Australian Government
Australian Communications and Media Authority

Frequency assignment requirements for the point-to-multipoint service in the VHF high, 400 MHz and 800 MHz bands

RALI: FX 16

DATE OF EFFECT: 25 MARCH 2025

Amendment history

Date	Comments
November 1999	Initial release.
October 2003	Tables B1 and B2 amended to add missing channels.
September 2012	Amendments to align with 400 MHz changes.
January 2015	Updated to include additional spectrum for PMP two-frequency services, as per the update to MS22.
May 2016	Consultation draft for update to introduce a low power service model for use in the 400 MHz frequency band.
February 2018	Inclusion of the new PMP segment in the 800 MHz band
December 2019	Addition of 50 kHz channels and the VHF High band
July 2020	Remove legacy 800/900MHz bands. See IFC 12/2020.
17 May 2024	Update to include additional criteria and guidance for coordination with spectrum licensed services.
25 March 2025	Updates to align with the remade Radiocommunications Licence Conditions (Fixed Licence) Determination 2025, including clarification around managing potential interference from remote and remote-control stations in Section 3.1.

Suggestions for improvements to Radiocommunications Assignment and Licensing Instruction FX 16 may be addressed to:

The Manager, Spectrum Planning Section
Australian Communications and Media Authority
PO Box 78
Belconnen ACT 2616

or by email to: freqplan@acma.gov.au.

Please notify the ACMA of any inaccuracy or ambiguity found in this RALI, so that it can be investigated and appropriate action taken.

Contents

1 Introduction

1.1 Purpose

The purpose of this Radiocommunications Assignment and Licensing Instruction (RALI) is to provide information on frequency coordination and licensing arrangements for two frequency fixed point-to-multipoint (PMP) services operating in the VHF High, 400 MHz and 800 MHz bands.

The information in this document reflects the ACMA's statement of current policy in relation to frequency assignment requirements for PMP services in the VHF High, 400 MHz and 800 MHz bands. In making decisions, accredited frequency assigners and the ACMA's officers should take all relevant factors into account and decide each case on its merits.

Issues relating to this document that appear to fall outside the enunciated policy should be referred to:

The Manager, Spectrum Planning Section
Australian Communications and Media Authority
PO Box 78
Belconnen ACT 2616

or by email to: freqplan@acma.gov.au.

2 Service description

A two frequency PMP system consists of a single central master station communicating with a number of outlying remote fixed stations. The use of PMP services is usually for data transmission; typical applications include telemetry, supervisory control and data acquisition (SCADA) systems, computer networking and alarm systems.

The master station (also referred to as a base station)[1] may also be wired as a repeater, with outlying remote-control stations (RCSs) operating in the remote frequency configuration and communicating with remote stations via the master station.

If necessary, supplementary stations[2] may be used to improve coverage within the service area. The master station may be linked to a supplementary station via a remote station configured as a repeater or by a separate fixed link.

From an interference management perspective, a PMP system is characterised by:

- a central master station usually at a high site
- a number of remote stations - distributed randomly throughout the service area
- one or more RCSs that control the master station
- no direct communication between remote stations
- full duplex (two frequency working) or half duplex (single frequency working) operation
- data throughput in the range 1.2kbps or greater.

[1] In the *Radiocommunications Licence Conditions (Fixed Licence) Determination 2025* (the Fixed licence LCD 2025), a ‘master station’ is referred to as a ‘base station’ and a ‘supplementary station is referred to as a ‘supplementary base station’ and these terms can be used interchangeably for PMP systems covered by this RALI.

[2] In the Fixed licence LCD 2025, a ‘supplementary station is referred to as a ‘supplementary base station’, and these terms can be used interchangeably for PMP systems covered by the RALI.

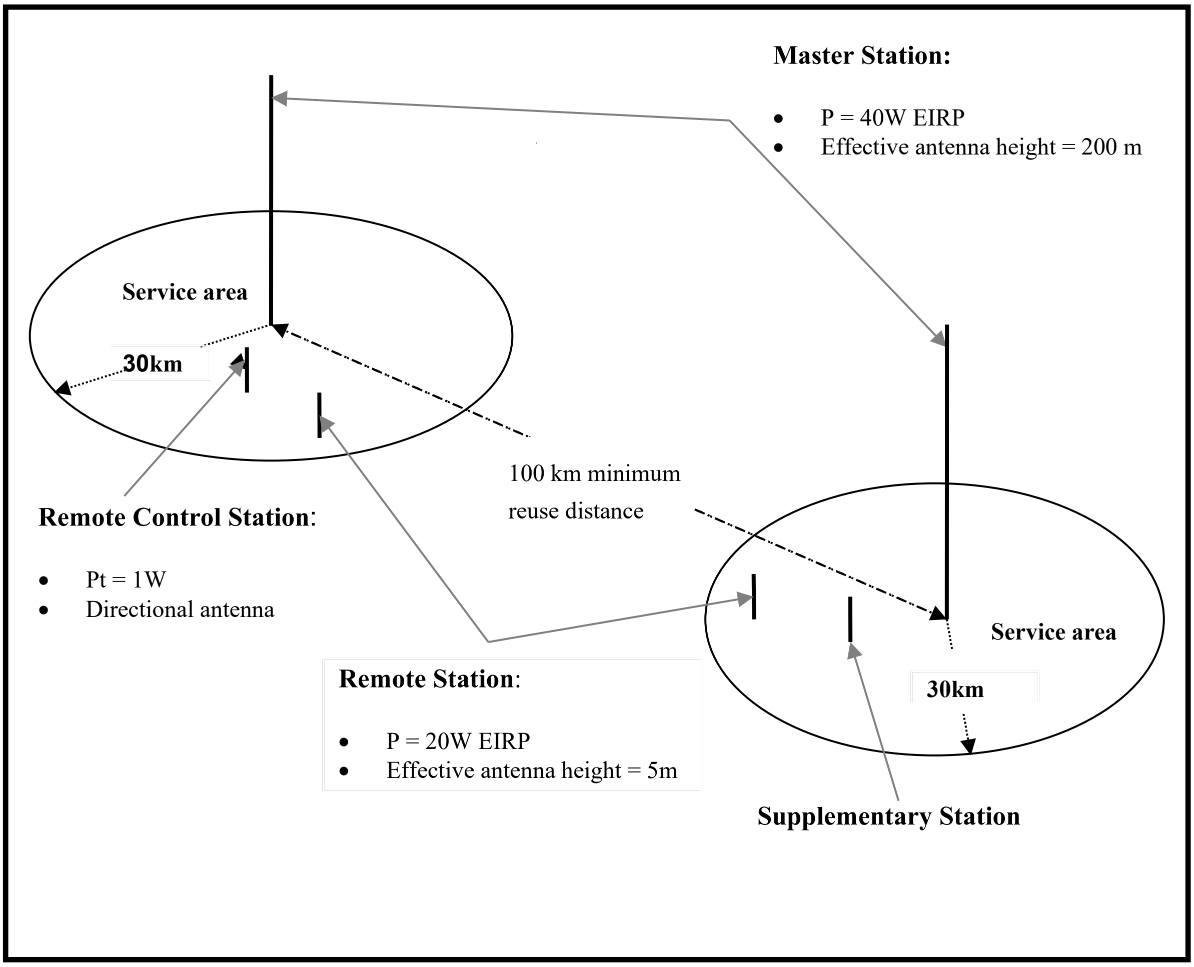
3 Service models

The purpose of the service model is to define a set of characteristics for PMP services that will result in a specified (“target”) grade of service. There are two service models defined; one for large area coverage applications (High Power Service Model) and the other for small area coverage applications in the VHF High and 400 MHz bands (Low Power Service Model).

The target grade of service (TGS) is defined as a 10 dB signal to noise ratio (SNR) at the receiver input for an output bit error rate (BER) of 10^{-3}. The service model is designed to achieve the TGS for receivers at 90% of locations within the service area.

3.1 High power service model description

Figure 1: High power PMP service model



Key features of the service model are:

- Transmitter power requirements:
  - the maximum station EIRP (considering transmitter power, cable loss, antenna gain) for master stations shall be 40 W;
  - the maximum station EIRP (considering transmitter power, cable loss, antenna gain) for remote and supplementary stations shall be 20 W.
- Minimum antenna performance characteristics for an RCS:
  - in the VHF High Band: directional antenna with a mid-band gain of 6 dBi, minimum front-to-back ratio of 12 dB and a maximum beam width (in E-plane) of 75° (e.g. a 3 element Yagi);
  - in the 400 MHz band: directional antenna with a mid-band gain of 13 dBi, minimum front-to-back ratio of 16 dB and a maximum beam width (in E-plane) of 47° (e.g. a 9 element Yagi);
  - in the 800 MHz band: directional antenna with a mid-band gain of 16 dBi, minimum front-to-back ratio of 17 dB and a maximum beam width (in E-plane) of 30° (e.g. a 15 element Yagi).
- For a master station the antenna shall be a vertically polarised antenna with a maximum gain of 8.2 dBi. Use of a directional antenna is permitted (maximum gain 8.2 dBi).
- For a remote station use of directional antennas is encouraged but not mandatory, e.g. typical antennas used:
  - in the VHF High Band: directional antenna with a mid-band gain of 6 dBi, minimum front-to-back ratio of 12 dB and a maximum beam width (in E-plane) of 75° (e.g. a 3 element Yagi);
  - in the 400 MHz band directional antenna with a mid-band gain of 13 dBi, minimum front-to-back ratio of 16 dB and a maximum beam width (in E-plane) of 47° (e.g. a 9 element Yagi);
  - in the 800 MHz band: directional antenna with a mid-band gain of 16 dBi, minimum front-to-back ratio of 17 dB and a maximum beam width (in E-plane) of 30° (e.g. a 15 element Yagi).
- In all bands radiated power 180 degrees from the direction of the remote station to the base shall not exceed 5 Watts, i.e. if an omnidirectional antenna is used on a remote, the EIRP shall not exceed 5 Watts.
- Remote stations transmitting on frequencies in the bands 451.5–452.5 MHz or 805.5–806 MHz are limited to a maximum transmitter output power at the input of the antenna of 5 W and in all other bands to a maximum transmitter power of 1 W, by the requirements of the *Radiocommunications Licence Conditions (Fixed Licence) Determination 2025* (the Fixed licence LCD 2025)[3].
- Typical master station effective antenna height of 200 m above surrounding terrain.
- Typical remote station effective antenna height of 5 m above surrounding terrain.
- In general, remote stations and RCSs have a low risk of causing interference when operating in accordance with this RALI, however licensees should use their judgement to assess if particular deployments have a higher potential to cause interference, such as deployments in areas having a relatively high concentration of transmitters and receivers.

[3] https://www.legislation.gov.au/Details/F2018C00890

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In these situations, licensees should consider taking additional measures to minimise their potential for causing intermodulation interference, such as:

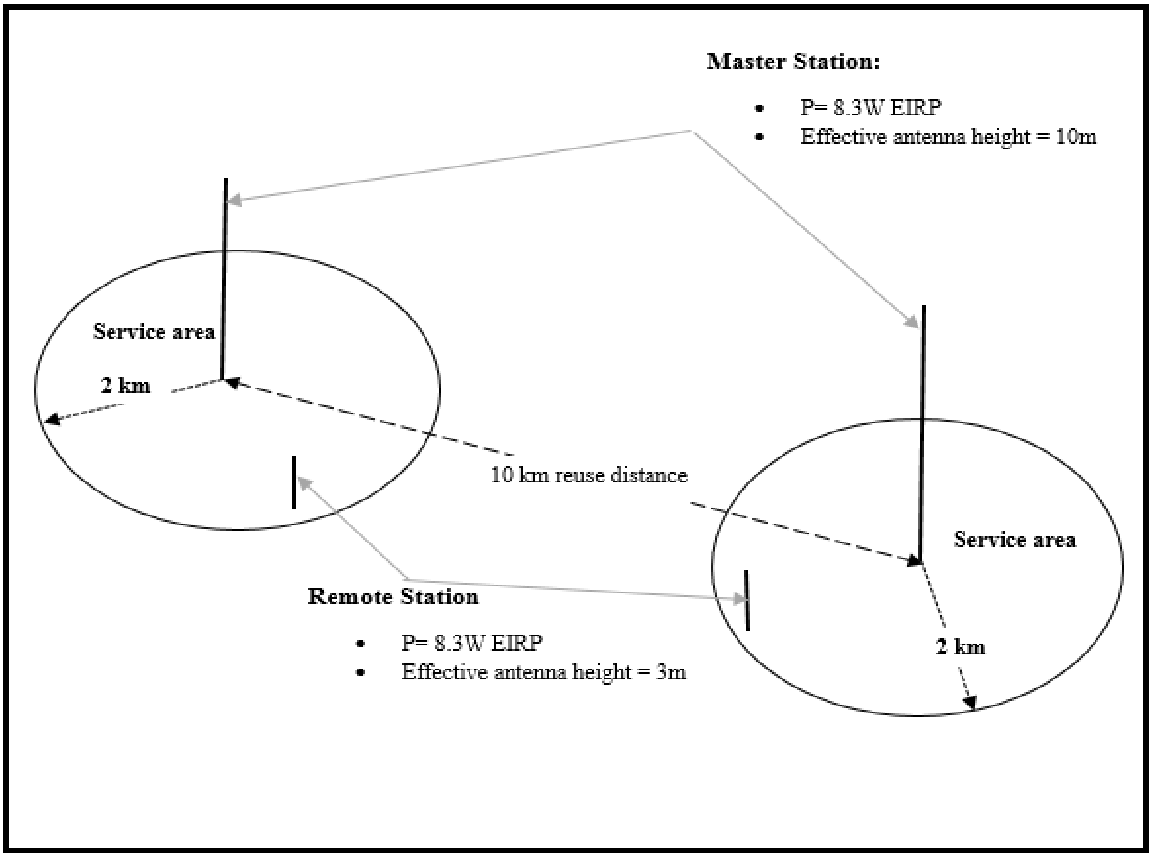
- Installation of devices (such as an in line attenuator or isolator) between the transmitter output and the antenna;
- Operating at a lower effective antenna height (e.g. below 30 m).

In the event that interference from remote stations or RCSs occurs, the Fixed licence LCD 2025 contains a condition that those transmitters must not be operated if they cause harmful interference.

- Unwanted emission limits for transmitters are mandated in Annex A.
- Frequency coordination is performed for the master station only (interference protection for remote stations, supplementary stations and RCSs is intrinsic to the service model).
- A service area radius of 30 km. All stations must be contained within the service area.
- A co-channel minimum re-use distance of 100 km between master stations.
- Supplementary stations have no re-use distance requirements, they are included to improve the service reliability within, but not outside, the service area.
- In the VHF High and 400 MHz bands, maximum necessary bandwidths of 12.5, 25 or 50 kHz may be used. In the 800 MHz band maximum necessary bandwidths of 12.5 and 25 kHz may be used.

3.2 Low power service model description

Figure 2: Low power PMP service model



Key features of the service model are:

- Transmitter power requirements:
  - the maximum station EIRP (considering transmitter power, cable loss, antenna gain) for master stations shall be 8.3 W;
  - the maximum station EIRP (considering transmitter power, cable loss, antenna gain) for remote stations shall be 8.3 W.
- While a maximum antenna gain is not specified for a master station, coordination requirements have been based on an assumption of a vertically polarised antenna with a maximum gain of 8.2 dBi. Use of higher gain antenna might result in interference levels at the master station receiver greater than those assumed in the planning modelled. No protection from interference is provided in such situations. Use of a directional antenna is permitted.
- For a remote station use of directional antennas is encouraged but not mandatory, e.g. typical antenna used:
  - a directional antenna with a mid-band gain of 13 dBi, minimum front-to-back ratio of 16 dB and a maximum beam width (in E-plane) of 47° (e.g. a 9 element Yagi);
- Typical master station effective antenna height of 10 m above surrounding terrain.
- Typical remote station antenna height of 3 m above surrounding terrain.
- The reuse distance specified for the low power service is based on the maximum EIRP for the remote station (equivalent to the use of an omni directional antenna), and as such there is no need to place an additional restriction on the radiated power 180 degrees from the direction of the master station.
- Low power services typically do not use remote control stations because of the small service area, however, should they be required, they must comply with the parameters specified for remote stations.
- Unwanted emission limits for transmitters are mandated in Annex A.
- Frequency coordination is performed for the master station only (interference protection for remote stations, and RCSs is intrinsic to the service model).
- A service area radius of 2 km. All stations must be contained within the service area.
- A co-channel minimum re-use distance of 10 km between master stations.
- In the VHF High and 400 MHz bands, maximum necessary bandwidths of 12.5, 25 or 50 kHz may be used.

4 Frequency assignment policy

To successfully manage interference, all PMP stations (master, remote, RCS) are expected to comply with the technical constraints in this RALI.

Frequency assignment must take into consideration both inter-service and intra-service requirements consistent with the assignment philosophy promulgated in RALI MS 42, RALI MS 22, RALI MS 40 and RALI MS 41 (where applicable).

Inter-service coordination of PMP services with other radiocommunications services is not addressed in this document, with the exception of spectrum-licensed services as detailed in section 5.6. This may be addressed, in some cases, by ITU-R Recommendations. However, because of the diversity and complexity of sharing situations which may arise, it is not possible to provide rigorous and explicit procedures covering all inter-service coordination requirements. In these cases, coordination should be performed in accordance with good engineering practice based on fundamental interference mitigation principles.

Intra-service requirements form an essential element of the service model upon which frequency assignment requirements are based. They are detailed in the following paragraphs. The intra service frequency coordination procedure is also part of this policy framework and is outlined in section 5 of this RALI.

4.1 Spectrum and channelling arrangements

All bands available for two frequency PMP data services are based on 12.5 kHz channelling arrangements.

Use of 25 kHz bandwidth, by assignment of two contiguous 12.5 kHz channels, is permitted in the VHF High Band and the 400 MHz Band provided that a data rate of at least 9.6 kbps is used. When contiguous channels are combined the lowest channel shall be an odd numbered channel (e.g. 39-40). In locations where the service area is contained entirely within Low Density and Remote Density geographic areas[4] the data rate requirement does not need to be applied.

Use of 50 kHz bandwidth, by assignment of four contiguous 12.5 kHz channels, is permitted in the VHF High Band and the 400 MHz band where the service area is contained entirely within Low Density and Remote Density geographic areas. The aggregation scheme shall be channels 1-4, 5-8 etc.

[4] As defined in the ACMA's Apparatus Licence Fee Schedule.

The bands of operation, as specified in the relevant ACMA plans[5], are:

Table 1: PMP bands of operation

	Master transmit	Master receive
1.	150.05 – 151.39375 MHz	154.65625 – 156 MHz
2.	461.0125 - 462.0 MHz	451.5125 - 452.5 MHz
3.	850.5 – 851 MHz	805.5 – 806 MHz

Detailed channelling arrangements are given in the appropriate RALIs.

For use of Land Mobile frequencies for PMP services refer section 5.4 of this RALI.

4.2 Assignment strategy

The assignment strategy for dedicated PMP segments shall be as follows:

- assign the highest available channel
- this channel is assigned until it is fully loaded
- once a channel is fully loaded, the next highest available channel is assigned.

This strategy optimises the protection of services in the lower adjacent spectrum.

When PMP services are assigned in 400 MHz land mobile segments, the assignment process shall be as prescribed in RALI LM8.

4.3 Supplementary transmitters

A supplementary station is a transmitter intended to improve the service reliability within the 30 km service area of the master station. It operates on the same frequency sense as the master station and does not require frequency/distance coordination, however it is recommended that checks to identify and mitigate against intermodulation issues should be carried out. A supplementary station must not cause interference to other radiocommunications services, and no additional level of protection from interference to a related receiver (above that offered intrinsically to a remote station) is provided.

Note that a transmitter that extends coverage beyond a 30 km radius of the master station is not a supplementary transmitter; it is another master station and must be separately licensed and coordinated in the same manner as any other master station.

Note that for the low power service model supplementary transmitters are not included due to the smaller service area radius.

Power and height constraints applying to supplementary stations are as follows:

[5] The “400 MHz Plan” - RALI MS 22, the “800 MHz Band Plan” – RALI MS41, and the “900 MHz Band Plan” – RALI MS 41.

Table 2: Height constraints

Distance from master:	Max. EIRP	Effective antenna height
< 10 km	20 W	100 m
< 20 km	10 W	25 m
< 30 km	5 W	5 m

5 Frequency coordination procedure

Frequency coordination is performed only for master stations; interference protection for remote stations, supplementary stations and RCSs is intrinsic to the service model described in section 3 of this RALI.

The following section details the coordination procedure that may be applied for frequency assignment of PMP master stations.

Alternative frequency coordination procedures may be used provided they produce equivalent results, that is, the target grade of service is achieved at 90% of locations within the service area (refer to section 3 of this RALI). Accredited frequency assigners may be required to demonstrate that an alternative methodology is suitable.

5.1 Site selection

Initial site selection is likely to be based on the client's needs but may need to be altered dependent on the outcome of the frequency selection process outlined below.

5.2 Frequency selection

Perform a cull (i.e. produce a list) of existing systems which due to their frequency and distance separation from the proposed system have the potential to cause or receive interference through co-channel emissions and unwanted emissions (including transmitter broadband noise). The minimum radii and frequency ranges for this cull are:

Table 3: Cull parameters

Band of operation	Cull radius	Tx	Rx
VHF High Band	140 km	±100 kHz	±100 kHz
400 MHz Band	120 km	±100 kHz	±100 kHz
800 MHz Band	100 km	±25 kHz	±25 kHz

The appropriate table in Annex C of RALI LM8 shall be used to establish frequency-distance relationships for PMP master stations in the 400 MHz band. For the purposes of selecting the appropriate table a high power PMP is considered to be equivalent to a LMRS and a low power PMP is considered to be equivalent to a LPMRS.

For the 800 MHz band, channels are deemed not available if another master station of a PMP system has been assigned with any part of its channel within the proposed channel and is located within 100 km (the re-use distance) of the proposed site. For example, if operation of a 25 kHz system is sought on channels 1 and 2, and there is an existing 12.5 kHz assignment on channel 1 then the re-use distance is 100 km.

Of the remaining channels available, the channel with the highest centre frequency should then be selected, in accordance with the vertical loading principle outlined in section 4.2 of this RALI. Note that this will involve selection of a pair of frequencies (master transmit and master receive).

5.3 Intermodulation checks

5.3.1 Introduction

Intermodulation checks are performed for two-signal 3rd order and two-signal 5th order intermodulation, for high power PMP systems only. Typically, only existing LMS and PMP services need to be considered – although sound engineering judgement should be used to determine if other existing service types should also be considered in specific circumstances.

Transmitter intermodulation

The proposed transmitter must be evaluated for the potential for its emissions to mix with emissions from other transmitters at the site, to produce 3rd or 5th order intermodulation products that have the potential to cause interference to the proposed or existing receivers.

Mixing of transmitter emissions can occur in passive components (e.g. site hardware such as couplers, isolators or mechanical/structural joints) as well as in non-linear transmitter output stages, and can result in intermodulation products that are co-channel with the proposed or existing receivers. As the characteristics of the components in which the mixing occurs cannot be known under these circumstances, the criterion for harmful interference caused by transmitter intermodulation is simply the occurrence of a 'hit' between co-sited systems, unless other evidence can be cited to demonstrate that the intermodulation interference is acceptable or is unlikely to cause interference.

Receiver intermodulation

The proposed receiver, and existing receivers within specified frequency ranges and distances of the proposed system, must also be evaluated for their potential to receive interference due to intermodulation products caused by the mixing of transmitter emissions in proposed and existing receivers.

Intermodulation products can be generated in the **rf** input stages of receivers if sufficient signal power is applied to drive a stage into a non-linear condition. Because of this input level dependency, the 'quality' of a hit can be quantified and either noted as having the potential to cause harmful interference or discarded because it does not have a sufficient level to cause harmful interference.

5.3.2 Cull for intermodulation checks

Perform a cull of existing systems for which the potential for intermodulation interference must be considered. The cull identifies all such systems within defined frequency and distance limits from the proposed system. The radius and frequency range for each required cull is specified in Annex B, Table B1, of this RALI.

5.3.3 Performance of intermodulation checks

Perform checks for intermodulation interference between the selected assignment frequency (both transmit and receive, if they are different) and existing systems yielded by the cull, in the manner described below.

Transmitter intermodulation

If the operating frequencies of any two co-sited transmitters (including the proposed transmitter) are contained in the relevant frequency range (see Annex B Table B1), and can be algebraically combined in the form shown in Table 4 to produce a 3rd or 5th order intermodulation product within the 'hit' range of a co-sited receiver (as defined in Annex B, Table B2, of this RALI) the proposed frequency should not be assigned, unless other evidence can be cited to demonstrate that the level of intermodulation interference is acceptable.

Table 4: Algebraic expressions for 3rd and 5th order intermodulation product frequencies

Frequencies of 3rd order products*	Frequencies of 5th order products*
$2f_1 - f_2$	$3f_1 - 2f_2$
$2f_2 - f_1$	$3f_2 - 2f_1$

* f_1 = centre frequency of first co-sited transmitter
f_2 = centre frequency of second co-sited transmitter

Receiver intermodulation

All systems falling within the cull limits specified in Annex B, Table B1, of this RALI are first evaluated for the occurrence of 3rd and 5th order intermodulation product 'hits' as per Table 4. A 'hit' is deemed to occur when an intermodulation product falls within the frequency ranges from a receiver specified in Annex B, Table B2, of this RALI.

Once the existence of a 'hit' has been confirmed, mathematical expressions (1) and (2) shown at Annex B3 of this RALI are evaluated to determine whether unacceptable interference would be caused due to receiver intermodulation by assignment of the proposed frequency.

When equations (1) and (2) at Annex B3 of this RALI are satisfied, the level of intermodulation interference is permissible; conversely, when the equations are not satisfied the level of interference is considered harmful, and the proposed frequency should not be assigned, unless other evidence can be cited to demonstrate that the level of intermodulation interference is acceptable.

If either receiver or transmitter intermodulation checks fail against the selected frequency, select the frequency that passed the frequency-distance constraints by the next greatest margin and perform intermodulation checks on that frequency.

Continue to perform intermodulation checks on frequencies passing the frequency-distance constraints until an acceptable frequency is found.

In cases where the prospective licensee of the new assignment is also the only victim of any harmful intermodulation products, the licensee may elect to accept any interference and proceed with the assignment.

5.4 Use of land mobile frequencies for PMP services

Under section 2.1 of RALI MS 22, a PMP service is limited to segments allocated to the fixed service (point-to-multipoint) and the upper 1.5 MHz of segments NN/SS. Segments allocated for the land mobile service may only be used for PMP services if assignments cannot be accommodated in the above-mentioned segments. Segments allocated exclusively for the land mobile service (trunked) are not to be used for the point-to-multipoint service.

Exceptions to this policy may be sought for existing two-frequency systems wishing to expand in segments other than those allocated to for PMP services, or the 1.5 MHz of segments NN/SS specified above.

For the purpose of frequency assigning of such PMP services, the principles and coordination procedure provided in RALI LM8 shall be used, except that the EIRP (Master Station and Supplementary) and antenna requirements of this RALI must be adhered to. The service area radius of a PMP system assigned in frequencies allocated for the land mobile service is 30 km for a high power system and 2 km for low power system.

The practical implementation of these out-of-band PMP services will be the same as in-band services. They will be issued with PMP licences, and still have a service model identical to the PMP service models outlined in section 3 of this RALI (i.e. the antenna and power requirements of this RALI still apply).

The procedure detailed in RALI LM8 shall be applied for avoidance of intra-service intermodulation issues. Also perform inter-service checks (including intermodulation) in accordance with the approach outlined in section 4 for harmful interference between the selected frequency (both transmit and receive) and existing radiocommunications systems. If the checks fail, select another frequency as outlined above until a suitable frequency is found.

5.5 Local environment

There may be circumstances where the channel selected using the above-mentioned procedure is not the optimal channel to be assigned due to the local environment. Examples are: a large mountain range offering additional propagation loss to/from a service in an adjacent area; a transmitter located on a site at a height much greater than the planning model assumes; or an anomalous propagation mode occurring due to a path over water.

Under such circumstances, modified frequency/distance constraints may be applied if interference to adjacent services is maintained to levels prescribed in the service model, and that service areas do not overlap[6] (e.g. 60 km separation is maintained). Remote stations in at least 90% of the area of any adjacent cells using the same frequency shall be protected to a level of -120.5 dBm on channel.

Propagation path loss may be determined using any appropriate method described in section 4 of ITU-R P.526 (versions 4 through 14). All methods must use computer modelling software utilising a 9 second digital elevation model (such as RadDEM) or better. Other methods for determining the propagation path loss may also be used pending ACMA agreement.

5.6 Coordination with spectrum licensed services

The 800 MHz PMP band is in close frequency proximity to spectrum-licensed services.

The '*Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters – 700 MHz Band) 2023*', and '*Radiocommunications Advisory Guidelines (Managing Interference from Spectrum Licensed Transmitters – 850/900 MHz*

[6] The distance will depend on the power of the systems and whether both are PMP systems or one is a land mobile service (LMS). The coverage area of a high power LMS is 40 km.

Bands) 2021' set out protection requirements for services operating frequency adjacent to spectrum licensed transmitters. In summary, these protection requirements are:

- protection of PMP radiocommunications receivers from spectrum licensed radiocommunications transmitters is on a first-in-time basis.
- any existing PMP master-station receiver licensed prior to the registration of a spectrum licensed transmitter in the Register[7] is to be provided protection to the ratio specified in this RALI. Initial assessments can be made using the applicable protection ratio and sensitivity level by considering the unwanted emissions from a spectrum licensed transmitter that fall within the passband of the receiver. Applicable protection ratios and sensitivity levels are:
    - for coordination between 700 MHz spectrum licensed transmitters and PMP receivers licensed after 17 May 2024: a receiver sensitivity of -111 dBm and a 12 dB protection ratio[8]
    - in all other cases: a usable sensitivity of -119 dBm with a 10 dB protection ratio (also see Table B3).

Where the device registration for an existing spectrum licensed transmitter has been modified, the transmitter does not need to be re-coordinated with an existing receiver if the interference potential for that receiver has not been increased. For example, if the transmitting antenna has been modified but the EIRP in the direction of the receiver is the same or less than radiated by the old antenna, then coordination would not be required.

In some scenarios, an apparatus licensee may choose to accept a higher level of interference. In these scenarios, the below special condition is to be included on their licence to ensure that existing licensees are not negatively impacted. For example, if future modifications are made to an existing spectrum licensed transmitter, from which the apparatus licensee has accepted a higher level of interference, the spectrum licensee will only need to re-coordinate to the level accepted by the apparatus licensee (not to the level in RALI FX16).

Special condition
'The licensee agrees to accept a level of interference which is [xx] dB higher than the level provided by RALI FX16, with respect to a transmitter operated under device registration number(s) [yyyyyy].' [where 'xx' is the amount in which the receiver fails the coordination criteria in RALI FX16]

Unless otherwise stated, spectrum-licensed transmitters that are exempt from registration are not required to be coordinated with PMP services. Although these transmitters have a low risk of causing interference, spectrum licensees should use judgement to identify cases where this risk might be higher than normal, e.g., for operation of high-sited stations. In the event that interference from unregistered spectrum licensed transmitters occurs, the 850/900 MHz spectrum licence contains a condition that registration exempt transmitters must not cause harmful interference to other radiocommunications devices operated under a different spectrum licence or apparatus licence.[9]

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[7] Register has the same meaning as in the *Radiocommunications Act 1992*.

[8] This relaxed criteria is based on receiver performance requirements in ETSI EN 302 561 V2.1.1 (2016-03) and is intended to enhance coexistence between PMP and 700 MHz spectrum licensed services.

[9] Radiocommunications Spectrum Marketing Plan (850/900 MHz Band) 2021.

Out-of-band protection requirements for interference from PMP services operating in bands adjacent to spectrum-licensed services are set out in the '*Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers – 700 MHz band) 2023*', and '*Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers – 850/900 MHz Bands) 2021'*.

Coordination of proposed PMP transmitters with spectrum licensed receivers operating in the 703–748 MHz range or above 890 MHz is not required, as the frequency separation is considered sufficient to enable coexistence.

5.6.1 Additional guidance for coordination with 700 MHz spectrum licensed base transmitters

The 805.5-806 MHz PMP master-receive segment is 2.5 MHz separated from the upper frequency limit of the 700 MHz spectrum licensed segment which is optimised for the deployment of base station transmitters. For cases where an initial coordination assessment fails, the accredited person and/or licensee may wish to undertake a more detailed assessment and/or negotiation to achieve a satisfactory outcome. This may include:

- coordination using actual unwanted emission levels from the spectrum licensed transmitter, which are likely to be less than the maximum limits specified on the licence.
- consideration of additional filtering on the spectrum-licensed transmitter to further reduce unwanted emission levels. This may be particularly relevant when a proposed spectrum-licensed transmitter is attempting to coordinate with an existing apparatus licensed receiver.
- use of actual antenna patterns, accounting the for effects of orientation and tilt.
- undertaking on-site measurements to assess the actual level of interference coming from an existing spectrum-licensed transmitter which may be impacted by higher path losses than anticipated (e.g. resulting from terrain and/or local clutter).
- engagement with the affected apparatus licensee to ascertain whether they might accept a higher level of interference than the minimum level prescribed in this RALI. For example, where PMP remote stations will always be in close proximity to the master station. This may be particularly relevant when attempting to coordinate a proposed apparatus licensed PMP receiver with an existing spectrum licensed transmitter.

Discussion and negotiation between licensees is encouraged where appropriate and may be necessary to implement some of the above suggestions.

6 Exceptions

Exceptions to the requirements of this RALI for prospective assignments require case-by-case consideration by the Manager, Spectrum Planning Section.

A request for exemption from the requirements of this RALI would need to be accompanied by evidence to support the request.

All requests for exemptions should be submitted to freqplan@acma.gov.au.

7 RALI Authorisation

Approved 25 March 2025

Manager
Spectrum Planning Section
Spectrum Planning and Engineering Branch

Communications Infrastructure Division
Australian Communications and Media Authority

8 Bibliography

[1] SP 4/89: '*A Rationale for the Guidelines for the Assignment of Frequencies in the Two-Frequency Point-to-Multipoint Fixed Service using a minimum of 12.5 kHz Channelling in the 400 MHz and 900 MHz Bands* - Spectrum Planning Report No. SP 4/89, March 1990.

[2] SP 2/90: '*Assignment Guidelines for the Two Frequency Point-to-Multipoint Service in the 400 MHz and 900 MHz Bands',* Spectrum Planning Report No. SP 2/90, March 1990.

[3] ETSI EN 302 561 V2.1.1, Radio equipment using constant or non-constant envelope modulation operating in a channel bandwidth of 25 kHz, 50 kHz, 100 kHz or 150 kHz

Appendix A: Unwanted emission limits

A.1 12.5 kHz PMP systems

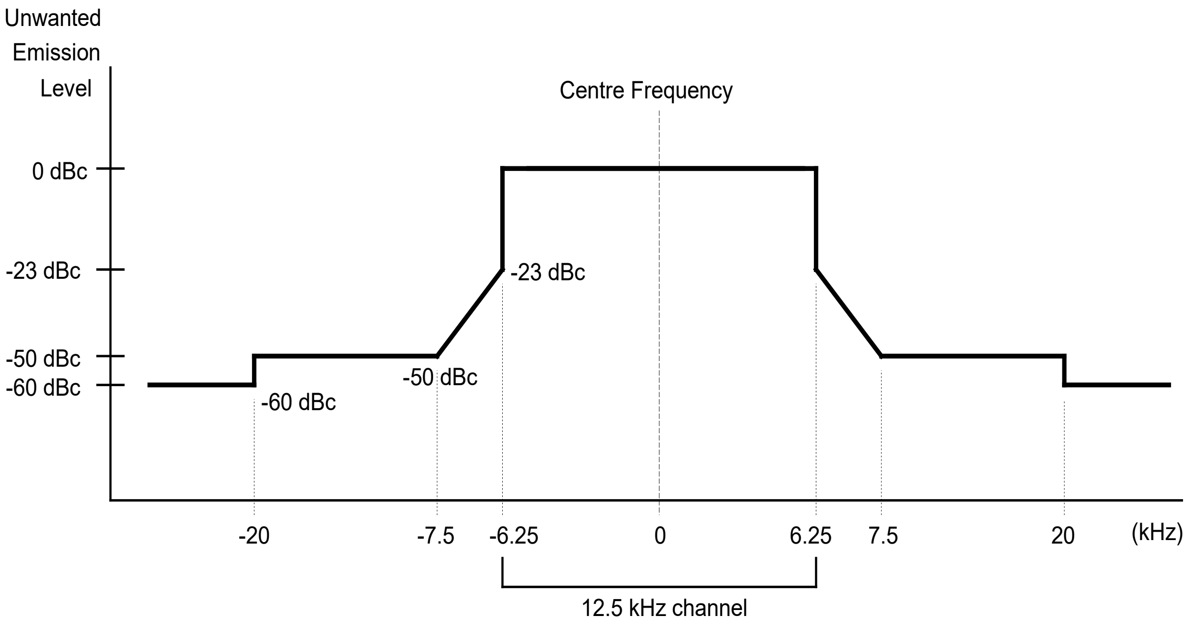
Unwanted emission limits for 12.5 kHz point to multipoint transmitters in the VHF High, 400 MHz and 800 MHz bands are as follows[10]:

- Over the temperature range 0°C to 60 °C, taking into consideration the transmitters frequency stability, the level of any unwanted emissions shall be attenuated below the unmodulated carrier power as follows:
  - On any frequency removed from the assigned frequency by more than 6.25 kHz and up to 7.5 kHz - at least 23 dB linear to 50 dB.
  - On any frequency removed from the assigned frequency by more than 7.5 kHz and up to 20 kHz - at least 50 dB.
  - On any frequency removed from the assigned frequency by more than 20 kHz - at least 60 dB.

These unwanted emission limits are shown graphically in Figure A1 below.

NOTE: For non-continuous envelope emissions, where there is no provision for unmodulated carrier power transmission and for TDMA services, the reference level shall be established from the RMS power level during the period of transmission.

Figure A1: Emission mask for 12.5 kHz PMP systems



[10] The limits beyond the +/-7.5 kHz frequency offsets apply to noise and modulation components summed in any 4 kHz bandwidth

A.2 25 kHz PMP systems

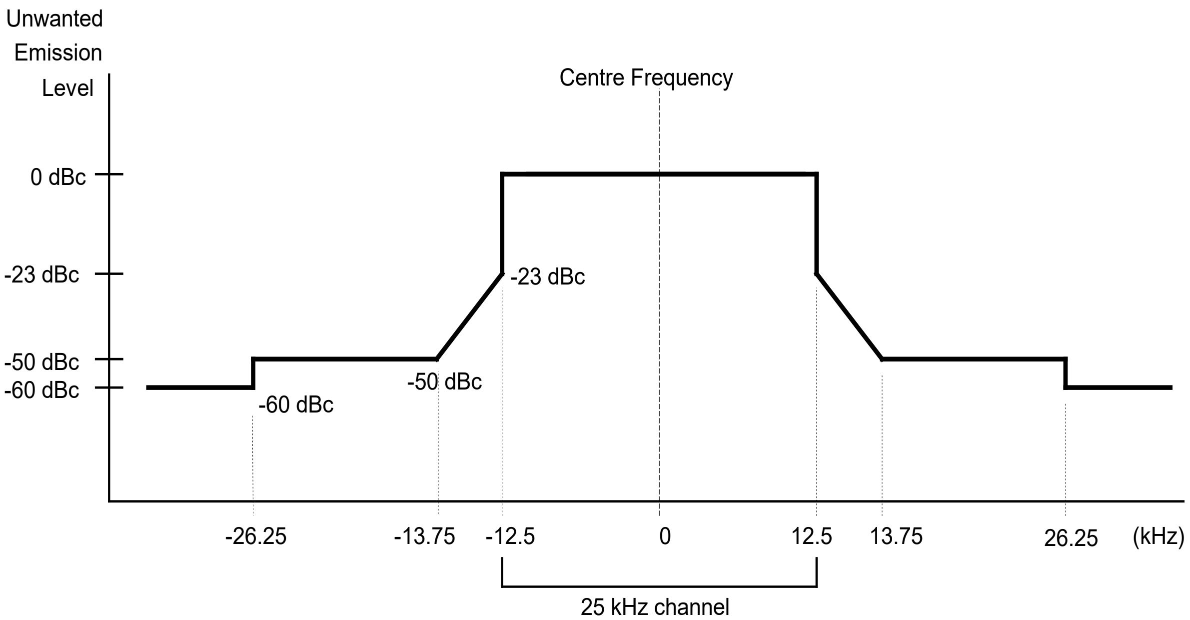
Unwanted emission limits for 25 kHz point to multipoint transmitters in the VHF High, 400 MHz and 800 MHz band are as follows[11]:

- Over the temperature range 0°C to 60°C, taking into consideration the transmitters frequency stability, the power of any unwanted emissions shall be attenuated below the unmodulated carrier power as follows:
  - On any frequency removed from the assigned frequency by more than 12.5 kHz and up to 13.75 kHz - at least 23 dB linear to 50 dB.
  - On any frequency removed from the assigned frequency by more than 13.75 kHz and up to 26.25 kHz - at least 50 dB.
  - On any frequency removed from the assigned frequency by more than 26.25 kHz - at least 60 dB.

These unwanted emission limits are shown graphically in Figure A2 below.

NOTE: For non-continuous envelope emissions, where there is no provision for unmodulated carrier power transmission and for TDMA services, the reference level shall be established from the RMS power level during the period of transmission.

Figure A2: Emission mask for 25 kHz PMP systems



A.3 50 kHz PMP systems

Unwanted emission limits for 50 kHz point-to-multipoint transmitters in the VHF High and 400 MHz bands are as specified in ETSI EN 302 561 V2.1.1 [3].

[11] The limits beyond the +/-13.75 kHz frequency offsets apply to noise and modulation components summed in any 4 kHz bandwidth

Appendix B: Intermodulation checks

Receiver and transmitter intermodulation checks are required to be performed for two-signal 3rd order and two-signal 5th order products. These intermodulation products have the potential to cause interference as a result of:

1. Emissions from two existing transmitters mixing and falling within the 'hit' range of an existing (Scenario 1) or proposed receiver (Scenario 2); or
2. Emissions from the proposed transmitter mixing with emissions from an existing transmitter and falling within the 'hit' range of an existing (Scenario 3) or proposed receiver (Scenario 4).

Scenarios 2, 3 and 4 are required to be assessed using the applicable frequency-distance constraints detailed in Table B1.

B1. Cull limits applicable to intermodulation checks

Table B1: Cull limits applicable to intermodulation checks

	Frequency - Distance Cull Range	
Receiver Intermodulation		
Description	Third Order Intermodulation	Fifth Order Intermodulation
Scenario 2 - *caused in proposed receiver by existing transmitters*	Transmitters within 2 km & 2.25 MHz of proposed receiver frequency	Transmitters within 0.2 km & 0.375 MHz of proposed receiver frequency
Scenarios 3 and 4 - *caused in proposed or existing receiver by proposed transmitter as Outer*	Transmitters within 4 km & 1.125 MHz of proposed transmitter frequency Receivers within 2 km & 2.25 MHz of proposed transmitter frequency	Transmitters within 0.4 km & 0.125 MHz of proposed transmitter frequency Receivers within 0.2 km & 0.375 MHz of proposed transmitter frequency
Scenarios 3 and 4- *caused in proposed or existing receiver by proposed transmitter as Inner*	Transmitters within 4 km & 1.125 MHz of proposed transmitter frequency Receivers within 2 km & 1.125 MHz of proposed transmitter frequency	Transmitters within 0.4 km & 0.125 MHz of proposed transmitter frequency Receivers within 0.2 km & 0.25 MHz of proposed transmitter frequency
Transmitter Intermodulation		
Scenarios 2, 3 and 4 - *caused by proposed or existing transmitters*	Transmitters and receivers within 0.2 km & within the band 20 MHz above and 20 MHz below the proposed transmitter frequency	

B2. Frequency offset from victim receiver within which an intermodulation 'hit' is deemed to occur

Table B2: Frequency offset from victim receiver within which an intermodulation 'hit' is deemed to occur

Frequency offset from receiver centre frequency (± kHz)								
Interferer channel width*	Receiver channel width / Intermodulation Order							
	6.25 kHz		12.5 kHz		25 kHz		50 kHz	
	3rd order	5th order	3rd order	5th order	3rd order	5th order	3rd order	5th order
6.25 kHz	**9.375**	**12.5**	**12.25**	**15.5**	**18.5**	**22**	**30.5**	**34**
12.5 kHz	**15.125**	**21.125**	**18**	**24**	**24.5**	**30.5**	**37**	**42**
25 kHz	**28**	**40**	**30.5**	**43**	**37**	**49**	**49**	**60**
50 kHz	**53**	**75**	**56**	**80**	**62**	**90**	**74**	**95**

* The interferer channel width is taken as the wider of the two intermodulation-producing interferers

B3. Expressions for evaluating intermodulation interference

The following equations should be used to evaluate receiver generated intermodulation interference. When the equations are satisfied, the level of the intermodulation product is not high enough[12] to cause harmful interference.

The equation for two signal 3rd order receiver intermodulation is:

$PR + 2*(EIRP_{dBm} - L_{b\ inner} + L_c - RF_{inner}) + (EIRP_{dBm} - L_{b\ outer} + L_c - RF_{outer}) + ECR\ 2/3 \leq RS$...........**(1)**

The equation for two signal 5th order receiver intermodulation is:

$PR + 3*(EIRP_{dBm} - L_{b\ inner} + L_c - RF_{inner}) + 2*(EIRP_{dBm} - L_{b\ outer} + L_c - RF_{outer}) + ECR\ 2/5 \leq RS$..........**(2)**

The parameter values applicable to equations (1) and (2) above are specified in Table B3.

[12] It is assumed that harmful interference will occur if the level of the intermodulation product is greater than the usable sensitivity level (RS).

B4. Parameter values applicable to intermodulation checks

Table B3: Parameter Values Applicable to Intermodulation Checks**Parameter**	**Assumed Value**
RS (Master Station Usable Sensitivity[13])	-119 dBm (800 MHz Trunking Band) -116 dBm (400 MHz Band) -112 dBm (VHF High Band)
PR (Protection Ratio)	10 dB
$EIRP_{dBm}$ (Transmitter EIRP)	30 + 10*log[$EIRP_{watts}$] (typically 46 dBm for high power PMP and 39.2 dBm for 8.3 W low power PMP)
L_b (propagation loss: from 'inner' or 'outer' transmitter to victim receiver)	Free Space Loss + 10 dB
L_c (antenna gain and feeder loss)	2 dBi (VHF High Band) 6.2 dBi (400 MHz & 800 MHz Bands)
RF (receiver front-end response: achieved by the RF selectivity of a receiver in conjunction with a cavity filter)	**For the VHF High and 400 MHz Band:** **5 dB** for Freq Offset <=0.1 MHz **5 + 60 log [1+ (2 × (Freq Offset - 0.1)/1.5)$^{0.8}$]dB** for 0.1 < Freq Offset <= 15 MHz **70 dB** for Freq Offset > 15 MHz **For the 800 MHz Band:** **2 + 60*log[1 + (2*Freq Offset/5)$^{1.5}$] dB** for Freq Offset <= 2.5 MHz **2 + 60*log[1 + (2*Freq Offset/5)^{2}] dB** for 2.5 < Freq Offset <= 9 MHz **70 dB** for Freq Offset > 9 MHz
ECR (effective conversion ratio of intermodulation products)	2 Signal Third Order: ECR 2/3 = -9 dB 2 Signal Fifth Order: ECR 2/5 = -28 dB

[13] These are static usable sensitivity levels assumed by the service model for base receivers in built up areas and take into consideration man made noise levels. It is expected that receivers will have bench measured sensitivity levels at their rf input terminals better than those specified.

Appendix C: Channel tables

Table C1: Channels for the VHF High Band Segments E/J

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
1	150.0625	150.06875	150.08125	154.6625	154.66875	154.68125
2	150.075			154.675		
3	150.0875	150.09375		154.6875	154.69375	
4	150.1			154.7		
5	150.1125	150.11875	150.13125	154.7125	154.71875	154.73125
6	150.125			154.725		
7	150.1375	150.14375		154.7375	154.74375	
8	150.15			154.75		
9	150.1625	150.16875	150.18125	154.7625	154.76875	154.78125
10	150.175			154.775		
11	150.1875	150.19375		154.7875	154.79375	
12	150.2			154.8		
13	150.2125	150.21875	150.23125	154.8125	154.81875	154.83125
14	150.225			154.825		
15	150.2375	150.24375		154.8375	154.84375	
16	150.25			154.85		
17	150.2625	150.26875	150.28125	154.8625	154.86875	154.88125

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
18	150.275			154.875		
19	150.2875	150.29375		154.8875	154.89375	
20	150.3			154.9		
21	150.3125	150.31875	150.33125	154.9125	154.91875	154.93125
22	150.325			154.925		
23	150.3375	150.34375		154.9375	154.94375	
24	150.35			154.95		
25	150.3625	150.36875	150.38125	154.9625	154.96875	154.98125
26	150.375			154.975		
27	150.3875	150.39375		154.9875	154.99375	
28	150.4			155		
29	150.4125	150.41875	150.43125	155.0125	155.01875	155.03125
30	150.425			155.025		
31	150.4375	150.44375		155.0375	155.04375	
32	150.45			155.05		
33	150.4625	150.46875	150.48125	155.0625	155.06875	155.08125
34	150.475			155.075		
35	150.4875	150.49375		155.0875	155.09375	
36	150.5			155.1		
37	150.5125	150.51875	150.53125	155.1125	155.11875	155.13125
38	150.525			155.125		

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
39	150.5375	150.54375		155.1375	155.14375	
40	150.55			155.15		
41	150.5625	150.56875	150.58125	155.1625	155.16875	155.18125
42	150.575			155.175		
43	150.5875	150.59375		155.1875	155.19375	
44	150.6			155.2		
45	150.6125	150.61875	150.63125	155.2125	155.21875	155.23125
46	150.625			155.225		
47	150.6375	150.64375		155.2375	155.24375	
48	150.65			155.25		
49	150.6625	150.66875	150.68125	155.2625	155.26875	155.28125
50	150.675			155.275		
51	150.6875	150.69375		155.2875	155.29375	
52	150.7			155.3		
53	150.7125	150.71875	150.73125	155.3125	155.31875	155.33125
54	150.725			155.325		
55	150.7375	150.74375		155.3375	155.34375	
56	150.75			155.35		
57	150.7625	150.76875	150.78125	155.3625	155.36875	155.38125
58	150.775			155.375		
59	150.7875	150.79375		155.3875	155.39375	
60	150.8			155.4		

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
61	150.8125	150.81875	150.83125	155.4125	155.41875	155.43125
62	150.825			155.425		
63	150.8375	150.84375		155.4375	155.44375	
64	150.85			155.45		
65	150.8625	150.86875	150.88125	155.4625	155.46875	155.48125
66	150.875			155.475		
67	150.8875	150.89375		155.4875	155.49375	
68	150.9			155.5		
69	150.9125	150.91875	150.93125	155.5125	155.51875	155.53125
70	150.925			155.525		
71	150.9375	150.94375		155.5375	155.54375	
72	150.95			155.55		
73	150.9625	150.96875	150.98125	155.5625	155.56875	155.58125
74	150.975			155.575		
75	150.9875	150.99375		155.5875	155.59375	
76	151			155.6		
77	151.0125	151.01875	151.03125	155.6125	155.61875	155.63125
78	151.025			155.625		
79	151.0375	151.04375		155.6375	155.64375	
80	151.05			155.65		
81	151.0625	151.06875	151.08125	155.6625	155.66875	155.68125

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
82	151.075			155.675		
83	151.0875	151.09375		155.6875	155.69375	
84	151.1			155.7		
85	151.1125	151.11875	151.13125	155.7125	155.71875	155.73125
86	151.125			155.725		
87	151.1375	151.14375		155.7375	155.74375	
88	151.15			155.75		
89	151.1625	151.16875	151.18125	155.7625	155.76875	155.78125
90	151.175			155.775		
91	151.1875	151.19375		155.7875	155.79375	
92	151.2			155.8		
93	151.2125	151.21875	151.23125	155.8125	155.81875	155.83125
94	151.225			155.825		
95	151.2375	151.24375		155.8375	155.84375	
96	151.25			155.85		
97	151.2625	151.26875	151.28125	155.8625	155.86875	155.88125
98	151.275			155.875		
99	151.2875	151.29375		155.8875	155.89375	
100	151.3			155.9		
101	151.3125	151.31875	151.33125	155.9125	155.91875	155.93125

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
102	151.325			155.925		
103	151.3375	151.34375		155.9375	155.94375	
104	151.35			155.95		
105	151.3625	151.36875		155.9625	155.96875	
106	151.375			155.975		
107	151.3875			155.9875		

Table C2: Channels for 400 MHz Segments R/V

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
1	461.01875	461.025	461.0375	451.51875	451.525	451.5375
2	461.03125			451.53125		
3	461.04375	461.05		451.54375	451.55	
4	461.05625			451.55625		
5	461.06875	461.075	461.0875	451.56875	451.575	451.5875
6	461.08125			451.58125		
7	461.09375	461.1		451.59375	451.6	
8	461.10625			451.60625		
9	461.11875	461.125	461.1375	451.61875	451.625	451.6375
10	461.13125			451.63125		
11	461.14375	461.15		451.64375	451.65	
12	461.15625			451.65625		
13	461.16875	461.175	461.1875	451.66875	451.675	451.6875
14	461.18125			451.68125		
15	461.19375	461.2		451.69375	451.7	
16	461.20625			451.70625		
17	461.21875	461.225	461.2375	451.71875	451.725	451.7375
18	461.23125			451.73125		
19	461.24375	461.25		451.74375	451.75	
20	461.25625			451.75625		
21	461.26875	461.275	461.2875	451.76875	451.775	451.7875

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
22	461.28125			451.78125		
23	461.29375	461.3		451.79375	451.8	
24	461.30625			451.80625		
25	461.31875	461.325	461.3375	451.81875	451.825	451.8375
26	461.33125			451.83125		
27	461.34375	461.35		451.84375	451.85	
28	461.35625			451.85625		
29	461.36875	461.375	461.3875	451.86875	451.875	451.8875
30	461.38125			451.88125		
31	461.39375	461.4		451.89375	451.9	
32	461.40625			451.90625		
33	461.41875	461.425	461.4375	451.91875	451.925	451.9375
34	461.43125			451.93125		
35	461.44375	461.45		451.94375	451.95	
36	461.45625			451.95625		
37	461.46875	461.475	461.4875	451.96875	451.975	451.9875
38	461.48125			451.98125		
39	461.49375	461.5		451.99375	452	
40	461.50625			452.00625		
41	461.51875	461.525	461.5375	452.01875	452.025	452.0375
42	461.53125			452.03125		
43	461.54375	461.55		452.04375	452.05	
44	461.55625			452.05625		

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
45	461.56875	461.575	461.5875	452.06875	452.075	452.0875
46	461.58125			452.08125		
47	461.59375	461.6		452.09375	452.1	
48	461.60625			452.10625		
49	461.61875	461.625	461.6375	452.11875	452.125	452.1375
50	461.63125			452.13125		
51	461.64375	461.65		452.14375	452.15	
52	461.65625			452.15625		
53	461.66875	461.675	461.6875	452.16875	452.175	452.1875
54	461.68125			452.18125		
55	461.69375	461.7		452.19375	452.2	
56	461.70625			452.20625		
57	461.71875	461.725	461.7375	452.21875	452.225	452.2375
58	461.73125			452.23125		
59	461.74375	461.75		452.24375	452.25	
60	461.75625			452.25625		
61	461.76875	461.775	461.7875	452.26875	452.275	452.2875
62	461.78125			452.28125		
63	461.79375	461.8		452.29375	452.3	
64	461.80625			452.30625		
65	461.81875	461.825	461.8375	452.31875	452.325	452.3375
66	461.83125			452.33125		
67	461.84375	461.85		452.34375	452.35	

	Master Transmit			Master Receive		
Channel	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**	**12.5 kHz Centre Frequency**	**25 kHz Centre Frequency**	**50 kHz Centre Frequency**
68	461.85625			452.35625		
69	461.86875	461.875	461.8875	452.36875	452.375	452.3875
70	461.88125			452.38125		
71	461.89375	461.9		452.39375	452.4	
72	461.90625			452.40625		
73	461.91875	461.925	461.9375	452.41875	452.425	452.4375
74	461.93125			452.43125		
75	461.94375	461.95		452.44375	452.45	
76	461.95625			452.45625		
77	461.96875	461.975		452.46875	452.475	
78	461.98125			452.48125		
79	461.99375			452.49375		

Table C3: Channels for 800 MHz

Centre Frequency (MHz)					Centre Frequency (MHz)				
Channel Number	Master Transmit		Master Receive		Channel Number	Master Transmit		Master Receive	
1	850.50625	850.5125	805.50625	805.5125	21	850.75625	850.7625	805.75625	805.7625
2	850.51875		805.51875		22	850.76875		805.76875	
3	850.53125	850.5375	805.53125	805.5375	23	850.78125	850.7875	805.78125	805.7875
4	850.54375		805.54375		24	850.79375		805.79375	
5	850.55625	850.5625	805.55625	805.5625	25	850.80625	850.8125	805.80625	805.8125
6	850.56875		805.56875		26	850.81875		805.81875	
7	850.58125	850.5875	805.58125	805.5875	27	850.83125	850.8375	805.83125	805.8375
8	850.59375		805.59375		28	850.84375		805.84375	
9	850.60625	850.6125	805.60625	805.6125	29	850.85625	850.8625	805.85625	805.8625
10	850.61875		805.61875		30	850.86875		805.86875	
11	850.63125	850.6375	805.63125	805.6375	31	850.88125	850.8875	805.88125	805.8875
12	850.64375		805.64375		32	850.89375		805.89375	
13	850.65625	850.6625	805.65625	805.6625	33	850.90625	850.9125	805.90625	805.9125
14	850.66875		805.66875		34	850.91875		805.91875	
15	850.68125	850.6875	805.68125	805.6875	35	850.93125	850.9375	805.93125	805.9375
16	850.69375		805.69375		36	850.94375		805.94375	

Centre Frequency (MHz)					Centre Frequency (MHz)				
Channel Number	**Master Transmit**		**Master Receive**		**Channel Number**	**Master Transmit**		**Master Receive**	
17	850.70625	850.7125	805.70625	805.7125	37	850.95625	850.9625	805.95625	805.9625
18	850.71875		805.71875		38	850.96875		805.96875	
19	850.73125	850.7375	805.73125	805.7375	39	850.98125	850.9875	805.98125	805.9875
20	850.74375		805.74375		40	850.99375		805.99375	