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Radiocommunications Assignment and Licensing Instruction

FREQUENCY ASSIGNMENT REQUIREMENTS FOR THE LAND MOBILE SERVICE

AUSTRALIAN COMMUNICATIONS AUTHORITY

SPECTRUM PLANNING AND STANDARDS GROUP

CANBERRA

RADIOCOMMUNICATIONS ASSIGNMENT AND LICENSING INSTRUCTIONS

Suggestions for improvements to Radiocommunications Assignment and Licensing Instructions may be addressed to the ACA at PO Box 78, Belconnen, ACT, 2616. It would be appreciated if notification to the ACA of any inaccuracy or ambiguity found, be made without delay in order that the matter may be investigated and appropriate action taken.

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Frequency Assignment Requirements for the Land Mobile Service

1.0 Purpose

The purpose of this Radiocommunications Assignment and Licensing Instruction (RALI) is to provide advice on frequency assignment policy and coordination procedures for single and two frequency land mobile systems employing angle and digital modulation methods.

This RALI replaces RALI LM 8, dated 3 July 1997, Sequence Number 113.

The information in this document reflects the Australian Communications Authority's statement of current policy in relation to frequency assignment requirements for the land mobile service. In making decisions, Australian Communications Authority (ACA) and accredited frequency assigners should take all relevant factors into account and decide each case on its merits. If an issue related to this document appears to fall outside the enunciated policy, please consult the Manager, Spectrum Planning Team, Central Office.

2.0 Current Applicability

This RALI currently applies to angle and digital modulated:

- single and two frequency systems in the VHF Mid and High bands[1] using 12.5 kHz channelling;
- single and two frequency systems in the 400 MHz band[2] using 12.5 and 25 kHz channelling; and
- 800 MHz trunked systems[3] using 25 kHz channelling.

It is intended that this RALI will be expanded to cover single and two frequency systems in the VHF Mid and High bands using 25 kHz channelling, and single and two frequency systems in the VHF-low frequency band, as the assignment requirements are able to be consolidated.

1 These frequency bands are defined in the VHF Mid Band Frequency Band Plan (70 to 87.5 MHz), Statutory Rules 1991 No. 355, and the VHF High Band Frequency Band Plan (148 to 174 MHz), Statutory Rules 1991 No. 354.

2 The 400 MHz band (403 to 520 MHz) is defined in RALI MS 22 [3].

3 The frequency band for the 800 MHz trunked land mobile service is defined in the 900 MHz Band Plan, Statutory Rules 1992 No.47.

3.0 Service Description

Radiocommunications systems operating in the land-mobile service (LMS) are typically used to communicate information between a controlling station and vehicular mobile or personal stations often for, but not limited to, the purposes of dispatch activities related to the performance of a business or other organisational activity.

In the case of two frequency systems, communication usually occurs between a remote control station (RCS) and mobile stations via a centrally located land station (often referred to as a 'base' station or repeater) which is located at a high site in order to serve the surrounding area. The base station receives transmissions on its 'base receive' frequency from the RCS or any mobile within the notional service area and subsequently repeats those transmissions on its 'base transmit' frequency for reception by any other mobile (or the RCS) within the notional service area.

In single frequency systems, the controlling station typically is the 'base' station and is at the centre of the notional service area, although in some cases the controlling station is linked (sometimes by land line) to a 'base' station at a high site. All communications occur on the one frequency.

Trunked land mobile systems (TLMS) are functionally similar to the two frequency non-trunked systems described above. However, in a trunked system, a group of channels at the base station site is time-shared between a large number of users so that the channels can be used more efficiently.

Low-power land mobile radio systems (LPMRS) are functionally similar to the systems described above but have a much smaller coverage area. They are located primarily in high-density areas and have greater frequency re-use. LPMRS are generally single frequency systems but may be two frequency systems and are used typically in crane control and ambulatory applications.

From an interference management perspective, an LMS has the following characteristics:

- it has a central fixed land station (generally referred to as a base station); in practice this is the controlling station in a single frequency system and the repeater in a two frequency system, and is commonly located at a high site;
- the base station serves a number of mobile/personal mobile stations, distributed randomly throughout the service area;
- in the case of a two frequency system, the controlling station (RCS) is treated as a 'fixed mobile' in the service area; and
- communication occurs mostly between mobiles and the controlling station (via a repeater in a two frequency system) although, in some cases, direct mobile-to-mobile or personal mobile-to-personal mobile communication may occur.

4.0 Service Model

The purpose of the service model is to define a set of characteristics for the LMS that will result in a specified 'target' grade of service for land mobile systems. There are two service models defined; one for large coverage applications (LMRS) and the other for small coverage applications (LPMRS).

The target grade of service (TGS) is defined as a signal quality of 12 dB SINAD[4] for voice systems or a bit error rate of 10^{-2} for data systems at the receiver output for a 5 dB[5] ratio of wanted to unwanted signals at the receiver RF input terminal. The model defines values for a set of parameters (at the inter-system, intra-system and equipment levels) that, when satisfied, will achieve the TGS for LMS receivers at 90% of locations within the notional service area of a land mobile system. The model also manages interference to acceptable levels, planned not to exceed 1% of the time in any 1 hour period.

Sections 5 and 6 of this RALI detail the frequency assignment policy and coordination procedures for land mobile systems which use, as their basis, the service model as described in this section.

4.1 LMRS Service Model Description

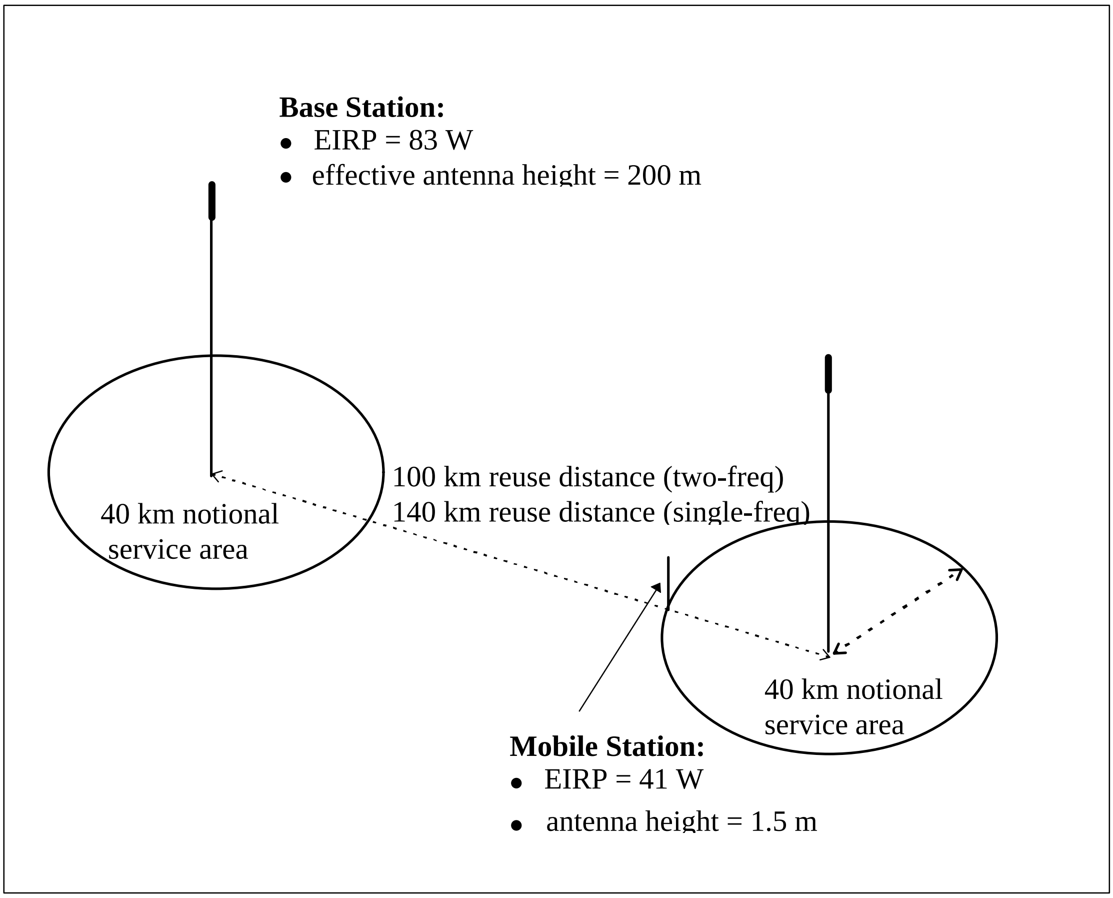

Figure 1 - LMRS Service Model

4 SINAD - the ratio of (signal + noise + distortion) to (noise + distortion).

5 This value is assumed in a static environment. In a faded environment, the median wanted to unwanted ratio is assumed to be 15 dB. This assumes Rayleigh fading and a lognormal (6 dB variance) location variability.

Key features of the service model are:

- the radiated power is limited to an equivalent isotropically radiated power (EIRP) for all stations as follows;
  - 83 watts (W) for base stations (50 W into a 2.15 dBi dipole antenna);
  - 41 W for mobile stations (25 W into a 2.15 dBi λ/4 monopole antenna);
  - 41 W for supplementary transmitters (25 W into a 2.15 dBi λ/4 monopole antenna);
  - 20 W maximum for RCSs (1 W maximum into a 13 dBi yagi antenna);
  - 8.3 W for personal mobile stations (5 W into a 2.15 dBi λ/4 monopole antenna);
- an assumed base station effective antenna height of 200 metres above surrounding terrain and a mobile antenna height of 1.5 metres above ground level;
- assumed receiver usable sensitivity levels (refer to Annex D, Table D3, of this RALI);
- the use of a modified Longley-Rice model (base-to-base) and the modified Hata model (base-to-mobile) for propagation loss calculations associated with frequency-distance constraints (refer to Annex A of this RALI);
- the use of free space loss plus 10 dB for intermodulation propagation loss calculations associated with cull distances for intermodulation checks;
- a notional service area radius of 40 km;
- a notional antenna for base station receivers, assumed to be a vertically polarised dipole array with a maximum antenna gain in any direction of 2 dBi at VHF and 6 dBi at UHF (Note that these figures include cable and combiner loss, but exclude cavity filter loss);
- an assumed adjacent channel isolation (ACI) of 50 dB (ACI describes the isolation achieved between systems operating on adjacent channels, as a consequence of transmitter adjacent channel power and receiver adjacent channel selectivity performance);
- an assumed transmitter adjacent channel power not exceeding -16 dBm;
- a co-channel re-use distance of 140 km and 100 km between single and two-frequency base stations respectively;
- frequency coordination that is performed for base stations only (specific levels of protection for mobiles and RCSs are intrinsic to the service model);
- assumed maximum levels of spurious emissions, including broadband noise radiated from a transmitter;
- an assumed receiver blocking performance of 90 dB above the receiver usable sensitivity levels specified in Annex D, Table D3, of this RALI;
- an assumed receiver Intermediate Frequency (IF) bandwidth of 11 kHz at the 6 dB points for 12.5 kHz channelled equipment and 16 kHz at the 6 dB points for 25 kHz channelled equipment;
- an assumption that additional RF selectivity, equivalent to that achieved by a 6-inch cavity filter, is installed on base station receivers, to reduce their susceptibility to interference from site-based intermodulation products (refer to Annex D, Table D3, of this RALI);
- a limit on RCS transmitter output power to a maximum of 1 watt, which requires that a directional antenna be used to achieve the EIRP limit referred to above. The model

presumes that the EIRP is limited to the minimum necessary to achieve a signal level 15 dB above the base station receiver's 12 dB SINAD sensitivity level at its input terminal. These limits minimise the potential for interference between the RCS and an adjacent co-channel base station;

- specific requirements for RCSs to minimise their potential for causing intermodulation interference in areas having a relatively high concentration of transmitters and receivers. The model presumes the following requirements for RCSs located in central business districts:
  - the height of an RCS antenna does not exceed 30 metres above ground level; and
  - a 20 dB in-line attenuator[6] is fitted between the output of an RCS transmitter and its associated antenna;
- the assumption that services are co-sited when they are located within 200 metres of each other;
- the inclusion of co-channelled transmitters (supplementary transmitters) to improve the service reliability within, but not outside, the notional service area; and
- the assumption that 800 MHz trunked equipment is approved to Federal Communications Commission (FCC) Rules Part 90.

Note that equipment meeting the Australian radiocommunications equipment standard(s) relevant to operation in the LMS will also meet the level of performance assumed above for adjacent channel isolation, receiver sensitivity, and transmitter spurious and out-of-band emissions.

6 The model allows for the use of other devices such as isolators or feed-forward amplifiers which give intermodulation performance equivalent to or better than that achieved by a 20 dB in-line attenuator.

4.2 LPMRS Service Model Description

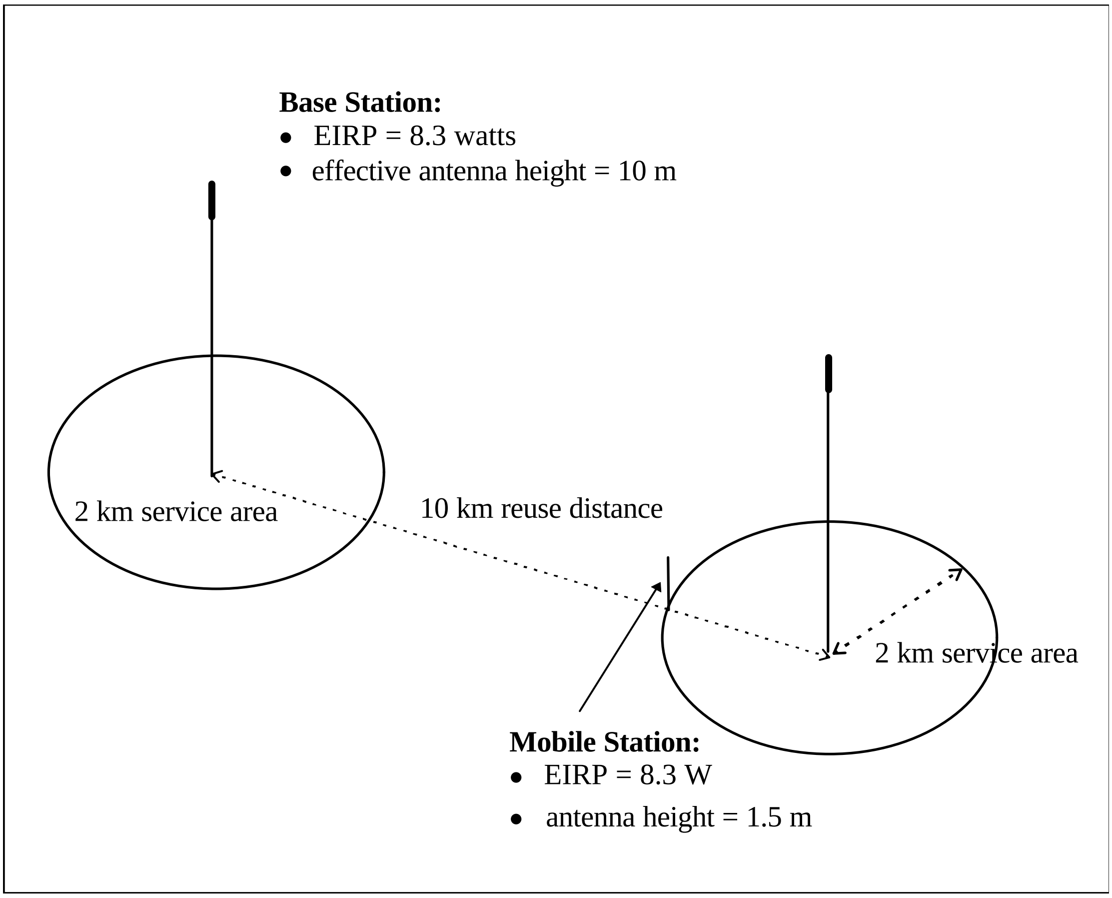

Figure 2 - LPMRS Service Model

Key features of the LPMRS service model are:

- the radiated power is limited to an EIRP for all stations as follows;
  - 8.3 W for base stations (5 W into a 2.15 dBi dipole antenna);
  - 8.3 W for mobile stations (5 W into a 2.15 dBi $\lambda/4$ monopole antenna);
  - 8.3 W for personal mobile stations (5 W into a 2.15 dBi $\lambda/4$ monopole antenna);
- base station effective antenna height of 10 metres above surrounding terrain and a mobile antenna height of 1.5 metres above ground level;
- assumed receiver usable sensitivity levels (refer to Annex D, Table D3, of this RALI);
- the use of the modified Hata model for base-to-base and base-to-mobile propagation loss calculations associated with frequency-distance constraints (refer to Annex A of this RALI);
- the use of free space loss plus 10 dB for intermodulation propagation loss calculations associated with cull distances for intermodulation checks;
- a notional service area radius of 2 km;

- a notional antenna for base station receivers, assumed to be a vertically polarised dipole array with a maximum antenna gain in any direction of 2 dBi at VHF and 6 dBi at UHF (Note that these figures include cable and combiner loss, but exclude cavity filter loss);
- a notional antenna for base station receivers, assumed to be a vertically polarised dipole array with a maximum antenna gain in any direction of 6 dBi (including cable and combiner loss, excluding cavity filter loss);
- an assumed adjacent channel isolation (ACI) of 50 dB;
- an assumed transmitter adjacent channel power not exceeding -16 dBm;
- a co-channel re-use distance of 10 km between base stations;
- frequency coordination that is performed for base stations only (specific levels of protection for mobiles and RCSs are intrinsic to the service model);
- assumed maximum levels of spurious emissions, including broadband noise radiated from a transmitter;
- an assumed receiver blocking performance of 90 dB above the receiver sensitivity levels specified in Annex D, Table D3, of this RALI;
- an assumed receiver IF bandwidth of 11 kHz at the 6 dB points for 12.5 kHz channelled equipment and 16 kHz at the 6 dB points for 25 kHz channelled equipment;
- an assumption that additional RF selectivity, equivalent to that achieved by a 6 inch cavity filter, is installed on base station receivers to reduce their susceptibility to interference from site-based intermodulation products;
- the assumption that services are co-sited when they are located within 200 metres of each other; and
- specific requirements for crane control applications using LPMRS. The transmitter output power is assumed to be a maximum of 1 watt. The crane antenna is assumed to have a maximum beamwidth of 80 degrees with down tilt.

Note that equipment meeting the Australian radiocommunications equipment standard(s) relevant to operation in the LMS will also meet the level of performance assumed above for adjacent channel isolation, receiver sensitivity, and transmitter spurious and out-of-band emissions.

5.0 Frequency Assignment Policy

Frequency assignment must take into consideration both inter-service and intra-service requirements consistent with the assignment philosophy promulgated in RALI MS 2.

Successful management of interference in the LMS requires that all stations operating in the service (mobile, base and RCS) comply with specific technical constraints.

Intra-service constraints form an essential element of the service model upon which frequency assignment requirements are based, and are detailed in the following paragraphs. The intra-service frequency coordination procedure is also part of this policy framework and is outlined in section 6 of this RALI.

Inter-service coordination of land-mobile services with other radiocommunications services are addressed, in some cases, by specific RALIs. Annex E lists inter-service coordination requirements prepared by the ACA. In other cases, ITU-R Recommendations may exist. 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.

5.1 Spectrum and Channelling Arrangements

Spectrum and channelling arrangements are specified in the band plans referenced at section 2 of this RALI. Trunked systems may operate in ‘non-trunked’ two-frequency spectrum; however spectrum allocated in the relevant band plans for trunking should not be assigned to non-trunked systems.

As well as complying with the channelling arrangements specified in the relevant band plans, assignments to a TLMS at any given site should be in accordance with the Block and Group arrangements tabulated at Annex B of this RALI. These arrangements have been established to minimise the occurrence of site-based intermodulation interference.

5.2 Assignment Strategy

The procedure for assigning land mobile base station frequencies is based on a strategy of horizontal loading and maximum isolation between assigned services. Under this strategy, frequencies that pass interference checks by the greatest margin are assigned. This approach maximises the isolation between systems which typically achieve a grade of service well in excess of the TGS; the actual grade of service and reliability will reduce, over time, towards the TGS as the spectrum becomes more congested.

5.3 Supplementary Transmitters

A supplementary transmitter is a transmitter intended to improve the service reliability within a 40 km radius of the ‘parent’ base station. A supplementary transmitter does not require frequency coordination. However, it must not cause interference to other radiocommunication services, and no additional level of protection from interference to a related supplementary receiver (above that offered to a mobile receiver) is provided.

Note that a transmitter which extends coverage beyond a 40 km radius of the ‘parent’ base station is not a supplementary transmitter; it is another base station and must be frequency coordinated in the same manner as any other base station.

5.4 Trunked Systems

5.4.1 VHF High Band Trunking Groups and Sub-segments

The basic trunking assignment unit is the group, which consists of five channels (refer to Annex B1 of this RALI). The 120 channels in each sub-segment are arranged into 12 blocks, each consisting of two groups of five channels. Channels should be assigned at any given site in groups of five, as shown at Annex B1 of this RALI, wherever possible.

Note that the VHF High Band trunking segments are divided into two equal sub-segments, A and B (refer to Annex B1 of this RALI), in order to minimise the potential for site-based interference due to 3rd and 5th order intermodulation products. At any one site, assignments may be made from either sub-segment, A or B, but not both. Sites at which frequencies from different sub-segments are used must be separated by at least 200 metres.

5.4.2 400 MHz Trunking Groups

The basic trunking assignment unit is the group, which consists of five channels (refer to Annex B3 of this RALI). Four groups comprise a block. The 200 channels are arranged into 10 blocks, each consisting of four groups of five channels. Channels should be assigned at any given site in sets of five, as shown at Annex B3 of this RALI, wherever possible.

5.4.3 800 MHz Trunking Groups

The basic trunking assignment unit is the group, which consists of five channels (refer to Annex B4 of this RALI). Four groups comprise a block. The 200 channels are arranged into 10 blocks, each consisting of four groups of five channels. Channels should be assigned at any given site in groups of five, as shown at Annex B4 of this RALI, wherever possible.

6.0 Frequency Coordination Procedure

Frequency coordination is performed only for base stations in the LMS; interference protection for mobiles and RCSs is intrinsic to the service model described in section 4 of this RALI.

The following sections detail a coordination procedure that may be applied for frequency assignment of LMS base stations.

Alternative frequency coordination procedures may be used provided that they produce equivalent results, that is, the target grade of service is achieved at 90% of locations within the notional service area (refer to section 4 of this RALI).

Note that automation of the coordination procedure (by means of an appropriate software application) is highly desirable, particularly when coordinating services in areas of high spectrum occupancy.

6.1 Overview

The general procedure for frequency coordination and assignment of land mobile base stations takes the following form:

- site selection;
- application of frequency-distance constraint checks;
- initial frequency selection;
- intermodulation checks; and
- the frequency assignment.

The following sections describe the above steps in more detail.

6.2 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 coordination process outlined below.

6.3 Frequency-Distance Constraints

6.3.1 Cull for Frequency-Distance Constraints

Perform a cull (ie, 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, out-of-band emissions, and transmitter broadband noise. The minimum radius and frequency range for this cull are specified at Annex C, Table C1 of this RALI.

6.3.2 Application of Frequency-Distance Constraints

Apply the frequency-distance constraints to assess the potential for interference between the proposed assignment and the systems yielded by the cull. The frequency-distance constraints for single frequency and two frequency services are detailed at Annex C of this RALI.

Tables C2, C3.1, C3.2, C4.1 and C4.2 apply whenever a single frequency system (proposed or existing) requires frequency coordination, or whenever two-frequency systems are to be coordinated with one another and one operates with reverse frequency sense to the other (ie, the transmit frequency of one equals the receive frequency of the other).

Tables C5, C6, C7 and C8 apply in the situation where both systems to be coordinated (proposed and existing) use two frequency operation, and have the same frequency sense.

6.4 Initial Frequency Selection

Ideally, the channel that passes the frequency-distance constraints by the greatest margin should be selected for subsequent intermodulation checks. Note that for two-frequency systems this will involve selection of a pair of frequencies (base transmit and base receive) that each satisfy the frequency-distance constraints by the greatest possible margin. If however, particular needs of the client are best satisfied with a channel passing by a lesser margin, that channel may be selected instead.

6.5 Intermodulation Checks

6.5.1 Introduction

Intermodulation checks are performed for two-signal 3rd order, three-signal 3rd order and two-signal 5th order intermodulation.

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 are likely to cause interference to the proposed or existing receivers. Mixing of transmitter emissions can occur in passive components (eg, 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.

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.

6.5.2 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 D, Table D1, of this RALI.

6.5.3 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 bandplan (eg, the entire VHF Mid or High Band), and can be algebraically combined in the form shown in Table 1 to produce a 3rd or 5th order intermodulation product within the ‘hit’ range of a co-sited receiver (as defined in Annex D, Table D2, of this RALI) the proposed frequency should not be assigned.

Frequencies of 3rd Order Products *	Frequencies of 5th Order Products *
$2f_1 - f_2$	$3f_1 - 2f_2$
$2f_2 - f_1$	$3f_2 - 2f_1$
$f_1 + f_2 - f_3$ $f_1 - f_2 + f_3$	

* f_1 = centre frequency of first co-sited transmitter
f_2 = centre frequency of second co-sited transmitter
f_3 = centre frequency of third co-sited transmitter

Table 1 - Algebraic expressions for 3rd and 5th order intermodulation product frequencies

Receiver Intermodulation

All systems falling within the cull limits specified in Annex D, Table D1, of this RALI are first evaluated for the occurrence of 3rd and 5th order intermodulation product ‘hits’ as per Table 1. A ‘hit’ is deemed to occur when an intermodulation product falls within the frequency ranges from a receiver specified in Annex D, Table D2, of this RALI.

Once the existence of a ‘hit’ has been confirmed, mathematical expressions (1), (2) and (3) shown at Annex D3 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), (2) and (3) at Annex D3 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.

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.

6.5.4 Inter-Service Intermodulation Checks

Perform intermodulation checks with other radiocommunication services such as television and FM radio broadcasting and paging systems using the frequency chosen above in section 6.5.3 in this RALI. If the inter-service intermodulation checks fail, find another acceptable frequency as per the procedure in section 6.5.3 in this RALI and perform inter-service intermodulation checks on that frequency until an acceptable frequency is found.

6.6 The Frequency Assignment

Assign to the proposed system the channel that passes the intermodulation checks and satisfies the frequency-distance constraints by the greatest margin consistent with meeting the client's operating frequency requirements as far as practicable.

6.7 Frequency Assignment Procedure - Trunked Systems

The procedure for frequency coordination and assignment of trunked systems is identical to that for conventional two frequency systems; however frequency-distance constraints and intermodulation requirements must be met for all frequencies in the proposed trunking block or group at the proposed site (refer to Annex B of this RALI).

Note that intra-service intermodulation checks are not required for 800 MHz trunking assignments due to the homogeneous nature of the trunking segment and the 45 MHz base transmit/receive split. Inter-service intermodulation checks should be performed with other services such as the UHF television service.

6.8 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 provided that the target grade of service is achieved at 90% of locations within the notional service area (refer to section 4 of this RALI).

RALI Authorisation

.... 6/4/98

Barry Matson
Executive Manager
Spectrum Planning and Standards Group
Australian Communications Authority

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Annex A - Propagation Loss Models

A1. Modified Longley-Rice Model

A modified version of the Longley-Rice propagation loss model [13] has been used in the calculation of propagation loss for the determination of frequency-distance constraints appearing in Annex C when the interference path is between two high sites having effective antenna heights of 200 metres above surrounding terrain. The model has also been used for the determination of intermodulation parameters appearing in Annex D. For information, parameter values used in the model are detailed in Table A1 below.

Band	Frequency Limits (MHz)	Distance (km)	Path Loss (dB)
VHF Mid and High Bands	70 to 87.5 148 to 174	0 < distance <= 0.006 0.006 < distance <= 40 distance > 40	41 FSL + 10 96 + (0.55 x distance)
400 MHz Band	403 to 520	0 < distance <= 0.003 0.003 < distance <= 40 distance > 40	45 FSL + 10 104 + (0.55 x distance)
800 MHz Trunking Band	820 to 870	0 < distance <= 0.003 0.003 < distance <= 55 distance > 55	50 FSL + 10 107 + (0.55 x distance)

Table A1 - Parameter Values used in the Modified Longley-Rice Propagation Loss Model

Note: 1. distance = spatial separation between antennas

2. FSL = Free Space Loss [in dB]

= 32.5 + 20 log (distance [in km]) + 20 log (frequency [in MHz])

3. The model estimates propagation loss to a 90 % confidence level and assumes a terrain irregularity factor of 90 metres [13].

A2. Modified Hata Model

The modified Hata propagation loss model [14] has been used in the calculation of propagation loss for the determination of frequency-distance constraints appearing in Annex C when the interference path is between a high site and a low site (base to mobile). The modified Hata urban model has been used in the determination of LPMRS base-to-base and base-to-mobile parameters.

The modified Hata model estimates mean propagation loss (50% of locations for 50% of the time). A correction factor of 11 dB has been applied to convert the loss to be applicable for 90% of locations [14]. Also, a correction factor of 4 dB has been applied to convert the loss to be applicable for 1% of the time [14]. The modified Hata equations are as follows:

$$L_{urban} = 69.55 + 26.16 \log (f) - 13.82 \log (h_b) - a + [44.9 - 6.55 \log (h_b)] \times [\log (d)]^{\alpha} \quad \text{dB}$$

$$L_{suburban} = L_{urban} - 2 \times [\log (f / 28)]^2 - 5.4 \quad \text{dB}$$

where:

$$a = [1.1 \log (f) - 0.7] \times h_m - [1.56 \log (f) - 0.8]$$

$$\alpha = 1 + [0.14 + (1.87\times10^{-4} \times f) + (1.07\times10^{-3} \times h_b)] \times [\log (d / 20)]^{0.8} \quad \text{for } d > 20 \text{ km}$$

$$= 1 \quad \text{for } d \leq 20 \text{ km}$$

d = distance (km)

f = frequency (MHz)

h_b , h_m = base and mobile antenna heights respectively (metres)

Annex B - Block, Group and Channel Allocations for Trunking Channels

B1. Block and Group Allocations for VHF High Band Trunking Channels

BLOCK	GROUP	CHANNEL NUMBER*				
1	1	**1**	**13**	**25**	**37**	**49**
	2	**61**	**73**	**85**	**97**	**109**
2	1	**2**	**14**	**26**	**38**	**50**
	2	**62**	**74**	**86**	**98**	**110**
3	1	**3**	**15**	**27**	**39**	**51**
	2	**63**	**75**	**87**	**99**	**111**
4	1	**4**	**16**	**28**	**40**	**52**
	2	**64**	**76**	**88**	**100**	**112**
5	1	**5**	**17**	**29**	**41**	**53**
	2	**65**	**77**	**89**	**101**	**113**
6	1	**6**	**18**	**30**	**42**	**54**
	2	**66**	**78**	**90**	**102**	**114**
7	1	**7**	**19**	**31**	**43**	**55**
	2	**67**	**79**	**91**	**103**	**115**
8	1	**8**	**20**	**32**	**44**	**56**
	2	**68**	**80**	**92**	**104**	**116**
9	1	**9**	**21**	**33**	**45**	**57**
	2	**69**	**81**	**93**	**105**	**117**
10	1	**10**	**22**	**34**	**46**	**58**
	2	**70**	**82**	**94**	**106**	**118**
11	1	**11**	**23**	**35**	**47**	**59**
	2	**71**	**83**	**95**	**107**	**119**
12	1	**12**	**24**	**36**	**48**	**60**
	2	**72**	**84**	**96**	**108**	**120**

Table B1.1 - VHF High Band Subsegment A

***	For allocations of channel numbers to frequencies, see Table B2.1**

BLOCK	GROUP	CHANNEL NUMBER*				
1	1	**121**	**133**	**145**	**157**	**169**
	2	**181**	**193**	**205**	**217**	**229**
2	1	**122**	**134**	**146**	**158**	**170**
	2	**182**	**194**	**206**	**218**	**230**
3	1	**123**	**135**	**147**	**159**	**171**
	2	**183**	**195**	**207**	**219**	**231**
4	1	**124**	**136**	**148**	**160**	**172**
	2	**184**	**196**	**208**	**220**	**232**
5	1	**125**	**137**	**149**	**161**	**173**
	2	**185**	**197**	**209**	**221**	**233**
6	1	**126**	**138**	**150**	**162**	**174**
	2	**186**	**198**	**210**	**222**	**234**
7	1	**127**	**139**	**151**	**163**	**175**
	2	**187**	**199**	**211**	**223**	**235**
8	1	**128**	**140**	**152**	**164**	**176**
	2	**188**	**200**	**212**	**224**	**236**
9	1	**129**	**141**	**153**	**165**	**177**
	2	**189**	**201**	**213**	**225**	**237**
10	1	**130**	**142**	**154**	**166**	**178**
	2	**190**	**202**	**214**	**226**	**238**
11	1	**131**	**143**	**155**	**167**	**179**
	2	**191**	**203**	**215**	**227**	**239**
12	1	**132**	**144**	**156**	**168**	**180**
	2	**192**	**204**	**216**	**228**	**240**

Table B1.2 - VHF High Band Subsegment B

*** For allocations of channel numbers to frequencies, see Table B2.2**

B2. Channel Allocations for VHF High Band Trunking Channels

CHAN	BASE TX	BASE RX	CHAN	BASE TX	BASE RX	CHAN	BASE TX	BASE RX
1	165.20000	169.80000	**41**	165.70000	170.30000	**81**	166.20000	170.80000
2	165.21250	169.81250	**42**	165.71250	170.31250	**82**	166.21250	170.81250
3	165.22500	169.82500	**43**	165.72500	170.32500	**83**	166.22500	170.82500
4	165.23750	169.83750	**44**	165.73750	170.33750	**84**	166.23750	170.83750
5	165.25000	169.85000	**45**	165.75000	170.35000	**85**	166.25000	170.85000
6	165.26250	169.86250	**46**	165.76250	170.36250	**86**	166.26250	170.86250
7	165.27500	169.87500	**47**	165.77500	170.37500	**87**	166.27500	170.87500
8	165.28750	169.88750	**48**	165.78750	170.38750	**88**	166.28750	170.88750
9	165.30000	169.90000	**49**	165.80000	170.40000	**89**	166.30000	170.90000
10	165.31250	169.91250	**50**	165.81250	170.41250	**90**	166.31250	170.91250
11	165.32500	169.92500	**51**	165.82500	170.42500	**91**	166.32500	170.92500
12	165.33750	169.93750	**52**	165.83750	170.43750	**92**	166.33750	170.93750
13	165.35000	169.95000	**53**	165.85000	170.45000	**93**	166.35000	170.95000
14	165.36250	169.96250	**54**	165.86250	170.46250	**94**	166.36250	170.96250
15	165.37500	169.97500	**55**	165.87500	170.47500	**95**	166.37500	170.97500
16	165.38750	169.98750	**56**	165.88750	170.48750	**96**	166.38750	170.98750
17	165.40000	170.00000	**57**	165.90000	170.50000	**97**	166.40000	171.00000
18	165.41250	170.01250	**58**	165.91250	170.51250	**98**	166.41250	171.01250
19	165.42500	170.02500	**59**	165.92500	170.52500	**99**	166.42500	171.02500
20	165.43750	170.03750	**60**	165.93750	170.53750	**100**	166.43750	171.03750
21	165.45000	170.05000	**61**	165.95000	170.55000	**101**	166.45000	171.05000
22	165.46250	170.06250	**62**	165.96250	170.56250	**102**	166.46250	171.06250
23	165.47500	170.07500	**63**	165.97500	170.57500	**103**	166.47500	171.07500
24	165.48750	170.08750	**64**	165.98750	170.58750	**104**	166.48750	171.08750
25	165.50000	170.10000	**65**	166.00000	170.60000	**105**	166.50000	171.10000
26	165.51250	170.11250	**66**	166.01250	170.61250	**106**	166.51250	171.11250
27	165.52500	170.12500	**67**	166.02500	170.62500	**107**	166.52500	171.12500
28	165.53750	170.13750	**68**	166.03750	170.63750	**108**	166.53750	171.13750
29	165.55000	170.15000	**69**	166.05000	170.65000	**109**	166.55000	171.15000
30	165.56250	170.16250	**70**	166.06250	170.66250	**110**	166.56250	171.16250
31	165.57500	170.17500	**71**	166.07500	170.67500	**111**	166.57500	171.17500
32	165.58750	170.18750	**72**	166.08750	170.68750	**112**	166.58750	171.18750
33	165.60000	170.20000	**73**	166.10000	170.70000	**113**	166.60000	171.20000
34	165.61250	170.21250	**74**	166.11250	170.71250	**114**	166.61250	171.21250
35	165.62500	170.22500	**75**	166.12500	170.72500	**115**	166.62500	171.22500
36	165.63750	170.23750	**76**	166.13750	170.73750	**116**	166.63750	171.23750
37	165.65000	170.25000	**77**	166.15000	170.75000	**117**	166.65000	171.25000
38	165.66250	170.26250	**78**	166.16250	170.76250	**118**	166.66250	171.26250
39	165.67500	170.27500	**79**	166.17500	170.77500	**119**	166.67500	171.27500
40	165.68750	170.28750	**80**	166.18750	170.78750	**120**	166.68750	171.28750

Table B2.1 - VHF High Band Subsegment A

CHAN	BASE TX	BASE RX	CHAN	BASE TX	BASE RX	CHAN	BASE TX	BASE RX
121	166.70000	171.30000	**161**	167.20000	171.80000	**201**	167.70000	172.30000
122	166.71250	171.31250	**162**	167.21250	171.81250	**202**	167.71250	172.31250
123	166.72500	171.32500	**163**	167.22500	171.82500	**203**	167.72500	172.32500
124	166.73750	171.33750	**164**	167.23750	171.83750	**204**	167.73750	172.33750
125	166.75000	171.35000	**165**	167.25000	171.85000	**205**	167.75000	172.35000
126	166.76250	171.36250	**166**	167.26250	171.86250	**206**	167.76250	172.36250
127	166.77500	171.37500	**167**	167.27500	171.87500	**207**	167.77500	172.37500
128	166.78750	171.38750	**168**	167.28750	171.88750	**208**	167.78750	172.38750
129	166.80000	171.40000	**169**	167.30000	171.90000	**209**	167.80000	172.40000
130	166.81250	171.41250	**170**	167.31250	171.91250	**210**	167.81250	172.41250
131	166.82500	171.42500	**171**	167.32500	171.92500	**211**	167.82500	172.42500
132	166.83750	171.43750	**172**	167.33750	171.93750	**212**	167.83750	172.43750
133	166.85000	171.45000	**173**	167.35000	171.95000	**213**	167.85000	172.45000
134	166.86250	171.46250	**174**	167.36250	171.96250	**214**	167.86250	172.46250
135	166.87500	171.47500	**175**	167.37500	171.97500	**215**	167.87500	172.47500
136	166.88750	171.48750	**176**	167.38750	171.98750	**216**	167.88750	172.48750
137	166.90000	171.50000	**177**	167.40000	172.00000	**217**	167.90000	172.50000
138	166.91250	171.51250	**178**	167.41250	172.01250	**218**	167.91250	172.51250
139	166.92500	171.52500	**179**	167.42500	172.02500	**219**	167.92500	172.52500
140	166.93750	171.53750	**180**	167.43750	172.03750	**220**	167.93750	172.53750
141	166.95000	171.55000	**181**	167.45000	172.05000	**221**	167.95000	172.55000
142	166.96250	171.56250	**182**	167.46250	172.06250	**222**	167.96250	172.56250
143	166.97500	171.57500	**183**	167.47500	172.07500	**223**	167.97500	172.57500
144	166.98750	171.58750	**184**	167.48750	172.08750	**224**	167.98750	172.58750
145	167.00000	171.60000	**185**	167.50000	172.10000	**225**	168.00000	172.60000
146	167.01250	171.61250	**186**	167.51250	172.11250	**226**	168.01250	172.61250
147	167.02500	171.62500	**187**	167.52500	172.12500	**227**	168.02500	172.62500
148	167.03750	171.63750	**188**	167.53750	172.13750	**228**	168.03750	172.63750
149	167.05000	171.65000	**189**	167.55000	172.15000	**229**	168.05000	172.65000
150	167.06250	171.66250	**190**	167.56250	172.16250	**230**	168.06250	172.66250
151	167.07500	171.67500	**191**	167.57500	172.17500	**231**	168.07500	172.67500
152	167.08750	171.68750	**192**	167.58750	172.18750	**232**	168.08750	172.68750
153	167.10000	171.70000	**193**	167.60000	172.20000	**233**	168.10000	172.70000
154	167.11250	171.71250	**194**	167.61250	172.21250	**234**	168.11250	172.71250
155	167.12500	171.72500	**195**	167.62500	172.22500	**235**	168.12500	172.72500
156	167.13750	171.73750	**196**	167.63750	172.23750	**236**	168.13750	172.73750
157	167.15000	171.75000	**197**	167.65000	172.25000	**237**	168.15000	172.75000
158	167.16250	171.76250	**198**	167.66250	172.26250	**238**	168.16250	172.76250
159	167.17500	171.77500	**199**	167.67500	172.27500	**239**	168.17500	172.77500
160	167.18750	171.78750	**200**	167.68750	172.28750	**240**	168.18750	172.78750

Table B2.2 - VHF High Band Subsegment B

B3. Block, Group and Channel Structure for the 400 MHz Trunking Band

BLOCK	GROUP	CHANNEL NUMBER*				
1	1	**1**	**41**	**81**	**121**	**161**
	2	**21**	**61**	**101**	**141**	**181**
	3	**11**	**51**	**91**	**131**	**171**
	4	**31**	**71**	**111**	**151**	**191**
2	1	**2**	**42**	**82**	**122**	**162**
	2	**22**	**62**	**102**	**142**	**182**
	3	**12**	**52**	**92**	**132**	**172**
	4	**32**	**72**	**112**	**152**	**192**
3	1	**3**	**43**	**83**	**123**	**163**
	2	**23**	**63**	**103**	**143**	**183**
	3	**13**	**53**	**93**	**133**	**173**
	4	**33**	**73**	**113**	**153**	**193**
4	1	**4**	**44**	**84**	**124**	**164**
	2	**24**	**64**	**104**	**144**	**184**
	3	**14**	**54**	**94**	**134**	**174**
	4	**34**	**74**	**114**	**154**	**194**
5	1	**5**	**45**	**85**	**125**	**165**
	2	**25**	**65**	**105**	**145**	**185**
	3	**15**	**55**	**95**	**135**	**175**
	4	**35**	**75**	**115**	**155**	**195**
6	1	**6**	**46**	**86**	**126**	**166**
	2	**26**	**66**	**106**	**146**	**186**
	3	**16**	**56**	**96**	**136**	**176**
	4	**36**	**76**	**116**	**156**	**196**
7	1	**7**	**47**	**87**	**127**	**167**
	2	**27**	**67**	**107**	**147**	**187**
	3	**17**	**57**	**97**	**137**	**177**
	4	**37**	**77**	**117**	**157**	**197**
8	1	**8**	**48**	**88**	**128**	**168**
	2	**28**	**68**	**108**	**148**	**188**
	3	**18**	**58**	**98**	**138**	**178**
	4	**38**	**78**	**118**	**158**	**198**
9	1	**9**	**49**	**89**	**129**	**169**
	2	**29**	**69**	**109**	**149**	**189**
	3	**19**	**59**	**99**	**139**	**179**
	4	**39**	**79**	**119**	**159**	**199**
10	1	**10**	**50**	**90**	**130**	**170**
	2	**30**	**70**	**110**	**150**	**190**
	3	**20**	**60**	**100**	**140**	**180**
	4	**40**	**80**	**120**	**160**	**200**

Table B3.1 - Block and Group Structure for the 400 MHz Trunking Band

***	For allocations of channel numbers to frequencies, see Table B3.2**

CH #	BASE TX	BASE RX	CH #	BASE TX	BASE RX	CH #	BASE TX	BASE RX	CH #	BASE TX	BASE RX
1	415.5750	406.1250	**51**	416.2000	406.7500	**101**	416.8250	407.3750	**151**	417.4500	408.0000
2	415.5875	406.1375	**52**	416.2125	406.7625	**102**	416.8375	407.3875	**152**	417.4625	408.0125
3	415.6000	406.1500	**53**	416.2250	406.7750	**103**	416.8500	407.4000	**153**	417.4750	408.0250
4	415.6125	406.1625	**54**	416.2375	406.7875	**104**	416.8625	407.4125	**154**	417.4875	408.0375
5	415.6250	406.1750	**55**	416.2500	406.8000	**105**	416.8750	407.4250	**155**	417.5000	408.0500
6	415.6375	406.1875	**56**	416.2625	406.8125	**106**	416.8875	407.4375	**156**	417.5125	408.0625
7	415.6500	406.2000	**57**	416.2750	406.8250	**107**	416.9000	407.4500	**157**	417.5250	408.0750
8	415.6625	406.2125	**58**	416.2875	406.8375	**108**	416.9125	407.4625	**158**	417.5375	408.0875
9	415.6750	406.2250	**59**	416.3000	406.8500	**109**	416.9250	407.4750	**159**	417.5500	408.1000
10	415.6875	406.2375	**60**	416.3125	406.8625	**110**	416.9375	407.4875	**160**	417.5625	408.1125
11	415.7000	406.2500	**61**	416.3250	406.8750	**111**	416.9500	407.5000	**161**	417.5750	408.1250
12	415.7125	406.2625	**62**	416.3375	406.8875	**112**	416.9625	407.5125	**162**	417.5875	408.1375
13	415.7250	406.2750	**63**	416.3500	406.9000	**113**	416.9750	407.5250	**163**	417.6000	408.1500
14	415.7375	406.2875	**64**	416.3625	406.9125	**114**	416.9875	407.5375	**164**	417.6125	408.1625
15	415.7500	406.3000	**65**	416.3750	406.9250	**115**	417.0000	407.5500	**165**	417.6250	408.1750
16	415.7625	406.3125	**66**	416.3875	406.9375	**116**	417.0125	407.5625	**166**	417.6375	408.1875
17	415.7750	406.3250	**67**	416.4000	406.9500	**117**	417.0250	407.5750	**167**	417.6500	408.2000
18	415.7875	406.3375	**68**	416.4125	406.9625	**118**	417.0375	407.5875	**168**	417.6625	408.2125
19	415.8000	406.3500	**69**	416.4250	406.9750	**119**	417.0500	407.6000	**169**	417.6750	408.2250
20	415.8125	406.3625	**70**	416.4375	406.9875	**120**	417.0625	407.6125	**170**	417.6875	408.2375
21	415.8250	406.3750	**71**	416.4500	407.0000	**121**	417.0750	407.6250	**171**	417.7000	408.2500
22	415.8375	406.3875	**72**	416.4625	407.0125	**122**	417.0875	407.6375	**172**	417.7125	408.2625
23	415.8500	406.4000	**73**	416.4750	407.0250	**123**	417.1000	407.6500	**173**	417.7250	408.2750
24	415.8625	406.4125	**74**	416.4875	407.0375	**124**	417.1125	407.6625	**174**	417.7375	408.2875
25	415.8750	406.4250	**75**	416.5000	407.0500	**125**	417.1250	407.6750	**175**	417.7500	408.3000
26	415.8875	406.4375	**76**	416.5125	407.0625	**126**	417.1375	407.6875	**176**	417.7625	408.3125
27	415.9000	406.4500	**77**	416.5250	407.0750	**127**	417.1500	407.7000	**177**	417.7750	408.3250
28	415.9125	406.4625	**78**	416.5375	407.0875	**128**	417.1625	407.7125	**178**	417.7875	408.3375
29	415.9250	406.4750	**79**	416.5500	407.1000	**129**	417.1750	407.7250	**179**	417.8000	408.3500
30	415.9375	406.4875	**80**	416.5625	407.1125	**130**	417.1875	407.7375	**180**	417.8125	408.3625
31	415.9500	406.5000	**81**	416.5750	407.1250	**131**	417.2000	407.7500	**181**	417.8250	408.3750
32	415.9625	406.5125	**82**	416.5875	407.1375	**132**	417.2125	407.7625	**182**	417.8375	408.3875
33	415.9750	406.5250	**83**	416.6000	407.1500	**133**	417.2250	407.7750	**183**	417.8500	408.4000
34	415.9875	406.5375	**84**	416.6125	407.1625	**134**	417.2375	407.7875	**184**	417.8625	408.4125
35	416.0000	406.5500	**85**	416.6250	407.1750	**135**	417.2500	407.8000	**185**	417.8750	408.4250
36	416.0125	406.5625	**86**	416.6375	407.1875	**136**	417.2625	407.8125	**186**	417.8875	408.4375
37	416.0250	406.5750	**87**	416.6500	407.2000	**137**	417.2750	407.8250	**187**	417.9000	408.4500
38	416.0375	406.5875	**88**	416.6625	407.2125	**138**	417.2875	407.8375	**188**	417.9125	408.4625
39	416.0500	406.6000	**89**	416.6750	407.2250	**139**	417.3000	407.8500	**189**	417.9250	408.4750
40	416.0625	406.6125	**90**	416.6875	407.2375	**140**	417.3125	407.8625	**190**	417.9375	408.4875
41	416.0750	406.6250	**91**	416.7000	407.2500	**141**	417.3250	407.8750	**191**	417.9500	408.5000
42	416.0875	406.6375	**92**	416.7125	407.2625	**142**	417.3375	407.8875	**192**	417.9625	408.5125
43	416.1000	406.6500	**93**	416.7250	407.2750	**143**	417.3500	407.9000	**193**	417.9750	408.5250
44	416.1125	406.6625	**94**	416.7375	407.2875	**144**	417.3625	407.9125	**194**	417.9875	408.5375
45	416.1250	406.6750	**95**	416.7500	407.3000	**145**	417.3750	407.9250	**195**	418.0000	408.5500
46	416.1375	406.6875	**96**	416.7625	407.3125	**146**	417.3875	407.9375	**196**	418.0125	408.5625
47	416.1500	406.7000	**97**	416.7750	407.3250	**147**	417.4000	407.9500	**197**	418.0250	408.5750
48	416.1625	406.7125	**98**	416.7875	407.3375	**148**	417.4125	407.9625	**198**	418.0375	408.5875
49	416.1750	406.7250	**99**	416.8000	407.3500	**149**	417.4250	407.9750	**199**	418.0500	408.6000
50	416.1875	406.7375	**100**	416.8125	407.3625	**150**	417.4375	407.9875	**200**	418.0625	408.6125

Table B3.2 - Channel Allocations for the 400 MHz Trunking Band

B4. Block, Group and Channel Structure for the 800 MHz Trunking Band

BLOCK	GROUP	CHANNEL NUMBER*				
1	1	**1**	**41**	**81**	**121**	**161**
	2	**21**	**61**	**101**	**141**	**181**
	3	**11**	**51**	**91**	**131**	**171**
	4	**31**	**71**	**111**	**151**	**191**
2	1	**2**	**42**	**82**	**122**	**162**
	2	**22**	**62**	**102**	**142**	**182**
	3	**12**	**52**	**92**	**132**	**172**
	4	**32**	**72**	**112**	**152**	**192**
3	1	**3**	**43**	**83**	**123**	**163**
	2	**23**	**63**	**103**	**143**	**183**
	3	**13**	**53**	**93**	**133**	**173**
	4	**33**	**73**	**113**	**153**	**193**
4	1	**4**	**44**	**84**	**124**	**164**
	2	**24**	**64**	**104**	**144**	**184**
	3	**14**	**54**	**94**	**134**	**174**
	4	**34**	**74**	**114**	**154**	**194**
5	1	**5**	**45**	**85**	**125**	**165**
	2	**25**	**65**	**105**	**145**	**185**
	3	**15**	**55**	**95**	**135**	**175**
	4	**35**	**75**	**115**	**155**	**195**
6	1	**6**	**46**	**86**	**126**	**166**
	2	**26**	**66**	**106**	**146**	**186**
	3	**16**	**56**	**96**	**136**	**176**
	4	**36**	**76**	**116**	**156**	**196**
7	1	**7**	**47**	**87**	**127**	**167**
	2	**27**	**67**	**107**	**147**	**187**
	3	**17**	**57**	**97**	**137**	**177**
	4	**37**	**77**	**117**	**157**	**197**
8	1	**8**	**48**	**88**	**128**	**168**
	2	**28**	**68**	**108**	**148**	**188**
	3	**18**	**58**	**98**	**138**	**178**
	4	**38**	**78**	**118**	**158**	**198**
9	1	**9**	**49**	**89**	**129**	**169**
	2	**29**	**69**	**109**	**149**	**189**
	3	**19**	**59**	**99**	**139**	**179**
	4	**39**	**79**	**119**	**159**	**199**
10	1	**10**	**50**	**90**	**130**	**170**
	2	**30**	**70**	**110**	**150**	**190**
	3	**20**	**60**	**100**	**140**	**180**
	4	**40**	**80**	**120**	**160**	**200**

Table B4.1 - Block and Group Structure for the 800 MHz Trunking Band

***   For allocations of channel numbers to frequencies, see Table B4.2**

CH #	BASE TX	BASE RX	CH #	BASE TX	BASE RX	CH #	BASE TX	BASE RX	CH #	BASE TX	BASE RX
1	865.0125	820.0125	**51**	866.2625	821.2625	**101**	867.5125	822.5125	**151**	868.7625	823.7625
2	865.0375	820.0375	**52**	866.2875	821.2875	**102**	867.5375	822.5375	**152**	868.7875	823.7875
3	865.0625	820.0625	**53**	866.3125	821.3125	**103**	867.5625	822.5625	**153**	868.8125	823.8125
4	865.0875	820.0875	**54**	866.3375	821.3375	**104**	867.5875	822.5875	**154**	868.8375	823.8375
5	865.1125	820.1125	**55**	866.3625	821.3625	**105**	867.6125	822.6125	**155**	868.8625	823.8625
6	865.1375	820.1375	**56**	866.3875	821.3875	**106**	867.6375	822.6375	**156**	868.8875	823.8875
7	865.1625	820.1625	**57**	866.4125	821.4125	**107**	867.6625	822.6625	**157**	868.9125	823.9125
8	865.1875	820.1875	**58**	866.4375	821.4375	**108**	867.6875	822.6875	**158**	868.9375	823.9375
9	865.2125	820.2125	**59**	866.4625	821.4625	**109**	867.7125	822.7125	**159**	868.9625	823.9625
10	865.2375	820.2375	**60**	866.4875	821.4875	**110**	867.7375	822.7375	**160**	868.9875	823.9875
11	865.2625	820.2625	**61**	866.5125	821.5125	**111**	867.7625	822.7625	**161**	869.0125	824.0125
12	865.2875	820.2875	**62**	866.5375	821.5375	**112**	867.7875	822.7875	**162**	869.0375	824.0375
13	865.3125	820.3125	**63**	866.5625	821.5625	**113**	867.8125	822.8125	**163**	869.0625	824.0625
14	865.3375	820.3375	**64**	866.5875	821.5875	**114**	867.8375	822.8375	**164**	869.0875	824.0875
15	865.3625	820.3625	**65**	866.6125	821.6125	**115**	867.8625	822.8625	**165**	869.1125	824.1125
16	865.3875	820.3875	**66**	866.6375	821.6375	**116**	867.8875	822.8875	**166**	869.1375	824.1375
17	865.4125	820.4125	**67**	866.6625	821.6625	**117**	867.9125	822.9125	**167**	869.1625	824.1625
18	865.4375	820.4375	**68**	866.6875	821.6875	**118**	867.9375	822.9375	**168**	869.1875	824.1875
19	865.4625	820.4625	**69**	866.7125	821.7125	**119**	867.9625	822.9625	**169**	869.2125	824.2125
20	865.4875	820.4875	**70**	866.7375	821.7375	**120**	867.9875	822.9875	**170**	869.2375	824.2375
21	865.5125	820.5125	**71**	866.7625	821.7625	**121**	868.0125	823.0125	**171**	869.2625	824.2625
22	865.5375	820.5375	**72**	866.7875	821.7875	**122**	868.0375	823.0375	**172**	869.2875	824.2875
23	865.5625	820.5625	**73**	866.8125	821.8125	**123**	868.0625	823.0625	**173**	869.3125	824.3125
24	865.5875	820.5875	**74**	866.8375	821.8375	**124**	868.0875	823.0875	**174**	869.3375	824.3375
25	865.6125	820.6125	**75**	866.8625	821.8625	**125**	868.1125	823.1125	**175**	869.3625	824.3625
26	865.6375	820.6375	**76**	866.8875	821.8875	**126**	868.1375	823.1375	**176**	869.3875	824.3875
27	865.6625	820.6625	**77**	866.9125	821.9125	**127**	868.1625	823.1625	**177**	869.4125	824.4125
28	865.6875	820.6875	**78**	866.9375	821.9375	**128**	868.1875	823.1875	**178**	869.4375	824.4375
29	865.7125	820.7125	**79**	866.9625	821.9625	**129**	868.2125	823.2125	**179**	869.4625	824.4625
30	865.7375	820.7375	**80**	866.9875	821.9875	**130**	868.2375	823.2375	**180**	869.4875	824.4875
31	865.7625	820.7625	**81**	867.0125	822.0125	**131**	868.2625	823.2625	**181**	869.5125	824.5125
32	865.7875	820.7875	**82**	867.0375	822.0375	**132**	868.2875	823.2875	**182**	869.5375	824.5375
33	865.8125	820.8125	**83**	867.0625	822.0625	**133**	868.3125	823.3125	**183**	869.5625	824.5625
34	865.8375	820.8375	**84**	867.0875	822.0875	**134**	868.3375	823.3375	**184**	869.5875	824.5875
35	865.8625	820.8625	**85**	867.1125	822.1125	**135**	868.3625	823.3625	**185**	869.6125	824.6125
36	865.8875	820.8875	**86**	867.1375	822.1375	**136**	868.3875	823.3875	**186**	869.6375	824.6375
37	865.9125	820.9125	**87**	867.1625	822.1625	**137**	868.4125	823.4125	**187**	869.6625	824.6625
38	865.9375	820.9375	**88**	867.1875	822.1875	**138**	868.4375	823.4375	**188**	869.6875	824.6875
39	865.9625	820.9625	**89**	867.2125	822.2125	**139**	868.4625	823.4625	**189**	869.7125	824.7125
40	865.9875	820.9875	**90**	867.2375	822.2375	**140**	868.4875	823.4875	**190**	869.7375	824.7375
41	866.0125	821.0125	**91**	867.2625	822.2625	**141**	868.5125	823.5125	**191**	869.7625	824.7625
42	866.0375	821.0375	**92**	867.2875	822.2875	**142**	868.5375	823.5375	**192**	869.7875	824.7875
43	866.0625	821.0625	**93**	867.3125	822.3125	**143**	868.5625	823.5625	**193**	869.8125	824.8125
44	866.0875	821.0875	**94**	867.3375	822.3375	**144**	868.5875	823.5875	**194**	869.8375	824.8375
45	866.1125	821.1125	**95**	867.3625	822.3625	**145**	868.6125	823.6125	**195**	869.8625	824.8625
46	866.1375	821.1375	**96**	867.3875	822.3875	**146**	868.6375	823.6375	**196**	869.8875	824.8875
47	866.1625	821.1625	**97**	867.4125	822.4125	**147**	868.6625	823.6625	**197**	869.9125	824.9125
48	866.1875	821.1875	**98**	867.4375	822.4375	**148**	868.6875	823.6875	**198**	869.9375	824.9375
49	866.2125	821.2125	**99**	867.4625	822.4625	**149**	868.7125	823.7125	**199**	869.9625	824.9625
50	866.2375	821.2375	**100**	867.4875	822.4875	**150**	868.7375	823.7375	**200**	869.9875	824.9875

Table B4.2 - Channel Allocations for the 800 MHz Trunking Band

Annex C - Frequency-Distance Constraints

C1. Cull Limits Applicable to Frequency-Distance Constraints

Band of Operation	Cull Radius	Cull Frequency Range		
		Single Freq Segment	Two Freq Segment	
			Tx	Rx
VHF Mid Band	**250 km**	**±1.29 MHz**	**±1.29 MHz**	**±1.29 MHz**
VHF High Band	**200 km**	**±1.29 MHz**	**±1.29 MHz**	**±1.29 MHz**
400 MHz Band	**200 km**	**±1.2 MHz**	**±1.2 MHz**	**±1.2 MHz**
800 MHz Trunking Band	**200 km**	**N/A**	**±1.2 MHz**	**±1.2 MHz**

Table C1 - Cull Limits Applicable to Frequency-Distance Constraints

C2. Frequency-Distance Constraints for Single Frequency LMRS in the VHF Mid and High Bands

The following frequency-distance constraints apply whenever:

- a 83 W EIRP single-frequency system (proposed or existing) requires frequency coordination;
- two-frequency systems are to be coordinated with one another, and one operates with reverse frequency sense to the other (ie, the transmit frequency of one is the same as the receive frequency of the other); or
- a two-frequency system's transmit frequency is close to a single frequency service receive frequency.

Frequency Distance Constraints for **Single Frequency** Services		
Frequency Offset (kHz)	Distance Separation (km)	
Proposed 12.5 kHz from Existing	Existing 25 kHz	Existing 12.5 kHz
<1.25	**140**	**140**
<3.75	**140**	**140**
<6.25	**140**	**120**
<8.75	**120**	**80**
<11.25	**100**	**35**
<13.75	**80**	**5**
<16.25	**60**	**5**
<18.75	**35**	**5**
<21.25	**8**	**5**
<23.75	**5**	**5**
<26.25	**5**	**5**
<45	**5**	**5**
<75	**5**	**5**
<105	**3**	**3**
<135	**2.5**	**2.5**
<165	**2**	**2**
<195	**1.4**	**1.4**
<225	**.9**	**.9**
<255	**.6**	**.6**
<285	**.4**	**.4**
<315	**.3**	**.3**
<1290	**.2**	**.2**

Table C2 - Frequency-Distance Constraints for 12.5 kHz Single Frequency LMRS in the VHF Mid and High Bands

C3. Frequency-Distance Constraints for Single Frequency LMRS in the 400 MHz Band

The following frequency-distance constraints apply whenever:

- a 83 W EIRP single-frequency system (proposed or existing) requires frequency coordination;
- two-frequency systems are to be coordinated with one another, and one operates with reverse frequency sense to the other (ie, the transmit frequency of one is the same as the receive frequency of the other); or
- a two-frequency system's transmit frequency is close to a single frequency service receive frequency.

Frequency Offset (kHz)	Distance Separation (km)	
Proposed 12.5 kHz Tx from Existing Rx	Existing 12.5 kHz Rx	Existing 25 kHz Rx
< 3	**120**	**120**
<= 12.5	**90**	**105**
<= 25	**4**	**15**
<= 37.5	**2**	**2**
<= 50	**0.7**	**0.7**
<= 62.5	**0.6**	**0.6**
<= 75	**0.5**	**0.5**
<= 87.5	**0.4**	**0.4**
<= 100	**0.4**	**0.4**
<= 200	**0.2**	**0.2**

Table C3.1 - Frequency-Distance Constraints for 12.5 kHz Single Frequency LMRS in the 400 MHz Band

Frequency Offset (kHz)	Distance Separation (km)	
Proposed 25 kHz Tx from Existing Rx	Existing 12.5 kHz Rx	Existing 25 kHz Rx
< 3	**120**	**120**
<= 12.5	**95**	**105**
<= 25	**17**	**40**
<= 37.5	**3**	**3.5**
<= 50	**1.5**	**1.5**
<= 62.5	**1**	**1**
<= 75	**0.6**	**0.6**
<= 87.5	**0.55**	**0.55**
<= 100	**0.5**	**0.5**
<= 200	**0.2**	**0.2**

Table C3.2 - Frequency-Distance Constraints for 25 kHz Single Frequency LMRS in the 400 MHz Band

C4. Frequency-Distance Constraints for Single Frequency LPMRS in the 400 MHz Band

The following frequency-distance constraints apply whenever:

- a 8.3 W EIRP single-frequency LPMRS (proposed or existing) requires frequency coordination;
- two-frequency LPMRS are to be coordinated with one another, and one operates with reverse frequency sense to the other (ie, the transmit frequency of one is the same as the receive frequency of the other); or
- a two-frequency LPMRS transmit frequency is close to a single frequency service receive frequency.

Frequency Offset (kHz)	Distance Separation (km)	
Proposed 12.5 kHz Tx from Existing Rx	Existing 12.5 kHz Rx	Existing 25 kHz Rx
< 3	**10**	**10**
<= 12.5	**3**	**6**
<= 25	**0.4**	**0.4**
<= 37.5	**0.2**	**0.2**

Table C4.1 - Frequency-Distance Constraints for 12.5 kHz Single Frequency LPMRS in the 400 MHz Band

Frequency Offset (kHz)	Distance Separation (km)	
Proposed 25 kHz Tx from Existing Rx	Existing 12.5 kHz Rx	Existing 25 kHz Rx
< 3	**10**	**10**
<= 12.5	**5**	**7**
<= 25	**0.5**	**0.8**
<= 37.5	**0.2**	**0.2**

Table C4.2 - Frequency-Distance Constraints for 25 kHz Single Frequency LPMRS in the 400 MHz Band

C5. Frequency-Distance Constraints for Two Frequency LMRS in the VHF Mid and High Bands

Frequency Distance Constraints for **Two Frequency** Services		
Frequency Offset (kHz)	Distance Separation (km)	
Proposed 12.5 kHz from Existing	Existing 25 kHz	Existing 12.5 kHz
<1.25	**100**	**100**
<3.75	**100**	**100**
<6.25	**100**	**80**
<8.75	**100**	**40**
<11.25	**80**	**10**
<13.75	**60**	**0**
<16.25	**40**	**0**
<18.75	**20**	**0**
<21.25	**10**	**0**
<23.75	**5**	**0**
<199.0	**0.2**	**0**

Table C5 - Frequency-Distance Constraints for Two Frequency LMRS in the VHF Mid and High Bands

C6. Frequency-Distance Constraints for Two Frequency LMRS in the 400 MHz Band

The following frequency-distance constraints apply whenever both systems to be coordinated (proposed and existing) use two frequency operation, and have the same frequency sense.

Frequency Offset (kHz)	Distance Separation (km)	
Proposed 12.5 kHz LMRS from Existing	Existing 25 kHz	Existing 12.5 kHz
< 12.5	**100**	**100**
< 25	**80**	**0**
>= 25	**0**	**0**
Proposed 25 kHz LMRS from Existing		
< 12.5	**100**	**100**
< 25	**100**	**55**
>= 25	**0**	**0**

Table C6 - Frequency-Distance Constraints for Two Frequency LMRS in the 400 MHz Band

C7. Frequency-Distance Constraints for Two Frequency LPMRS in the 400 MHz Band

The following frequency-distance constraints apply whenever both systems to be coordinated (proposed and existing) use two frequency operation, and have the same frequency sense.

Frequency Offset (kHz)	Distance Separation (km)	
Proposed 12.5 kHz LPMRS from Existing	Existing 25 kHz	Existing 12.5 kHz
< 12.5	**10**	**10**
< 25	**8**	**0**
>= 25	**0**	**0**
Proposed 25 kHz LPMRS from Existing		
<12.5	**10**	**10**
< 25	**10**	**5**
>= 25	**0**	**0**

Table C7 - Frequency-Distance Constraints for Two Frequency LPMRS in the 400 MHz Band

C8. Frequency-Distance Constraints for Trunked Services in the 800 MHz Trunking Band

Frequency Offset	Distance Separation
<25 kHz	**100 km**
>= 25 kHz	**0 km**

Table C8 - Frequency-Distance Constraints for Trunked Services in the 800 MHz Trunking Band

Annex D - Intermodulation Checks

D1. Cull Limits Applicable to Intermodulation Checks

Intermodulation Type	Third Order Intermodulation	Fifth Order Intermodulation
Receiver Intermodulation		
Caused in Proposed Receiver	**Tx within 2 km & 2.25 MHz**	**Tx within 0.2 km & 0.375 MHz**
Caused by Proposed Transmitter as Outer	**Tx within 4 km & 1.125 MHz** **Rx within 2 km & 2.25 MHz**	**Tx within 0.4 km & 0.125 MHz** **Rx within 0.2 km & 0.375 MHz**
Caused by Proposed Transmitter as Inner	**Tx within 4 km & 1.125 MHz** **Rx within 2 km & 1.125 MHz**	**Tx within 0.4 km & 0.125 MHz** **Rx within 0.2 km & 0.25 MHz**
Transmitter Intermodulation		
Third Order & Fifth Order Intermodulation	**Tx within 0.2 km & within the band 20 MHz above and 20 MHz below the proposed frequency**	

Table D1 - Cull Limits Applicable to Intermodulation Checks

D2. 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			
	12.5 kHz		25 kHz	
	3rd order	5th order	3rd order	5th order
12.5 kHz	**15**	**17.5**	**19.5**	**22**
25 kHz	**21.5**	**26.5**	**26**	**31**

Table D2 - Frequency Offset from Victim Receiver Within which an Intermodulation 'Hit' is Deemed to Occur

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

D3. Expressions for Evaluating Intermodulation Interference

The following equations should be used to evaluate receiver generated intermoduation interference. When the equations are satisfied, the level of the intermodulation product is not high enough[1] to cause harmful interference.

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

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

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

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

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

$PR + (EIRP - L_{b\ inner} + L_c - RF_{inner}) + (EIRP - L_{b\ middle} + L_c - RF_{middle}) +$
$(EIRP - L_{b\ outer} + L_c - RF_{outer}) + ECR\ 3/3 \leq RS$..**(3)**

The parameter values applicable to equations (1), (2) and (3) above are specified in Table D3.

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

D4. Parameter Values Applicable to Intermodulation Checks

Parameter		Assumed Value
RS	(Base Receiver Usable Sensitivity[2])	-119 dBm (800 MHz Trunking Band) -116 dBm (400 MHz Band) -107 dBm (VHF High Band) -101 dBm (VHF Mid Band)
PR	(Protection Ratio)	5 dB for 12 dB SINAD
EIRP	(Transmitter EIRP)	83 W (for LMRS) 8.3 W (for LPMRS)
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) 6 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 Mid and High Bands:** **2 dB** for Freq Offset <= 0.06 MHz **23.3 + 18.7*log(Freq Offset) dB** for 0.06 < Freq Offset <= 1.5 MHz **23.3 + 18.7*log(Freq Offset) + (Freq Offset – 1.5)*18/1.5** dB for 1.5 MHz < Freq Offset <= 4.4 MHz **70 dB** for Freq Offset > 4.4 MHz **For the 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 Trunking 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)	3 Signal Third Order: ECR 3/3 = -5 dB 2 Signal Third Order: ECR 2/3 = -9 dB 2 Signal Fifth Order: ECR 2/5 = -28 dB

Table D3 - Parameter Values Applicable to Intermodulation Checks

2 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.

Annex E - Inter-service Coordination

The following inter-service coordination requirements have been prepared by the ACA. Note that this list is not exhaustive. In some cases, specific ITU-R Recommendations may exist to address inter-service coordination. 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 defaults to the identification of all non-homogeneous services in the band in question, followed by a manual assessment of their impact on the interference environment.

E1. VHF Mid and High Assignments Adjacent to Television Channels 2, 3 and 6

The frequency-distance constraints detailed in RALI LM 5 [2] should be observed for all VHF Mid and High band land mobile frequency assignments within 7 MHz below or 2 MHz above the edges of VHF television channels 2, 3 or 6.

E2. 400 MHz Assignments in the Vicinity of Wideband Fixed Services

The frequency coordination requirements detailed in RALI FX 5 [6] should be observed for 403 – 500 MHz assignments within 160 km of wideband fixed services.

There are restrictions on the assignment of certain trunked channels in low demand areas to provide protection to wideband fixed services. These restrictions are detailed in Embargo 19 of RALI MS 3 [4].

E3. 400 MHz Assignments Within 675 km of Jervis Bay

The frequency coordination requirements detailed in Embargo 11 of RALI MS 3 [4] must be observed for single frequency land-mobile assignments within the 410.96875 - 412.25 MHz part of Segment H within 675 km of of Jervis Bay, NSW.

E4. 800 MHz Trunking Assignments Adjacent to UHF Television Channel 69

The frequency coordination requirements detailed in Annexure J of RALI LM 3 [1] should be observed for 800 MHz trunking assignments on channels 1, 2, 3 or 4 within 200 km of a UHF television channel 69 transmitter.

E5. 800 MHz Trunking Assignments Adjacent to Spectrum Licensed Services

Immediately adjacent to the 800 MHz trunking segments are the segments used by the AMPS mobile telephone service (825 - 845/870 - 890 MHz) which are being progressively withdrawn and are intended to be spectrum licensed.

Spectrum licensed receiver compatibility requirements are specified in *Radiocommunications Advisory Guidelines (Managing Interference from Apparatus-licensed Transmitters - 800 MHz Band) 1998* and should be observed for new 800 MHz trunking assignments to protect registered spectrum licensed receivers from harmful interference. Note that registered spectrum licensed receivers will appear in the ACA's Register of Radiocommunication Licences.