

SPECTRUM LICENCE
CERTIFICATION RULES

for

CROWN MANAGEMENT RIGHTS

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. These rules are made under the authority of the Crown's ownership of the management rights. 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. Correspondence received will be acknowledged, investigated and appropriate action taken.

Amendment History		
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Section One: General

1.1 Purpose of this Public Information Brochure

This Public Information Brochure (PIB 39) document (the Rules) outlines the requirements of the Manager, Ministry of Economic Development, to be followed when certifying new and modified radio services in Crown management rights. These management rights are currently used for sound and television broadcasting services, and fixed wireless access services.

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, but 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 RSMlicensing@med.govt.nz for clarification.

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.

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 role of the Ministry of Economic Development (the Ministry) in relation to the radio spectrum includes:

- 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 particular management right bands; and,
- The Appendices technical details and examples relevant to the content of the Rules.

1.3 Acts, Regulations, Forms and Gazettes

The Act provides the contents, certification requirements, registration requirements and associated rules for spectrum licences and related matters. The Radiocommunications Regulations 2001 (the Regulations) contain requirements prescribed by Order in Council. 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 include matters such as spectrum licence mortgages, caveats and consents.

Gazette Notices prescribed under s133 of the Act that identify reference standards

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

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

1.4 Interpretation, Terminology and Definitions

The interpretation and terminology contained in this document shall have the meanings as defined 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.

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 Limit (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.

The Ministry 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:
 - (i) Made on the demand of a particular person for reception only by that person; or,
 - (ii) 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 Rights

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 summarised in the following table.

Table 1 Crown Management Right Frequency Bands;

Management Right	Broadcasting Service	Frequency Band
MR 15 and 206	MF – AM Sound Broadcasting	521 – 1612 kHz
MR 143 and 207	VHF – FM Sound Broadcasting	88.4 – 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 and 212	UHF – TV Television Broadcasting	518 – 582 MHz
Radio Licence Band and MR213	UHF – TV Television Broadcasting (Ministry of Culture and Heritage)	614 – 646 MHz
MR 2 and 213	UHF – TV Television Broadcasting	646 – 806 MHz
MR 144, 145, 155 and 156	Fixed Wireless Access	Part of 3.4 to 3.6 GHz band
MR 241 and MR258	Managed Spectrum Park	2.575 – 2.620 GHz

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

Licences in the UHF-TV Television Broadcasting band (614 – 646 MHz) are currently granted as radio licences not spectrum licences. A management right for this band (MR213) commences in April 2010. Radio licences in this band shall be engineered in accordance with the requirements of these Rules and administered as radio licences until the commencement of MR 213.

1.6 Spectrum Licence Policies for Broadcasting Services

In addition to the certification requirements outlined in this document, 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).

The spectrum licences for broadcasting services may be allocated on a commercial or non-commercial basis, depending upon Government policy. 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 to meet government broadcasting objectives and policies. These are allocated without a resource charge and are often referred to as “non-commercial” licences although advertising may be permitted. 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

Government policies require that broadcasting licences are allocated 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 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 Radio Spectrum Management website, <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.

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 \(Ministry of Māori Development\) http://www.tpk.govt.nz/](http://www.tpk.govt.nz/), 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 http://www.mch.govt.nz/](http://www.mch.govt.nz/), 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 Radio Spectrum Management (RSM) to either Te Puni Kōkiri 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 and the availability of a reserved, unused, licence in the relevant area. Most licences will be subject to contractual arrangements in regard to program content and other operational matters.

1.9 Allocation Policies for Fixed Wireless Access Services

Fixed Wireless Access (FWA) services are normally short or medium range radio services that can provide an alternative to wireline services. Prior to auctioning a number of FWA management rights, the Crown retained two pairs of Fixed Wireless Access management rights (MR 144, MR145, MR155 and MR156), for the purpose of providing spectrum licences for use by 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 created by the Ministry with transmit and protection areas based on Territorial Local Authority areas and have been publicly auctioned. A few licences remain unsold (in 2009). Policy documents and information on recent auctions are available at <http://www.rsm.govt.nz> (search on FWA).

1.9 Allocation Policies for services in the Managed Spectrum Park

Services within The Managed Spectrum Park (MSP) are allocated in accordance with the Park Rules and Rules for Initial Allocation. These are available on the Radio Spectrum Management website. The MSP is within Crown management rights MR 241 and MR 258.

1.10 Ministry 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 The Ministry and checked to ensure compliance with the current policy requirements and/or to determine resource value payments for new and modified licences.

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

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

Instruments received by The Ministry are appropriately completed and meet the policy requirements, and where resource payments (if appropriate) are also 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 Types of Spectrum Licence

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.

Most of the spectrum licences issued in the Crown management right bands are granted under section 48(1)(a) of the Act.

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 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 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 current and planned licences 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 Ministry 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.”

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 Radiocommunications Regulations 2001 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 Limits (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 the table below:

Frequency range	Measurement bandwidth
< 150 kHz	1 kHz
150 kHz to 30 MHz	10 kHz
30 MHz to 1 GHz	100 kHz
> 1 GHz	1 MHz

Particular requirements for specific radio service types are included in [Section 3](#) 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 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;
- Restrictions on the purpose of transmissions
- Restrictions on types of equipment used pursuant to the operation of the licence;
- Restrictions that prohibit operation while emissions are generated in accordance with another licence;
- Exceptions in relation to the right to have no interference
- Restrictions relating to the hours of operation;
- Restrictions on program content as might relate to non-commercial licences;
- Restrictions to applicability of MPIS levels in relation to other licences to facilitate synchronous operation: and
- For interference evaluation licences – the requirement that any transmission pursuant to the licence reduce power, or cease operation, should interference be caused to other services licensed pursuant to a spectrum licence. For these types of licences, the Crown retains the authority to modify or cancel the licence as necessary.

Appendix 5 provides examples of typical standard spectrum licence. Additional conditions may be required 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	Manager and Rightholder	Manager and Rightholder	Manager and Rightholder

	Together	Together	Together	Together
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In respect of the table, the 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 or other purposes 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 or limited term spectrum licence, usually less than 12 months.

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. This authority can be used in respect of a Cancel authority to permit either the rightholder to Cancel or the manager to Cancel. This authority might be exercised by the manager, for example, should the rightholder not comply with agreements established prior to the granting of a spectrum licence to the rightholder..

1.17 Simultaneous Certification of Licences

It is possible for two or more persons acting independently to apply for spectrum licences in the same area resulting in incompatible spectrum licences in Crown management rights. Should that occur, the licence that shall have precedence shall be that determined by the Manager, Licensing. This decision shall normally be made on the basis of first in time delivery and shall be determined based on the dates and times recorded as follows:

- in the case of Form 8 paper applications, by the Ministry mailroom timestamp, and
- in the case of Form 8 online applications, by the SMART application date and time and
- in the case of all Form 7 applications, by the SMART "Planned status date and time

For determining the first in time between licences, the decision of the Ministry shall be final and may be to not grant either licence and to place the disputed licence in the next available Ministry public spectrum auction.

Should any incompatible spectrum licences become registered, the Ministry will determine which licence has first in time right using the principles outlined above 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.

A complete licence application, Form 7 or Form 8 means 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.

The Ministry's internal process for determining first in time of applications submitted to the Ministry for processing is the following:

- ONLINE APPLICATION: A completed spectrum licence application lodged in SMART; or,
- PAPER APPLICATION; A completed spectrum licence application lodged with RSM Licensing; or,

1.18 Requirements for Certifying Engineers

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

The Ministry publication, PIB34, provides all necessary information for people seeking to become an Approved Radio Engineer.

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 relevant to the licence;
- Bibliography of referenced standards, recommendations, reports and other information.

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

The certification documentation is to be retained by the ARE and made available for audit purposes for the period of 5 years from the date of certification of 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 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.”

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.
- 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.”
- ‘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.

The reception of radiocommunications by inappropriate receivers as declared under the Radiocommunications Regulations shall not be considered either in respect of technical compatibility or harmful interference.

ITU-R Recommendations relating to Broadcast Services include minimum usable field strengths and minimum receiver performance requirements in order to provide a satisfactory service for general reception. Broadcasting services operate with high powers and on a continuing basis and therefore need to be carefully considered in assessment of potential interference to distress and safety communications.

2.2 Distress and Safety Communications

The International Radio Regulations (ITU-R RR), Articles 30 to 34 relating to Distress and Safety 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 must be considered by certifying engineers use frequencies included in the General User Radio Licence for Emergency Transmitters which 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 here.

Consideration should be given to potential intermodulation and de-sensitisation of distress and safety communications receivers.

2.3 Aeronautical Navigational Services

Aeronautical navigation 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 operate in the band 285 to 415 kHz at regional airports and other key locations. Special care is required with the certification of new high powered broadcast transmitters in the band 521 to 1612 kHz, close to aircraft landing routes at airports using low frequency NDBs. Aircraft receivers are susceptible to overloading when subject to high field strengths (for example when at low altitudes closer to terrestrial transmitters). Evaluation of new MF AM licences near airports requires thorough awareness of frequencies in use in the area and analysis of the potential for receiver de-sensing and intermodulation along aircraft landing approaches.

- The localiser (Horizontal) component of Instrument Landing Services (ILS) operates 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 licences for 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/cms/resource-library/publications/broadcasting/AeroFMBC-Coord-Process-Web.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.

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

2.4 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. In particular lower cost receivers can be susceptible to de-sensing 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 dB μ V/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 de-sensing issues at VHF and higher frequencies, sitting high power transmitters away from urban area is preferred.

2.5 Equipment and Site Issues

While AREs are responsible for certification requirements being met for harmful interference and technical compatibility aspects, the rightholder is responsible to ensure that the installation complies with the spectrum licence.

Where known certifying engineers should also advise 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.

2.6 Services in Adjacent Frequency Bands

Certifying engineers need to consider whether a proposed licence is compatible with existing radio and spectrum licences using adjacent frequency bands in the same area. In particular, careful consideration of wanted and unwanted emissions, receive protection limits and receiver performance is important. Examples of previous incompatibilities include;

- Use of mobile transmitters with moderate transmit power levels and unwanted emissions have been known to be incompatible with receivers designed for low power density wideband signals. This required the introduction of greater frequency separation; and,
- The location of moderate power VHF paging transmitters adjacent to maritime shipping lanes, ports and shore stations operating on adjacent frequencies was incompatible with maritime receivers. An upgrade of those affected receivers was required.

Consideration should include evaluation of potential for interference to and 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 to identification of the combinations of signals that could result in an intermodulation product falling on safety of life frequencies. Inevitably, at a site like Mt Kaukau in Wellington, there will always be a potential for intermodulation products to affect safety of life channels. Experience has shown that these rarely result in harmful interference, but certifying engineers should evaluate whether the addition of a new service to a site can cause issues and plan appropriate measures to avoid those possibilities.

2.7 Protection Locations

This section discusses the requirements for defining and selecting protection locations. Protection locations are to be identified using NZMS 260 map grid references or NZMS long grid references (see Section [2.15, Site Naming Conventions and Geographic Coordinates](#)).

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 large geographic 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.
- 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;
- protection locations must be identifiable points for practical field measurement. Preferred locations are parks, school playgrounds, or cemeteries. Inaccessible places such as forest, lakes, and private property should not be chosen;
- protection locations shall not be in areas heavily shaded or obscured by geographical features, which are not typical of the general area.
- some protection locations may 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,

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 protection location 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 $\pm 3\text{dB}$ 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 $\pm 50\text{m}$.
 - 2. Difficult to identify exact location but description enables revisit to within $\pm 50\text{m}$.
 - 3. Well described with unique features allowing revisit to within $\pm 10\text{m}$.

- 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 identification of protection locations required for night time Eu calculations and measurements for MF-AM services. See section 3.2 below.

The Ministry, as manager, reserves the right to determine whether a proposed protection location is satisfactory..

2.8 Maximum Permitted Interfering Signal (MPIS) Level Requirements

The Maximum Permitted Interfering Signal (MPIS) concept is not specified in the Act as a requirement of a spectrum licence. The form (Form 7) for registration of the spectrum licence has provision for MPIS levels which are a limit on the right to receive no harmful interference from co-channel emissions.

The engineering rule for the purposes of this publication is that proposed spectrum licences shall not permit unwanted signal levels that exceed the MPIS levels of the existing (or planned) spectrum licences at the protection location of those existing (or planned) licences.

Proposed spectrum licences for broadcasting services shall identify an MPIS level for each protection location.

MPIS levels of existing spectrum licences. Also, MPIS levels for the proposed licence shall be calculated on the basis of the wanted signal level less an appropriate protection ratio if either these requirements are not met, the proposed licence should not be certified. Specific exceptions to this requirement maybe made for synchronous or single frequency networks on a case by case basis...

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

The calculations for spectrum licences must 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. These parameters are not applicable for calculations of MPIS levels for MF-AM or FMBC services.

2.9 Signal Strength Calculations

Calculation of both wanted and unwanted field strengths requires use of propagation models, path profiles and standard processes. The Ministry 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 assist in validating the use of signal strength calculation algorithms when required provided measurement accuracy can be determined. Measurements are not necessarily determinative however.

The Ministry uses processes based on ITU-R 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
- P.526 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

It is noted that there is a variety of software available for the completion of path profiles and the assessment of signal strengths. The information provided in this section outlines a benchmark of information and settings for use by AREs.

The Ministry currently uses commercially available software for path profiles and calculating signal strengths associated with VHF and UHF radio and television services, with the following parameters, models and settings;

- K Factor; 4/3 for wanted and 2.0 for unwanted signal strength analysis
- Prediction; 50 % of locations and 50 % of the time (50/50)
- ITU 525/526 Model and Deygout 94 Diffraction geometry for wanted and unwanted interference profiles.
- Subpath attenuation loss is included. This relates to Fresnel obstruction loss and Foreground loss
- Fresnel zone 0.6
- Clutter loss not included.

For the purposes of this document the term clutter loss is defined as loss due to, or associated with, trees or buildings only. A further term, known as Epstein Peterson Clutter Loss (EPCL) includes an assessment of loss associated with terrain. That is, the effect of terrain on the Fresnel zone of an emission. Assessment of wanted and unwanted path profiles should include the use of EPCL where this is an option in the software used.

The calculation of field strengths on either a signal path profile basis, or multiple paths for the assessment of coverage can be complex, and prediction software, whether produced in-house or commercially purchased, can produce varying results. Accordingly, some configuration of the software may be required. For example, the software used for the recent renewal of FM broadcast licences required a 3 dB correction factor for assessment of coverage, to obtain results similar to those obtained when using the Ministry's software.¹

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 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.

An 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. The Ministry does not recommend any particular software tool.

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

¹ This example is presented to emphasize the statistical nature of radio wave propagation prediction and associated issues. No criticism of any propagation software tools is intended.

- 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 pixel based tool that can provide coverage predictions are available. With such tools two coverage predictions can be made and overlaid. Correctly used coverage predictions will quickly indicate areas at high risk of 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.
- Care should be taken with digital terrain models (DTM) that its terrain resolution and its algorithms are sufficient to produce the required prediction accuracy. DTM pixel size should not exceed 100m and height resolution of more than 25 m can not be expected to provide accurate results. Vertical resolution accuracy should be sufficient to ensure mountain and hill tops are not 'flattened'. It is noted that hilltop data is available for purchase from LINZ.
- Accuracy of predictions made on a radial basis will vary depending upon the angular interval between radio path profiles and the distance from the transmitter.

When an engineer is creating a licence modification for commercial purposes, the client may wish estimates of the increased population coverage to be undertaken. This matter is outside the certification requirements of the Act, but might conveniently be completed using the same software tools as used for certification.

2.10 Parameter and Reference Bandwidths

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 total power of the emission. This practice may create difficulties when considering interference between services of different bandwidths.

The increasing number of services with different bandwidths, power levels and equipment characteristics, 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 in relation to several common emission types.

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.

The Ministry uses reference bandwidths for some equipment standards as identified in the radio equipment [standards](#) on the Radio Spectrum Management website. Engineers specifying spectrum licence parameters shall identify measurement bandwidths for unwanted emissions and interference signal levels where these are different from the reference bandwidth required for a licence. Those reference bandwidths, are 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

2.11 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-R Recommendations dealing with these matters include:

- MF-AM Broadcast services, Rec. ITU-R BS.598

- VHF FMBC Broadcast services, Rec. ITU-R BS.412
- Analogue TV Analogue Television Broadcast services, Rec. ITU-R BT.655
- Digital TV Digital Terrestrial Television, Rec. ITU-R BT.1368

Note that 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. Single Frequency Networks (SFNs) use these techniques.

2.12 Antenna Radiation Patterns

Transmit antenna

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

Broadcast transmit antennas shall have their horizontal radiation patterns recorded on 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 for the determination of services coverage and also the limiting of that coverage when there is potential for interference to other services.

Receive antenna

For the reception of television broadcast 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.

2.13 Site Naming Conventions and Geographic Coordinates

Site naming conventions need to be simple and flexible. 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 Register of Radio Frequencies (SMART) should use the following convention:

- if a current site used in SMART is suitable it is preferable that it 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 number and street name should be used. 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.
- 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 coordinates 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 metres. The coordinates 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 641.12 802.12 (NZMS 260 Series) or long reference 2664112E 5980212N.

In the future the Ministry is planning to move to the New Zealand Geodetic datum 2000 (GD200). For information on GD2000 and conversion calculator see the Land Information New Zealand website <http://www.linz.govt.nz/>

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 section [1.18, Requirements for Certifying Engineers](#).

Departures from the rules for particular purposes shall require the written approval of Manager Licensing and shall be addressed to via email to RSMLicensing@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
- 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

International planning methods involve the calculation of Eu values for aggregate night time interference. National licensing requirements do not readily incorporate the prescription of an Eu value, but the Eu value is used as a wanted field strength (WFS) to calculate a night time MPIS level with appropriate licence conditions.

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 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.

Channel 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 search can be obtained by AREs from the Register of Radio Frequencies in SMART and selecting Search the Register and then Select licence. This search is required to identify other services with which the proposed new service will require Groundwave coordination (see task below).

International 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 affect 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 dB μ V/m
- For night time operation the MUFS is 74 dB μ V/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 \geq 36 dB μ V/m
- For Night-time operation MPIS = Eu – PR = 44 dB μ V/m

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 st Adj.Ch)	9
18 (2 nd Adj.Ch)	-25*
27 (3 rd 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 dB μ V/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;

$$E_u = \sqrt{[\sum_i (a_i E_{ni})^2 + E_{min}^2]}$$

where;

- Eu is the night time useable field strength for sky-wave signals at a site in μ V/m and is normally expressed in dB μ V/m
- Eni is the night time field strength of the i-th transmitter in μ V/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;
- Emin is the minimum usable field strength of the wanted service.

The required maximum permitted value for Eu shall be 74 dB μ V/m and therefore for night-time reception the equivalent night-time MPIS shall be 44 dB μ V/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. Where the current night time MPIS value is 44 dB μ 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 μ V/m, any additional new service shall not exceed that MPIS by more than 1 dB.
- Where the current night time MPIS for an existing licence is greater than 43 dB μ V/m but less than 44 dB μ V/m, any additional new service shall not exceed the MPIS to greater than 44 dB μ V/m.

Synchronous Operation

The protection ratio for synchronous operation of co-channel MF– AM broadcast services shall be 8 dB. Recommendation ITU-R BS.598-1, Annex 2, refers.

Polarisation

Vertical polarisation is used for MF– AM broadcasting.

Unwanted Emission Limits

These are outlined in Appendix 4 of this document and 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 in the bands 200 to 450 kHz and 1515 to 1600 kHz to provide reliable navigational guidance for both en-route 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. Harmful interference can result in aircraft direction guidance errors.

SMART MPIS Records

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

- One night time MPIS value, shall be identified at the transmit location. The protection location is nominal and any measurements required at the location shall be completed sufficiently remote from the antenna or similar large structures so that their effect in terms of obstruction and induction are minimised;
- 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.

International Coordination

MF – AM broadcast 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 a treaty-level document to which New Zealand is a signatory, also referred to as the GE-75 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 be confirmed 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 more than 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-R. The Ministry's Radio Spectrum Policy and Planning group is responsible for coordination with other overseas spectrum administrations and ITU-R. Requirements for this coordination will be determined by the Licensing Manager at 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 in April 2011.

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 88.4 to 106.63 MHz – see above.
- Channel bandwidth is 256 kHz
- Emission designation for analogue services with RDS is 256KF9EHW. Other digital services are not permitted
- 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 a small number of assignments have 400 kHz spacing with Ministry approval. The Ministry is currently reviewing the use of 400 kHz spacing.
- 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 BS.412 Planning Standards for terrestrial FM Sound Broadcasting
- ITU-R BS.450 Transmission Standards for FM Sound Broadcasting at VHF
- ITU-R BS.415 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 BS.704 Characteristics of FM Sound Broadcasting Reference receivers for Planning Purposes

FMBC usage in New Zealand, and in many overseas countries, is based on a minimum frequency separation of 800 kHz between licences at the same transmitting site. This is known as an "800 kHz raster" and is consistent with ITU-R technical standards. It recognises the typical quality of receivers in use, and the efficient practice of multiplexing transmitters to a common antenna.

The Ministry wishes to maximise the utility of the FMBC band and is (April 2009) in the process of examining whether a frequency separation of less than 800 kHz can be applied at major transmission sites.

It is generally inefficient to use frequencies suitable for a main transmission site for coverage infill, or extension. Such infill coverage is generally provided on frequencies offset from the raster of the main transmission site, but it is necessary to ensure satisfactory reception is possible in any areas of common coverage from the main and infill site. Typically, incompatibilities are minimised when the infill site has a 400 kHz separation from the main coverage site. However, this arrangement can only be satisfactory when

there are no listeners in the immediate vicinity of either transmission site and the required protection ratios are met in any common coverage areas. The Ministry treats applications involving narrow frequency separations (400 kHz) on a case by case basis with the over-riding objective of protecting a long term frequency plan, currently based on a separation of 800 kHz at any given site, or at different sites which serve common coverage areas.

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 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 small specific area, and wide frequency range. This information is available in Register of Radio Frequencies in SMART. The information is to be used to identify transmitters and receivers on a site.

Initial Co-channel 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-channel and adjacent channel assignments within +/- 800 kHz from the proposed frequency. The process includes determining outgoing field strength calculations based on the relevant ITU-R 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 ITU-R curves from the adjacent assignment to the proposed assignment protection areas. A search tool can be obtained by AREs from the Register of Radio Frequencies in SMART and selecting Search the Register and then Select licence.

Detailed Co-channel and Adjacent Channel Impact Analysis

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

Interference Analysis Report

The co-channel 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. Radiation pattern data must be included.

Coverage Map

Predicted coverage for FM Broadcast services can be uncertain due to varying topographic factors. Practical field strength measurements may assist in confirming predicted coverage if computer generated algorithms are relied upon to predict coverage.

Interference Levels

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

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

- $MPIS = MUFS (66dB\mu v/m) - PR$

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

- $MPIS \text{ level} = WFS - PR$

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

For licences issued after 1 July 2002, the interference levels for protection locations are established for steady interference conditions using the Protection Ratios indicated in the table below.

Channel Spacing (kHz)	Protection Ratio	Interference Level (dB μ V/m)
0 (Co-channel)	45	WFS - 45
100 (1 st Adj.Ch)	33	WFS - 33
200 (2 nd Adj.Ch)	7	WFS - 7
300 (3 rd Adj.Ch)	-7	WFS - (-7)
400 (4 th Adj.Ch)	-20	WFS - (-20)
> 400	-20	WFS - (-20)

See also section 2.7 in relation to defining and selecting protection locations.

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.

Urban Sites

When engineering 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. This is relevant when it is proposed to establish a site which would result in significantly different signal levels from two different sites in a common coverage area. In particular, no new licence should be introduced to an urban or city area that may cause broadcast receiver de-sensing or intermodulation that can lead to interference to existing services. The certification of 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.
- Reference Standard RS001 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 power output in build-up areas of 100 Watts or 20 dBW e.i.r.p. are to be referred to the Ministry for consideration. However, applications for licences as low as 10 dBW or less may be declined due to the potential for harmful interference to adjacent channels or services within short distances.

Coordination with other Services

FMBC spectrum licences services have the capacity to cause interference with land mobile services in the adjacent A Band below 88 MHz and bands above 141 MHz. In particular, higher power FMBC spectrum licences services can cause receiver overload leading to receiver de-sensing, blocking and intermodulation. Care must be taken to ensure new FMBC spectrum licences do not cause significant issues for land mobile service repeater sites and mobiles.

Similarly, FMBC spectrum licence services can cause interference to aeronautical navigation 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 Recommendation ITU-R SM.1009. A monologue on coordination between FMBC and aeronautical services has been published on the Radio Spectrum Management website under engineering certification.

Recommendation ITU-R SM.1009 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.

Recommendation ITU-R SM.1009 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.

Recommendation ITU-R SM.1009 does not provide a comprehensive method of determining A1 type interference. 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 dB μ V/m.

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

- Coordination shall be based on the latest version of Recommendation ITU-R SM.1009.
- Coordination shall include analysis of Type B1 and B2 interference.
- Coordination shall be based on use of the Montreal receiver potential incompatibility formulae in section 4.2 of Recommendation ITU-R SM.1009.
- Where the General Assessment Method (GAM) is used, individual intermodulation component potential incompatibilities as calculated using formulae (3) and (4) in section 4.2.3.1 of Recommendation ITU-R SM.1009 shall be less than 0 dB.
- Where actual FMBC field strength measurements are used for all FMBC signals contributing to significant intermodulation 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 Recommendation ITU-R SM.1009 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 Recommendation ITU-R SM.1009 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 Recommendation ITU-R SM.1009.
- Coordination shall take into account all likely locations of aeroplanes when on aerodrome landing approaches and normal flight routes based on Civil Aviation Authority (CAA) information available at <http://aip.net.nz/>.
- Calculation of minimum test point clearance heights over LPFM and FMBC transmitters shall be based on use of AIP Aerodrome Landing Charts. The MAP t 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 Recommendation ITU-R SM.1009 Annex 2.
- Airways and NZDF field strength measurements of ILS services and published on the Radio Spectrum Management website (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 polarised field strength impacts on a wanted vertical, mixed or linear signal, the effective power output of the circular polarised 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 the Ministry.

Band Expanders

A High Court judgment has determined that 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 use of RDS and SCA systems, provided the transmitted spectrum is maintained within the permitted frequency band of 256 kHz.

A list of RDS program code allocations is maintained by the Radio Broadcasters Association (RBA).

Unwanted Emission Limits

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

3.4 Television Broadcasting

Planning

Analogue Television

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 806 MHz
- Channel bandwidth is 7 MHz (VHF) and 8 MHz (UHF).
- Emission designations 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 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:
 - Recommendation ITU-R BT.1700, Characteristics of video signals for conventional analogue television systems
 - Recommendation ITU-R BT.1701, Characteristics of radiated signals for conventional analogue television systems
 - Recommendation ITU-R BT.655, Radio frequency protection ratios for AM vestigial sideband television systems interfered with by unwanted analogue vision signals and their associated sound signals
 - Recommendation ITU-R BS.707, Transmission of multi-sound in terrestrial television systems PAL B, D1, G, H, and I, and SECAM D, K, K1, and L
 - Recommendation ITU-R BT.804, Characteristics of TV receiver essential for frequency planning with PAL/SECAM/NTSC television systems.

Digital Television

Planning criteria for digital television is based on;

- Digital Video Broadcasting – Terrestrial DVB – T format conforming to ETSI standard ETS 300 744
- ITU-R BT.1206 Spectrum Shaping Limits for digital terrestrial television broadcasting
- ITU-R BT.1368-7, 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.

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, $\frac{3}{4}$ Forward Error Correction, $\frac{1}{4}$ Guard Interval and MPEG 4 coding.

Engineering

Analogue Television

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. The Ministry use commercially available software with the following parameters, models and settings;

- K Factor; 4/3 for wanted and 2.0 for unwanted signal strength analysis
- Prediction; 50 % of locations and 50 % of the time (50/50)
- ITU 525/526 Model and Deygout 94 Diffraction geometry for wanted and unwanted interference profiles.
- Subpath attenuation loss is included. This relates to Fresnel obstruction loss and Foreground loss
- Fresnel zone 0.6
- Clutter loss not included.

Digital Television

When engineering a digital television service. The Ministry use commercially available software with the following parameters, models and settings;

- K Factor; 4/3 for wanted and 2.0 for unwanted signal strength analysis
- ITU 525/526 Model and Deygout 94 Diffraction geometry for wanted and unwanted interference profiles.
- Subpath attenuation loss is included. This relates to Fresnel obstruction loss and Foreground loss
- Fresnel zone 0.6
- Clutter loss not included.

Interference Levels

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

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 antenna directivity and polarisation figures can be obtained from ITU-R BT.419-3. This recommendation provides for 16 dB for polarity orthogonal difference or up to 16 dB for direction.

Offsets

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.

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.

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

Video and Sound Carrier Levels

Television services must operate with FM sound carriers suitable for a PAL B or G service. NICAM sound is optional.

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 dB μ V/m and are based on Recommendation ITU-R BT.655 (PAL B/G) and Recommendation ITU-R BT.1368-6 (DVB-T) and calculated at each protection location using the protection ratios given below for digital (DVB-T) and analogue (PAL-G) services using the formula MPIS = WFS – PR.

Protection Ratios

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

Wanted	Unwanted	Lower adjacent channel		Co-channel		Upper adjacent channel	
		C	T	C	T	C	T
PAL B	PAL B	2	-9*	52	45	2	-12**

*The 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 channel		Co-channel		Upper adjacent channel		Image 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		
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C = Continuous propagation
T = Tropospheric propagation

Some earlier licences may have 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 for analogue television is as follows:

- 48 dB μ V/m for Band I (44 to 51 and 54 to 68 MHz);
- 55 dB μ V/m for Band III (174 to 230 MHz);
- 65 dB μ V/m for Band IV (518 to 582 MHz);
- 70 dB μ V/m for Band V (582 to 806 MHz).

Minimum wanted signal strength for digital television is 48 dB μ V/m for coverage, but protection locations are required to have a minimum signal strength of 57 dB μ V/m

Signal strength and coverage measurements are measured at a height of 10 m above ground level.

Unwanted Emission Limits

These shall conform to the masks located in the Reference Data in SMART, and as outlined in Appendix 4

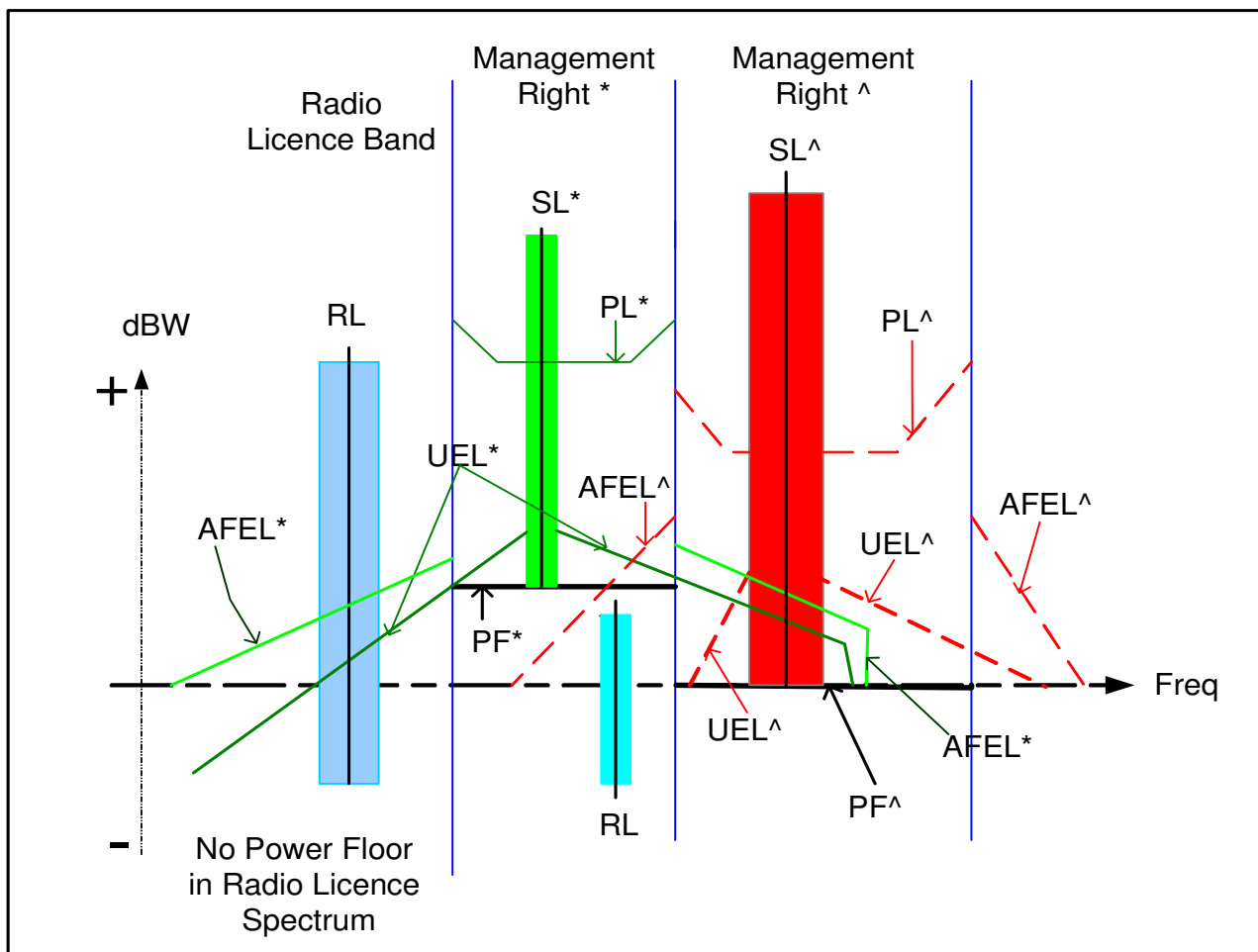
3.5 Fixed Wireless Access (3.5 GHz)

Spectrum licences for Fixed Wireless Access (FWA) frequency bands in Crown management rights (management rights 144 and 145) have been prepared by the Ministry 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 Radiocommunications 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)

**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 are contained in the square brackets and are 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]. 03-Apr-2011

2. The expiry date of this licence is [specify date]. 02-Apr-2031

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]: 105.400000 MHz
 - (b) the frequency band is [specify the lower boundary frequency and the upper boundary frequency in MHz]: 105.272000 MHz to 105.528000 MHz

4. Unwanted emission limits applying to emissions from the transmitter (expressed as the maximum e.i.r.p. (in dBW) of those emissions):

Power (dBW eirp)	Frequency (MHz)	TO	Power (dBW eirp)	Frequency (MHz)
-50.0	87.600000		-43.0	88.000000
-43.0	88.000000		-43.0	104.800000
-43.0	104.800000		-3.0	104.800000
-3.0	104.800000		-3.0	105.160000
-3.0	105.160000		7.0	105.160000
7.0	105.160000		7.0	105.272000

limits applying to frequencies below the lower boundary frequency:

Power (dBW eirp)	Frequency (MHz)	TO	Power (dBW eirp)	Frequency (MHz)
7.0	105.528000		7.0	105.640000
7.0	105.640000		-3.0	105.640000
-3.0	105.640000		-3.0	106.000000
-3.0	106.000000		-43.0	106.000000
-43.0	106.000000		-43.0	107.030000
-43.0	107.030000		-50.0	107.030000
-50.0	107.030000		-50.0	107.430000

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

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 follows:
 - (a) maximum power of emissions 32 dBW e.i.r.p.
 - (b) designation of emissions: 256KF9EHW

- (c) horizontal radiation pattern of antenna (maximum e.i.r.p. (in dBW) per sector in degrees relative to true North):

Bearing (From) Bearing (To) Power (dBW eirp)

0.0	145.0	32.0
145.0	155.0	22.0
155.0	175.0	18.0

Bearing (From) Bearing (To) Power (dBW eirp)

175.0	185.0	22.0
185.0	360.0	32.0

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

Map	Easting	Northing	Site Name	Altitude (metres above sea level)
S20 NZMS260 (METRIC)	991.00	915.00	WAIPUNA	749 m

Polarisation: [specify polarisation]: Mixed or Linear

Height: [specify antenna height in metres above ground level]. 15 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 or protection area and (b) the maximum permitted interfering signal that apply to those location(s) are:

:

Map	Easting	Northing	Altitude	Site Name	MPIS
S20 NZMS260 (METRIC)	150.00	040.00		HOROPITO PL	30.0 dB μ V/m
S20 NZMS260 (METRIC)	064.00	951.00		KING ST RAETIHI PL	36.0 dB μ V/m
S20 NZMS260 (METRIC)	180.00	961.00		SHANNON ST OHAKUNE PL	36.0 dB μ V/m

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

- (a) The authority to transfer this licence is held by the RightHolder acting alone
 (b) The authority to cancel this licence is held by the RightHolder acting alone
 (c) The authority to modify this licence is held by the agreement between the RightHolder and Manager

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 conditions applying to the exercise of the rightholder's rights under this licence are: 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 rightholder at all reasonable times entry to any place, premises or building for the purposes of ensuring compliance with this licence. Maximum permitted interfering signals shall be measured at a height of 10 metres above ground level. The maximum permitted interfering signal or signals that apply to the protection location or locations or protection area are conditions on the exercise of the right to have no harmful interference from co-channel emissions on the frequencies that apply to this licence in accordance with section 49(1)(j) of the Radiocommunications Act 1989. The levels are calculated using the wanted signal level and Recommendation ITU-R BS.412-9 which specifies a ratio of 45 dB, 33 dB and 7 dB for frequency

differences of 0 kHz, 100 kHz, and 200 kHz respectively between wanted and unwanted signals. The designation of emissions on this licence provides for the transmission of supplementary information for station and programme identification in FM broadcasting and other applications, using the radio-data system (RDS) as specified in Recommendation ITU-R BS.643-2. Other digital emissions are not permitted.

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.

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.

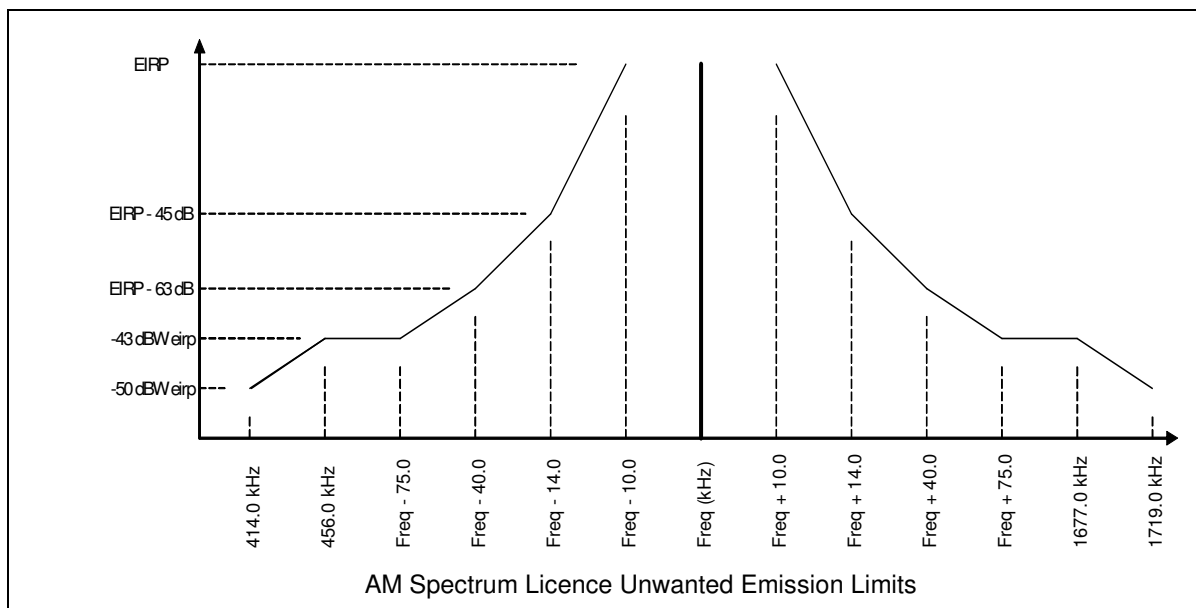
Note that unless otherwise indicated in the UEL tables in this appendix, for frequencies below lower band edges and above upper band edges, where the band edge frequency indicates as maximum UEL level of -43 dBW, the UEL level is not to exceed -50 dBW.

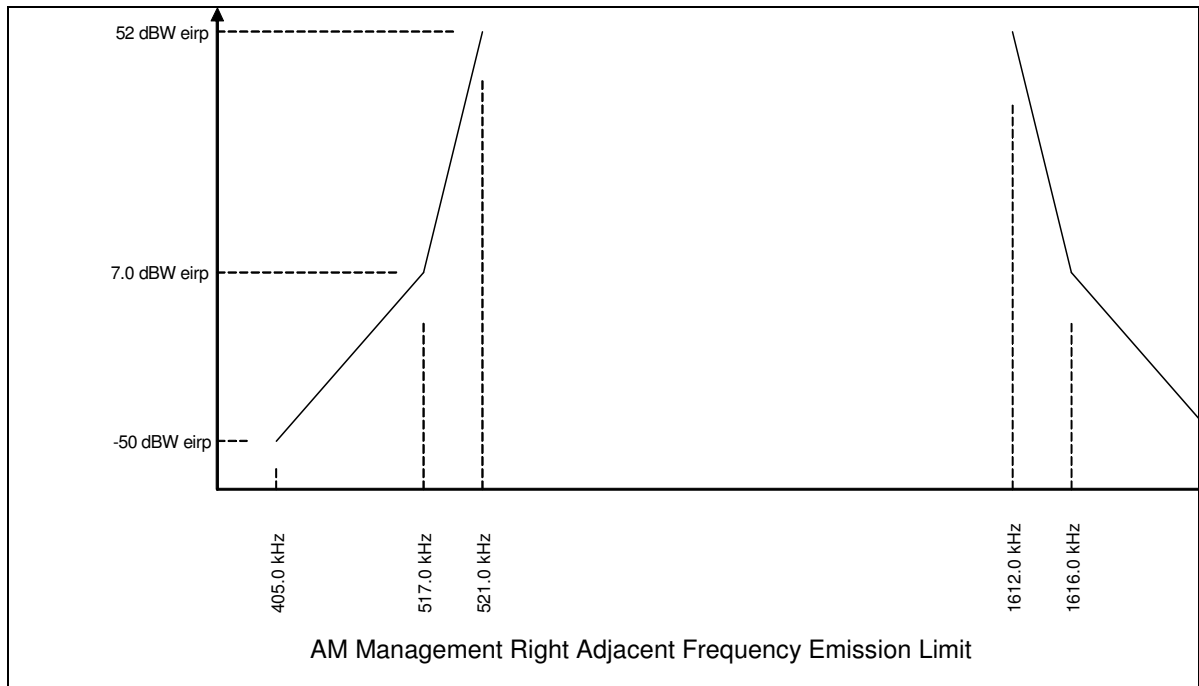
MF AM Unwanted Emission Limits and Associated AFELs

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



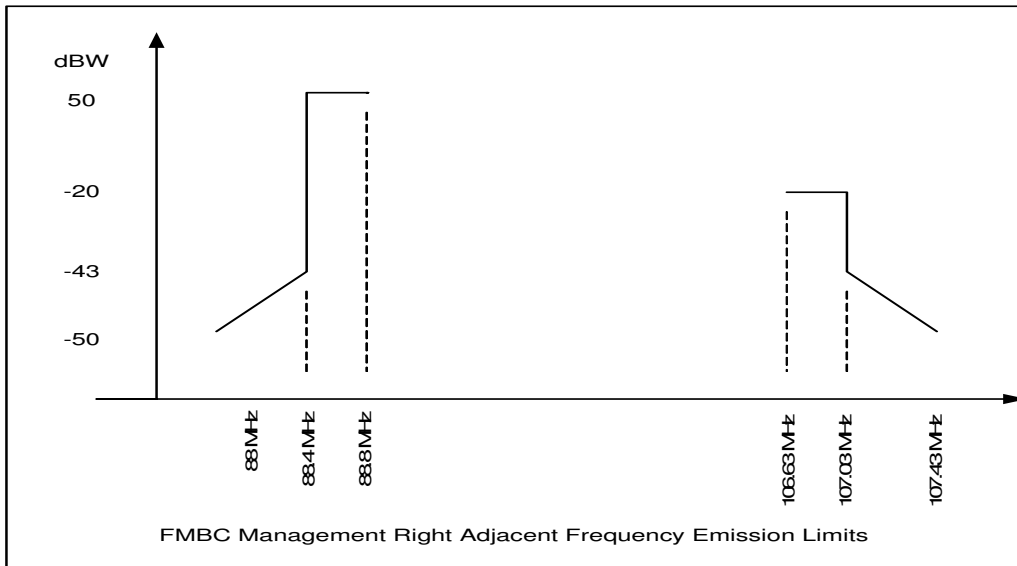
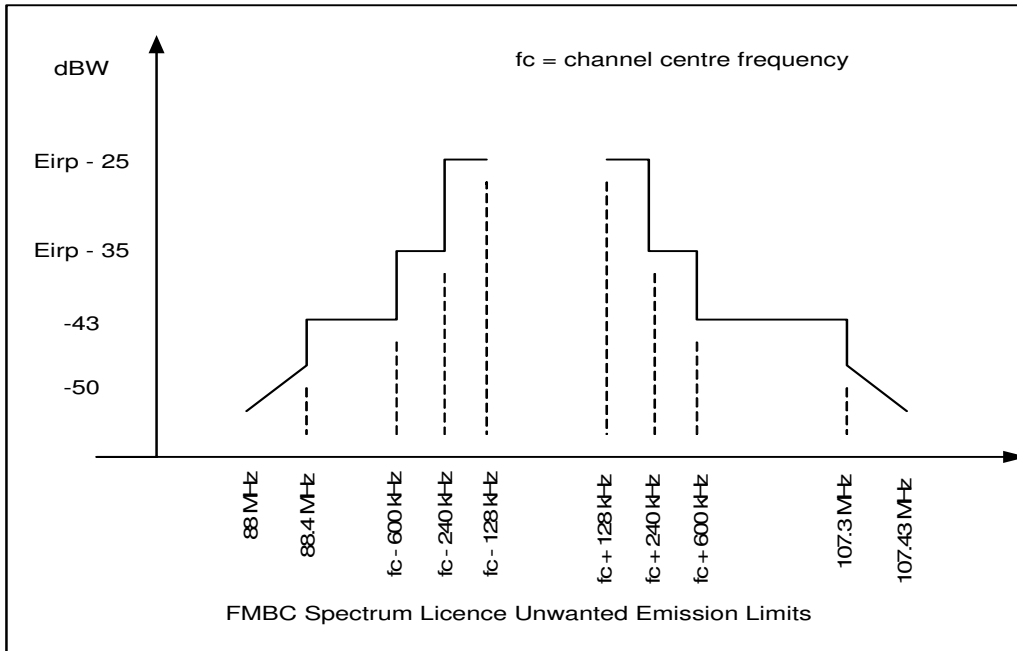


FMBC Unwanted Emission Limits and Associated AFELs

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.

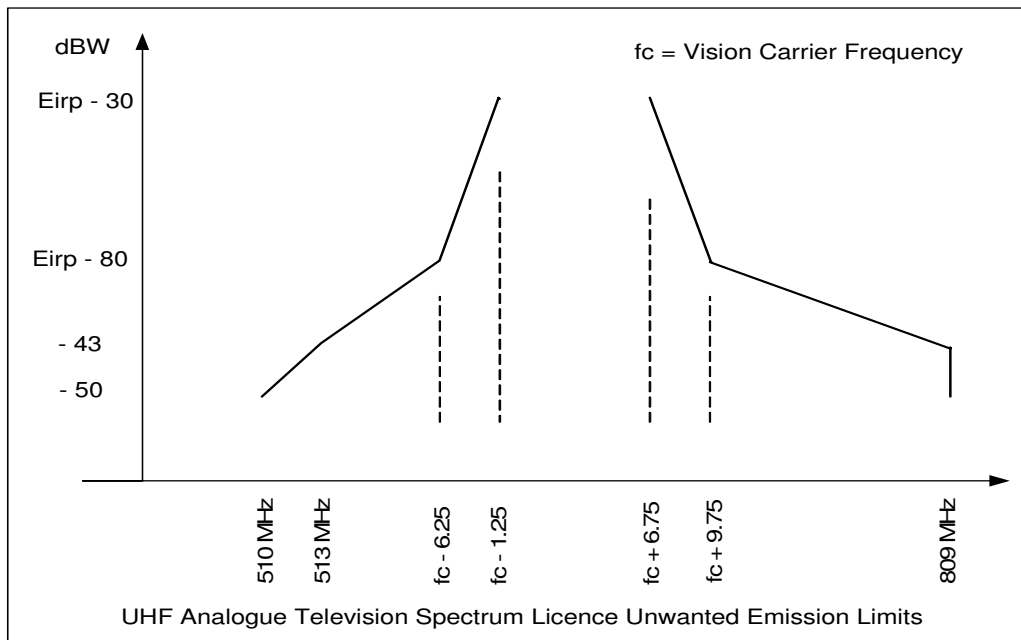
UHF Analogue Television Unwanted Emission Limits and Associated AFELs

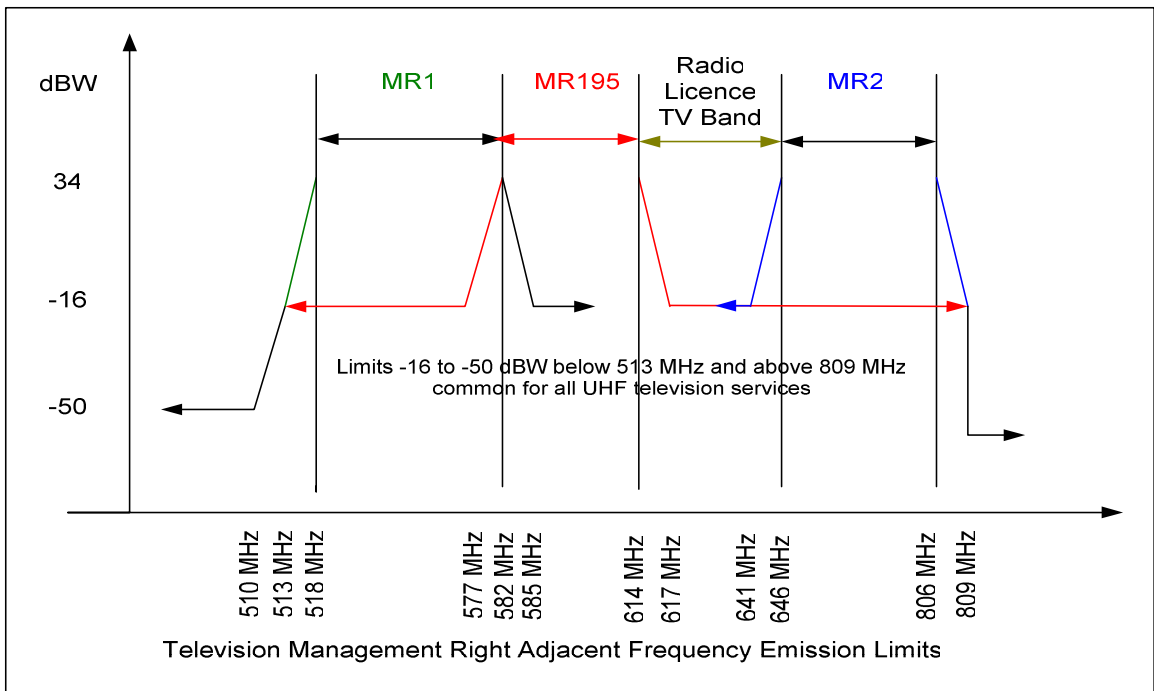
The UELs and AFELs for UHF analogue television spectrum licences are as identified in the table and graphical representations below.

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)
fc – 6.25 MHz	eirp – 80 dBW (if level > -43 dBW)
fc – 1.25 MHz	eirp – 30 dBW (if level > -43 dBW)
fc + 6.75 MHz	eirp – 30 dBW (if level > -43 dBW)
fc + 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 fc – 6.25 is not applicable.



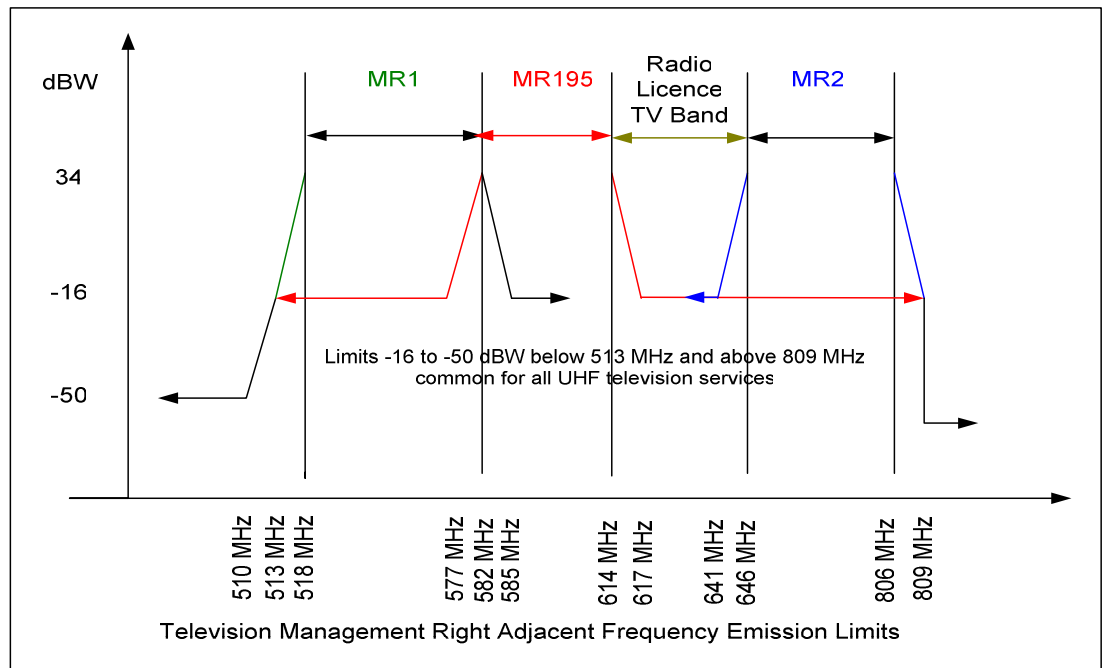
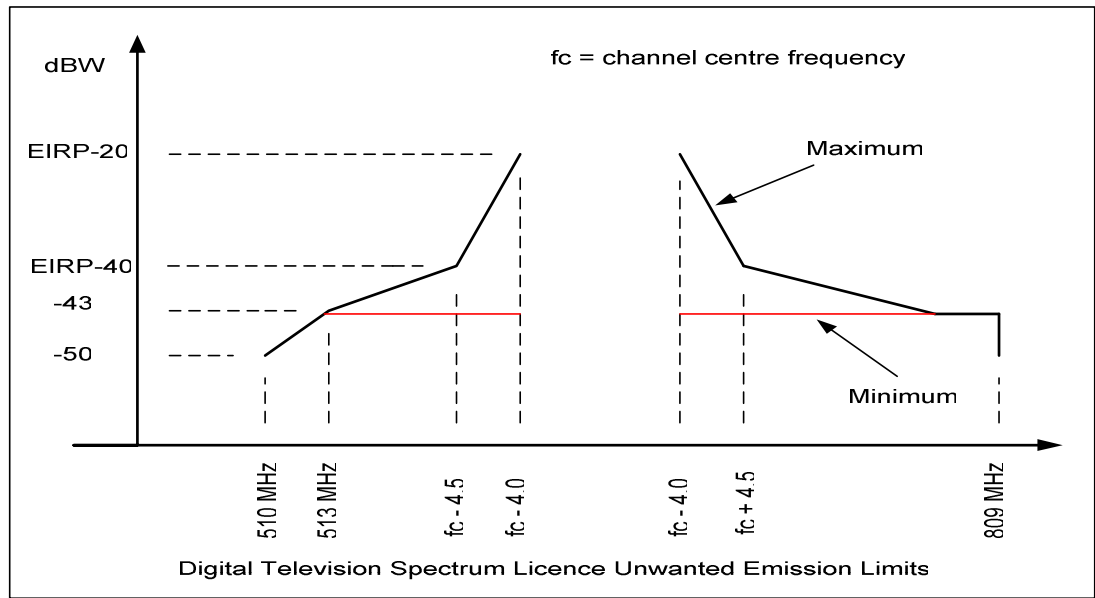


UHF Digital Television Unwanted Emission Limits and Associated AFELs

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



Appendix 5 Standard Spectrum Licence Conditions

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 rightholder 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:

- This spectrum licence is constrained by and subject to international agreements on medium frequency (MF) broadcasting, in particular the Final Acts of the Regional Agreement on LF/MF Broadcasting, Geneva 1975, including any revision, amendment or agreement in substitution for such Final Acts.
- Maximum permitted interfering signals shall be measured at a height of 2 metres above ground level.
- The maximum permitted interfering signal or signals that apply to the protection location or locations or protection area are conditions on the exercise of the right to have no harmful interference from co-channel emissions on the frequencies that apply to this licence in accordance with section 49(1)(j) of the Radiocommunications Act 1989.
- A protection location that is identified as having the same grid reference as the transmit location is to be used solely for assessing the likelihood of harmful interference resulting from sky-wave propagation. The levels are calculated in accordance with the Final Acts of the Regional Administrative Conference (Regions 1 and 3), Geneva, 1975 and Recommendation ITU-R BS.560-4 which specifies a ratio of 30 dB and 9 dB for frequency differences of 0 kHz and 9 kHz respectively.
- Measurements to determine whether harmful interference is being created as a result of sky-wave propagation may be taken at any location within a 2 kilometre radius of the transmit location. Identification of a suitable measurement location will depend upon the proximity of antenna structures, earth mat radials, buildings, trees or any other thing that may unduly affect the measurement results. Additionally, identification of a suitable measurement site should take into account other issues that may affect measurement results such as proximity to sea water.
- A protection location that is identified as having a grid reference that is not that same as the transmit location is to be used solely for assessing the likelihood of harmful interference resulting from ground wave propagation. The levels are calculated using the wanted signal level and Recommendation ITU-R BS.560-4 which specifies a ratio of 30 dB and 9 dB for frequency differences of 0 kHz and 9 kHz respectively between wanted and unwanted signals.

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 0600-2400 hours daily.
- This licence is for daytime hours of operation only. The hours defining daytime/night-time will be in accordance with figure 20, Chapter 3 (Annex 2) of the Final Acts of the Regional Administrative LF/MF Broadcasting Conference (Regions 1 and 3), Geneva 1975.
- During night-time hours, the maximum EIRP will be restricted to [39.0] dBW. The hours defining daytime/night-time operation will be in accordance with Chapter 3 (Annex 2) of the Final Acts of the Regional Administrative LF/MF Broadcasting Conference (Regions 1 and 3), Geneva 1975.

- This licence is provided for service evaluation and shall cease operation when required by the Ministry.

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

- Maximum permitted interfering signals shall be measured at a height of 10 metres above ground level.
- The maximum permitted interfering signal or signals that apply to the protection location or locations or protection area are conditions on the exercise of the right to have no harmful interference from co-channel emissions on the frequencies that apply to this licence in accordance with section 49(1)(j) of the Radiocommunications Act 1989. The levels are calculated using the wanted signal level and Recommendation ITU-R BS.412-9 which specifies a ratio of 45 dB, 33 dB and 7 dB for frequency differences of 0 kHz, 100 kHz, and 200 kHz respectively between wanted and unwanted signals.
- The designation of emissions on this licence provides for the transmission of supplementary information for station and programme identification in FM broadcasting and other applications, using the radio-data system (RDS) as specified in Recommendation ITU-R BS. 643-2. Other digital emissions are not permitted.

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

- Conditions include: (1) A limit of maximum permitted field strength of 110dBuV/m measured at a height of 2 metres above ground level; (2) A maximum level of all unwanted emissions in the band 80.0 to 84.5MHz of -1dBuV/m, measured at a height of 2 metres above ground level and in a 10kHz bandwidth.
- 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:

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