



Telco  
Authority

# 400 MHz Harmonised Government Spectrum Transition Plan

(Pre-rationalisation)

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## Contents

1. Purpose .....	4
2. Background .....	4
3. Transition Principles .....	5
4. ACMA 400 MHz Transition Arrangements .....	7
5. Transition Tasks .....	9
5.1. Transition Approval .....	9
5.2. Fixed Services .....	9
5.3. Land Mobile Services .....	10
5.3.1. Large Networks .....	10
5.3.2. Small Networks .....	10
5.3.3. Low Power systems .....	11
5.3.4. Equipment restricted systems .....	11
5.3.5. Transportable repeaters .....	11
5.4. Transition Deadlines .....	11
6. Spectrum Transition Plan Detail .....	11
6.1. Current Licence Details .....	12
6.2. Transition Assessment .....	13
6.2.1. Transition Activity and Timing Assessment .....	13
6.2.2. Capacity Assessment .....	15
6.2.3. Intermodulation Assessment .....	18
7. HGS Band Transition Summary .....	19
7.1. HGS Band 1 and 2 .....	19
7.2. HGS Band 3 .....	19
7.3. HGS Band 4 .....	19
7.4. HGS Band 5 .....	19
7.5. HGS Band 6 .....	19
7.6. Low Power Systems .....	20
7.7. Mitigation Strategies .....	20
8. Appendix B - Recommended frequencies to support specific purposes ..	21

## 1. Purpose

The purpose of this Spectrum Transition Plan (Plan) is to identify the principles, tasks, risks and mitigation strategies associated with managing 400MHz spectrum during this period of change regarding the new regulatory requirements in this band. It aims to provide a clear pathway for agencies to transition and highlights areas where congestion mitigation strategies will be required.

## 2. Background

The Spectrum Management Office (SMO) capability established in the Telco Authority is responsible for ensuring a coordinated, efficient and strategic approach to the management of spectrum that supports government operations in NSW. It is also responsible for meeting Corporate Plan objectives that relate to the efficient allocation and use of spectrum.

The Australian Communications and Media Authority (ACMA) commenced the 400 MHz harmonisation review in 2008 due to increasing congestion in the band. The review culminated in the creation of a new 400 MHz band plan in 2010 that includes a dedicated allocation of Harmonised Government Spectrum (HGS). The ACMA intends to finalise transition to the new band arrangements by 31 December 2015 in areas where congestion is defined, and by 31 December 2018 outside of these areas. The ACMA compliance requirements are captured in milestones aligning to prescribed dates.

The National Coordinating Committee for Government Radiocommunications (NCCGR) developed the Licensing Instruction RALI GS1 for assigning in the HGS. This Instruction designates the HGS into bands that consist of the band segments defined in the ACMA's RALI MS22 e.g. the ACMA defined segment O (420-430 MHz) is designated as Band 5 in RALI GS1.

The amount of spectrum identified in the HGS is finite and at the time of announcement by the ACMA in 2010, was less than the total amount of spectrum being used by government agencies in NSW. A number of projects being managed by the Telco Authority have the potential to impact adversely on the capacity to provide sufficient spectrum to support proposed operational requirements. The most critical of these is the consolidation of services in the Sydney Greater Metropolitan Area (GMA).

The SMO is using the opportunity provided by the ACMA compliance milestone regime to review and assess current NSW spectrum allocations and ensure any allocation is aligned to Telco Authority planning/ strategies and supports identified government operational requirements.

This Plan will only support the allocation of dedicated spectrum that underpins operational requirements where the transition review and assessment process indicates it is the only viable option and other options including consolidating services, use of existing services or alternative communication applications (e.g. public mobile phone) have been exhausted.

The Plan has been developed to guide the transition of government services that are not compliant with the new arrangements.

### **3. Transition Principles**

The Plan is based on a number of Guiding Principles to ensure that it effectively achieves the aims of the NSW Telco Authority.

These Principles are:

- The Plan should support and drive the government policy to maximise efficiency and minimise waste. HGS is a limited resource that must be used efficiently to maximise public benefit through its use.
  - The NSW Government owned shared trunked land mobile network (GRN) is the most spectrally efficient way of providing voice radio services to government agencies and should always be the first option considered to meet operational requirements.
  - The HGS may only be used to support government operational requirements. Any system that is to transition into the HGS must first demonstrate that a dedicated allocation of spectrum is the most appropriate option for meeting the agencies operational requirements. Spectrum allocations may not be assigned on a “like for like” approach especially where this would lead to a duplication of networks and therefore inefficient use of spectrum.
  - Factors that are to be considered in determining if a dedicated allocation of spectrum is justified include but are not limited to, the number of users, the geographic coverage area, the density of users, and if there is an overlap in coverage area with the GRN.
  - Wherever possible allocations in the HGS should support and enable future rationalisation of services. Where possible, allocations are to be made in such a way that they can be migrated to or integrated into the GRN e.g. frequencies in regional areas that may be targeted for a future trunked network should be assigned from Band 4 or 5 (the bands that support trunking services).
  - The Plan should provide spectrum for the future expansion of shared network services in terms of both user capacity and geographic coverage.

- o There is a strict requirement that any allocated spectrum is utilised in a manner which limits spectrum denial. When an allocation of spectrum is made, the use of that spectrum is denied to other users. The extent of that denial is chiefly governed by the channel bandwidth, the transmit power level and the geographical location. It is therefore critical that both the channel bandwidth and the transmit power are kept at lowest possible level that still meets the operational requirement in a given location.
- The Plan must support frontline operations and not unduly inhibit their role in protecting the public or providing essential services.
  - o The Plan should be implementable and not assume agencies undertake activities that are not possible or practical.
  - o Where a system has been deemed appropriate for an allocation of spectrum, the Plan should where possible align with agencies existing plans for equipment replacement programs and network upgrades to minimise cost impact. All planned new and upgraded equipment must be as spectrally efficient as possible.
  - o There should be a provision for temporary allocations where technical equipment constraints prevent direct transition to the preferred HGS band. This would provide a two-step process to transition through an alternative HGS band. This initial transition to the alternative HGS band would ensure compliance with the ACMA transition milestone deadline. At the next equipment upgrade the transition to the preferred HGS band would be completed. The Plan should be fair, equitable and transparent while balancing equity of access to spectrum with efficiency and other competing principles. Given the comparative lack of congestion in areas outside Greater Metropolitan Area (GMA) the comparative balance achieved by the plan would be tailored to take that into account.
- The Plan should comply with all relevant legislation, instruments and policies.
  - o Legislation, policies and ACMA instruments e.g. Radiocommunications Act 1992, RALI LM08, RALI MS22 and, all relevant spectrum embargoes.
  - o The NCCGR Licensing Instruction RALI GS1
  - o The NSW Government Telecommunications Act 1991 No 77
  - o The timeline and order for transitions in the Plan that will be determined by the ACMA's timeframes and implementation plans for the 400 MHz Band.
- The Plan should provide timelines and milestones that can be managed, reported and tracked so that progress of the transition is transparent.

- The NSW Telco Authority should manage the licensing process for all government agencies to ensure efficient use and demand management during and beyond the transition phase. All new or amended licensing in the HGS in NSW needs to be endorsed by the NSW Telco Authority before proceeding to the ACMA.

#### 4. ACMA 400 MHz Transition Arrangements

The creation of the HGS by the ACMA triggered a review of existing licences to determine what changes may need to be made in order to comply with the new arrangements. The impact of the ACMA milestone compliance requirements on licences are to transition:

- to narrowband channels (High and Medium Density Areas only)
- to Low Power (no greater than 83 watts Effective Isotropic Radiated Power [EIRP])
- into the HGS (Government Licences)
- out of the HGS (Non-Government Licences)
- to 10 MHz duplex split in the 450-470 MHz part of the HGS (Band 6).

The ACMA's transition arrangements have been defined for.

- High and Medium Density Areas and within 100km of the boundary around these areas
- Low and Remote Density Areas

The compliance requirements and timelines for the two ACMA defined areas are shown in Table 1 and Table 2 below.

HIGH-DENSITY AREAS, MEDIUM-DENSITY AREAS & WITHIN 100 KM BOUNDARY	31 December 2012	31 December 2014	31 December 2015
Non-government	Transitioned to narrowband  Transitioned to low power or cease operation  Clearance from certain band segments	Transitioned to 10 MHz duplex split  Relocated out of certain harmonised government band segments	Relocated out of all remaining harmonised government band segments

HIGH-DENSITY AREAS, MEDIUM-DENSITY AREAS & WITHIN 100 KM BOUNDARY	31 December 2012	31 December 2014	31 December 2015
Government	<p>Transitioned to narrowband</p> <p>Transitioned to low power or cease operation</p> <p>Clearance from certain band segments</p>	<p>Transitioned to 10 MHz duplex split</p> <p>Relocated into harmonised government band segments from certain band segments</p>	Relocated into harmonised government band from all other band segments

Table 1 - High and Medium Density Areas Compliance Timeline

LOW-DENSITY AREAS & REMOTE-DENSITY AREAS	31 December 2013	31 December 2015	31 December 2018
Non-government	<p>Transitioned to low power or cease operation</p> <p>Clearance from certain band segments</p>	<p>Transitioned to 10 MHz duplex split</p> <p>Relocated out of certain harmonised government band segments</p>	Relocated out of all remaining harmonised government band segments
Government	<p>Transitioned to low power or cease operation</p> <p>Clearance from certain band segments</p>	<p>Transitioned to 10 MHz duplex split</p> <p>Relocated into harmonised government band segments from certain band segments</p>	Relocated into harmonised government band from all other band segments

Table 2 - Low and Remote Density Areas Compliance Timeline



The ACMA's Register of Radiocommunications Licences (RRL) database has given all 400 MHz licences milestone compliance tags. These tags allow licensees to easily see if their licences are compliant or not compliant. If licences are not compliant the tag shows the required transition activity and timeframe. In some cases multiple compliance tags will be applied e.g. a licence in the 450-470 MHz band that needs to transition to the HGS may also have an additional compliance tag about transitioning to a 10 MHz duplex split. In this case the second tag relating to the 10 MHz duplex split is not necessarily critical as after transition the licence will need to adhere to the duplex split appropriate for the destination HGS band rather than the current band segment.

## **5. Transition Tasks**

### **5.1. Transition Approval**

Not all non-complaint licences will be transitioned to the HGS. The NSW Telco Authority will assess any proposal to transition in accordance with the transition principles in Section 3.

A number of licences have already been approved for transition using the principles, providing a knowledge base to assist in the assessment of outstanding licences still requiring a transition activity against the ACMA milestones.

### **5.2. Fixed Services**

There is no dedicated HGS band for assigning fixed services (point-to-point or point-to-multipoint). Where there is an ACMA milestone compliance issue on a government fixed service licence, it will transition to the designated 400 MHz fixed services segments as shown below unless the Telco Authority assesses there is an advantage in assigning HGS to support the service.

- Fixed point to point services with a 12.5 kHz channel bandwidth can be assigned frequencies from segments B/J or Q/U
- Fixed point to multipoint services with a 12.5 kHz channel bandwidth can be assigned frequencies from segments R/V

These segments are not designated as either Government or Non-Government and are available for use by either group.

Government fixed services that currently use band segments that are designated for Non-Government use have a compliance requirement to move out of those band segments. The ACMA's RRL database has a compliance tag for these licences stating "Relocate into Harmonised Government Spectrum (HGS) Bands". The wording of this requirement is misleading, as frequencies can be assigned from the designated 400 MHz fixed services segments that are not part of the HGS.

Fixed point to point services can reuse the same frequency in close proximity due to angular discrimination of the antennas. There are relatively few point to point licences that may need to transition (52) therefore there is a low risk that these licences will be unable to find a channel if a transition is required.

Fixed point to multipoint services can re-use frequencies in a similar manner to land mobile services. In cases where it is impossible to find a spectrum allocation in the designated fixed point to multipoint band segment (R/ V) then the ACMA permits Land Mobile frequencies to be used. In these cases HGS frequencies would be used therefore the agency should seek approval from the NSW Telco Authority and the request will be assessed against the principles in Section 3.

### **5.3. Land Mobile Services**

Licensed frequencies that support land mobile services operated by State or Federal Government agencies must be assigned from the HGS and adhere to the nationally endorsed band plan and instructions that details the designated HGS band for specific applications (shown in RALI GS1).

Not all non-complaint licences will be transitioned to the HGS. The NSW Telco Authority will assess any proposal to transition in accordance with the transition principles in Section 3.

Land Mobile systems that are to transition to the HGS should be transitioned to a HGS band in accordance with RALI GS1.

#### **5.3.1. Large Networks**

Large trunked or conventional networks that are operated by agencies with state wide operations should be assessed for integration into the GRN. Any parts of these networks that cannot be integrated into the shared network at this time should be assessed for transitioning to HGS Band 5.

#### **5.3.2. Small Networks**

Small and localised networks operated by agencies should be assessed to see if they require dedicated spectrum as per the transition principles in Section 3. If they are validated as needing an allocation of spectrum then it should be assigned from HGS Band 1 or 2 (2 frequency systems), HGS Band 3 (single frequency systems) or in some cases, the channels available in HGS Band 5 (single frequency systems).

### **5.3.3. Low Power systems**

Low power systems operating at 5 watts transmit power have a channel reuse distance of 10 kilometres as opposed to 100 kilometres for a system operating at 50 watts transmit power. In order to increase spectrum efficiency, a discrete number of channels have been allocated for low power use enabling maximum channel reuse. The channels to be used for Low Power Systems are detailed in Appendix B. and are already in use as a result of the NSW Telco Authority authorisation.

### **5.3.4. Equipment restricted systems**

Some existing aged equipment currently operates above 500 MHz and cannot be tuned down to the lower bands of the HGS as part of a transitioning requirement to 403-430 MHz so will initially transition into HGS Band 6. When the equipment is next replaced the system should be transitioned to the preferred HGS band. As with low power systems, the Telco Authority has designated a discrete set of channels to facilitate this strategy. Channels reserved for this purpose are detailed in Appendix B.

### **5.3.5. Transportable repeaters**

RALI GS1 sets aside two channel sets in HGS band 5 in sub-segment II (channel sets 29 and 39) for the exclusive use of transportable two frequency services (transportable repeaters). Where possible, other services should not be assigned to these channels.

## **5.4. Transition Deadlines**

All licences that are currently non-compliant will have a milestone with relevant details indicating the transition activity required. Along with the transition activity is a timeframe that corresponds to the timelines detailed in Table 1 and Table 2. Should the transition not be possible before the deadline then a request for extension of the deadline (exception request) can be made to the ACMA. This request should include details of the transition plan and timing. Open ended requests for extension will not be accepted.

## **6. Spectrum Transition Plan Detail**

The Spectrum Transition Plan Detail is in Appendix A. It is a spread sheet that details every licence in NSW that currently belongs to a government agency and is non-compliant with the new 400 MHz arrangements at the time of publishing (11/9/2014). The criteria for a licence being included in the plan are:

- The ACMA's RRL database has them categorised as "Government". This includes all state and federal government agencies
- The ACMA's RRL database has a compliance tag against the licence other than "No action required"

- The site location of the licence is in NSW

### 6.1. Current Licence Details

To identify each licence and its current details the Spectrum Transition Plan Detail has the following data fields taken directly from the ACMA's RRL database

Data Field name	Data Field description
LIC_TYPE	Identifies the type of licence, in the case of this STP licences are either Fixed or Land Mobile.
LIC_CAT	Identifies the category of licence, for Fixed services this is either Point to Point or Point to Multipoint, for Land Mobile services, this can be an normal Land Mobile System or a type of Ambulatory System.
Current Segment	This identifies the band segment (as per RALI MS22) that the licence currently uses.
ACCESS_ID	The identifier of the RADCOM Spectrum Access record. Each licence may have more than one Spectrum Access record and therefore multiple Access IDs and entries in the table.
FREQ_ASS	The frequency (in Hertz) in the centre of the occupied bandwidth
EIRP	Effective Isotropic Radiated Power - the maximum level permitted of radiated power from the antenna referenced to an isotropic (point source) radiator in Watts.
TX_POWER	The maximum level of RF power permitted to be produced by the transmitter
CLIENT_NO	Each client is identified with a unique client number
LICENCE_NO	Each licence has its own unique number
LICENSEE	Contains the name of the Licensee as printed on licences held by the Client
LIC_BW	The bandwidth used for licence charging purposes calculated from the Upper and Lower frequency limits
LIC_AREA	The licensing charge area, also known as the spectrum use density area

Data Field name	Data Field description
COVERAGE	Australia, Regional, Local or Sub-Local
SITE_ID	Each site is at a unique location and the Site ID is unique. Sites greater than 10 metres apart will have their own discrete Site ID even though they are in close proximity.
LOCATION	Site name and address
LATITUDE	Latitude in AGD66
LONGITUDE	Longitude in AGD66
SITE_STATE	State of Australia
POSTCODE	Australian Postcode
ACMA Transition Tag	The transition tag taken directly from the ACMA's RRL database.

Table 3 – Data field code & descriptions

## 6.2. Transition Assessment

### 6.2.1. Transition Activity and Timing Assessment

In accordance with the Transition Tasks outlined in section 5 each licence has been allocated detail for the following fields

Data Field name	Data Field description
Transition activity	<p>This is a brief description of what milestone transition activity is planned for each licence. These descriptions are explained on below. Note that for some licences multiple descriptions may apply.</p> <ul style="list-style-type: none"> <li>• Approved for transition – these are licences that have already been assessed and approved for transition to the HGS. These licences will need spectrum to be allocated from the HGS.</li> <li>• Yet to be approved for transition – these are licences that have not yet been assessed for transition to the HGS. These licences will either be surrendered or approved for transition.</li> </ul>

Data Field name	Data Field description
	<ul style="list-style-type: none"> <li>• May be retagged as Non-Government – these licences belong to agencies where their future status as Government licences is unknown. In most cases if they are retagged as Non-Government then they will also be retagged as compliant and will not need to transition.</li> <li>• Will be retagged as compliant (10 MHz split) – these licences belong to the NSW Police Force, the ACMA's RRL database currently tags them as non-compliant because they do not have a 10MHz duplex split. They are compliant voting systems and the ACMA will update their system to retag these as compliant.</li> <li>• Need to reduce bandwidth – these licences do not need to relocate. They need to reduce from 25 kHz to 12.5 kHz channel bandwidth. They can be allocated half of their existing spectrum without any risk of being denied spectrum.</li> <li>• Will be surrendered – these licences will be surrendered before the transition deadline. The services currently provided by these licences will be provided using other arrangements such as the GRN</li> <li>• Change Duplex Split – these licences can stay in their current band segment but they need to change the duplex split to be compliant with the new arrangements. They need vacant channels to move in the current band segment but they will not change the overall utilisation of the band.</li> <li>• Re-Licence as Point to Point – there is one licence for a point to point link that has been given the incorrect licence type and category. It needs to be re-licenced with the correct type and category, it does not need to change frequency or any other details.</li> <li>• Relocate out of the Rail Industry channels band – there are a number of licences that are currently assigned in the Rail Industry portion of HGS Band 4. These licences should transition to another HGS location.</li> </ul>

Data Field name	Data Field description
	<ul style="list-style-type: none"> <li>Relocate to the Rail Industry channels – these are licences operated by the rail industry that are currently assigned in the HGS. These licences should transition to Rail Industry channels within HGS Band 4.</li> <li>Relocate to HGS Band 5 or change duplex split – there are 2 licences that belong to the Ambulance Service of NSW that currently use HGS Band 6. They do not comply with the new duplex split arrangements in HGS Band 6. Ideally these licences would transition to HGS Band 5 along with the other Ambulance Service of NSW Licences. However if this is not possible before the deadline then the service can change their duplex split. The transition assessment for these licences has been done assuming they will transition to HGS Band 5.</li> </ul>
Transition deadline	This is the deadline by which the Transition activity will need to be completed. This clarifies the deadline in the ACMA Transition tag in cases where multiple tags apply.
Deadline extension	Details of any deadline extensions that have been granted by the ACMA. <i>These details are not yet available. They are currently being sought from the ACMA by the NSW Telco Authority.</i>
Destination band	This specifies the destination HGS band for all licences that might need to transition whether or not they have been approved. For fixed services this will be a band segment that is not part of the HGS. This field is not specified for licences where it is known that the service will not be relocating. For low power systems this will be the subset of channels set aside as detailed in Appendix B.

Table 4 – Data field name & description

### 6.2.2. Capacity Assessment

For each licence where a destination band in the HGS has been specified it has been determined whether there will be sufficient available spectrum. HGS Bands 1 and 2 are to be used for the same purpose therefore the capacity assessment for these two bands have been combined. All values for these two bands in the capacity assessment are the combined values of both bands.

First the channel capacity of the destination band was determined and specified in the data field below.

Data Field name	Data Field description
Destination band capacity	The total number of channels in the destination band, as per RALI MS22. This excludes any channels reserved for special purposes such as those detailed in Appendix B.

Table 5 – Band Capacity description

Then a geographic based analysis of all current licences in the destination band was undertaken. Each Licence will have a re-use distance defined in RALI LM08. Channels cannot be re-used within the re-use distance range due to the risk of co-channel interference. The analysis determined how many channels are currently being used within the re-use distance of the site in question. This determines the value for the data field below.

Data Field name	Data Field description
Existing occupied channels	The number of channels that are currently occupied in the destination band, within the re-use distance. This value is calculated from the ACMA's RRL database using geographic based queries.

Table 6 – Existing occupied channels description

A number of services have already been approved for transition and will require channels. For each licence a geographic analysis of the already approved services was undertaken to determine the required number of channels which is specified in the data field below.

Data Field name	Data Field description
Required channels for approved services	The number of channels that are required to accommodate the already approved services transitioning to the destination band, within the reuse distance. This value is calculated from the other entries in the STP detail spread sheet using geographic based queries.

Table 7 – Required channels for approved service description

The previous three data fields are used to determine how many channels remain free for use by services that have not yet been approved. This data field is calculated as follows



Data Field name	Data Field Description
Number of channels that remain free for use by services that have not yet been approved	Value = Destination Band Capacity – Existing occupied channels – Required Channels for Approved services

Table 8 – Number of channels that remain free for use by services that have not yet been approved description

The remainder of the services have not yet been approved for an allocation of spectrum in the destination band. If they are approved they will require channels to be allocated. For each licence a geographic analysis of the yet to be approved services was done to determine the required number of channels which is specified in the data field below.

Data Field name	Data Field description
Required channels for yet to be approved services	The number of channels that are required to accommodate the yet to be approved services transitioning to the destination band, within the reuse distance. This value is calculated from the other entries in the STP spread sheet using geographic based queries.

Table 9 – Required channels for yet to be approved services description

The required number of channels for yet to be approved services is assessed against the number of channels that remain free for use by services that have not yet been approved. If this number is higher than what remains free then there will be a capacity deficit which is specified in the data field below.

Data Field name	Data Field description
Capacity Deficit	Value = Required channels for yet to be approved services – number of channels that remain free for use by services that have not yet been approved

Table 10 – Capacity Deficit description

In cases where the capacity deficit is positive then a capacity deficit exists. Not all licences with a capacity deficit can be approved for transition.

### 6.2.3. Intermodulation Assessment

Intermodulation checks need to be performed during frequency assignment to ensure that any intermodulation products do not cause interference to the proposed licence and collocated or nearby services.

The process for intermodulation checks is specified in RALI LM08. The bandwidth range of existing services that need to be taken into account are defined for collocated services (within 200m) and nearby services (up to 4km).

A geographic analysis has been done to determine the number of existing services that may need to be considered in the intermodulation check at the site. The bandwidth for consideration used is from the lower limit of the destination band minus the bandwidth range specified in RALI LM08 to the upper limit of the destination band plus the bandwidth range specified in RALI LM08. This gives the following two data fields.

Data Field name	Data Field description
Number of Collocated Services contributing to Intermodulation	The number of existing services within 200m of the site that are within the consideration bandwidth. This value is calculated from the ACMA's RRL database using geographic based queries.
Number of Nearby Services contributing to Intermodulation	The number of existing services within 4km of the site that are within the consideration bandwidth. This value is calculated from the ACMA's RRL database using geographic based queries.

Table 11 – Collocated and nearby services description

If an intermodulation issue is encountered on a proposed channel during frequency assignment then an alternative channel is chosen. A problem arises only if there are no longer any alternative free channels to choose from. Busier sites with a greater number of existing services will create a larger number of intermodulation products and are more likely to need to choose alternative channels. These sites should be assigned first while the greatest number of channels is still free. Less busy sites are unlikely to need to choose alternative channels and can be assigned later when there are a limited number of free channels remaining.

To differentiate the sites they have been divided into High, Medium and Low Risk. A "High" risk rating has been assigned to the busiest third of the sites, a "Medium" risk rating has been assigned to the middle third, and a "Low" risk rating has been assigned to the least busy third. This gives the data field below.

Data Field name	Data Field description
Intermodulation Risk	High, Medium or Low risk

Table 12 - Intermodulation risk description

## 7. HGS Band Transition Summary

For each of the HGS Bands the transition is summarised below.

### 7.1. HGS Band 1 and 2

As explained in section 5.3.2, small networks should use HGS Bands 1 and 2 if they are approved for transition. In the GMA the current utilisation of HGS Bands 1 and 2 is approximately 50%. For transitioning services there is a capacity deficit at a number of sites within the GMA. In these areas mitigation strategies must be employed.

Outside the GMA there is not a capacity deficit channels and will be available for all licences that are approved for transition.

### 7.2. HGS Band 3

Currently there are no licences designated to transition to HGS Band 3.

### 7.3. HGS Band 4

A number of licences need to relocate from the Rail Industry segments to other channels in HGS Band 4. There is not a capacity deficit and channels will be available for all licences that are approved for transition.

### 7.4. HGS Band 5

Ambulance NSW operates a large network that should transition to HGS Band 5. There is not a capacity deficit and channels will be available for all licences that are approved for transition.

### 7.5. HGS Band 6

HGS Band 6 has a number of licences that need to change their duplex split to the 10 MHz. Free channels are needed in order to change the duplex split but transitioning the licences should not change the overall utilisation in the Band. There is not a capacity deficit and channels will be available for all licences that are approved for transition.

## **7.6. Low Power Systems**

As explained in section 5.3.3, Low Power System should use dedicated channels detailed in Appendix B if they are approved for transition. There are no sites with a capacity deficit but there are sites where the calculated capacity deficit is equal to zero. This means that in some areas all of the available channel may be used leaving no free channels for future systems. It is therefore prudent to be cautious with allocations of spectrum and apply mitigation strategies where appropriate.

## **7.7. Mitigation Strategies**

The chief mitigation strategy in areas where there is a capacity deficit is the approval process for transitioning licences. It is clear from the calculations in the STP Detail (Appendix A) that not all licences will be able to receive an allocation of spectrum for transition. A significant percentage of services that currently have a licence will not be given a spectrum allocation and will need to make alternative arrangements.

An alternative mitigation strategy in areas where there is a capacity deficit is the use of more spectrally efficient equipment and technologies. In High Density Areas, Medium Density Areas and Areas within 100 km of the boundary, services should have already transitioned to 12.5 kHz channels (narrowband). The capacity deficit is calculated on the assumption that all existing and future equipment uses 12.5 kHz channels or less. There is equipment on the market that uses 6.25 kHz channels (P25 Phase 2). Using 6.25 kHz channels would reduce the required spectrum and has the potential to greatly reduce the capacity deficit if used widely.

## 8. Appendix B - Recommended frequencies to support specific purposes

The frequencies in the table below were selected after analysis of available channels in the nationally endorsed bands. This approach enables maximum reuse opportunities and will be extended to support other transitioning activities where individual frequencies can be identified from the nationally agreed designated HGS Bands.

Low power local or sub-local networks paired frequencies			
Options	HGS Band	Rx (MHz)	Tx (MHz)
Permanent Pair 1.	1	403.0750	412.5250
Permanent Pair 2.	1	403.1500	412.6000
Permanent Pair 3.	1	403.1625	412.6125
Permanent Pair 4.	1	403.2250	412.6750
Permanent Pair 5.	1	403.2500	412.7000
Permanent Pair 6.	1	403.3875	412.8375
Permanent Pair 7.	1	403.5250	412.9750
Transition Pair 1.	6	457.5500	467.5500
Low power local or sub-local networks single frequencies			
Single Frequency 1.	3	0	415.4625
Single Frequency 2.	5	0	426.1000
Single Frequency 3.	5	0	426.1250
Single Frequency 4.	5	0	426.3250
Single Frequency 5.	6	0	469.4500
Single Frequency 6.	6	0	469.6500
Transition frequencies for temporary use where legacy equipment operating above 500 MHz will not enable assignment lower in the HGS (403-420 MHz)			
Transition Pair 2.	6	457.6375	467.6375
Transition Pair 3.	6	457.6500	467.6500
Transition Pair 4.	6	457.6625	467.6625
Transition Pair 5.	6	459.6875	469.6875
Transition Pair 6.	6	459.6250	469.6250
Transition Pair 7.	6	459.7625	469.7625

END of DOCUMENT

