms commonly used in this document shall have the following meanings:

- RRF means the Register of Radio Frequencies and is the legal repository for records of all management rights, spectrum licences and radio licences;
- SMART means the Spectrum Management and Registration Technology online database system, which includes the RRF, associated reference data, radio spectrum client records and record maintenance facilities, licence billing and payment facilities, licence application and assignment facilities and other administration and information facilities. SMART is accessible at <http://www.rsm.med.govt.nz/pls/web/dbssiten.main>. Some SMART facilities are accessible by general public access and others are available to external approved engineers, clients and Ministry staff with access via key and password facilities.

Particular definitions regarding the services discussed in this document are as follows;

- Broadcasting, as defined in the Broadcasting Act 1989, means any transmission of programs, whether or not encrypted, by radio waves or other means of telecommunication for reception by the public by means of broadcasting receiving apparatus but does not include any such transmission of programs ;-
- Made on the demand of a particular person for reception only by that person; or,
- Made solely for performance or display in a public place.
- Fixed Wireless Access (FWA) services means short and medium range fixed radio services that can provide an alternative to cable reticulation services suitable for voice and internet communications.
- Broadband Wireless Access (BWA) services means short and medium range fixed and mobile radio services suitable for voice, internet and video communications.

The terms wanted signal and unwanted signals used in these Rules generally refer to the signals produced by the wanted transmitter and interfering transmitters respectively. The definitions associate with discussions on transmitter spectra and bandwidths including out-of-band emissions, spurious emissions and unwanted emissions are those available in the ITU Radio Regulations, refer ITU-R RR s1.144 to s1.147 inclusive. These emission parameters are discussed in detail in the ITU-R Recommendations SM.328 and SM.329.

## 1.5 Crown Management Right Frequency Bands

The requirements of this document apply to all frequencies within AM and FM radio and television broadcasting bands, and two Fixed Wireless Access management rights. The frequency bands for these services are defined in [PIB 21 - Table of Radio Spectrum Usage in New Zealand](#) and summarized in the following table.

Table 1 Crown Management Right Frequency Bands;

Management Right	Broadcasting Service	Frequency Band
MR 15	MF – AM Sound Broadcasting	521 – 1612 kHz
MR 143	VHF – FM Sound Broadcasting	88.8 – 106.63 MHz
MR 47	VHF – TV Television Broadcasting	44 – 51 MHz
MR 48	VHF – TV Television Broadcasting	54 – 68 MHz
MR 49	VHF – TV Television Broadcasting	174 – 230 MHz
MR 1	UHF – TV Television Broadcasting	518 – 582 MHz
MR 195	UHF – TV Television Broadcasting (Māori Television Service)	582 – 614 MHz
Radio Licence Band	UHF – TV Television Broadcasting (Ministry of Culture and Heritage)	614 – 646 MHz
MR 2	UHF – TV Television Broadcasting	646 – 806 MHz
MR 144 and 145	Fixed Wireless Access	Part of 3.4 to 3.6 MHz band

Parameters for the management rights can be located in [SMART](#) and using Search the Register link.

Licence in the UHF-TV Television Broadcasting band (614 – 646 MHz) are currently granted as radio licences not spectrum licences. Plans exist to convert this band into a management right. Radio licences in this band shall be engineered in accordance with the requirements of these Rules and administered as radio licences until the conversion is completed.

## 1.6 Spectrum Licence Policies for Broadcasting Services

Spectrum licence applications being presented for granting in Crown management rights shall comply with the RSM Operational Policy documents (POLDOCs), available at <http://www.rsm.govt.nz> (search on POLDOC), and government policies, available at <http://www.rsm.govt.nz> (search on Ministerial).

The spectrum licences for broadcasting services may be commercial or non-commercial. Commercial licences, including those with requirements described in related POLDOCs, can include:-

- Long term licences, i.e., whose duration can extend to the end of a management right;
- Low value licences;
- Limited term broadcasting licences;
- Temporary pending auction licences; and,
- Interference evaluation licences, i.e., short term licences granted to allow evaluation of service compatibility and coverage.

Some spectrum licences are allocated for cultural and governmental purposes through government agencies and legislation for particular purposes. These licences are generally referred to as non – commercial and involve no resource fees. Such licences can include the following;

- Long term licences, i.e., whose duration can extend to the end of a management right;
- Temporary licences, i.e., whose duration may be a year or so to allow compliance monitoring of content; and,
- Interference evaluation licences.

Other current spectrum licence POLDOCs relate to;

- Changes to population counts arising from changes such as antenna radiation pattern modifications, antenna height adjustments, transmit site relocations and power levels increases.
- Assessment of resource fees for short term and temporary pending auction spectrum licences.
- Definitions for and measurement of licensed power.
- VHF TV public tender limitations.
- Booster Systems for remote area TV.
- Limitations associated with reductions in transmitted power and other matters.
- FM 400 kHz – revised Criteria for VHF-FM Broadcasting Services.
- Policies for VHF-FM Broadcasting Services – relates to planning of further licences, Power Upgrading and Synchronous Coverage Systems and Frequency Separation between Services.
- Limitations for the creation of new licences.

## 1.7 Allocation Policies for Commercial Broadcasting Services

It is the policy of Government that broadcasting frequencies will be available for commercial purposes via open market mechanisms such as auctions and tenders. In addition, low value, temporary, interference evaluation and temporary pending tender licences may be issued on a short-term basis and in accordance with particular policies. Information regarding the auctioning of spectrum licences can be located at <http://www.rsm.govt.nz/auctions/index.html>. Other information is available in the Spectrum Policy and Planning, and Resource Library pages of the RSM web site, <http://www.rsm.govt.nz>.

## 1.8 Allocation Policies for Reserved Broadcasting Services

Government has reserved some broadcasting frequencies for a range of “not-for-profit” purposes including national public broadcasting, Maori, Pacific Island, Parliament, and Community Access Radio services, through the Schedule 7 and Radio New Zealand provisions of the Radiocommunications Act and government policies.

These frequencies include a number of frequencies for Maori and non-commercial purposes that are collectively known as Crown Reserve Broadcasting (CRB) frequencies. Use of these frequencies requires the approval of either;

- [Te Puni Kōkiri \(Ministry of Māori Development\)](#), who is responsible for developing policy on reserving radio and television broadcasting frequencies for the promotion of Māori language and culture, and for determining successful applicants, and monitoring compliance, for particular reserved frequencies; or,
- The [Ministry for Culture and Heritage](#), who is responsible for developing policy on reserving radio and television broadcasting frequencies for other purposes, such as Community Access Radio and National Public Radio. It is also responsible for applying the Government's non-commercial broadcasting framework to decide between competing applicants for reserved frequencies.

All applications for non-commercial licences will be referred by RSM to either Te Puni Kokiri or the Ministry for Culture and Heritage prior to the grant of a licence. It is strongly recommended in the first instance, that applicants consult with the relevant agency regarding their eligibility for a licence. Most licences will be subject to contractual arrangements in regard to program content and other operational matters.

A number of policies noted in section [1.6 Spectrum Licence Policies for Broadcasting Services](#) ..... 6\_ above are relevant to

## 1.9 Allocation Policies for Fixed Wireless Access Services

Fixed Wireless Access (FWA) services are normally short and medium range radio services that can provide an alternative to cable reticulation services. Prior to auctioning a number of FWA management rights, the Crown retained two Fixed Wireless Access management rights, MR 144 and MR145, for the purpose of providing spectrum licences for use by:-

- Project PROBE building requirements (Remote Internet Access for public use); and,
- parties interested in providing services in specific areas who may not have had incentives or resources to acquire nationwide rights.

All available FWA spectrum licences in MR 144 and MR145 have been prepared by MED on a Territorial Local Authority basis and have been publicly auctioned. Those currently unsold will be re-auctioned. Any licences remaining after the second auction will be available at the reserve auction price to those meeting policy requirements.

Any applications for FWA Services licences received after the second auction will be referred by RSM to Manager Radio Spectrum Planning and Policy. Policy documents and information on recent auctions are available at <http://www.rsm.govt.nz> (search on FWA).

## 1.10 RSM Processes for Externally Engineered Spectrum Licences

Spectrum licence Form 7's (new licences) and Form 8's (modified licences) for registration in Crown management rights, that have been engineered by external AREs, are received by RSM and checked to ensure compliance with the most recent policy requirements and/or to determine resource value payments for new and modified licences.

Applications for the registration of spectrum licence instruments received by RSM shall include;

- any applicable fees
- completed Form 7 (spectrum licence) schedule or other applicable form; and,
- an engineering certificate signed by an Approved Radio Engineer.

Instruments received by RSM that meet the requirements of completeness and policy, and when resource payments (if appropriate) are completed, are sent for registration to the Registrar of Radio Frequencies. Those not meeting the requirements are returned to the applicant.

Instructions for presenting a spectrum licence instrument for registration are included at <http://www.rsm.govt.nz/cms/licensing/how-do-i/register-a-spectrum-licence>.

## 1.11 Spectrum Licence Rights

The Act in s48(1) specifies that there are three types of spectrum licence that “.. a manager (of management right) intends to reserve for himself or herself or grant to any other person –

- (a) the right to transmit on a frequency band, and the right to have no harmful interference from co-channel emissions in the protected area on the frequency band within the range of frequencies specified in the managers record of management rights; or
- (b) the right to transmit on a frequency band on a frequency band within the range of frequencies specified in the managers record of management rights; or
- (c) the right to have no harmful interference from co-channel emissions in the protected area on the frequency band within the range of frequencies specified in the managers record of management rights,-

that manager may execute for the purposes of registration a spectrum licence in the form prescribed for spectrum licence .”

The Act s48(2) states that a spectrum licence is not valid until that licence is registered in the Register of Radio Frequencies.

## 1.12 Spectrum Licence Certification Requirements

New spectrum licences submitted for registration must be certified in accordance with the requirements of s 25(4) of the Act. That section states that “The registrar must not register any spectrum licence unless the

Registrar receives a certificate from an approved radio engineer (being a person approved by the Secretary) dated not more than 3 months before the receipt of that certificate by the Registrar.

Section s57D(4) of the Act identifies the same requirement for modified spectrum licences.

Sections s25(5) and s57D(5) of the Act, which relate to new and modified licences respectively, require that “The Radio Engineer’s certificate must certify that, in the opinion of that engineer, the exercise of rights to which the spectrum licence relates;

- (a) will not endanger the functioning of any radio navigation services; and,
- (b) will not endanger the functioning of any radio service essential to the protection of life and property; and,
- (c) will not cause harmful interference to rights conferred by registered spectrum or radio licences; and
- (d) is technically compatible with services authorized to be operated under existing spectrum licences and radio licences; and,
- (e) will sufficiently define the protection area and the nature and characteristics of the proposed transmissions to enable subsequent spectrum and radio licences to be coordinated with exercise of rights to which the spectrum licence relates for the purpose of avoiding harmful interference.”

In addition, sections s25A, which relate to new and modified licences respectively, which concerns matters relevant to a radio engineer’s certificate, requires that “A radio engineer issuing a certificate;

- (a) must, before issuing the certificate, have regard to;
  - (i) the nature and characteristics of the rights described in the spectrum licence; and,
  - (ii) the International Radio Regulations; and,
  - (iii) the ITU-R reports and recommendations; and,
  - (iv) Annex 10 to the Convention on International Civil Aviation; and,
  - (v) the International Convention for the Safety of Life at Sea; and,
  - (vi) the nature of the service proposed to be operated under the spectrum licence; and,
  - (vii) any relevant reference standards issued by the Secretary, but
- (b) must not, in considering whether to the issuing of the certificate, have regard to the reception of radio waves by inappropriate receivers.”

With regard to the phrase ‘existing spectrum and radio licences in sections s25(5)(c) and s57D(5)(c), for the purposes of certifying licences in Crown management rights, the meaning of the word “existing” shall include new, modified, reserved and planned licences, except for planned licence where the certificate has expired, as recorded in the Register of Radio Frequencies, i.e., those recorded in the SMART database.

The requirements of sections s25, s25A, s57D and s57E of the Act are embodied in the certificate used by MED radio engineers, a copy of which is included in Appendix 2 to this document.

### 1.13 Spectrum Licence Contents

A Registrar of Radio Frequencies receiving a spectrum licence for registration is responsible for ensuring that the licence is accompanied by a certificate issued by radio engineer that confirms that the content of the spectrum licence conform to the requirements of the Act and the parameters and/or restrictions stated in the associated management right.

The Act specifies the minimum contents of a spectrum licence in section s49(1). “Every spectrum licence must specify -

- (a) the name and address of the rightholder; and
- (b) the frequency band within which radio waves may be transmitted; and
- (c) except for licences granted or reserved under section s48(1)(b), the protected area; and,
- (d) except for licences granted or reserved under section s48(1)(c), any unwanted emission limits applying to emissions from a radio transmitter or transmitters; and,
- (e) the commencement date of the spectrum licence, being date not earlier than the commencement date of the record on management rights to which the spectrum licence relates; and,
- (f) the expiry date of the spectrum licence, being a date not later than the expiry date of the record on management rights to which the spectrum licence relates; and,
- (g) whether the spectrum licence may be transferred to another person by the rightholder with or without the consent of the manager; and
- (h) whether the spectrum licence may be cancelled by 1 or more of the rightholder, the manager, or the rightholder and manager together; and
- (i) whether the spectrum licence may be modified by 1 or more of the rightholder, the manager, or the rightholder and manager together; and
- (j) any conditions on the exercise of the right to transmit radio waves or the right to have no harmful interference under the spectrum licence, being conditions that do not contravene the conditions specified in the record of management rights to which the spectrum licence relates; and
- (k) any other matters that may be specified by the regulations made under this Act.”

The references included in the section s49(1) and above have the following meanings;

- In c) above, the reference to section s48(1)(b), means that protected areas need not be specified for transmit only spectrum licences;
- In d) above, the reference to section s48(1)(c), means that unwanted emission limits need not be specified for receive protection spectrum licences; and,
- In k) above, the reference to other matters specified in the current Radio Regulations means the existence of three licence types as identified in Form 7 Spectrum Licence of Schedule 7 of the Radio Regulations and additional matters that may be gazetted from time to time. The three licence types are:-
  - Type A - the right to transmit radio waves on the frequencies specified in clause 3\* and the right to have no harmful interference from co-channel emissions on those frequencies in the protection location(s) or area specified in clause 7\* of the schedule.
  - Type B - the right to transmit radio waves on the frequencies specified in clause 3\*.
  - Type C – the right to have no harmful interference from co-channel emissions on the frequencies specified in clause 3\* of the Schedule.
  - Note that the clauses 3 and 7 referenced in the above licence types refer to clauses in the Form 7 Spectrum Licence Schedule.

### 1.14 Spectrum Licence Parameters

The parameters used in spectrum licences presented to the Registrar of Radio frequencies for registration shall comply with those identified in the Form 7 Schedule included in the Radio Regulations and in particular with the requirements as follows;-

- Maximum power of emissions and emission powers associate with horizontal and vertical radiation patterns stated in a licence shall mean the total power in dBW of the emissions in the necessary bandwidth, i.e., total power is the mean power integrated across bandwidth. Parameters based on Power Density Function (PDF) values, e.g., dBW/Hz, do not meet this requirement. Where an ARE needs to identify the PDF values these may be included in the licence conditions.
- Emission powers associated with Protection Levels (PL), Power Floors, Adjacent Frequency Emission Limits (AFEL), and Unwanted Emission Limits (UEL) may be in dBW with measurement reference bandwidths as stated in the licence conditions. Where measurement reference bandwidths are not so stated the bandwidth shall be as identified in “Table 2 Unwanted Emission Limits” located at <http://www.rsm.govt.nz/cms/resource-library/gazette-notices/product-compliance/radiocommunications-radio-standards-notice-2007>
- Particular requirements for specific radio service types are included in [Section 3](#) 25 of these Rules.

### 1.15 Spectrum Licence Conditions and Other Content Specified by the Act

Section s49(1)(j) of the Act provides for the recording in a spectrum licence any conditions the manager and rightholder may agree on the exercise of the right to transmit radio waves or the right to have no harmful interference under the spectrum licence, being conditions that do not contravene the conditions specified in the record of management rights to which the spectrum licence relates. These conditions may relate to any matter relevant to the spectrum licence including, **but not limited to**;

- Any clarification or definitions associated with parameters in the licence such measurement bandwidths for parameters;
- The purpose of transmissions
- Any special standards for equipment used pursuant to the operation of the licence;
- Maximum permitted interfering signal levels applying to protection areas and can include protection locations;
- Protection area, protection location and coverage area descriptions;
- Restrictions that prohibit operation while another service is transmitting;
- Whether operation of the licence is provided on a shared basis with other services;
- Restricted hours of operation;
- Additional restrictions on unwanted emissions;
- Restrictions on program content as might relate to non-commercial licences;
- For synchronous operation only:
- The Chief Executive or any inspector duly authorised by him shall be granted by the licenceholder at all reasonable times entry to any place, premises or building for the purposes of ensuring compliance with this licence: and,

- For interference evaluation licences – the requirement that any transmission pursuant to the licence change frequency, reduce power, or cease operation, should interference be caused to other services licensed pursuant to a spectrum licence.

Section s49(1)(k) provides for the recording in a spectrum licence any conditions the manager and rightholder may agree regarding the establishment of caveat and mortgage instruments, and other matters.

Appendix 5 provides examples of typical standard spectrum licence. These licence conditions are those that may be required for licences issued in the broadcasting management rights beginning in 2010 and 2011 as appropriate. Additional conditions may be required by or agreed by the Manager.

## 1.16 Spectrum Licence Authorities

Sections 49(1)(g), 49(1)(h) and 49(1)(i) of the Act identify spectrum licence conditions that are referred to as the Authorities of a spectrum licence. They are included in the spectrum licence to record the agreement reached between the management rightholder (the manager) and the spectrum licence rightholder (the rightholder) in regard to who has the authority to transfer, modify and cancel the spectrum licence.

The authorities to Transfer, Cancel and Modify broadcasting spectrum licences registered in Crown management rights shall be in accordance with the following table.

Table 3 Authorities Required for Spectrum Licences in Crown Management Rights

Spectrum Licence Authorities	Commercial	Reserved	Temporary	Evaluation
Transfer S49(1)(g)	Rightholder Alone	Manager and Rightholder Together	Manager and Rightholder Together	Manager and Rightholder Together
Cancel S49(1)(h)	Rightholder Alone	Manager Alone	Manager Alone	Manager Alone
Modify S49(1)(l)	Manager and Rightholder Together	Manager and Rightholder Together	Manager and Rightholder Together	Manager and Rightholder Together

In respect of the table, the service definitions are;

- Commercial; means a long term spectrum licence usually allocated by auction.
- Reserved; means a long term spectrum licence granted without any resource payment to the Crown being required. Such licences may be subject to contractual arrangements in regard to purpose and use of the licence for public radio, promotion of the Maori language and culture, parliamentary broadcasting and other services in accordance with Government policy.
- Evaluation; means a short term spectrum licence granted for the purposes of testing compatibility with existing services.
- Temporary; means a short term, temporary pending auction or limited term spectrum licence.

Note that an additional authority requirement based on ‘Manager or Rightholder’ that can be and is used in spectrum licences for some FWA services in Crown management rights, at the Ministry’s discretion. This authority can be used in respect of a Cancel authority to ensure both the rightholder may Cancel or the manager may Cancel should the rightholder not comply with agreements established before the issue of a spectrum licence.

## 1.17 Simultaneous Certification of Licences

There is a possibility that two or more persons acting independently could input spectrum licence applications, Form 7s or Form 8s for spectrum licence services in the same area that could result in incompatible spectrum licences in Crown management rights. Should that occur, the licence that shall have precedence shall be that determined as being the first in time of the following;

- a completed spectrum licence application lodged in SMART; or,
- a completed spectrum licence application lodged with RSM Licensing; or,
- a completed spectrum licence Form 7 or Form 8 delivered to the Registrar of Radio Frequencies.

The first in time delivery shall be determined based on the dates and times recorded as follows:

- in the case of online applications made and submitted in SMART, by the SMART submit date/time stamp; and,
- in the case of emailed and facsimile licence applications, Form 7s and Form 8s, by the date and time stamp recorded on the document by the transmission network, and,
- in the case of licence applications, Form 7s and Form 8s, received by normal mail, by the time of 8:00 am on the date of receipt of the complete documentation; and,
- in the case of licence applications, Form 7s and Form 8s, received by courier, the time and date of receipt of the complete documentation.

Should any two of licence applications, Form 7s or Form 8s be received by same normal mail or courier service or any other means or should any valid dispute arise about which document was received first in time, the service shall be made available at the next available MED public spectrum auction. The parameters of any such auctioned service will be determined by MED in accordance with sound spectrum management practices.

Should any incompatible spectrum licences become registered, the MED will determine which licence has first in time right using the these principles and the rightholder associated with the licence not first in time shall arrange for provision of an appropriate Form 10 to the Registrar for cancellation of that licence.

In regard to these matters, a complete licence application, Form 7 or Form 8 shall mean a form

- as prescribed for the purpose in SMART, the Radio Regulations or include in <http://www.rsm.govt.nz/cms/>; and,
- that includes all requested information; and,
- is properly signed.

Licence applications entered into SMART and not moved to Planned status within one month are automatically discarded in SMART and will lose first-in-time rights. Similarly, planned licences whose certificates have expired (after 3 months) are expired in SMART and will lose first in time rights.

ARE's may wish to have contractual arrangements with their clients that would enable them to cancel any incompatible licences that were not submitted first in time.

## 1.18 Requirements for Certifying Engineers

AREs must be thoroughly conversant with the requirements the Radiocommunications Act 1989 relating to the issuing certificates required under sections 25, 39, 40 and 57D of the Act. They should also be familiar with the Act in general, the Radio Regulations 2001 and their amendments, and POLDOCs relating to Crown management rights.

AREs engineering new or modified licences are required to comply with these rules but shall respect the rights of existing licences that may have been established under past rules.

It is recommended that once new licences become registered AREs check to ensure that;

- There are no other co-channel or adjacent channel licences registered simultaneously that would invalidate or conflict with the certification of the licence they certified;
- To ensure their licence is accurately recorded in the register; and,
- To ensure that licences replaced by their new licence are cancelled.

Radio spectrum planners and international and national agencies have established service and equipment standards to try to ensure minimal impact between radio services. The role of certifying engineers includes ensuring these standards are achieved through the proper engineering of spectrum licences and, in particular, that the endangerment, harmful interference and technical incompatibility of spectrum (and radio) licences are avoided.

Certifying engineers have declared, in their application for ARE status, that they will only certify licences for which they have the requisite level of competency. The application form may be viewed in the Appendix of PIB 34 at <http://www.rsm.govt.nz> and search on PIB 34.

The requisite level of competency will depend upon the service type of the licence being certified and should include relevant knowledge and experience of:-

- The appropriate ITU recommendations;
- National radio spectrum planning, policies and usage;

- The performance parameters of equipment and antenna used in the operation of the licence to be certified and those used by existing adjacent and co-channel services;
- The analysis of the radio propagation and interference analysis required;
- Radio equipment and site installation practices;
- Potential equipment and site intermodulation issues and quantification;
- Transmitter unwanted emission issues and quantification;
- Co- and adjacent channel performance issues;
- Receiver selectivity, tuning, image frequency rejection, desensing and blocking issues and quantification; and,
- Investigating and clarifying any related areas and issues.

Detailed discussion of these matters in relation to certification is beyond the scope of these Rules and only information based on the Ministry's experience that will provide direction in relation to specific matters is included. The Ministry does not purport to have all the necessary experience or information that may be required.

Where AREs identify potential incompatibility issues concerning design, equipment, site and service they should advise the intending licence rightholders of any assumptions that may have been made and special matters regarding the usage of a licence or the installation of equipment pursuant to that usage.

RSM have developed ISO processes for the determination of radio and spectrum licences that take into account planning, policy, usage, propagation, interference, equipment, site and installation matters, and involve independent verification of engineering and processes for common broadcasting licence types. External engineers will use their own processes for their licensing activities and should consider the need for independent verification.

## 1.19 Records of Certification and their Retention

The certification documentation associated with the planning and coordination of a proposed radio service in a Crown Management Right is required to be retained for audit purposes. The actual documentation retained would be at the certifying engineer's discretion but would likely include;

- An overall summary report of the coordination calculations and any usage and policy assumptions made;
- A record on the transmitter and receiver parameters, frequency, antenna radiation patterns, site details, out of band emissions, receive protection areas, protection locations and MPIS values of all existing and planned assignments likely to impact upon or by impacted by the proposed licence for co- and adjacent channel services;
- Copies of path profile, path loss calculations and assumptions made in the analysis of interference paths;
- Copies of calculations and/or assumptions relating to miscellaneous matters such as synchronisation, RDS/SCA, protection ratios and urban coverage issues;
- Copies of calculations and assumptions related to intermodulation and safety of life interference issues, e.g., FMBC to aeronautical calculations;
- Assumptions relating to compatibility between services;
- Descriptions of design features required for implementation, e.g., MF antenna arrangements to produce specific coverage patterns;
- Antenna combiner and other equipment technical specifications;
- Bibliography of referenced standards, recommendations, reports and other information.

The foregoing documentation must be retained by the ARE and made available for audit purposes for the period of 5 years from the date of certification or 5 years from the date of the start of continuous operation pursuant to the licence.

Certification documentation is to be made available within 10 working days on a request by the Ministry.

## Section Two: Compatibility and other Technical Issues

### 2.1 Technical Compatibility

The principle of technical compatibility is significantly embodied in Article 3.3 of the International Radio Regulations where it notes:

“Transmitting and receiving equipment intended to be used in a given part of the frequency spectrum should be designed to take into account the technical characteristics of transmitting and receiving equipment likely to be employed in neighbouring and other parts of the spectrum, provided that all technically and economically justifiable measures have been taken to reduce the level of unwanted emissions from the latter transmitting equipment and to reduce the susceptibility to interference of the latter receiving equipment.”

The significance of technical incompatibility can vary from Safety of Life (SOL) to barely nuisance value. For certifying engineers the order of the terms below reflects the increasing seriousness of the effect of interference issues on radio system operations;

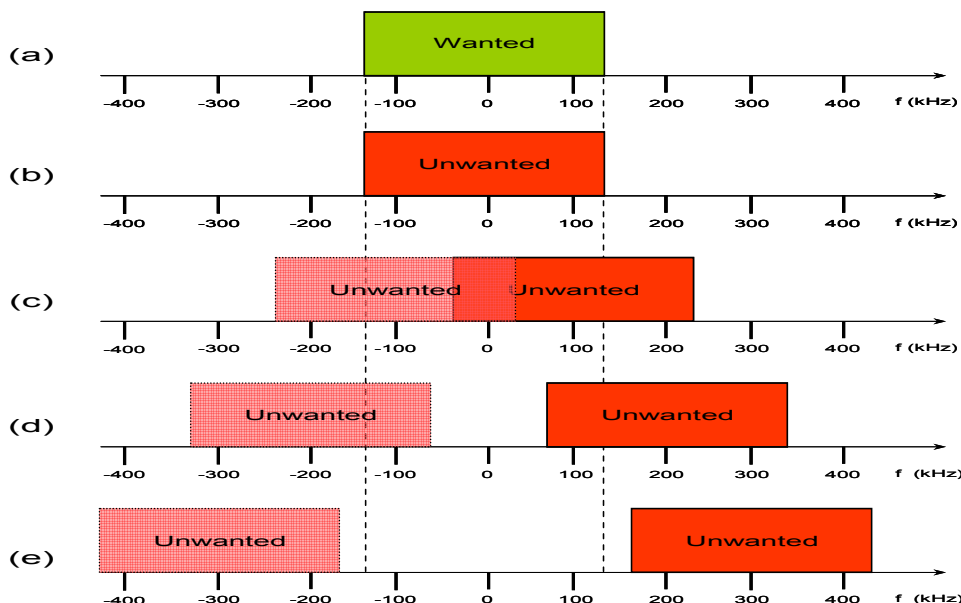
- The term ‘technical compatibility’ as used in the Act sections S25(5) and S57D(5) in relation to the certification of spectrum licences is not defined in the Act 1989 but can be taken to mean that that radio services operating normally will not significantly reduce the ability of other radio services to perform with an appropriate quality of service.
- ‘Harmful interference’ is defined under the Act as meaning “interference which endangers the functioning of a radionavigation service, or other safety services, or seriously degrades, obstructs or repeatedly interrupts radio communications.” Hence interference is deemed harmful if it prohibits the operation of a radiocommunications service functioning at an appropriate usable level.
- Endangerment relates to the reduction of the functioning of radio navigation and safety of life services to the point where life and/or property may be threatened.

Endangerment, harmful interference and technical compatibility issues are the significant matters concerning the responsibility of certifying radio engineers.

Interference is defined in the Act as “.. the effect of radio waves owing to 1 or more emissions, radiations, or inductions, or any combinations of these things, on the reception of radiocommunications.” This different from the definition for harmful interference and because the rights associated with spectrum licence refer to co-channel interference, rather than all harmful interference, there is need to identify how non co-channel interference, i.e., adjacent channel interference, should be considered.

The following diagram, Figure 1, illustrates when an interferer can be deemed to be harmful interference under s(99) of the Act. In the figure case (a) shows the wanted signal limits of an FMBC spectrum licence, and cases (b), (c) and (d) illustrate co-channel harmful interference. Case (e) shows an adjacent channel service that cannot not cause harmful interference as defined by the Act, but can, because of high level emissions, still cause receiver blocking and desensing and therefore technical incompatibility with the wanted signal.

Figure 1 - Showing Fully and Partial Overlapping Co-channel and Adjacent Channel services



A similar situation to that in the Figure 1 arises with MF-AM broadcasting channels in the band 521 to 1612 kHz that are spaced at 9 kHz separation and have emission bandwidths of 20 kHz.

From a wider perspective the interference aspect not included in the definition of harmful interference can be considered to be covered by the technical compatibility aspect and because the interference parameters in a spectrum licence are not defined separately, the effect of both co-channel and harmful interference can be considered within the same parameters, i.e., minimum usable field strength, the maximum permitted interference signal level and protection ratio parameters.

Note that the reception of radiocommunications by inappropriate receivers such as those connected through a band expander is not required to be considered either in respect of technical compatibility or harmful interference.

In respect of broadcasting services consideration is required for audience perception and the potential for interference into other services, particularly those relating to SOL. ITU-R recommendations relating to spectrum planning take audience expectations into account when considering such parameters as minimum usable wanted signal levels and maximum permitted interference levels.

## 2.2 Distress and Safety Services

The International Radio Regulations (ITU-R RR), Volume 1, Chapter SVII Safety and distress communications, contain the provisions for the operational use of the global maritime distress and safety system (GMDSS), and also similar aeronautical and land mobile provisions. The key Distress and Safety services operating in New Zealand are based on these provisions, and include voice and data messaging, and maritime and aeronautical navigational services.

The voice and data services that require the attention of certifying engineers use frequencies included in the General User Radio Licence for Emergency Transmitters identifies frequencies for avalanche beacons, survival craft radiotelephone transmitters, emergency position indicating radio beacons, and 'search and rescue' (SAR) calling and transponder frequencies. That GUL can be reviewed at <http://www.rsm.govt.nz/licensing/gurls/gurl-et.html>.

The frequencies in the GUL are isolated in frequency from high power applications in Crown management rights. However, care is needed to ensure intermodulation and desensing of distress and safety services receiving stations does not occur.

Maritime navigational services are normally below 30 MHz and not close to frequencies available for engineering by external engineers, though it is possible for them to receive intermodulation signals from high power MF-AM on inadequately maintained sites close to maritime areas or receive signals from those sites that can cause receiver blocking or desensing.

SOL systems are relied upon to be available and usable for nearly 100 percent of the time. However, because radio can suffer from propagation variations and where safe operation is imperative other operational mechanisms or backup plans are required.

## 2.3 Aeronautical Navigational Services

Aeronautical navigational services are used for aircraft landing, route navigation and aircraft identification services and are both key to aircraft operations and safety of passengers. The services requiring special attention are;

- Non-directional beacon (NDB) services that operate in the band 285 to 415 kHz at regional airports are used to facilitate aircraft landing in low cloud conditions. Special care is required with the certification of new high powered MF AM broadcast transmitters close to aircraft landing routes at airport using LF NDB. Aircraft receivers are susceptible to overloading and intermodulation, particularly at low altitudes and aircraft can be forced to abandon landing when NDB facilities are unusable in low cloud. Evaluation for new AM stations near airports requires wide searches and receiver desensing and intermodulation analysis along aircraft landing approaches.
- The Localiser (vertical) component of Instrument Landing Services (ILS) operate in the band 108 to 114 MHz at Whenuapai, Auckland, Ohakea, Wellington, Christchurch and Dunedin airports to facilitate aircraft landing in low cloud conditions. Special care is required with the certification of new high powered FM broadcast transmitters close to aircraft landing routes at those airports. A Technical Monograph discussing these matters is located at <http://www.rsm.govt.nz/publications/tms/tm2001-003.pdf> and the details of the analysis required are given in ITU recommendations SM 1009. The analysis also requires knowledge of related ICAO requirements and New Zealand aeronautical frequency usage.

- Variable Omni-Range Radio (VOR) services operate in the band 108 to 117.95 MHz at major airports and some remote sites to provide route guidance for aircraft. Care is required with the certification of high power FM broadcasting transmitters close to airports equipped with VOR services and at test points above high powered FM broadcasting stations elsewhere.

These matters are further discussed in relation to particular broadcast services in [Section 3 25](#) of this document.

Aeronautical and other navigational systems are relied upon to be available and usable for nearly 100 percent of the time.

## 2.4 Compatibility Planning for Broadcasting Services

Having regard to;

- the general expectations of broadcasting service providers, listeners and viewers that radio reception should be significantly interference free and able to sustain satisfactory reception for the majority of time in the coverage area;
- the variable nature of propagation and the geographical terrain between both the wanted and interfering transmitters and each point location in a planned broadcasting coverage area means that both wanted and unwanted signals levels are available only on a statistical basis;
- the ITU-R based calculations models and standards can provide methods to determine satisfactory reception; and,
- the need to maximise the potential for reuse of co-channel and adjacent channel frequencies,

the Ministry has determined that for the provision of technical compatibility and the protection from harmful interference for broadcasting spectrum licences, as required under the Act;

- the protection area of a spectrum licence shall be described by one or more Protection Locations to indicate the Protection area given by the relevant minimum field strength contour (refer [Section 3 25](#)). In some cases each protection location/s may describe distinct and separated protection areas;
- that those protections locations will be used as reference points where wanted and unwanted signal levels are calculated, for the purposes of describing the wanted field strength (WFS) signal levels and unwanted maximum permitted interfering signal (MPIS) levels, where;
- the relationship between the WFS and MPIS is based on the formula  $MPIS = WFS - PR$  where PR is the protection ratio defined and recommended by the ITU-R;
- the wanted and unwanted signal levels shall be determined in accordance with ITU-R recommendations;
- In addition to calculations at the protection locations, certification shall consider significant areas of coverage within the relevant minimum field strength contour but not adjacent to a Protection Location;
- that the field strength at each protection location will each be significantly representative of the field strength in their adjacent areas; and,
- that technical compatibility and protection from harmful interference in accordance with the requirements of the Act will have been achieved when both the measured and calculated mpis levels at those locations are not greater than the wanted field strength minus the protection ratio at co-channel and adjacent channel frequencies are identified in ITU-R recommendations appropriate for each broadcasting service type, as identified in [Section 3 25](#) of these rules.

To enable the protection locations of a spectrum licence to fulfil those functions;

- an appropriate number of protection locations will be used for each spectrum licence that would provide effective representative of the protection area of the licence;
- each protection location for FMBC and television services will sited so that at a height of 10 metres above ground level, and to the extent possible, there shall be a clear radio line of sight to the transmit location on the spectrum licence;
- each protection location for MF-AM services will sited so that at a height of 2 metres above ground level, and,
- protection locations shall not be included in areas remote from populated areas, or high points without a significant population and which would, if included in protected areas, reduce the potential for reuse of co-channel or adjacent channels elsewhere. In particular any high peak, within, adjacent to or remote from a protected area shall not be used as a protection location for the purposes of providing protection for off-air linking receivers.

The requirements of protection areas of a spectrum licence shall be;

- protected areas shall comprise significantly contiguous adjacent areas that each have protection locations;

- the reception of listeners/viewers within coverage areas where the wanted signal level is not less than the engineering minimum usable field strengths (MUFS) identified [Section 3 25](#) and [Appendix 6](#) of these Rules shall be protected;
- that reception of signals outside the coverage area of a service is considered to be fortuitous reception, is not protected;
- that the determination of technical compatibility and protection in protected areas shall also be based upon the requirements of ITU-R recommendations appropriate to the service type in regard to broadcast receiver performance standards, propagation analysis, spectrum channelling, engineering standards and parameters.

With regard to the determination of which areas should be included in the protected area of a licence, i.e., as described by the protection locations, it is noted that modern computer based radio prediction tools now allow very detailed pixel by pixel estimates of whether an area (say 50 m by 50 m) receives the minimum signal level set for the system design (the coverage area). It is possible for cases where high sites and rough terrain are involved to identify many isolated pockets where effective coverage will be provided, particularly in high uninhabited mountain ranges. The requirements listed above regarding selection of protection areas shall also apply to translation of these detailed area predictions into protection areas. That is to say, distant uninhabited mountain ranges should not be named as protection areas on a licence.

Further discussion of requirements for choosing protection locations are include in [2.8 Protection Locations 18](#), and ITU-R recommendations appropriate to broadcasting service types are identified in [Section 3 25](#) of these Rules.

The ITU-R recommendations relating to engineering and equipment standards, and minimum usable signal strengths and protection ratios for radio broadcasting services are typically based upon the provision of high receiver output signal to noise ratios, e.g., of 50 dB for FMBC services and 40 dB for MF - AM services. This can suggest that, minor departures from the ITU-R recommendations could be possible. Such departures from those recommendations and these rules can result in substantial reductions in the quality of service and can have significant consequences for the listeners, rightholders and certifying engineers.

## 2.5 Transmitters in Urban Areas

When broadcasting services are to be located in or close to an urban environment it is important to consider their ability to co-exist with other existing licensed services already in the local area. There is an expectation from the public that any new services will not have a negative impact on those broadcast services, they currently receive. In particular lower cost FMBC receivers can be susceptible to desensing and blocking in areas close to multiple high power transmitters or if adjacent to a single high power transmitter.

The Reference Standard RS001, FM Radio Broadcasting – Intermodulation in Radio Receiver Apparatus, identifies two requirements in this respect. These are;

- radio receiver apparatus of no more than 1 % of the population in that area coverage should be subject to a field strength of greater than 110 dBµV/m.
- no new transmission in the same frequency range should present a field strength to a radio receiver apparatus, within the same coverage area, that exceeds the field strength of existing transmissions for more than 10 % of the coverage the area by;
  - 24 dB if the frequency on the new licence is within 2 MHz of the frequency on the existing licence
  - In all other cases 40 dB.

While use of antennas mounted at high levels, antennas with suitable vertical radiation patterns and use of relatively low radiated power levels can be used to reduce potential local blocking and desensing issues at VHF and higher frequencies, siting high power transmitters away from urban area is preferred.

## 2.6 Equipment and Site Issues

While AREs are responsible for certification requirements being met for endangerment, harmful interference and technical compatibility aspects, in the absence of any other agreements the rightholder is responsible to ensure that the installation complies with the certified spectrum licence and appropriate site installation and maintenance standards. There are no current appropriate New Zealand site standards but reference can be made to AS 3516 (four parts, available at [www.standards.com.au](http://www.standards.com.au)) and the ETSI standard ETS 300 086. A new revision AS 3516 standard is expected to published as an AS/NZ standard in 2008

Certifying engineers who doubt that appropriate equipment standards and site practices would be adopted by the proposed licence rightholder, should advise that rightholder that the use of inappropriate standards and practices may lead to licence compliance issues for which that rightholder is responsible.

Certifying engineers should also inform the rightholder of any special site and/or equipment requirements resulting from the certification of the licence that are necessary to ensure satisfactory compliance with the licence parameters and conditions.

Service incompatibility and intermodulation can be significant site issues particularly where the site owner/manager/installation engineers may not be familiar with good practices for radio and antenna installation, site earthing, power supplies and tower maintenance. Health and safety, resource consent and service performance matters can also be issues for the rightholder and/or site manager.

## 2.7 Adjacent Service Issues

With regard to service aspects, certifying engineers need to consider whether different services in the same area using similar parameters and adjacent bands or channels are in fact compatible. In particular, careful consideration of wanted and unwanted emissions, receive protection limits and receiver performance may be warranted. Examples of incompatibilities include;

- Use of mobile transmitters with moderate transmit power levels and out of band emissions have been known to cause interference to receivers designed for low power density wideband signals and has required the introduction of wider guard bands; and,
- The location of moderate power VHF paging transmitters close to maritime shipping lanes, ports and shore stations listening on adjacent frequencies has caused harmful interference into legacy maritime receivers and required an upgrade of those receivers.

These processes include evaluation of potential for each frequency proposed to cause interference to and receive interference from co-channel and adjacent channel services, intermodulation analysis based on the inclusion of all transmitter frequencies at or capable of impacting a site; and using software to identify all the combinations of signals that could, in a non linear amplifier or rusty tower bolt, give rise to a product falling on SOL frequencies. Inevitably, at a site like Kaukau in Wellington, there will always be intermodulation products that fall into the safety of life channels. Experience has shown that while these possibilities rarely lead to real problems, certifying engineers should evaluate whether new products resulting from the addition of a new service to a site can cause issues, discuss possible issues and solutions with the site manager, and plan appropriate measures to avoid those possibilities.

On-site interference and compatibility issues (intermodulation, broadband noise) are the responsibility of the individual site manager, site management committees (where these exist) and site users.

## 2.8 Protection Locations

[2.4 Compatibility Planning for Broadcasting Services.....](#) 16, above, identifies the protection locations must be carefully chosen. This section discusses in more detail the requirements for defining and selecting protection locations. Protection locations are to be identified using NZMS 260 map references or NZMS long references (see [2.15 Site Naming Conventions and Geographic Coordinates.....](#) 23).

The principles used for selecting the number of protection locations for new or replacement broadcast spectrum licences should be based upon the following;

- for licences with significant coverage areas there shall be at least 3 but may be up to 6 or 8 protection locations;
- for licences with small coverage areas there should be 2 or 3 protection locations though for small isolated coverage areas (probably surrounded by steep terrain) one protection location may be sufficient;
- a number of protection locations should be chosen to be representative of the outer edges of the prime coverage area for the service, i.e., where the field strength is not significantly greater than the minimum usable field strength engineering values noted in Appendix 6 of these rules.

The principles used for selecting the location of protection locations for new or replacement broadcast spectrum licences should be based upon the following;

- protection locations used in current spectrum licences should be used except where those locations are considered unsatisfactory. For example, where the protection location does not meet the principles for site selection included below.
- protection locations should not be in areas that are exposed to co-channel interference such as hill tops or isolated areas that are not representative of the populated coverage area;
- a number of protection locations must be identifiable points for practical field measurement. Preferred locations are parks, school playgrounds, or cemeteries. Inaccessible places such as forest, lakes should not be chosen;

- protection Locations should not be located on private properties;
- protection locations should be representative of the general area “wanted signal” for the service proposed. Hence the protection locations shall not be in areas heavily shaded or obscured by geographical features, which are not typical to the general area.
- a number of protection locations should be in or near a significant area of population where the resulting reception conditions, would be representative of those typical for local viewers or listeners;
- protection locations should be located clear of power lines and away from steel structures or steel clad buildings;
- protection locations should be chosen so that the radio path between the protection location and wanted transmitter should be free, to the extent possible, of obstructions and large radio signal reflection sources; and,
- protection locations adjacent to a high power transmitter in a built-up area may be appropriate for use with measurements associated with determining whether maximum signal levels could be an issue for receiver performance, i.e., refer to Reference Standard RS001 requirements.

Alternative protection locations to those already adopted for broadcasting services and in regard to a particular transmission location may be selected. However, use of existing protection locations can provide comparisons with earlier measurements and reduce the need for multiple site visits for future measurements.

Guidelines for establishing new protection locations are as follows;

- Estimate the approximate coverage area of a new assignment;
- Select the appropriate number of proposed protection locations.
- Identify protection locations on any existing assignments with a similar coverage area using SMART.
- Check that protection locations provide effective representation of the coverage area.
- Verify grid references using NZMS260 series maps.
- Evaluate the protection locations against applicable criteria below.

#### Evaluation Criteria for a Protection Location

The quality of each protection location shall be evaluated against seven set criteria rated on a three point scale as follows:

- Rating = 1 Problematic
- Rating = 2 Adequate
- Rating = 3 Very Good

Every acceptable protection location should rate 2 or higher for each criteria identified below. A rating of 1 indicates the RCL is unsuitable and an alternative should be found unless local terrain restricts choice.

The criteria, with associated ratings, are as follows:

- a) The protection location is line of sight with the wanted station.
  1. Heavily obstructed path.
  2. Slightly obstructed path, but field strength unlikely to vary significantly over time.
  3. Clear line of sight with wanted station.
  
- b) The signal from the wanted station exceeds the minimum useable field strength and is representative of the area.
  1. Wanted field strength is well below minimum useable level.
  2. Wanted field strength is within +3dB (-3dB) of minimum level, and viewers/listeners in the area are in a slightly worse (better) location than the protection locations.
  3. Wanted field strength clearly exceeds minimum level and is typical of the area.
  
- c) The protection location is an electrically acceptable measuring point with no high voltage lines, or large metal reflectors like tanks, fences, or piping installations, in the foreground or vicinity.
  1. Very noisy and/or severe reflections.
  2. Some electrical noise or reflections, but not sufficient to invalidate results.
  3. Electrically quiet and no major reflection sources.
  
- d) The protection location is easily accessible for the measurement vehicle.
  1. Poor or hazardous access, or access prohibited.
  2. Site access or ownership creates difficulties or inconvenience.
  3. Good, safe access on public property.

- e) The protection location is a practical and safe measurement location with level ground and no overhead obstructions.
  - 1. Sloping or boggy ground and/or overhead obstructions.
  - 2. Weather dependent site or requires skill in finding suitable flat area.
  - 3. Level site on firm ground and no overhead obstructions.
  
- f) The exact measurement location is easily found.
  - 1. Description of site is non-specific and difficult to revisit within +/- 50m.
  - 2. Difficult to identify exact location but description enables revisit to within +/- 50m.
  - 3. Well described with unique features allowing revisit to within +/-10m.
  
- g) The protection location characteristics are unlikely to change drastically in the foreseeable future. Path obstruction, electrical, and physical suitability is unlikely to be compromised by natural or other development.
  - 1. Existing industrial development or electrical plant construction in the vicinity.
  - 2. Signs of residential development or young trees unlikely to have adverse effects.
  - 3. No signs of any development or adverse changes due to natural phenomena.

The exception to these requirements concerns the protection locations required for night time Eu calculations and measurements for MF-AM services. New MF AM licences shall use the format for recording MPIS values that is used for roll-over licences required for replacement of current MF-AM spectrum licences in 2011. Those roll-over licences identify the first protection location on a spectrum licence as being at the transmitter site and have an MPIS value based on the night time Eu value determined using Skywave calculations. This arrangement allows for the night time MPIS, and therefore the Eu value, to be clearly identifiable in the Register of Radio frequencies and available for selection as a data field for use in reports generated from that database. The protection location is nominal and any measurements required at the location shall be completed sufficiently remote from the antenna so that the effect of the mast in terms of obstruction and induction are minimised. Other protection locations on those 2011 MF AM licences identify the daytime MPIS values. Further discussion on these matters is included in section [3.2 MF-AM Sound Broadcasting Services](#) ..... 25.

## 2.9 Population Counts

Population counts required for determining the value of a spectrum licence will be produced by the Ministry based upon the area and population within a contour identified as the minimum usable field strength contour and generally identified as the coverage area of a spectrum licence and includes PLs and their adjacent areas where the received signal strength is represented by that at the PLs.

Population outside the minimum usable field strength contour and receiving fortuitous coverage will not be included in the count.

Policy requires population counts to be based on the most recent census where data is available in the format required.

Modifications to the station technical parameters that alter the coverage area, such as an increase in power, may also attract a new resource component for the licence.

Applications for registration of spectrum licences in Crown management rights with estimates of population counts will be reviewed by the Ministry. Significant differences between the Manager's estimate and the applicant's population count can be discussed.

## 2.10 Maximum Permitted Interfering Signal (MPIS) Level Requirements

To protect existing and planned broadcasting services, new and modified broadcasting spectrum licences shall not provide unwanted signal levels that exceed the MPIS levels of the existing and planned spectrum licences at the protection area of those existing and planned services.

Spectrum licences for new and modified broadcasting services shall identify MPIS levels in its protection area.

MPIS levels must be established so that the unwanted co-channel and adjacent interference levels remain below the wanted signal level minus an appropriate protection ratio at each protection location, (except for MF-AM night time signals), i.e.,  $MPIS = WFS - PR$ .

For MF AM services the night time MPIS =  $E_u - PR$  ( $E_u$  is the night time useable field strength and its derivation is identified in section [3.2 MF-AM Sound Broadcasting Services](#)..... 25).

The receive protection ratio is be defined as the ratio of the wanted Minimum Usable Field Strength (MUFS) level to maximum Unwanted Field Strength level that would allow reception to the wanted services with an appropriate level of service.

Specific information for required MPIS levels and protection ratios applicable for particular service types in Crown Management Right bands is given in [Section 3](#) 25.

The calculations for spectrum licence shall incorporate appropriate cross polar and receive antenna discrimination and standard and precision offsets, where appropriate, in respect of the calculations of MPIS associated with television services. The same features are not available for use with MPIS calculations for MF-AM or FBMC services

Calculations detailing the use of co-polar, precision offsets and other engineering techniques to ensure transmissions comply with the MPIS requirements are to be included with the retained licence engineering certification documentation.

## 2.11 Signal Strength Calculations:

Calculation of both wanted and unwanted field strengths requires use of propagation models, path profiles and standard processes. RSM does not stipulate, endorse or recommend any commercial software product for this purpose. The selection of an appropriate method for conducting path profile analysis is the responsibility of the engineer.

Field measurements can be used to validate the use of signal strength calculation algorithms when required provided measurement accuracy can be determined.

The Ministry uses processes based on ITU recommendations and a conservative approach for the determination of field strengths. The ITU-R recommendations commonly referenced include;

- P.341 The concept of transmission loss for radio links
- P.368 Ground-wave propagation curves for frequencies between 10 kHz and 40 MHz
- P.525 Calculation of Free-Space Attenuation
- P526 Propagation by diffraction
- P.832 World Atlas of Ground Conductivities
- P.1147 Prediction of sky-wave field strength at frequencies between 150 and 1700 kHz

The Ministry currently uses ESRI Arcview GIS 3.2 for producing path profiles and Pathloss 3 and Pathloss 4 for calculating signal strengths associated with VHF and UHF radio and television services, with the following Pathloss parameters, models and settings;

- K Factor; 1.33 for wanted and 2.0 for unwanted signal strength analysis
- Climate; Maritime Temperate Overland.
- Prediction; 50 % of locations and 50 % of the time (50/50)
- Epstein Petersen diffraction algorithm; for wanted and unwanted interference profiles with a maximum of 5 obstacles.
- Deygout algorithm; for coverage profiles with a maximum of 2 obstacles.
- Foreground loss adjacent to transmit and receive antennas; not included as it is difficult to determine without detailed site knowledge.
- Fresnel zone obstruction loss; is included.
- Clutter loss; not included.
- Tree obstructions; wet evergreen.

Where there are interfering signal levels close to the maximum permitted, parameters can be varied to obtain an appreciation of the differences that can result and to test the sensitivity to different algorithms.

The determination of the maximum permitted interfering signal (MPIS) level for each protection location may require use of both Continuous and Tropospheric propagation models.

For signal strength calculations associated with MF-AM services the ministry historically used the ITU-R report, Final Acts of the Regional Administration LF/MF Broadcasting Conference (Regions 1 and 3) Geneva 1975. Those Acts identified processes for ground wave calculations using a CCIR Groundwave Atlas and a comprehensive skywave calculation process. The processes contained in those Acts are still appropriate but have been translated and updated into current ITU-R recommendations. The ministry processes were

recently modified to be based on the Radio Association of America digitised form of the CCIR Groundwave Atlas.

Currently these processes are being changed to the ICS Telecom software that is based on current ITU-R recommendations.

A certifying ARE should carry out comprehensive signal strength calculations at as many locations as necessary to properly assess harmful interference and technical compatibility. Such assessment is likely to involve methods based on computer software such as the ICS Telecom package. The ministry does not recommend any particular software tool.

AREs considering the acquisition of a software package may wish to note the following:

- Modern comprehensive computer based area coverage prediction tools can quickly and efficiently calculate estimated protection ratios and compare these against the minimum recommended. Such tools enable the inspection of thousands, or millions, of points for compatibility. Though such tools can be costly, interference limited coverage can be quickly assessed.
- A less costly pixel based tool that can provide coverage predictions but does not directly calculate estimated margins above MPIS levels. With such tools two coverage predictions can be made and overlaid, one at the primary coverage contour, and the other with a contour at the MPIS level at the edge of coverage. Significantly overlapping contours of this nature will quickly indicate areas at high risk of harmful interference or technical incompatibility.
- If no area coverage prediction tool is available to the ARE, then a sufficiently large set of points to adequately describe the primary coverage area should be selected for point-to-point calculation of MPIS levels and achieved protection ratios. This method can be quite time consuming and has a risk that sensitive parts of the protection area can be overlooked
- Care should be taken with digital terrain models (DTM) that its terrain resolution and its algorithms are sufficient to produce the required prediction accurate. The ICS Telecom package has a horizontal pixel resolution down to 25 m with vertical intervals of uses 20 and 25 m. DTM pixel size should not exceed of 100m and height resolution of more than 25 m can not be expected to provide accurate results. Vertical resolution accuracy should be as high as possible to ensure mountain and hill tops are not 'flattened'
- Pathloss enables coverage predictions on a radial basis and accuracy requirements will vary depending upon the angular interval between radio path profiles and the distance from the transmitter of the predication, 5° to 0.1° are typical for angular intervals.

## 2.12 Parameter and Reference Bandwidths

### Signal Strength Calculations

Parameter definition, calculation and measurement frequently require the identification of a bandwidth for reference. Historically, transmitter power for services has been defined without reference to a bandwidth and their levels stated in specifications and measurement have often be considered to relate to actual total power integrated of the bandwidth of the emission. This practice has been workable when considering services of similar bandwidths but does not easily apply when considering interference between services of different bandwidths.

The increasing range of services of different bandwidths, power levels and equipment characteristics over recent years has meant a need for more precise definition of emission and interference power levels and bandwidths. The ITU-R recommendation SM.328 and SM.329 define a number of standard terms for emission parameters and their determination in relation to several common emission types.

With regard to licensing in New Zealand both radio and spectrum licences shall state the effective transmit power which can be defined as the integrated power in the necessary bandwidth for continuous signal emissions and peak envelope power for pulse emissions.

Unwanted emissions can be managed effectively by relating to measurement bandwidths that can be related to measurement using spectrum analysers, measuring receivers and other devices, and can be used relatively effectively when estimating receiver performance in the presence of interference. The reference bandwidth practice does not easily cater for signal involving multiple signal types.

MED uses reference bandwidths established given ITU recommendations for some equipment standards as identified in the radio equipment [standards](#) on the RSM web. Engineers specifying spectrum licence parameters shall identify measurement bandwidths for unwanted emissions and interference signal levels where these as different from reference bandwidth required for a licence. Those reference bandwidths, i.e., those shown in the following table.

### Table of Reference Bandwidths

Frequency Range	Reference Bandwidth
9 kHz to 150 kHz	1 kHz
150 kHz to 30 MHz	10 kHz
30 MHz to 1 GHz	100 kHz
Above 1 GHz	1 MHz

### 2.13 Frequency Offset and Time Delay

The use of precision time delays and frequency offsets can significantly reduce the effects of co-channel interference. Details of any advantage gained from these or other benefits must be retained with the licence engineering certification documentation.

ITU recommendations dealing with these matters are;

- MF-AM Broadcast services in accordance with ITU-R Rec.598
- VHF FMBC Broadcast services refer to ITU-R BS 412
- Analogue TV Analogue Television Broadcast services refer ITU-R BT 655
- Digital TV Not applicable

Note with digital television can use carrier and data frame synchronisation to facilitate common frequency usage as well as time delay adjustments to synchronize incoming signals in overlapping receive coverage areas.

### 2.14 Antenna Radiation Patterns

Antenna gain and discrimination have key roles in the engineering of radio services and the reduction of interference when coordinating radio services. The reliable recording of antenna data is therefore a key component of spectrum licences.

Broadcast transmit antennas shall have their horizontal radiation patterns recorded in the spectrum licence. Vertical radiation patterns should also be recorded for transmitters in urban areas and other areas where special requirements exist, e.g., directional antennas within the designated coverage areas for instrument landing services at Whenuapai, Auckland, Ohakea, Wellington, Christchurch and Dunedin airports.

Radiation pattern data are to be recorded in dBW with steps of typically 2 to 4 dB, as appropriate and except where sharp nulls exist within an azimuth of 30 degrees or less, where the maximum null is to be identified at the maximum null azimuth. At least one azimuth shall be included at the full licensed transmit power.

The coordination of broadcast licensing requires use of transmitter antenna radiation pattern data in the determination of services coverage and limiting of that coverage when there is potential for interference to other services. Receive antenna radiation pattern discrimination is taken into account using ITU-R BT.419, Directivity and polarisation discrimination of antennas in the reception of television signals, when engineering television services. Receive antenna discrimination is not used when engineering MF-AM and FMBC coverage services.

### 2.15 Site Naming Conventions and Geographic Coordinates

Site naming conventions need to be simple and flexible, and followed. Unless there is a reasonably standard format the occurrence of multiple names for the same site in the New Zealand Register of Radio Frequencies will continue to grow, ensuring search tools will return significant, perhaps unmanageable, numbers of different names for the same site.

In general the site names in the New Zealand Register of Radio Frequencies should use the following convention;

- If a site current used in SMART is suitable it is preferable that is used
- if the site is named on a NZMS 260 series map, i.e., its LINZ name, that name should be used, perhaps with the addition of a north, south, east or west designation to indicate more closely the part of the named feature used.

- if the site is on a named street that street name should be used followed by a street number, or in the case of a rural address, its road distance reference, i.e., the distance from the start of the road in metres. (This is reference is used by the fire service to locate rural properties.) Also, because of the propensity to use the same road names in different town/areas, a street name and number should also be followed by a town or area name.
- for large named site, such as used for airports and oil refineries, etc, the site name should be followed by a building name or reference number. Generic names for large sites such as a Marae, park, factory, hospital name, etc. not on a map can also be used.
- where a site owner has a unique numbering/naming system for sites, e.g., 74 Kaukau, these should be converted to name followed by a number, Kaukau 74.
- Please do not use a customer's name in a site name unless it can be absolutely guaranteed to be unique for one site, i.e., Disney World Bldg DW98.

A check of site names in the New Zealand Register of Radio Frequencies, based on a search using the site name (a map reference search facility may be added with SMART, will often provide a suitable site name choice. Currently the entering of a street or other name in the Transmitter Location field of the SpectrumOnline Radio/Spectrum Licence Search will locate all licences with that name in their site location field. Once a licence local to the required site is identified and opened, a further search field is available based on area search radius. This may provide further site names in the area from which a choice can be made.

The co-ordination of any radio service is predicated on the accurate determination of the relative spatial (distance and azimuth) relationships between potential victim and interfering services.

It is important that the transmitter and protection location co-ordinates are derived and recorded accurately. The location point is defined as the co-ordinates at the centre or main axis of the antenna support structure (i.e. pole or tower). In the case of particularly large support structures, where the radial distance from the antenna to the support structure's axis is greater than 10 meters. The co-ordinates of the actual antenna are to be recorded using the Topographic Map 260 series 1:50000. New Zealand Map Grid projection is the New Zealand Geodetic datum 1949. For example, a location should be in the format R27 641802 (NZS 260 Series) or long reference 2664112E 5980212N.

## 2.16 Verification of Spectrum Licence Parameters

Verification of spectrum licence parameters is required for ensuring compliance with licence parameters and for the resolution of interference issues. The Ministry has Best Practice documents and ISO approved processes for these purposes that cover field strength, occupied bandwidth, site RF noise level, frequency and assessment of e.i.r.p. Equipment used in these measurements can include calibrated spectrum analysers, frequency measuring receivers, reference antennas, terminations and cables. Compliance requirements include ensuring site location and antenna height data are correct.

Measurements at broadcasting sites using transmitter calibrated tap-off points can facilitate prompt testing.

Non compliant measurement data will be stored in SMART as an event record for future reference and may be used in evidence with the appropriate infringement action.

## Section Three: Engineering Issues relating to Particular Management Rights

### 3.1 Introduction

This section identifies specific engineering requirements that are required for spectrum licences proposed for broadcasting services and other uses of Crown Management Rights. The section also discusses in general terms the key coordination and other matters that should be considered prior to certification of a licence. The description assumes an understanding of the general processes required in order to engineer a new radio service and in particular the requirements for establishing the required coverage area, the transmitter site, the transmitter power and antenna radiation pattern, receive protection locations and identifying a suitable frequency.

Some of the parameters in existing spectrum licences, such as protection ratios and MPIS requirements are based on previous engineering rules. It is therefore necessary for engineers planning and certifying new and modified licences to ensure that coordination for the new or modified licence takes into account the actual MPIS and other licence parameters and conditions that exist on the current licences.

New and modified licences shall meet the requirements of these rules.

Certifying engineers shall complete the requirements included in [1.18 Requirements for Certifying Engineers](#) 12.

Departures from the rules for particular purposes shall require the written approval of Manager Licensing and shall be addressed to via email to [RSM Licensing@med.govt.nz](mailto:RSM Licensing@med.govt.nz)

Throughout this section the following abbreviations are widely used and are;

- **Eu** = Usable Field Strength (use for sky wave calculations)
- **MPIS** = Maximum permitted interfering signal
- **MUFS** = Minimum Usable Field strength (use for ground wave calculations)
- **PR** = Protection Ratio (ratio of wanted to unwanted receive signal)
- **WFS** = Wanted Field strength
- **UFS** = Unwanted Field Strength

Note that ITU-R BS.638 identifies Eu as referencing Usable field strength. In these rules Eu relates to the night-time usable field strength for MF-AM services. That recommendation also identifies a definition for Minimum usable field strength as the "Minimum value of the field strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise, but in the absence of interference from other transmitter.

### 3.2 MF-AM Sound Broadcasting Services

#### Planning

The MF-AM broadcasting service in New Zealand has the following significant planning parameters;

- Occupied spectrum is 521 to 1612 kHz
- Channel bandwidth is 20 kHz
- Emission designation is 20K0A3EGN
- Channel allocation is on a 9 kHz raster
- Channel assignments for services that are co-sited or have significantly common ground wave coverage shall have a minimum of 54 kHz separation.
- Services can be synchronous or non synchronous.

Planning of MF-AM services has historically been based on the processes detailed in the ITU-R report, Final Acts of the Regional Administration LF/MF Broadcasting Conference (Regions 1 and 3) Geneva 1975. These processes have been updated and information on MF broadcasting extended in the following ITU-R recommendations;

- **BS.560 Radio Frequency Protection Ratios in LF, MF and HF Broadcasting;**
- **BS.415-2, Minimum performance specifications for low-cost sound- broadcast receivers**

- ITU-R BS.598 Factors influencing the limits of amplitude-modulation sound broadcasting in band 6 (MF)
- BS.703, Characteristics of AM sound broadcast reference receiver for planning purposes
- P.368, Groundwave propagation curves for frequencies between 10 kHz and 30 MHz
- P.832, World Atlas of Ground Conductivities (New Zealand Figure 40)
- P.1147, The prediction of sky-wave field strength at frequencies between 150 and 1700 kHz
- P.1321, Propagation factors affecting systems using digital modulation techniques at LF and MF

There are current MF-AM services that have a night-time minimum usable signal level Eu value that exceed the maximum permitted 74 dB $\mu$ V/m. The Ministry plans to review those licences prior to 2011 with a view to identifying modifications that will reduce the Eu and to discuss those modifications with the rightholders of those licences and any interference licence rightholders to determine whether improvements can be made. The outcome of the review is unknown but it is expected that few current licences will have their Eu value significantly improved.

## Engineering

When engineering a MF-AM broadcasting service the following tasks must be undertaken to confirm compatibility and suitability of a proposed frequency for use as a MF-AM broadcast service. The tasks are based upon the Ministry ISO processes, the ITU-R reports and recommendations noted above, and include requirements for key parameters:

### Identify New Service Parameters

This includes identifying the transmitter site, required coverage area, appropriate protection locations, transmit frequency, transmitter power and transmit antenna characteristics.

### Local Area Search

The purpose of this task is find all existing and planned transmitters within +/- 6 channels (+/- 54 kHz) of the proposed frequency for a new service, at the proposed service transmitter site and within New Zealand. This area search can be obtained by AREs from the Register of Radio Frequencies in SMART and selecting Search the Register and then Area Search. This area search is required to identify other services with which the proposed new service will require Groundwave coordination (see task below).

### International Area Search

The purpose of this task is to find all existing and planned transmitters within +/- 1 channels (+/- 9 kHz) of the proposed service transmitter site, within New Zealand, Australia and the local Pacific Islands. (Identifying planned licence outside New Zealand is not easily achieved.) This will require a search of the Ministries' Register of Radio Frequencies and the current ITU International Frequency Information Circular, Terrestrial Services BR IFIC. (This circular can be viewed by appointment with Manager Licensing at 33 Bowen Street, Wellington.) This area search is required to enable the Sky Wave Coordination calculation task (see task below).

### Coverage Prediction

The purpose of this task is to provide a prediction of coverage for purposes of population count and identifying sites for protection locations and for MF-AM services is base on ground-wave coverage.

The task requires use of P.368, Ground-wave propagation curves for frequencies between 10 kHz and 30 MHz and P.832, World Atlas of Ground Conductivities (New Zealand Figure 40) to estimate the limits of the minimum wanted field strength (MUFS) contour.

The ITU Ground-wave Propagation curves will provide the extent of coverage based upon a uniform flat earth. However, experience indicates that where terrain has very low conductivity coverage is limited and accurate prediction not possible. Accurate determination of actual coverage may then require field measurements.

There should be no common ground wave coverage for services within +/- 54 kHz of the required frequency.

### Ground-wave Coordination

The purpose of this task is to make an assessment of the day-time influence of existing and planned NZ stations that may impact on, or be impacted by, the proposed MF-AM service. The assessment would involve using the Local Area Search results and Coverage Prediction processes above.

### Skywave Coordination

The purpose of this task is to make an assessment of the night-time influence of the proposed service on all existing co-channel and adjacent channel NZ, Australian and local Pacific Island stations. The task also enables the determination of the impact of those current services on the proposed new service and may effect the viability of that proposed service. The assessment would use the International Area Search results, the processes detailed in ITU-R recommendation P.1147, The prediction of sky-wave field strength at frequencies between 150 and 1700 kHz.

### Wanted Signal Levels

The minimum usable field strength (MUFS) for wanted signal levels that are to be protected within protection areas are based on ITU-R recommendations. They are:

- For daytime operation the MUFS is 66 dBµV/m
- For night time operation the MUFS is 74 dBµV/m

### Interference Levels

Maximum permitted interfering co-channel signal levels (MPIS) within protection areas shall be based upon the following formula:

- For Day-time operation  $MPIS = MUFS - PR$  (PR = protection ratio)
- For Night-time operation  $MPIS = Eu - PR$  (Eu = night-time usable field strength)

The assessment of the effect of daytime interference shall be based upon the effect of individual daytime interferers and if the unwanted field strength level from any single interfering MF AM service exceeds the MPIS then compatibility cannot be assumed.

Maximum permitted interfering signal levels (MPIS) are based upon protection ratios given in ITU-R BS.560-3. These are;

Channel Spacing (kHz)	Protection Ratio
0 Co-channel)	30
9 (1 <sup>st</sup> Adj.Ch)	9
18 (2 <sup>nd</sup> Adj.Ch)	-25*
27 (3 <sup>rd</sup> Adj.Ch)	-27*
> 27	-27*

\* These values are used only when analysing possible sites where common ground wave coverage could occur.

The maximum permitted interfering signal level shall be 36 dBµV/m for a single daytime co-channel interferer.

Night time coverage is nearly always restricted by unwanted sky wave interfering signals.

The assessment of the effect of night-time interferers shall be based upon the effect of the six most significant co channel and adjacent channel night-time skywave interferers using the following formula;

$$Eu = \sqrt{[\sum_i(ai*Eni^2)]}$$

where;

- Eu is the night time useable field strength for sky-wave signals at a site in µV/m and is normally expressed in dBµV/m
- Eni is the night time field strength of the i-th transmitter in µV/m
- ai is the radio frequency protection ratio (PR) associated with the i-th unwanted transmitter (interferer) expressed as the ratio of the field strengths, in dB,
- i is 1 to 6, i.e., the six most significant night-time sky-wave interferers;
- if the site noise level is known to be greater than an significant incoming signal field strength the atmospheric site noise should be considered as a significant incoming signal.

The required maximum permitted value for Eu shall be 74 dBµV/m and therefore for night-time reception the equivalent night-time MPIS shall be 44 dBµV/m.

Few current MF-AM licences meet this Eu requirement and it is likely that no new MF-AM licence can be established that will meet the requirement.

To ensure existing and planned licences are not subjected to increasing unwanted night-time interference, it is necessary to restrict increments in interference levels as follows;

- Where the current night time MPIS value is 44 dB $\mu$ V/m or greater no increase shall be permitted unless there is a written agreement with the rightholder of the spectrum licence receiving the interference and the rightholder's licence is modified to record that agreement.
- Where the current night time MPIS for an existing licence is significantly less than 44 dB $\mu$ V/m, any additional new service shall not increase that MPIS by more than 1 dB.
- Where the current night time MPIS for an existing licence is greater than 43 dB $\mu$ V/m but less than 44 dB $\mu$ V/m, any additional new service shall not increase the MPIS to greater than 44 dB $\mu$ V/m.

#### Synchronous Operation

The protection ratio for synchronous operation of co-channel MF- AM services shall be 8 dB. ITU-R BS 598-1 Annex 2 discusses this matter.

#### Polarisation

Vertical polarisation is used for MF- AM broadcasting.

#### Unwanted Emission Limits

These shall conform to the spectrum mask in the SMART Reference Data, Spectrum, with the identifier AM and description AM 530 kHz – 1,650 kHz that are available for viewing by AREs.

#### Coordination with Aeronautical Services

Aeronautical Non-directional beacons (NDB) operate to the bands 200 - 450 kHz and 1515 – 1600 kHz at and/or adjacent to most national and regional airports to provide reliable navigational guidance for both enroute and landing aircraft. Aircraft receivers for these services can be overloaded and/or generate receiver intermodulation by adjacent high power MF-AM transmissions, particularly when MF-AM transmitter sites have multiple services, and can result in aircraft direction guidance errors. The problem is made more complex at NDB equipped aerodromes located near large bodies of sea water and/or steep terrain where non uniform NDB wave-fronts can also result in navigation guidance errors.

Intermodulation analysis can identify products close to an NDB frequency and a review of the

#### SMART MPIS Records

Spectrum licence MPIS details shall be identified in SMART and Forms for registration as follows;

- A Night-time MPIS value, based on the Eu level, shall be included in the MPIS location adjacent to the first Receive Protection Location, Location Name and Grid Reference. This location shall be identified with the Transmit Location, Location Name and (NT MPIS). See section 2.8 Protection Locations 18 last paragraph for requirements for measurements at this protection location;
- Day-time MPIS values shall be included in SMART in the MPIS locations adjacent to the second Receive Protection Location, Location Name and Grid Reference. This location shall be identified with the chosen Protection Location and the calculated MPIS.

One MPIS value shall be defined for a proposed AM assignment, for the 1st adjacent channel, shall be recorded in Licence Conditions of the spectrum licence for each protection location.

#### International Coordination

MF – AM services have the potential to deliver substantial signal levels over very long distances and there is potential for co-channel and adjacent channel interference to be received from and caused to services managed by other administrations.

MF-AM frequencies are therefore assigned by the ITU in accordance with the Final Acts of the Regional Administrative Conference (Regions 1 and 3) Geneva, 1975. This is referred to as the GE75 MFBC plan. Any changes to the plan can only take effect by following the procedures outline in that plan.

The implementation of a new broadcast frequency, or the variation of an existing license, cannot proceed until the following has been completed;

- Initial coordination with any affected overseas countries to gain acceptance.

- Proposal is incorporated into the Final Acts of the Regional Administrative Conference (Regions 1 and 3) Geneva, 1975, and distributed by the ITU for comment.
- The new or modified assignment is registered by the ITU in the International Frequency List.

Initial inspection of the MPIS calculations will determine if coordination with other administration is necessary. Where there is a chance that the Eu of any foreign co-channel broadcast service could be increased by 0.5 dB coordination will be required.

Parameters to be used in the co-ordination procedure are;

- Frequency
- EMRP (Effective Monopole Radiated Power = EIRP - 5dB)
- Longitude and Latitude
- Antenna horizontal radiation pattern
- Antenna height
- Antenna polarisation
- Distance to coast

Once agreement has been reached with an affected administration, the application can be sent to the ITU. The Ministry Radio Spectrum Policy and Planning group is responsible for coordination with other overseas spectrum administrations and ITU-R. Requirements for this coordination will be managed by the Licensing Manager at [RSMLicensing@med.govt.nz](mailto:RSMLicensing@med.govt.nz)

### 3.3 VHF FM Sound Broadcasting Services

#### Planning

The VHF FM Sound Broadcasting (FMBC) services band in New Zealand occupies the 88 to 108 MHz spectrum with 88 to 88.7 and 106.63 to 108 MHz bands being available under a General User Licence (GUL) and the 100 to 106.63 MHz band currently being limited to National, Concert, Māori and Pacific Island and limited commercial services. Use of the 100 to 106.63 MHz band currently requires Ministry approval. Note that the current 88.7 to 106.63 MHz band will be replaced by the 88.4 to 106.63 MHz band once new regional assignments required under a Ministerial Directive have been finalised.

Current long term FMBC services are analogue. There is one short term digital IBOC trial service. A decision on which digital standard will be used in the future has yet to be made.

The FMBC broadcasting service in New Zealand has the following significant planning parameters;

- Occupied spectrum is 88.8 to 106.63 MHz – see above.
- Channel bandwidth is 256 kHz
- Emission designation for analogue services without RDS is 256KF8EHF
- Emission designation for analogue services with RDS is 256KF9EHW
- Emission designation for digital trial services is 256KF9EHW
- Channel allocation is on a 100 kHz raster.
- Channel assignments for services that are co-sited or have significantly common coverage are on a 800 kHz spacing though some assignments have 400 kHz spacing with Ministry approval. A policy announcement regarding the use of 400 kHz spacing is due shortly.
- Services can be synchronous or non synchronous.
- Services can be monophonic or stereophonic.
- Frequency deviation is + /- 75 kHz.

Planning of FMBC services in New Zealand has been based on the processes detailed in the following ITU-R recommendations and reports;

- ITU-R BS412 Planning Standards for terrestrial FM Sound Broadcasting
- ITU-R BS450 Transmission Standards for FM Sound Broadcasting at VHF
- ITU-R BS415 Minimum Performance Standards for Low Cost-Sound Broadcasting
- ITU-R BS.642 Limiters for High-Quality Sound Programme Signals
- ITU-R BS.643 System for automatic tuning and other applications in FM radio receivers for use with the pilot tone system
- ITU-R BS704 Characteristics of FM Sound Broadcasting Reference receivers for Planning Purposes

#### Engineering

When engineering a FMBC service the following tasks must be undertaken to confirm compatibility and suitability of a proposed frequency for use as a FMBC. The tasks below are based upon the Ministry ISO processes, the ITU-R recommendations noted above, and include requirements for key parameters.

#### Identify New Service Parameters

This includes identifying the transmitter site, required coverage area, appropriate protection locations, transmit frequency, transmitter power and antenna characteristics.

#### Area Search

To find the frequencies and other parameters of all transmitters at a given site or within a specific area, and a specific frequency range. This information is available in Register of Radio Frequencies in SMART. The information is used to identify all likely co-channel and adjacent channel licences likely to cause interference to or suffer interference from the proposed new licence.

#### Initial Co- and Adjacent Channel Impact Analysis

To determine the likely impact of a proposed frequency on or by other broadcast assignments the engineer needs to identify all co- and adjacent channel assignments within +/- 800 kHz from the proposed frequency. The process includes determining outgoing field strength calculations based on the relevant CCIR curves from the wanted assignment to other co-channel and adjacent channel licence protection areas. The process also includes determining the incoming field strength calculations based on the relevant CCIR curves from the adjacent assignment to the proposed assignment protection areas.

#### Detailed Co- and Adjacent Channel Impact Analysis

Interference problems identified by the initial co- and adjacent channel impact analysis require further analysis using path profiles from the relevant transmitters to the appropriate protection areas and the associated radio path losses need to be determined.

#### Interference Analysis Report

The co- and adjacent channel impact analyses are combined with transmitter power, Protection Ratio and MPIS data to provide a summary of incoming and outgoing interference. When necessary, additional test points, other than protection locations can be used to assist in determining technical compatibility with existing spectrum and radio licences.

#### Coverage Map

Predicted coverage for FM Broadcast services can be uncertain due to varying topographic factors. Practical field strength measurements may be necessary to confirm predicted coverage if computer generated algorithms is relied upon to predict coverage. As the coverage may be used to determine resource cost component of licence, it is important to use an accurate method of determination.

#### Interference Levels

Maximum permitted interfering signal level requirements are based on ITU-R BS 412.

MPIS levels for licences issued prior to 1 July 2002 (excluding Skytower) were based on:-

- MPIS = MUFS (66dBµV/m) – PR

Licences issued on or after July 2002 including Skytower are/shall be based on:-

- MPIS level = WFS – PR

Spectrum licences must at least include one co-channel MPIS value for the proposed FMBC assignment.

The Interference levels for protection locations are established for steady interference conditions using the Protection Ratios indicated in the table below.

Channel Spacing (kHz)	PR Ratio dB	Interference Level (dBµV/m) prior to 01/07/02	Interference Level (dBµV/m) from 01/07/02
0 (Co-channel)	45	MUFS – 45 =.(21)	WFS – 45
100 (1 <sup>st</sup> Adj.Ch)	33	MUFS – 33 =.(33)	WFS – 33

200 (2 <sup>nd</sup> Adj.Ch)	7	MUFS – 7	=.(59)	WFS – 7
300 (3 <sup>rd</sup> Adj.Ch)	-7	MUFS – (-7)	=.(73)	WFS – (-7)
400 (4 <sup>th</sup> Adj.Ch)	-20	MUFS– (-20)	=.(86)	WFS – (-20)
> 400	-20	MUFS– (-20)	=.(86)	WFS – (-20)

If the unwanted field strength level from another FM assignment exceeds the MPIS then compatibility cannot be assumed.

MPIS levels are measured at 10 metres above the ground. MPIS levels at the reference frequency are used to describe the engineering undertaken for a protection area on a licence.

#### Urban Sites

When siting Frequency Modulated broadcast services in an urban environment it is important to consider the ability for the proposed transmissions to co-exist with other licensed services already with coverage established or planned in the local area. In particular, no new licence should be introduced to an urban or city area that may cause broadcast receiver desensing or intermodulation that can lead to masking of existing services. The certification FMBC spectrum licences in these areas should therefore have regard to the requirements of: -

- ITU-R BS.412-9, Annex 2, section 5, Interference Caused by Intermodulation of Strong RF Signals. This annex notes the reduction of Protection Ratios in receivers due to high signal levels.
- The MED "Reference Standard issued pursuant to section s133 (1) of the Radiocommunications Act 1989".

Where urban services are proposed, antennas should be mounted at high levels and antenna vertical radiation patterns provided to minimise local receiver overloading.

Proposals to exceed a maximum assigned EIRP in build-up areas of 100 Watts or 20 dBW should be referred to MED RSM for consideration. However, applications for licences as low as 10 dBW or less may need to be declined because of their potential for masking adjacent channels within short distances.

#### Coordination with other Services

FMBC spectrum licences services have the capacity to cause interference with Landmobile services in the adjacent A Band and bands above 141 MHz. In particular, higher power FMBC spectrum licences services can cause receiver overload leading to receiver desensing, blocking and intermodulation. The Landmobile industry is well versed in the techniques required to minimise these problems and care must be taken to ensure new FMBC spectrum licences do not cause any significant issues for Landmobile service user repeater sites and mobiles.

In the same way FMBC spectrum licence services can cause interference to aeronautical navigational services in the adjacent 108 to 117.975 MHz band. Aeronautical services in that band are used during the landing and general navigation of aircraft. These are safety of life services and must be coordinated with FMBC services in accordance with ITU-R SM1009. The MED RSM web site includes a background discussion monologue on FMBC/Aeronautical coordination.

ITU-R SM1009 indicates a need for separate calculations to cover both Montreal and ICAO Annex 10 1998 aircraft receivers. It is sufficient to consider only the Montreal receiver type as this represents the worst case scenario in the frequency band up to 106.32 MHz, the upper limit of the high power FMBC band.

ITU-R SM1009 also indicates a need for multiple (up to 50) test points at which comprehensive analysis is required. A careful review of distribution of field strength and locations of FMBC transmitters will identify a reduced number of points that require analysis.

ITU-R SM1009 does not provide a comprehensive method of determining A1 type interference. MED's RSM's current practice is to identify maximum levels of unwanted emissions from high power broadcast transmitters that ensure that the level of spurious emissions arriving at an aircraft receiver in an ILS Designated Coverage Area (DOC) are significantly less than the minimum level of ILS signal of 32 dBµV/m.

The rules for coordinating new FMBC, ILS and VOR services are as follows;

- Coordination shall be based on the latest version of ITU-R SM1009.
- Coordination shall include analysis of Type B1 and B2 interference.
- Coordination shall be based on use of the SM1009 Montreal receiver potential incompatibility formulae SM1009 section 4.2.

- Where the SM1009 General Assessment Method (GAM) is used, individual IM component potential incompatibilities as calculated using formulae (3) and (4) in SM1009 section 4.2.3.1 shall be less than 0 dB.
- Where actual FMBC field strength measurements are used for all FMBC signals contributing to significant IM components, the power summation of individual potential incompatibilities shall be less than 0 dB.
- Coordination required for new ILS and VOR services shall include all FMBC services that provide receive signal strengths that are not less than the SM1009 cutoff levels within the services area of the ILS or VOR service
- Coordination required for new FMBC services shall include all ILS and VOR services where the signal strength provided by the new services are not less than the SM1009 cutoff levels.
- Coordination for new ILS, VOR and FMBC services shall include all possible services operating pursuant to the 'General User Licence for Low powered FM Broadcasting short range devices' at each test point required by SM1009.
- Coordination shall taken into account all likely locations of aeroplanes when on aerodrome landing approaches and normal flight routes based on CAA information available at <http://aip.net.nz/>.
- Calculation of minimum test point clearances heights over LPFM and FMBC transmitters shall be based use of AIP Aerodrome Landing Charts. The MAPt point identified in those charts is to be used for the test point closest to the landing threshold and on the runway extended centre-line; and replaces test point E in the ILS DOC shown in Figure 4 of SM1009 Annex 2.
- Airways and NZDF field strength measurements of ILS services and published on the RSM web site (Restricted access for approved radio engineers) shall be used for determination of ILS Lc values and wanted signal level calculations.
- ILS signal levels used for determination of Lc frequency correction factors shall be reduced 3 dB below values extrapolated from aerodrome calibration flight measured values to allow for low transmit power levels.

More detailed information on coordination between FMBC and ILS/VOR services used by RSM Licensing is available in the Technical Monograph TM2007, [Aero-FMBC Coordination Processes](#).

#### Polarisation

FMBC spectrum licences are generally allocated a polarisation of vertical, mixed or linear. A few spectrum licences have been allocated a circular polarisation. Where an unwanted circular polarized field strength impacts on a wanted vertical, mixed or linear signal, the effective power output of the circular polarized transmitter can be reduced by 3 dB for interference calculations.

#### Transmit Antennas

The antenna polar diagrams are generally required to be provided as part of the engineering certification documentation and included on a new or proposed spectrum licence. Provision of a horizontal polar pattern is mandatory while a vertical pattern must be supplied for antennas in urban or city areas, or when requested by MED.

#### Band Expanders

A recent High Court judgment determined that the inappropriate receivers need not be considered when engineering and certifying spectrum licences. The ministry has determined that the performance of radio receivers fitted with band expanders are inappropriate receivers and need not be taken into account when certifying FMBC licences.

#### RDS / SCA

The MED has yet to finalise a long-term policy regarding the use of Radio Sub Carrier and Radio Data System technologies within the FM broadcast modulation envelope. The impact of using these technologies is currently under consideration. The interim policy is to continue to allow the use of RDS/SCA systems, provided the transmitted spectrum is maintained within the permitted frequency band of 256 kHz.

A policy regarding the management of RDS program code allocations is also under consideration by the Ministry.

## Unwanted Emission Limits

These shall conform to the relevant mask included in Appendix 4.

## Modulation Enhancement Devices

The use of modulation enhancement devices with FMBC transmissions is widespread. Such devices shall conform to the requirements of ITU-R BS.642.

### 3.4 Analogue Television Broadcasting

#### Planning

The analogue television services in New Zealand have the following significant planning parameters;

- Occupied spectrum is 44 to 51 MHz, 54 to 68 MHz, 174 to 230 MHz, 518 to 582 MHz, 582 to 614 MHz and 614 to 646 MHz and 646 to 806 MHz
- Channel bandwidth is 7 MHz (VHF) and 8 MHz (UHF).
- Emission designations for 7 MHz channels are 6M25C3F (video), 750KF3GN (FM audio) and 500KG2E (NICAM).
- Emission designations for 8 MHz channels are 6M25C3F (video), 750KF3GN (FM audio) and 500KG2E (NICAM).
- Channel allocation is on a channel plan.
- Channel assignments for services that are co-sited or have significantly common ground wave coverage have a one channel separation.
- Services can be synchronous or non synchronous.
- Use of PAL B (VHF) and PAL G (UHF)
- NICAM 728 kbit/s optional
- Frequency offset can be non-precision offset or precision offset.
- Polarisation is horizontal or vertical.
- Coordination shall include an allowance for receive antenna discrimination
- Planning criteria for analogue television is based on the following ITU-R recommendations;
- BT.419, Directivity and polarisation discrimination of antennas in the reception of television signals
- BT.470, Conventional television systems (B/G)
- BT.655, Radio frequency protection ratios for AM vestigial sideband television systems interfered with by unwanted analogue vision signals and their associated sound signals
- BS.707, Transmission of multi-sound in terrestrial television systems PAL B, D1, G, H, and I, and SECAM D, K, K1, and L
- BT.804, Characteristics of TV receiver essential for frequency planning with PAL/SECAM/NTSC television systems.

#### Engineering

When engineering an analogue television broadcasting service the following tasks must be undertaken to confirm compatibility and suitability of a proposed frequency for use as an analogue television broadcasting service. The tasks are based upon the ITU-R reports and recommendations noted above, and include requirements for key parameters.

When engineering an analogue television service coordination must be undertaken to confirm compatibility of a proposed new service with existing and planned analogue and digital television services.

The tasks required are similar to those required for FMBC services with the following significant differences:

##### Signal Level Calculations

Signal level calculations shall conform to ITU-R BT.655 Annex 3 criteria. MED use Pathloss 3 or 4 for these calculations with algorithm options as follows;

- Deygout Multiple knife edge method with a maximum of 2 obstacles
- Radius method – major obstacle only
- Fore-ground loss method is not used
- Diffraction parameters will be set for Wet evergreen trees or clear
- $K = 4/3$  for wanted and  $K = 2$  for unwanted signals

##### Interference Levels

MPIS levels shall be stated in dBµV/m and calculated at each protection location using the protection ratios given below using the formula MPIS = WFS - PR

#### Protection Ratios

Protection Ratios for TV Bands IV & V shall be as follows;

Wanted	Unwanted	Lower adjacent Channel		Co-channel		Upper adjacent Channel		Image	
		C	T	C	T	C	T	C	T
PAL G	PAL G	1	-9	52	45	-2	-12	6	-1
PAL G	DVB-T	-5	-9	40	35	-5	-9	-15	-19
DVB-T	DVB-T	-30	-30	21	21	-30	-30		
DVB-T	PAL G	-32	-32	9	9	-35	-35		

C = Continuous propagation

T = Tropospheric propagation

#### Antenna polarisation and directivity discrimination

The antenna effective radiated power characteristic and its effect on the interference calculation need to be considered. For television services the use of aerial polarisation and aerial directivity can offer advantages in most areas. The aerial directivity and polarisation figures can be obtained from ITU-R BT.419-3.

#### Off-sets

Precision Offsets and non precision offsets can be used to increase interference discrimination are prescribed in ITU R BT 655-7. Any methods use to increase signal discrimination characteristics must be documented in the engineering certification document.

Offset requirements are to be coordinated through Manager Licensing, at RSMLicensing@med.govt.nz

#### Video and Sound Carrier Levels

Television services may operate with either or both normal FM and NICAM sound services (carriers).

In the absence of a NICAM signal the nominal FM sound carrier level is 10 dB below the vision carrier peak envelope power.

Where both FM and NICAM signals are transmitted, the FM sound carrier level is -13 dBc and the NICAM sound carrier level shall have a nominal carrier level of -20 dBc.

#### Interference Levels

MPIS levels shall be stated in dBµV/m and are based on ITU-R BT655 and BT 1368-6. and calculated at each protection location using the protection ratios given below for digital (DVB-T) and analogue (PAL-G) to digital television services using the formula MPIS = WFS – PR.

#### Protection Ratios

Protection ratios for TV bands I and III shall be as follows;

Band	Lower adjacent Channel		Co-channel		Upper adjacent Channel		
	C	T	C	T	C	T	
I	2	-9*	-52	-45	2	-12	TO BE CONFIRMED
III	2	-9*	-52	-45	2	-12	TO BE CONFIRMED

C = Continuous propagation T = Tropospheric propagation

\*These Lower Adjacent Channel protection ratios are for an unwanted mono sound carrier to unwanted vision carrier ratio of –10 dB. Where a NICAM sound carrier is being transmitted on the unwanted transmission and the unwanted mono sound carrier to unwanted vision carrier ratio is –13 dB these Lower Adjacent Channel protection ratios can be reduced by 3 dB.

Protection Ratios for TV bands IV & V shall be as follows;

Wanted	Unwanted	Lower adjacent	Co-channel	Upper adjacent	Image
--------	----------	----------------	------------	----------------	-------

		Channel				Channel			
		C	T	C	T	C	T	C	T
PAL G	PAL G	1	-9	52	45	-2	-12	6	-1
PAL G	DVB-T	-5	-9	40	35	-5	-9	-15	-19
DVB-T	DVB-T	-30	-30	21	21	-30	-30		
DVB-T	PAL G	-32	-32	9	9	-35	-35		

C = Continuous propagation T = Tropospheric propagation

Note: Some earlier licences may have been set at MPIS values based on earlier rules. Hence coordination requires a check to be made of individual licence mpis values to ensure licence rights are not reduced.

If the unwanted field strength level from another assignment exceeds the MPIS then compatibility cannot be assumed;

#### Minimum Wanted Field Strength

Minimum wanted signal strength is 66 dBµV/m for coverage measured at 10 m above ground level.

#### Unwanted Emission Limits

These shall conform to the masks located in the Reference Data in SMART, as follows;

Band	Mask
44 to 68 MHz	Refer to Manager Licensing at <a href="mailto:RSMLicensing@med.govt.nz">RSMLicensing@med.govt.nz</a>
174 to 230 MHz	Refer to Manager Licensing at <a href="mailto:RSMLicensing@med.govt.nz">RSMLicensing@med.govt.nz</a>
518 to 806 MHz	ATV UHF

### 3.5 Digital Television Broadcasting

#### Planning

Until recently digital television was limited to trial services. Recently 39 digital television licences have been assigned and several of these are now operating. These services are expected to grow and a switch off program for analogue services is currently being planned.

Digital Television requirements were developed by MED in conjunction with the New Zealand Television Broadcasters' Council and were published as "Planning Criteria for Digital Terrestrial Television."

Planning criteria for Digital television is based on;

- [Digital Video Broadcasting – Terrestrial DVB – T format conforming to ETSI standard ETS 300744](#)
- [ITU-R BT.1206 Spectrum Shaping Limits for digital terrestrial television broadcasting](#)
- [BT.1368-6, Annex 2 Planning criteria for digital terrestrial television services in the VHF/UHF bands](#)

Certification of digital television licences must therefore be coordinated with Manager Licensing at [RSMLicensing@med.govt.nz](mailto:RSMLicensing@med.govt.nz).

Digital television broadcasting shall operate with the following spectrum characteristics:

- [DVB-T](#)
- [8k carriers](#)
- [Designated emission is 7M70D9WWW](#)
- [Frequency tolerance +/- 500 Hz](#)

Transmission standards may be selected to suit broadcaster needs. Typical parameters include 64 QAM modulation, ¾ Forward Error Correction, ¼ Guard Interval and MPEG 4 coding

#### Engineering

When engineering a digital television service the tasks required to be undertaken to confirm compatibility of a proposed frequency for use the available bands are similar to those required for FMBC services. Any differences are discussed below.

When engineering a digital analogue television service coordination must be undertaken to confirm compatibility of a proposed new service with both existing analogue and digital television services.

Particular requirements include;

#### Signal Level Calculations

Signal level calculations shall conform to ITU-R BT.655 Annex 3 criteria.

MED use Pathloss 3 or 4 for these calculations with algorithm options as follows;

- Deygout Multiple knife edge method with a maximum of 2 obstacles
- Radius method – major obstacle only
- Fore-ground loss method is not used
- Diffraction parameters will be set for Wet evergreen trees or clear
- $K = 4/3$  for both wanted and unwanted signals

#### Interference Levels

MPIS levels shall be stated in dB $\mu$ V/m and calculated at each protection location using the protection ratios given below for digital (DVB-T) and analogue (PAL-G) to digital television services using the formula; MPIS = WFS - PR

#### Protection Ratios

Protection Ratios for TV Bands IV & V shall be as follows;

	Wanted	Unwanted Channel		Lower adjacent Channel		Co-channel		Upper adjacent		Image
		C	T	C	T	C	T	C	T	
PAL G	PAL G	1	-9	52	45	-2	-12	6	-1	
PAL G	DVB-T	-5	-9	40	35	-5	-9	-15	-19	
DVB-T	DVB-T	-30	-30	21	21	-30	-30	-	-	
DVB-T	PAL G	-32	-32	9	9	-35	-35	-	-	

C = Continuous propagation

T = Tropospheric propagation

#### Minimum Wanted Field Strength

48 dB $\mu$ V/m for coverage but 57 dB $\mu$ V/m at protection locations, i.e., measured at 10 m above ground level.

#### Frequency Offset

Digital television does not use standard television frequency offset but can use carrier and data frame synchronisation to facilitate common frequency usage and time delay adjustment to synchronize incoming signals in overlapping receive coverage areas.

#### Unwanted Emission Limits

These shall conform to the mask DTV8 (Digital TV 8 MHz 502-806 BT1206) which is derived from ITU-R BT.1206 Annex 3. The UEL may be located by AREs in the SMART Reference data at <http://www.rsm.med.govt.nz/pls/web/dbssiten.main>

#### Receive Antenna Discrimination

Antenna discrimination adjustments shall be in accordance with ITU-R BT.419-3. This recommendation provides for 16 dB for polarity orthogonal difference or up to 16 dB for direction.

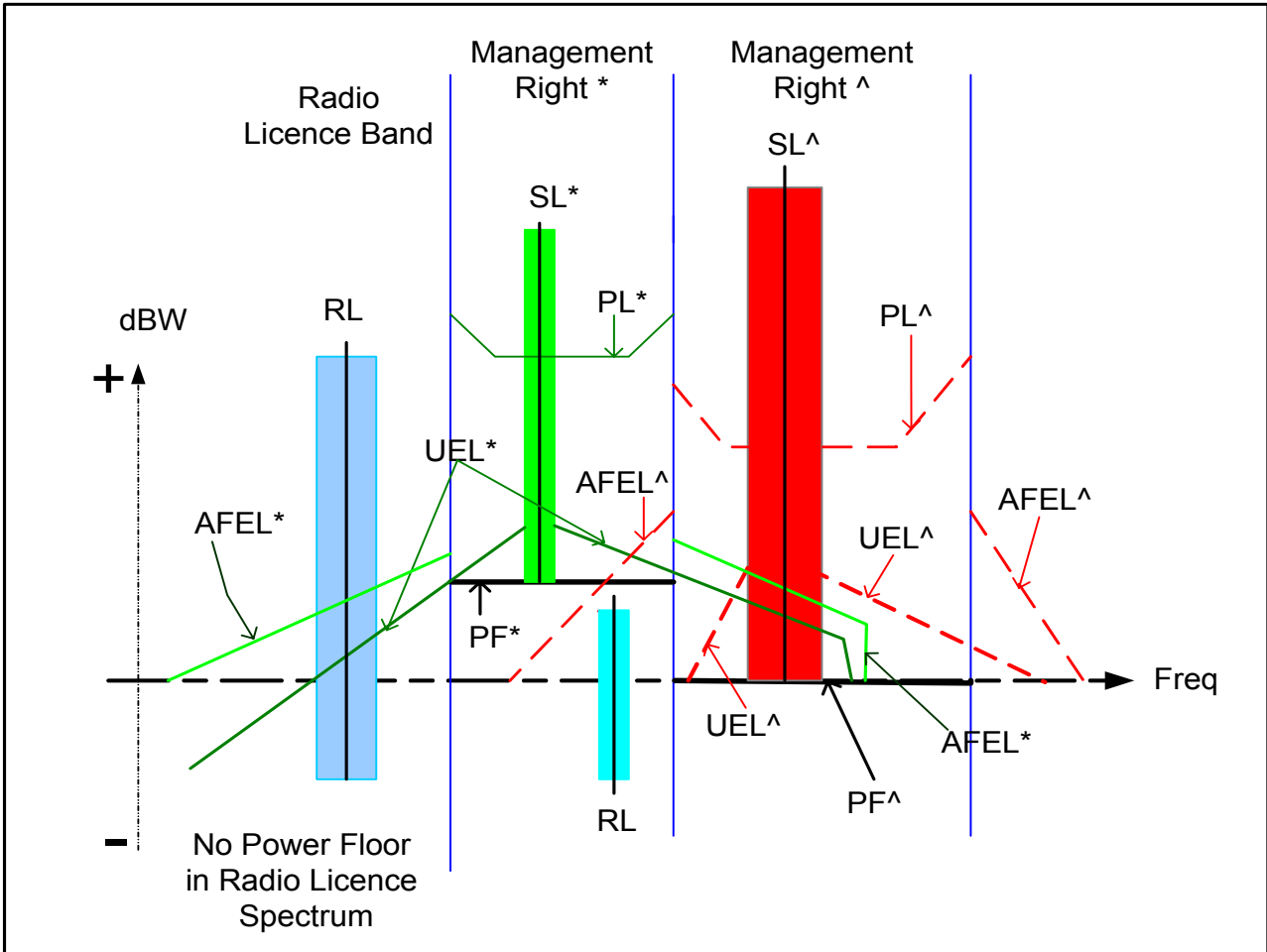
### 3.6 Fixed Wireless Access (3.5 GHz)

Spectrum licences for Fixed Wireless Access (FWA) frequency bands in Crown management rights (management rights 144 and 145) have been prepared by MED and there is currently no requirement for external engineering.

# Appendices

## Appendix 1 Terminology for Management Right Spectrum Parameters

The terminology used for defining management right spectrum parameters in the Radiocommunication Act 1989 and the associated Radio Regulations is illustrated in the following diagram:



**Spectrum Boundaries and Parameters Relating to Management Rights**

Where:

- SL = Spectrum Licence
- PL = Protection Limit (management right parameter)
- PF = Power Floor (management right parameter)
- RL = Radio Licence (can exist below the PF of a management right)
- AFEL = Adjacent Frequency Emission Limit (management right parameter)
- UEL = Unwanted Emission Limit (spectrum licence parameter)

**Appendix 2 Sample Approve Engineer's Certificate**

671.250000 MHz 9-Mar-2010  
FITZHERBERT

**1. CERTIFICATE ISSUED PURSUANT TO SECTION 25(4), 25(5), 57D(4)  
OF THE RADIOCOMMUNICATIONS ACT 1989**

I, ....., approved radio engineer, having regard to:-

- (i) the nature and characteristics of the rights described the spectrum licence; and
- (ii) the International Radio Regulations; and
- (iii) the ITU-R reports and recommendations; and
- (iv) Annex 10 to the Convention on International Civil Aviation; and
- (v) the International Convention for the Safety of Life at Sea; and
- (vi) the nature of the service proposed to be operated under the spectrum licence; and
- (vii) any relevant reference standards issued by the Chief Executive

but not having regard to the reception of radio waves by inappropriate receivers

hereby certify that in my opinion the exercise of the rights conferred by the spectrum licence to which this certificate relates, being the spectrum licence described as follows:

671.250000 MHz  
at FITZHERBERT (NZMS260 R27 743968)

- a) will not endanger the functioning of any radionavigation service; and
- b) will not endanger the functioning of any radio service essential to the protection of life and property; and
- c) will not cause harmful interference to rights conferred by registered spectrum or radio licences; and
- d) is technically compatible with services authorised to be operated under existing spectrum licences and radio licences, and
- e) will sufficiently define the protection area and the nature and characteristics of the proposed transmissions to enable subsequent licences and radio licences to be co-ordinated with the exercise of rights to which this spectrum licence relates, for the purpose of avoiding harmful interference.

.....

Approved Radio Engineer No 0XX  
24 January 2003

### Appendix 3 Sample Spectrum Licence

The Form 7 and Schedule required for a spectrum licence shown below include actual form requirements and clarifying information and notes together with sample data. The clarifying information and notes included below is contained in the square brackets and is not normally included when presenting a Form 7 and the Schedule.

**FORM 7**  
**Spectrum licence**  
*Section 48, Radiocommunications Act 1989*

I, **The Crown acting by and through The Chief Executive of The Ministry of Economic Development**, being the manager for the range of frequencies specified in record of management rights number **15**, give notice that I intend to grant **Radio Tauranga Company Limited, of Radio Village, 57 West Avenue, Waikikamuku**, the right to transmit radio waves on the frequencies specified in clause 3 of the Schedule, and the right to have no harmful interference from co-channel emissions on those frequencies in the protection location(s) or area specified in clause 7 of the Schedule (**Type A licence**).

The terms and conditions of the licence are set out in the Schedule.

Date: 1 April 2005

Signed by [The Manager's name]:

.....Signature.....

in the presence of:

.....Signature.....

Witness name: [An Other's name]

Occupation: Administrative Officer

Full address: [Business or private address]

## SCHEDULE

### Details of spectrum licence

[All clauses of the Schedule apply to Type A licences. All clauses of the Schedule apply to Type B licences except clause 7. All clauses of the Schedule apply to Type C licences except clauses 4, 5, and 6]

1. The commencement date of this licence is [specify date]. 1 April 2006
2. The expiry date of this licence is [specify date]. 31 March 2011
3. The frequencies that apply to this licence are as follows:
  - (a) the characteristic frequency is [specify characteristic frequency in MHz. The term characteristic frequency has the same meaning as in the International Radio Regulations]: 106.3 MHz
  - (b) the frequency band is [specify the lower boundary frequency and the upper boundary frequency in MHz]: 106.18 MHz to 106.42 MHz
4. Unwanted emission limits applying to emissions from the transmitter (expressed as the maximum e.i.r.p. (in dBW) of those emissions):
  - (a) limits applying to frequencies below the lower boundary frequency:
    - 50.0 dBW at 88.00 MHz to -43.0 dBW at 88.40 MHz
    - 43.0 dBW at 88.40 MHz to -43.0 dBW at 89.60 MHz
    - 9.0 dBW at 89.60 MHz to 9.0 dBW at 89.96 MHz
    - 19.0 dBW at 89.96 MHz to 19.0 dBW at 90.08 MHz
  - (b) limits applying to frequencies above upper boundary frequency:
    - 19.0 dBW at 90.32 MHz to 19.0 dBW at 90.44 MHz
    - 9.0 dBW at 90.44 MHz to 9.0 dBW at 90.80 MHz
    - 43.0 dBW at 90.80 MHz to -43.0 dBW at 100.60 MHz
    - 50.0 dBW at 100.60 MHz to -50.0 dBW at 101.00 MHz

[Repeat clauses 3 and 4 if necessary for multiple frequency licences or multiple frequency band licences.]

Note: The unwanted emission limits applicable to frequencies within each specified range must be determined in accordance with the following formula:

$$y = mx + C \quad \text{where} \quad y = \text{dBW} \quad x = \text{MHz} \quad m = dy/dx$$

C = the value of y where x = 0 (the y intercept)

5. The maximum power, designation of emissions, and horizontal radiation pattern permitted under this licence are as follow;
  - (a) maximum power of emissions 43 dBW e.i.r.p.
  - (b) designation of emissions: 256KF8EHF
  - (c) horizontal radiation pattern of antenna (maximum e.i.r.p. (in dBW) per sector in degrees relative to true North):
    - 000 degrees up to 035 degrees 44.0 dBW.

Over	035 degrees	up to	100 degrees	41.0 dBW.
Over	100 degrees	up to	130 degrees	42.0 dBW.
Over	130 degrees	up to	190 degrees	44.0 dBW.
Over	190 degrees	up to	230 degrees	42.0 dBW.
Over	230 degrees	up to	280 degrees	41.0 dBW.
Over	280 degrees	up to	295 degrees	42.0 dBW.
Over	295 degrees	up to	360 degrees	44.0 dBW.

6. The location of the transmitter, the antenna polarisation, and the antenna height are as follows:

(a) \*the location of the transmitter [being the fixed base transmitter of a mobile service, the fixed central hub transmitter of a fixed point-to-multipoint service, or a fixed transmitter of any other service] is:

Map	Grid Reference	Site Name	Altitude
NZMS 260	R11 675822	Sky Tower	27 m above sea level

(b) the antenna polarisation is [specify polarisation]: Vertical, Mixed or Linear

(c) the antenna height is [specify in metres above ground level]. 243 m

7. The protection location or locations or protection area that apply under this licence are described as follows:

(a) \*the protection location or locations are:

Map	Grid Reference	Site Name
NZMS 260	R10 620109	Centreway Road, Orewa PL.
NZMS 260	Q11 477896	Cnr Access Road & Station Rd, Kumeu PL
NZMS 260	R12 772540	Cnr Linwood Rd & Blackridge Rd, Karaka PL
NZMS 260	R11 827758	Gibraltar Reserve PL
NZMS 260	R11 691777	Cornwall Park PL
NZMS 260	R11 665886	Takapuna Golf Course PL

(b) the maximum permitted interfering signal or signals that apply to the protection location or locations or the protection area are [specify all of the maximum permitted interfering signals in dBuV/m].

8. The authorities that apply to this licence are as follows:

(a) this licence may be transferred \*by the rightholder acting alone [or] \*by agreement between the manager and the rightholder:

(b) this licence may be cancelled \*by the rightholder acting alone [or] \*by the manager acting alone [or] \*by agreement between the manager and the rightholder.

(c) this licence may be modified \*by the rightholder acting alone [or] \*by the manager acting alone [or] \*by agreement between the manager and the rightholder.

\*Delete if inapplicable. Underlining indicated authorities normally required for a commercial broadcasting licence.

9. The conditions applying to the exercise of the rightholder's rights under this licence are [specify conditions].

The rightholder shall not transfer the rightholder's interest in this licence, to any foreign government, or to any party on behalf of any foreign government, without first obtaining the written approval of the Chief Executive of the Ministry of Economic Development.

The maximum permitted interfering signals applying to protection locations on co-channel and adjacent channel frequencies shall not exceed: Co-channel ( $\pm 100$  kHz); 42 dBuV/m: Adjacent channel ( $\pm 200$  kHz); 68 dBuV/m: Adjacent channel ( $\pm 300$  kHz); 82 dBuV/m.

The maximum permitted interfering signal levels are not applicable to other transmissions from the same synchronous broadcast system.

A maximum level of all unwanted emissions in the band 80 - 84.5 MHz of -1 dBuV/m, measured at a height of 2 metres above ground level and in a 10 kHz bandwidth.

This licence is intended to operate as part of a synchronous broadcast system comprising licences on the same frequency at the following transmitter locations: Skytower (grid reference NZMS260 R11 675822), and Ruru (grid reference NZMS260 T14 357760).

The Chief Executive or any inspector duly authorised by him shall be granted by the licenceholder at all reasonable times entry to any place, premises or building for the purposes of ensuring compliance with this licence.

**Note:**

Before this licence may be registered, the Registrar must receive a certificate from an approved radio engineer under section 25(4) of the Radiocommunications Act 1989.

If a characteristic frequency is not specified in clause 3 of the Schedule, the centre frequency of the frequency band will be entered into the Register for reference purposes.

This notice must be accompanied by an acknowledgement of the mortgagee's consent if section 26 of the Radiocommunications Act 1989 applies.

This licence must be signed in duplicate.

## Appendix 4 Unwanted Emission Limits

The spectrum licences require the inclusion of Unwanted Emission Limits (UELs) applying to emissions from transmitters (to be expressed as the maximum e.i.r.p. (in dBW) of those emissions). AREs are responsible for ensuring the UEL values do not exceed Adjacent Frequency Emission Limits (AFELs) identified within management rights.

The current UEL requirements and AFEL values for AM, FMBC and UHF television management rights are outlined below.

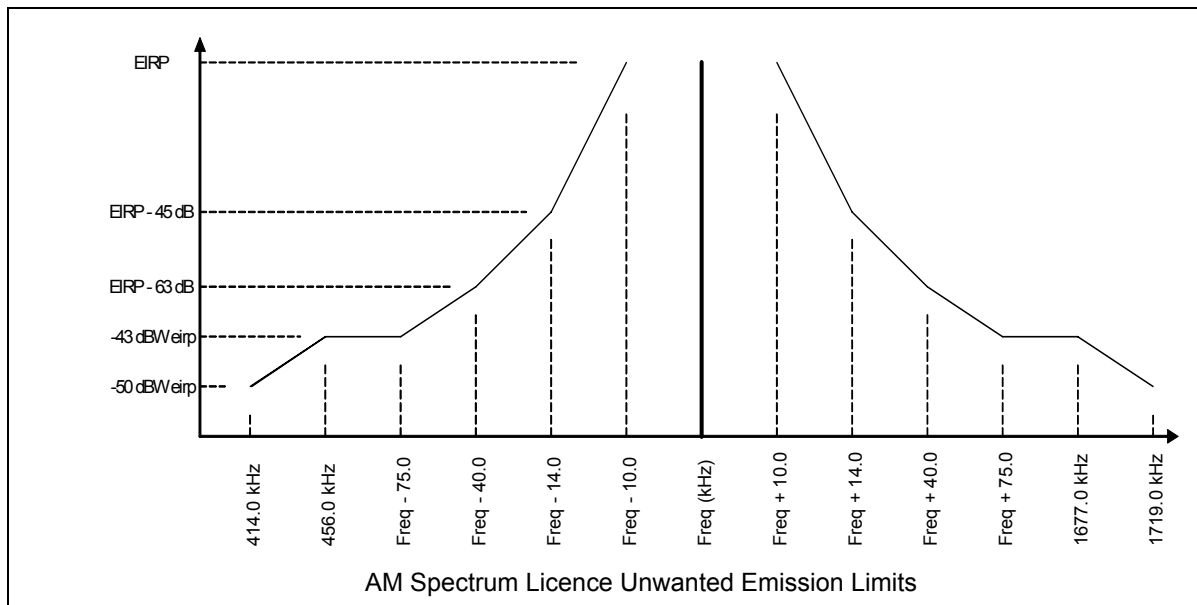
Note that unless otherwise indicated in the UEL tables in this appendix, for frequencies below lower band edges and above upper band edges, where the band edge frequency indicates as maximum UEL level of -43 dBW, the UEL level is not to exceed -50 dBW.

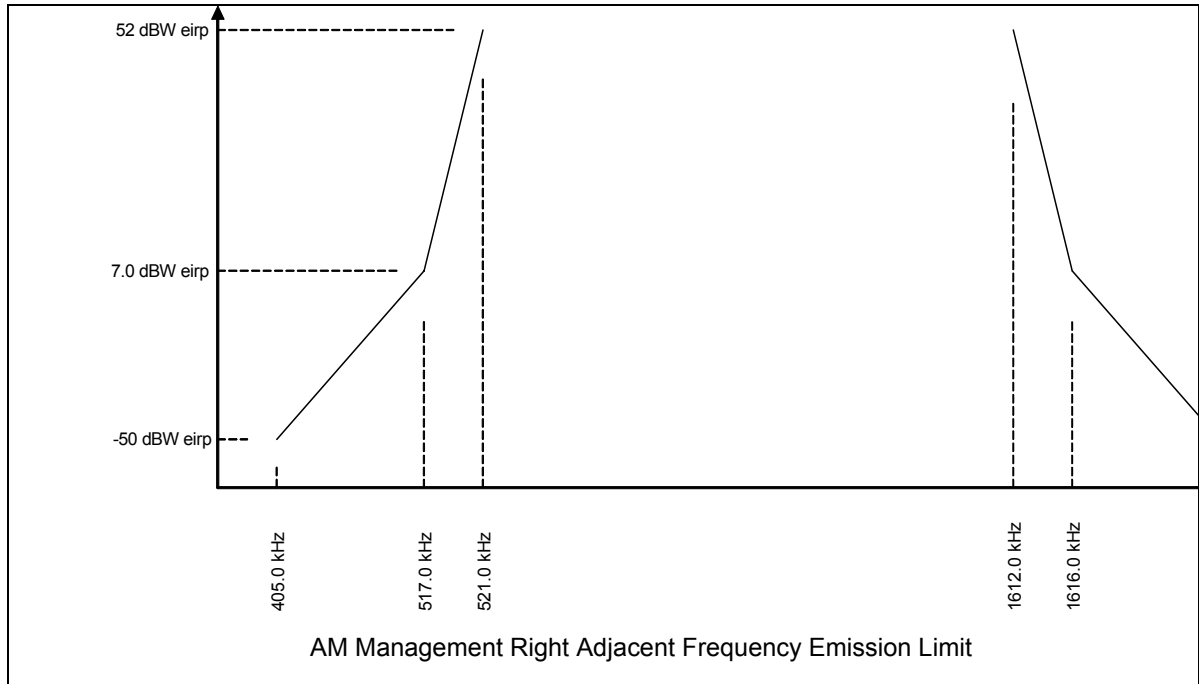
### MF AM Unwanted Emission Limits and Associated AFELs

The UELs for MF AM spectrum licences and associated AFELs are identified in the table and graphical representations below.

Table of Unwanted Emission Limits for MF-AM Services

Frequency	Maximum Level
414 kHz	-50 dBW eirp
456 kHz	-43 dBW eirp
fc - 75.0 kHz (if > 456 kHz)	-43 dBW eirp
fc - 40.0 kHz	eirp – 63 dB (if level > -43 dBW)
fc - 14.0 kHz	eirp – 45 dB (if level > -43 dBW)
fc - 10.0 kHz	eirp
fc + 10.0 kHz	eirp
fc + 14.0 kHz	eirp – 45 dB (if level > -43 dBW)
fc + 40.0 kHz	eirp – 63 dB (if level > -43 dBW)
fc + 75.0 kHz (if < 1677 kHz)	-43 dBW eirp
1677 kHz	-43 dBW eirp
1719 kHz	-50 dBW eirp



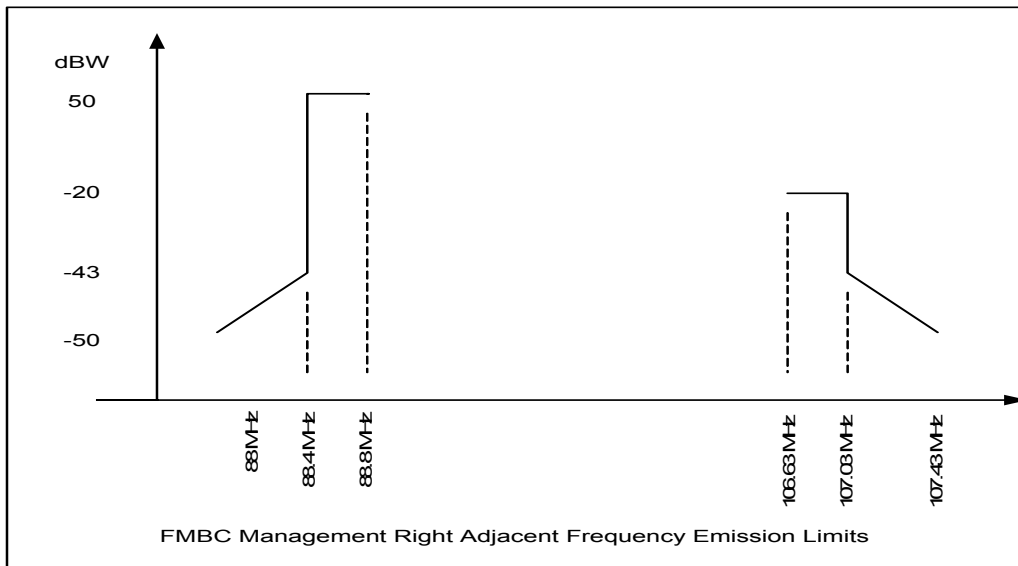
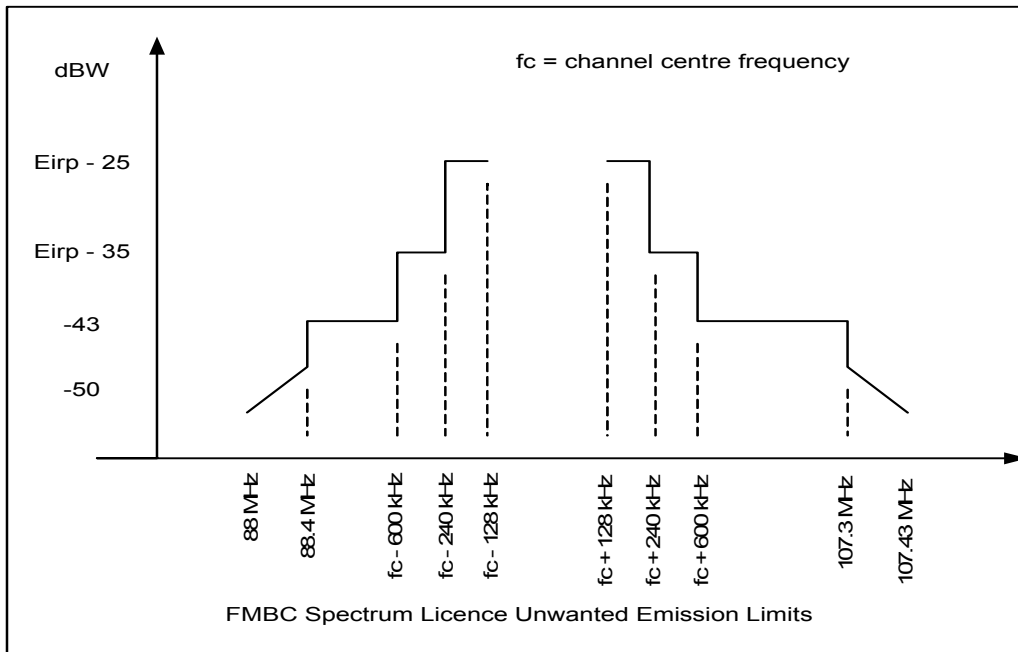


**FMBC Unwanted Emission Limits and Associated AFELs**

The UELs for FMBC spectrum licences and associated AFELs are identified in the table and graphical representations below.

Table of Unwanted Emission Limits for FMBC Services

Frequency	Level
88.00 MHz	-50 dBW eirp
88.40 MHz	-43 dBW eirp
fc - 600.0 kHz (if > 88.40 MHz)	-43 dBW eirp
fc - 600.0 kHz (if > 88.40 MHz)	eirp – 35 dB (if level > -43 dBW)
fc - 240.0 kHz	eirp – 35 dB (if level > -43 dBW)
fc - 240.0 kHz	eirp – 25 dB (if level > -43 dBW)
fc - 128.0 kHz	eirp – 25 dB (if level > -43 dBW)
fc + 128.0 kHz	eirp – 25 dB (if level > -43 dBW)
fc + 240.0 kHz	eirp – 25 dB (if level > -43 dBW)
fc + 240.0 kHz	eirp – 35 dB (if level > -43 dBW)
fc + 600.0 kHz (if < 107.03 MHz)	eirp – 35 dB (if level > -43 dBW)
fc + 600.0 kHz (if < 107.03 MHz)	-43 dBW eirp
107.03 MHz	-43 dBW eirp
107.43 MHz	-50 dBW eirp



### VHF Analogue Television Unwanted Emission Limits

There are 12 varieties of UELs for VHF analogue television spectrum licences that are currently unlikely to be required as there are few opportunities for new licences. Details for these UELs may be obtained by contacting [RSMLicensing@med.govt.nz](mailto:RSMLicensing@med.govt.nz).

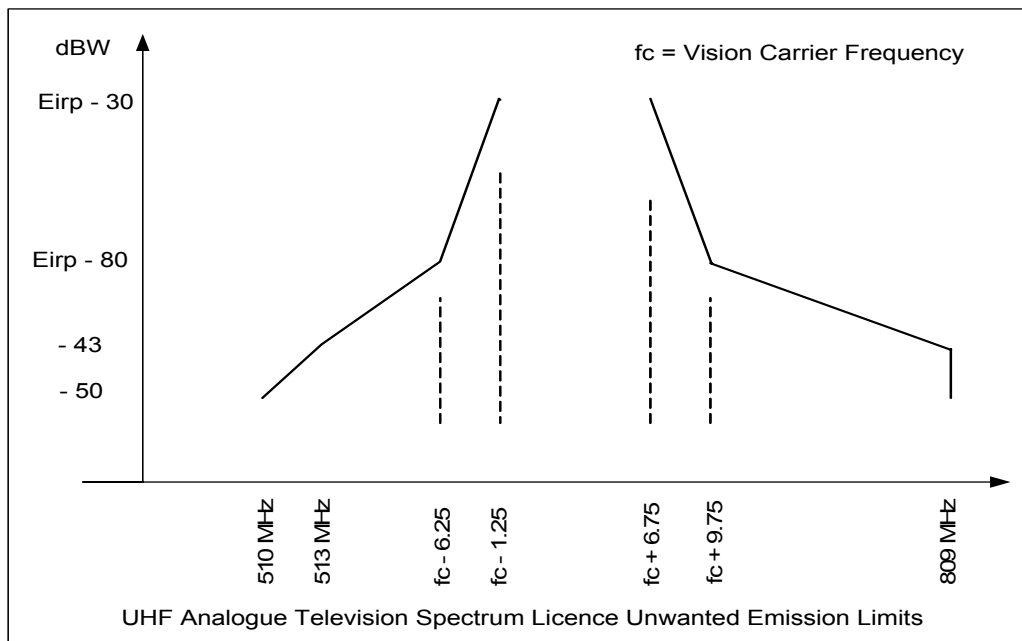
## UHF Analogue Television Unwanted Emission Limits and Associated AFELs

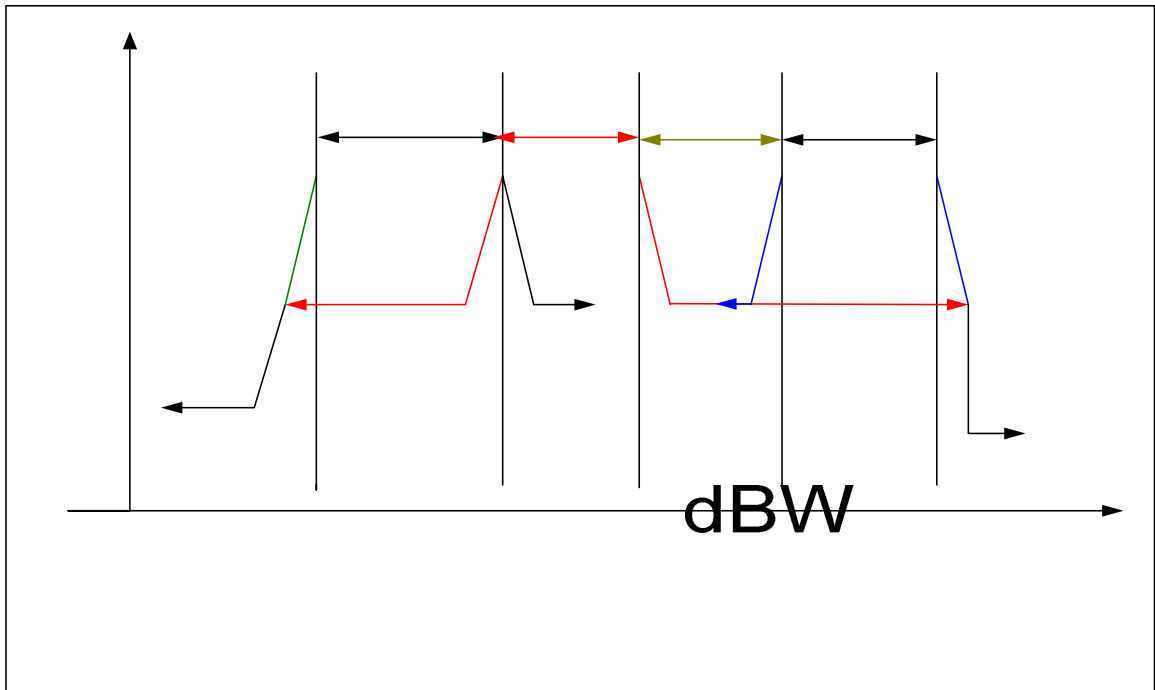
The UELs and AFELs for UHF analogue television spectrum licences are as identified in the table and graphical representations below.

Table of Unwanted Emission Limits for Analogue Television Services

Frequency	Level
510.0 MHz	-50 dBW eirp
513.0 MHz	eirp – 80 dBW (if level > -43 dBW)
$f_c - 6.25$ MHz	eirp – 80 dBW (if level > -43 dBW)
$f_c - 1.25$ MHz	eirp – 30 dBW (if level > -43 dBW)
$f_c + 6.75$ MHz	eirp – 30 dBW (if level > -43 dBW)
$f_c + 9.75$ MHz	eirp – 80 dBW (if level > -43 dBW)
809.0 MHz	eirp – 80 dBW (if level > -43 dBW)

Note for channel TV27 only the UEL level in this table at  $f_c - 6.25$  is not applicable.





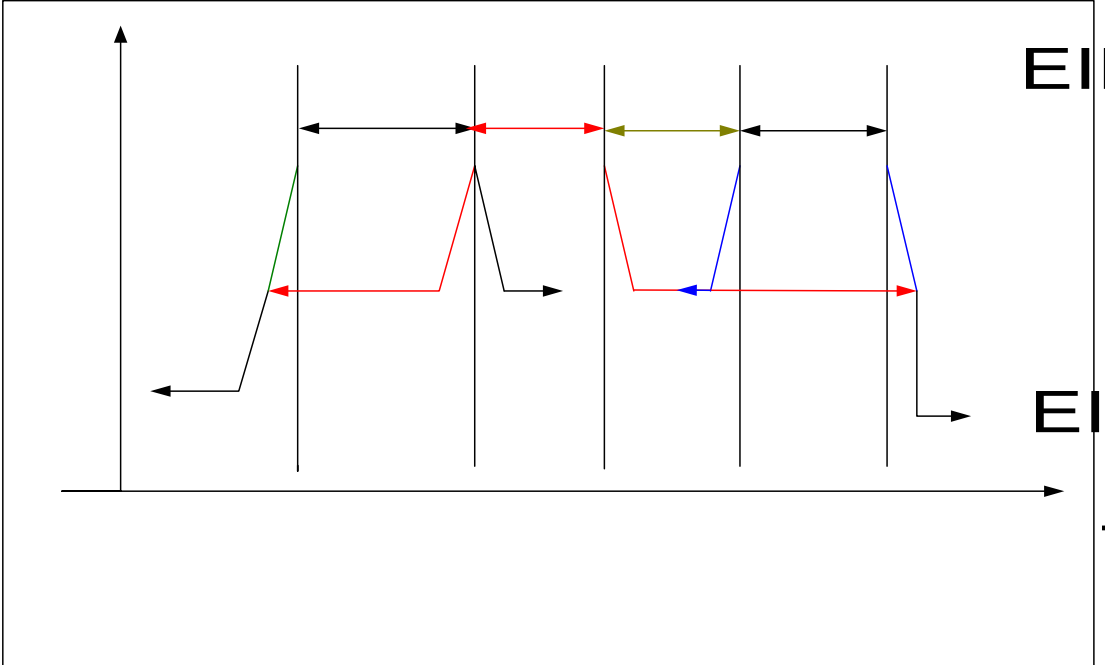
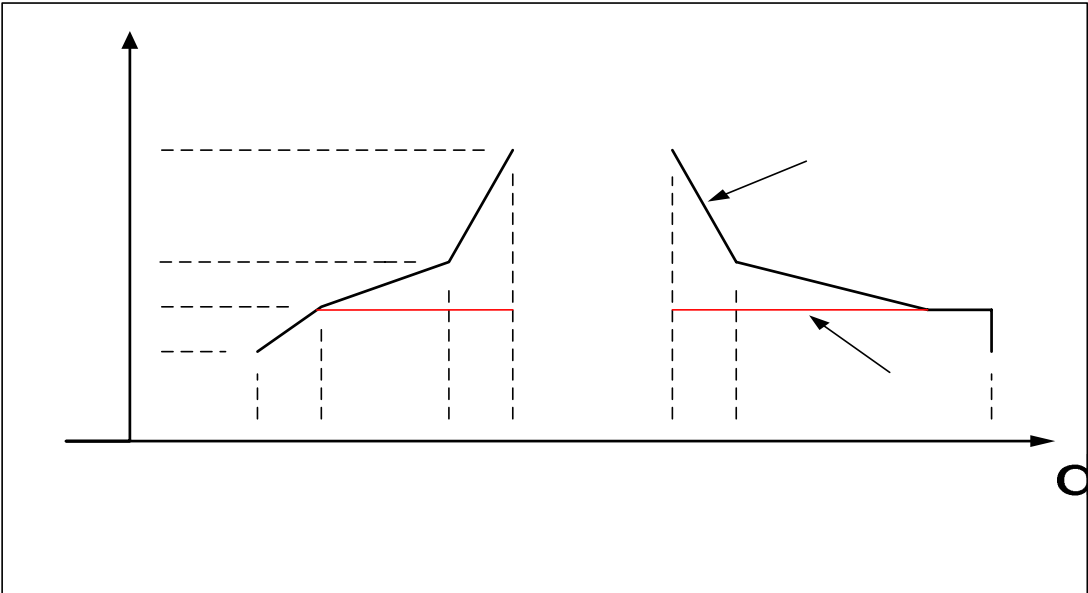
**UHF Digital Television Unwanted Emission Limits and Associated AFELs**

The UELs and AFELs for UHF digital television spectrum licences and associated AFELs are as identified in the table and graphical representations below.

Table of Unwanted Emission Limits for Digital Television Services

Frequency	Level
510.0 MHz	-50 dBW eirp
513.0 MHz	-43 dBW eirp
fc - 4.5 MHz	eirp - 40 dBW (if level > -43 dBW)
fc - 4 MHz	eirp - 20 dBW (if level > -43 dBW)
fc + 4 MHz	eirp - 20 dBW (if level > -43 dBW)
fc + 4.5 MHz	eirp - 40 dBW (if level > -43 dBW)
809.0 MHz	-43 dBW eirp

-50



## Appendix 5 Standard Spectrum Licence Conditions -- Still to be finalised

The following licence conditions apply to all spectrum licences in Crown management right and are included in the General Conditions attached to each and every spectrum licence:

- The rightholder shall not transfer the rightholder's interest in this licence to any foreign government, or to any party on behalf of any foreign government, without first obtaining the written approval of the Chief Executive of the Ministry of Economic Development.
- The Chief Executive or any inspector duly authorised by him shall be granted by the licenceholder at all reasonable times entry to any place, premises or building for the purposes of ensuring compliance with this licence.

The licence conditions relating to the application, variation, cancellation of caveats and mortgages may apply to spectrum licences in Crown management right and should be included when required. An example of such a condition is;

- No transfer or mortgage of this licence shall be registered by the Registrar of Radio Frequencies unless the Minister has consented to that transfer or mortgage. (See section 170 subsection 4 of the Radiocommunications Act 1989).

The following paragraphs are required for the licensing conditions of the AM licences:

- Wanted and maximum permitted interfering signals shall be measured at a height of 2 metres above ground level.
- The night-time maximum permitted interference level for this licence is that recorded at the protection location that has the same location name as the licence transmit location. The night-time minimum usable signal level (Eu) for this licence equals that MPIS + 30dB.

The following paragraphs are typical licensing conditions of the AM licences and should be included when required:

- The time periods during which broadcasting may occur are in accordance with a warrant or authorisation originally granted pursuant to a Broadcasting Tribunal decision and are 0600-2400 hours daily.
- During night-time hours, the maximum EIRP will be restricted to 39.0dBW. The hours defining daytime/night-time operation will be in accordance with ITU-R P.1147 Appendix 1
- Operation pursuant to this licence is permitted during daytime hours only where the daytime are those defined in. ITU-R P.1147 Appendix 1
- Daytime maximum permitted interfering signals applying to receive coverage location or locations on adjacent channels at  $\pm 9$ kHz at the protection location shall be 57 dBuV/m.
- This licence is granted in accordance with section 145 of the Radiocommunications Act 1989.
- This licence must accept interference from co-channel synchronous services.
- This licence is provided for service evaluation and shall cease operation when required by the Ministry

The following paragraphs are typical for the re-licensing conditions of the FM licences.

- Wanted and maximum permitted interfering signals shall be measured at a height of 10 metres above ground level.
- The maximum permitted interference signal levels for adjacent channels at 200, 300 and 400 kHz are engineered in accordance with ITU-R BS412-9 Planning Standards for terrestrial FM Sound Broadcasting.

- The maximum level of all unwanted emissions in the adjacent landmobile and aeronautical bands shall not be greater than – 70 dBW, measured at a height of 2 metres above ground level and in a 10kHz bandwidth.
- The use of RDS transmission is permitted until further notice.
- Operation of this licence is not protected from interference from existing FM broadcasting stations in the Wellington area that do not comply with the requirements of the MED reference standard RS001; "FM Radio Broadcasting - Intermodulation in Radio Receiver Apparatus".
- Operation of this licence shall not cause interference to the operation of existing FM broadcasting stations in the Wellington area in respect of the requirements of the MED reference standard RS001; "FM Radio Broadcasting - Intermodulation in Radio Receiver Apparatus".
- This licence is granted in accordance with section 145 of the Radiocommunications Act 1989.
- This licence is to be used exclusively for non-commercial purposes.
- This licence is to be used exclusively for transmission of the National Programme.
- This licence is provided for service evaluation and shall cease operation when required by the Ministry

## Appendix 6 Minimum Usable Field Strengths for Broadcast Services Protection Areas

The minimum usable field strengths (MUFS) applicable to the Protection Locations for broadcasting services are as follows:

<b>Band</b>	<b>Service</b>	<b>Source</b>	<b>MUFS</b>
512 -1612 kHz	MF-AM	Engineering Daytime Engineering ITU Night-time	66 dB $\mu$ V/m 74 dB $\mu$ V/m
88.8 – 106.63 MHz	FM	Engineering	66 dB $\mu$ V/m
88.8 – 106.63 MHz	FM	Engineering	66 dB $\mu$ V/m
44 – 51 MHz	TV	Engineering	48 dB $\mu$ V/m
54 – 68 MHz	TV	Engineering	48 dB $\mu$ V/m
174 – 230 MHz	TV	Engineering	55 dB $\mu$ V/m
518 – 582 MHz	TV Analogue	Engineering	65 dB $\mu$ V/m
518 – 582 MHz	TV Digital	Engineering	57 dB $\mu$ V/m
582 – 806 MHz	TV Analogue	Engineering	70 dB $\mu$ V/m
582 – 806 MHz	TV Digital	Engineering	57 dB $\mu$ V/m

## Appendix 7 List of Agencies for Band Usage Approval

BAND	GENERAL FREQUENCY RANGE	COMMENTS	AGENCY
	All ITU Region 3 bands allocated to 'Aeronautical Radionavigation' or 'Aeronautical Mobile' – except "OR" bands below 30 MHz	All land-based transmitters	CAA
	All ITU Region 3 bands allocated to 'Maritime Radionavigation' or 'Maritime Mobile'	All land-based transmitters	MSA
	AM and FM radio broadcasting bands, VHF and UHF television broadcasting bands	All applications for "not-for-profit" broadcasting	MCH & TPK
	AM and FM radio broadcasting bands, VHF and UHF television broadcasting bands	All applications for promotion of Maori language and culture broadcasting	MMD
	All Amateur bands (refer Amateur GUL schedule)	All repeaters and beacons	NZART
ESA	75 – 80 MHz	All	PSRFMG
ESB	138 – 144 MHz	All	PSRFMG
ESC	494 – 502 MHz (under consideration)	All	PSRFMG
ESD	812 – 813 MHz 857 – 858 MHz	All	PSRFMG
MMVHF	Maritime bands below 30 MHz and 156 – 162 MHz (MMVHF band)	All land-based maritime service transmitters (incl. maritime coast stations and repeaters)	MSA
DEF	Aeronautical Mobile (OR) < 30 MHz 230 – 328.6 MHz 335.4 – 399.9 MHz	All	NZDF

- CAA Civil Aviation Authority
- MCH Ministry for Culture and Heritage
- MMD Ministry of Maori Development (Te Puni Kokiri - TPK)
- MSA Maritime Safety Authority
- NZART New Zealand Association of Radio Transmitters
- NZDF New Zealand Defence Force
- PSRFMG Public Safety Radio Frequency Management Group
- TPK Te Puni Kokiri, Ministry of Maori Development

- Appendix 8 List of Maritime Sites used for Distress and Safety Communications

Important Note; This list does not constitute a complete list of all sites that may require coordination in respect of Distress and Safety Communications services and certifying engineers will need to undertake their own area search of services they determine as appropriate.

<b>Site</b>	<b>NZMS 260 Series Map Reference</b>	<b>Lat/Long Map Reference</b>
Taupo Maritime Radio Transmit Site (Matea)	U18 082538	38-52S 176-26E
Taupo Maritime Radio Receive Site (Goudies)	U18 079523	38-31S 176-29E
Cape Reinga Maritime (Te Paki)	M02 907481	34 28.14S 172 46.42E
Kaitaia Maritime (Maungataniwha)	O04 585703	35-10S 173-31E
Whangarei Maritime (Hikurangi)	P06 937287	35-32S 174-05E
Great Barrier Maritime Radio (Mt Isaacs)	T09 366377	36 20S 175-31E
Auckland Maritime (Waiatarua)	R11 501740	36-56S 174-35E
Plenty Maritime (Te Aroha)	T13 526039	37-32S 175-45E
Runaway Maritime (Tikirau)	Y14 511936	37-32S 177-59E
Tolaga Maritime (Pukeakura)	Y17 568811	38-34S 178-06E
Napier Maritime (Mt Erin)	V22 391556	39-45S 176-51E
Wairarapa Maritime (Mt Adams)	T27 416842	41-19S 175-46E
Wellington Maritime (Kaukau)	R27 590955	41-14S 174-47E
Taranaki Maritime (Egmont)	P20 036122	39-18S 174-05E
Cape Egmont Maritime (Kahui)	P20 906091	39-18S 173-59E
Wanganui Maritime (Kuranui)	R20 681567	39-49S 174-56E
Picton Maritime (Kahikatea)	P27 032946	41-16S 174-07E
Kaikoura Maritime (Blue Duck)	P31 782892	42-12S 173-47E
Akaroa Maritime (Mt Pearce)	N36 048219	43-43S 172-57E
Waitaki Maritime (Mt Studholme)	J40 443164	44-38S 170-54E
Chalmers Maritime (Mt Cargill)	I44 199855	45-49S 170-33E
Bluff Maritime (Hedgehope)	F45 782485	46-06S 168-38E
Stewart Island Maritime (Mt Rakeahua)	D48 200506	46 56.4027S 167 52.4692E
Puysegur Maritime (Wednesday Peak)	B46 346339	46-09S 166-51E
Fiordland Maritime (Mt Elder)	C41 625755	44-54S 167-20E
Fox Maritime (Karangarua)	G36 494284	43-36S 169-46E
Greymouth Maritime (Paparoa)	K31 736658	42-24S 171-21E
Westport Maritime (Mt Rochfort)	K29 053357	41-47S 171-44E
Farewell Maritime (Mt Burnett)	M25 796630	40-38S 172-38E
Durville Maritime (Attempt Hill)	P26 831388	40-51S 173-52E

Chathams Fisherman's Radio (Wharekauri)  
CHT (Waihere Pitt Island)

43-43S 176-35W  
44-16S 176-15W