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| Update to the 1800 MHz spectrum licence technical framework - Technical Liaison Group Consultation Paper |
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| |  |  |  | | --- | --- | --- | | **Version** | **Release Date** | **Comments** | | 1 | 4 March 2015 | Initial release | | 1.1 | 15 April 2015 | Inserted correct HCIS identifiers for Mackay area of high mobile use | | 2 | May 2015 | Changes made as outlined in the *1800 MHz TLG 2015:* *Response to Submissions Paper* | |

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# Abbreviations

|  |  |
| --- | --- |
| AP | Accredited Person |
| BS | Base Station |
| DBC | Device Boundary Criteria |
| FDD | Frequency Division Duplex |
| FDR | Frequency Dependant Rejection |
| IMT | International Mobile Telecommunications |
| OOB | Out-of-band |
| RAG | Radiocommunications Advisory Guidelines |
| SL | Spectrum Licence |
| TDD | Time Division Duplex |
| TF | Technical Framework |
| TLG | Technical Liaison Group |
| UE | User Terminal |
| USO | Universal Service Obligations |
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# Introduction

## Background

The 1800 MHz band spectrum licence technical framework (TF) was reviewed in 2012, the details of this review are available from the [ACMA website](http://www.acma.gov.au/Industry/Spectrum/Radiocomms-licensing/Spectrum-licences/spectrum-licence-technical-liaison-groups). The TF was optimised to support FDD IMT services. This revised technical framework is now in force for all 1800 MHz spectrum licences.

The ACMA is currently [consulting](http://www.acma.gov.au/Industry/Spectrum/Spectrum-projects/1800-MHz-band/draft-recommendation-for-regional-1800-mhz-band) on options to re-allocate for spectrum licensing up to 2x60 MHz of spectrum in the 1800 MHz band in regional Australia. There are numerous fixed links that are currently operating in this spectrum and in the areas under consideration. Telstra holds a majority of these licences. The ACMA is working to identify options for the continued delivery of these services, should arrangements in the regional 1800 MHz band change.

The ACMA is therefore investigating options to operate these fixed link services under an 1800 MHz band spectrum licence while managing interference and the potential for spectrum denial to other services. The 1800 MHz band technical liaison group (TLG) has been formed to provide advice on how best to achieve this.

## 1800 MHz spectrum licence band

The 1800 MHz spectrum licence band currently consists of:

* the 1710-1785 MHz / 1805-1880 MHz bands in Adelaide, Brisbane, Melbourne, Sydney and Perth;
* the 1710-1725 MHz / 1805-1820 MHz bands in regional areas of Australia (including Canberra, Darwin and Hobart).

Figure 1 displays those areas and frequencies that are subject to spectrum licensing in the 1800 MHz band. These areas are also available as a Placemark file viewable in Google Earth. The Placemark can be downloaded from the [ACMA website](http://www.acma.gov.au/interforms/placemarks/embargo/embargo_26.kmz).

The ACMA is currently consulting on extending spectrum licensing in the 1725-1785 MHz / 1820-1880 MHz bands in regional Australia (the blue areas in Figure 1).

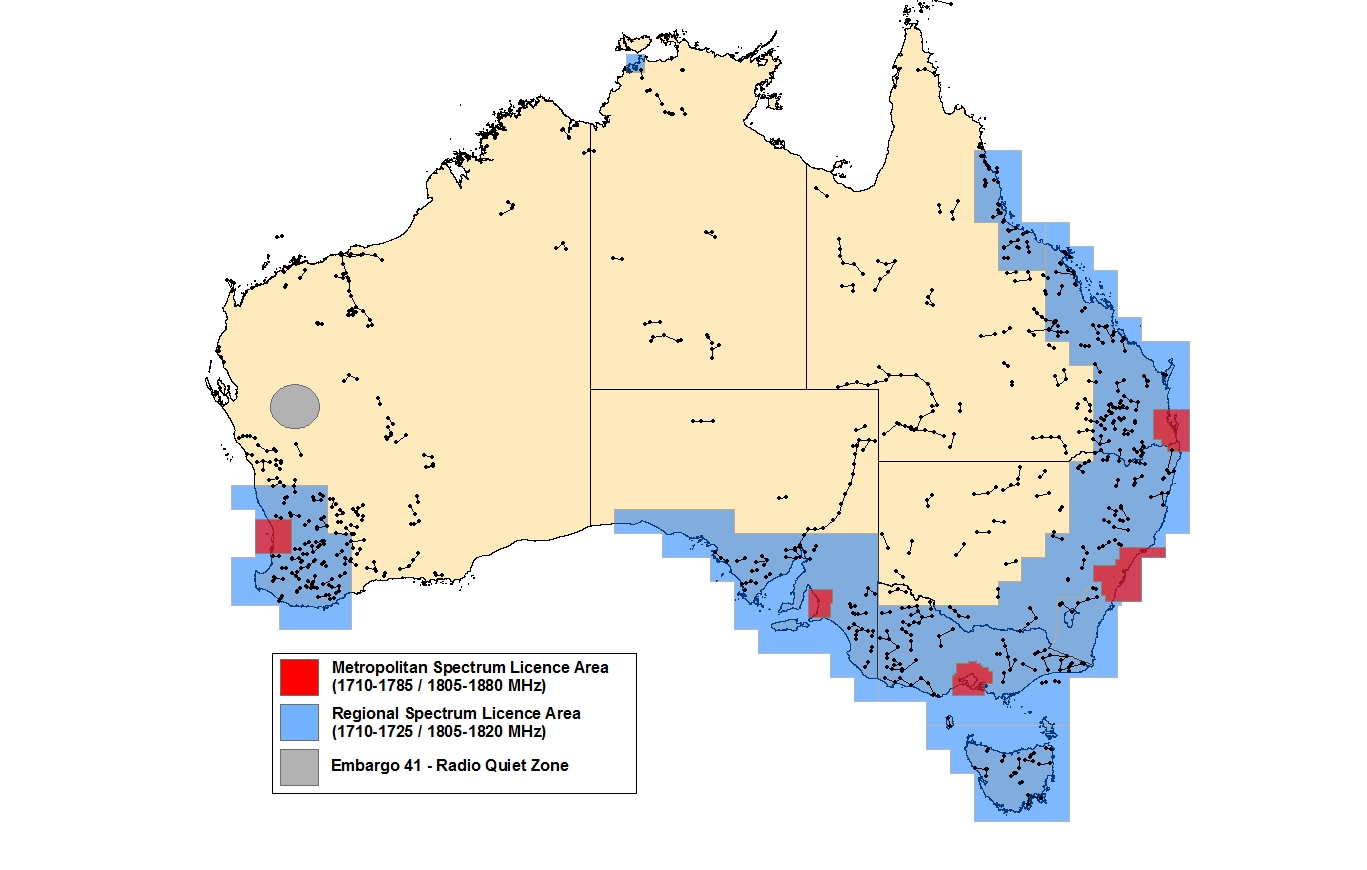


Figure : Areas corresponding to the current 1800 MHz spectrum licence band overlayed with 1800 MHz band fixed links

## Scope of the TLG

The 1800 MHz TLG will consider changes and provide advice on the following updates to the 1800 MHz band spectrum licence technical framework:

* Changes that will enable the deployment of both mobile broadband and fixed links under an 1800 MHz spectrum licence in regional areas of Australia; and
* Technical criteria/restrictions that will manage interference while minimising the potential for spectrum denial to be caused by the introduction of fixed links.

## Timeline

The timeline for the update to the 1800 MHz Band TF is provided in Table 2. This timeframe is designed to align with the ACMA’s consultation process for the release of regional 1800 MHz band spectrum licences.

Please note that, unless required, the ACMA is only planning to release one iteration of the TLG paper before publically consulting on updates to the relevant legislative instruments that for the 1800 MHz band technical framework. This is due to the short timeframe available to perform all necessary work to release regional 1800 MHz band spectrum licences by November this year.

Table : Timeline for 1800 MHz Band Spectrum Licence Technical Framework Update

|  |  |
| --- | --- |
| **Milestone** | **Date** |
| TLG Paper 1 Consultation | 4/3/15 - 1/4/15 |
| TLG Paper 2 Consultation (if required) | April-May 2015 |
| Review of submissions and inclusion of response proposals | April-May 2015 |
| Public Consultation on Updated Instruments[[1]](#footnote-1) | June-July 2015 |

# Assessment of Current Arrangements

The 1800 MHz band TF is optimised for the deployment of FDD IMT systems. This means the deployment of fixed link receivers in the 1710-1785 MHz band and transmitters in the 1805-1880 MHz band are naturally supported. A number of other elements were also included in the TF to support the deployment of fixed links under an 1800 MHz spectrum licence. Specifically these allow the deployment of fixed link transmitters in the 1710-1785 MHz band and fixed link receivers in the 1805-1880 MHz band.

## Fixed Link Transmitters in the 1710-1785 MHz band

Fixed link transmitters are authorised to operate in the 1710-1785 MHz band under an 1800 MHz band spectrum licence via the following mechanisms of the TF:

* The [*Radiocommunications (Unacceptable Levels of Interference – 1800 MHz Band) Determination 2012*](http://www.comlaw.gov.au/Details/F2012L02045) (S145 Determination) allows high sited (greater than 10 m in height) transmitters to be deployed outside areas of high mobile use in the 1710-1785 MHz band. Areas of high mobile use are defined in Schedule 4 of the S145 Determination and include all state and territory capitals. This limits the deployment of high-sited transmitters to regional areas.
* In-band interference from high sited transmitters deployed in the 1710-1785 MHz band is managed by the device boundary criteria defined in [*Radiocommunications Advisory Guidelines (Additional Device Boundary Criteria - 1800 MHz Lower Band) 2012*](http://www.comlaw.gov.au/Details/F2012L02046)(RAG–DBC). The device boundary criteria in the RAG-DBC is based on a high-site to high-site interference model. Adherence to the RAG-DBC is a requirement of the S145 Determination.
* Out-of-band interference is managed by the [*Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers - 1800 MHz Band) 2012*](http://www.comlaw.gov.au/Details/F2012L02047) (RAG-Rx). The RAG-Rx defined a first-in-time coordination process for the management of interference between transmitters and receivers operating under a spectrum licence in the 1710-1785 MHz band. Some degree of interference management is also provided by the out-of-band emission limits defined in the core conditions of an 1800 MHz band spectrum licence.

The current arrangements in the TF are considered to provide suitable protection from in-band interference. However, to assist in the management of interference and spectrum denial, it may be necessary to define additional locations where high sited transmitters are not permitted to be deployed. This would require a change to the list of areas of high mobile use that is defined in Schedule 4 of the S145 Determination.

The current arrangements for managing out-of-band interference are also considered adequate while spectrum licensing arrangements in regional Australia are limited to the 1710-1725 / 1805-1820 MHz band and a single licensee holds most of the spectrum. However, if spectrum licensing arrangements are extended to encompass more spectrum in regional Australia the arrangements for managing out-of-band interference need to be reviewed. This will help to avoid situations where spectrum is denied to adjacent band spectrum licensees at a number of locations based on who registered devices first-in-time. This effect is currently seen in the 1800 MHz band when coordinating Public Telecommunication Services (PTS) with currently apparatus licensed fixed links.

Although out-of-band interference can be managed to a large degree by appropriately defined out-of-band and spurious emission limits, no changes are proposed to the core conditions of the spectrum licences. This is because:

* Any such changes would be subject to agreement from licensees under s.72 of the Radiocommunications Act;
* Strict limits would need to be defined to minimise the chance for interference, such requirements may not be required in all circumstances resulting in an unnecessary cost and burden to licensees.

Instead of changing core conditions on the licence, the ACMA would suggest that there be a requirement for licensees to work with each other and manage OOB emissions if and when required to facilitate coexistence.

In relation to deployment of fixed link transmitters in the 1710-1785 MHz band, do TLG members agree:

* The arrangements for in-band interference management, as described in [*Radiocommunications Advisory Guidelines (Additional Device Boundary Criteria - 1800 MHz Lower Band) 2012*](http://www.comlaw.gov.au/Details/F2012L02046), are sufficient.
* The definition of areas of high mobile use, as defined in Schedule 4 of the S145 Determination, should be reviewed.
* The arrangements for out-of-band interference management, as described in the [*Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers - 1800 MHz Band) 2012*](http://www.comlaw.gov.au/Details/F2012L02047), need to be reviewed.
* No changes should be made to the core-conditions of 1800 MHz band spectrum licences. Instead licensees should be required to work with each other to find and implement practical solutions that will enable compatibility/coexistence between fixed links and IMT service.

Are there any other aspects of the 1800 MHz band TF that TLG members think should be reviewed to support the deployment of fixed link transmitters in the 1710-1785 MHz band while managing interference with high-sited receivers?

## Fixed Link Receivers in the 1805-1880 MHz band

1800 MHz band spectrum licensees are authorised to operate receivers in any part of their spectrum licence. There are no restrictions on the height of operation, location (they can be deployed in areas of high mobile use) or frequency (they can be operated in the either the 1710-1785 MHz or 1805-1880 MHz bands). However, in regards to interference management for fixed link receivers operating in the 1805-1880 MHz band, the following mechanisms of the 1800 MHz band TF apply:

* Receivers operating in the 1805-1880 MHz band are only provided with protection from in-band interference from transmitters operating in adjacent areas based on the device boundary criteria defined in [*Radiocommunications (Unacceptable Levels of Interference – 1800 MHz Band) Determination 2012*](http://www.comlaw.gov.au/Details/F2012L02045) (S145 Determination). The device boundary criteria in the S145 Determination is based on a high-site to low-site interference model (i.e. it is optimised for FDD IMT systems).
* High sited receivers (greater than 10 m in height) operating in the 1805-1880 MHz band are not afforded protection from out-of-band interference. This is described in the [*Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers - 1800 MHz Band) 2012*](http://www.comlaw.gov.au/Details/F2012L02047).

The current arrangements for the management of in-band interference are optimised for the deployment of FDD IMT systems. This means that a higher level of emissions are permitted across geographical boundaries in the 1805-1880 MHz band than might be acceptable for a fixed link system. However, it is not considered reasonable to change these arrangements for the following reasons:

* Any change would increase the dead zone (i.e. an area where services cannot be deployed) at the geographical boundary of licences;
* There are already significant deployments of mobile broadband services that adhere to the existing requirements;
* The directional nature of fixed links can be leveraged to manage in-band interference from services operating in adjacent licence areas.

The current arrangements for the management of out-of-band interference provides no protection for fixed link receivers operating in the 1805-1880 MHz band. The deployment of fixed links under spectrum licences may not be viable without a level of certainty of protection from interference. Of course any changes to arrangements to provide greater certainty to licensees will need to be balanced with the potential spectrum denial to IMT services that can be caused by fixed links.

In relation to deployment of fixed link receivers in the 1805-1880 MHz band, do TLG members agree:

* The arrangements for in-band interference management, as described in [*Radiocommunications (Unacceptable Levels of Interference – 1800 MHz Band) Determination 2012*](http://www.comlaw.gov.au/Details/F2012L02045), should remain as they are.
* The arrangements for out-of-band interference management, as defined in the [*Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers - 1800 MHz Band)* 2012](http://www.comlaw.gov.au/Details/F2012L02047), need to be reviewed.

Are there any other aspects of the 1800 MHz band TF that need to be reviewed to support the deployment of fixed link receivers in the 1805-1880 MHz band while managing interference with high-sited receivers?

# Studies

The aim of this TLG is to develop arrangements that will enable the operation of fixed links under 1800 MHz spectrum licences in regional Australia. These arrangements need to provide certainty to licensees by managing interference between fixed links and IMT services as well as minimising the potential for spectrum denial caused by deploying disparate services. In chapter 2, those aspects of the 1800 MHz band TF that require change to meet this objective were identified.

This chapter analyses the results of an interference study between fixed links and IMT services (refer to Annex A for the study). The results are also analysed to assist in the development of updates to the 1800 MHz band TF.

## Interference study

The ACMA performed a simple study to determine the frequency dependant rejection (FDR) required at different separation distances to enable coexistence between fixed links and IMT systems (based on LTE). This study is provided at Annex A. A summary and analysis of the results is provided below.

### Interference to and from an IMT Base Station (BS)

The required FDR (or other mitigation) at different separation distances to enable coexistence between fixed links and IMT Base Stations (BS) was studied. The results are summarised in Table 2 and Table 3.

Table : IMT Base Station transmitter interference into a fixed link Receiver - Separation distance (km) required for different FDRs and antenna discriminations.

|  |  |  |  |
| --- | --- | --- | --- |
| **IMT BS 🡪 FS** | **Antenna Discrimination (dB)** | | |
| **FDR (dB)** | **0** | **20** | **45** |
| 120 | 0.1 | 0.02 | <0.01 |
| 110 | 0.4 | 0.04 | <0.01 |
| 100 | 1.3 | 0.1 | <0.01 |
| 90 | 4.2 | 0.4 | 0.03 |
| 80 | 13 | 1.3 | 0.08 |

Table : Fixed link transmitter interference into an IMT Base Station Receiver - Separation distance (km) required for different FDRs and antenna discriminations.

|  |  |  |  |
| --- | --- | --- | --- |
| **FS 🡪 IMT BS** | **Antenna Discrimination (dB)** | | |
| **FDR (dB)** | **0** | **20** | **45** |
| 120 | 0.05 | <0.01 | <0.01 |
| 110 | 0.2 | 0.02 | <0.01 |
| 100 | 0.5 | 0.05 | <0.01 |
| 90 | 1.6 | 0.2 | <0.01 |
| 80 | 5.3 | 0.5 | 0.03 |

Based on the results of the study an FDR in the order of 120 dB is required to ensure coexistence in a majority of cases. However, such a high FDR is only required for cases where an IMT BS is within the main beam azimuth of the fixed link and at small separation distances (within 100 metres).

It is also noted that in this study FS receivers were protected to a level 6dB below the noise floor. In a number of cases this may be more conservative than using the protection criteria (i.e. protection ratios) specified for fixed links in RALI FX3. Consequently it could be considered that there is some ‘fat’ in the results.

Taking this into account, an FDR (or other mitigation) of 110 dB could be seen as a more appropriate level to enable coexistence in a majority of cases. This level is slightly less stringent while still enabling significant compatibility between services. To achieve such levels of mitigation a frequency separation of 10 MHz or more may be required.

In fact the notional receiver performance level defined in Schedule 1 of the RAG-Rx defines the following:

* A minimum notional blocking requirement, expressed as tolerance to a minimum unwanted signal level is -65 dBm per 30 kHz (measured at the input to the receiver unit) at frequency offsets greater than 5 MHz from the frequency limit of the licence and within the band 1690-1805 MHz.
* A notional level of external RF selectivity (between the antenna and the antenna connector of the receiver) may be assumed to be at least equal to:

1. 2+60 log[1+(2×FreqOffset/10)1.8] dB for FreqOffset ≤ 20.5 MHz; and
2. 70 dB for FreqOffset > 20.5 MHz

where “FreqOffset” is the smallest frequency difference between either the upper or lower limits of the frequency band of the spectrum licence under which the receiver operates and any frequency outside the frequency band.

Assuming there is sufficient filtering of the OOB emissions of a high sited transmitter and there is a minimum guard band of 10 MHz, then these requirements are considered sufficient to protect receivers operating in the 1710-1785 MHz band. That is the combination of the above two requirements will provide protection equivalent to an FDR (or other mitigation) in the order of 110 dB and 130 dB for guard bands of 10 MHz and 20.5 MHz respectively.

### Interference to and from an IMT User Equipment (UE)

The required FDR (or other mitigation) at different separation distances to enable coexistence between fixed links and IMT User Equipment (UE) was studied. The results are summarised in Table 4 and Table 5. It is noted that for the case of interference from an IMT UE into an FS receiver, the worst case EIRP was assumed (i.e. power control was not considered). ITU-R Recommendation M.2292 indicates an average EIRP for IMT UEs of -9 dBm for macro urban/suburban environments and 2 dBm for macro rural environments. The aggregate interference case using statistical analysis was not studied. However, it is considered unlikely that this scenario would produce worst results than the scenario actually modelled.

Table : IMT UE transmitter interference into a fixed link Receiver (using suburban modified HATA) - Separation distance (km) required for different FDR and antenna discriminations.

|  |  |  |  |
| --- | --- | --- | --- |
| **IMT UE 🡪 FS** | **Antenna Discrimination (dB)** | | |
| **FDR (dB)** | **0** | **20** | **45** |
| 80 | 0.1 | 0.02 | <0.01 |
| 70 | 0.2 | 0.05 | <0.01 |
| 60 | 0.4 | 0.1 | 0.01 |
| 50 | 0.8 | 0.2 | 0.03 |
| 40 | 1.7 | 0.4 | 0.07 |
| 30 | 3.5 | 0.8 | 0.1 |

Highlighted cells are those values in the table that are closest to the FDR achieved if specific IMT UE transmitter characteristics are assumed to dominate FDR calculations. Specially:

Green highlight = ACLR1st adjacent channel dominate FDR calculations in the second adjacent channel

Orange highlight = OOB emission levels dominate FDR calculations in the second adjacent channel

Red highlight = spurious emission levels dominate FDR calculations in the second adjacent channel

Table : Fixed link transmitter interference into an IMT UE Receiver (using suburban modified HATA) - Separation distance (km) required for different FDR and antenna discriminations.

|  |  |  |  |
| --- | --- | --- | --- |
| **FS 🡪 IMT UE** | **Antenna Discrimination (dB)** | | |
| **FDR (dB)** | **0** | **20** | **45** |
| 80 | 0.2 | 0.05 | <0.01 |
| 70 | 0.4 | 0.1 | 0.01 |
| 60 | 0.8 | 0.2 | 0.03 |
| 50 | 1.6 | 0.4 | 0.06 |
| 40 | 3.3 | 0.8 | 0.1 |
| 30 | 6.8 | 1.6 | 0.3 |

Highlighted cells are those values in the table that are closest to the FDR achieved if specific IMT UE receiver characteristics are assumed to dominate FDR calculations. Specially:

Green highlight = ACS dominates FDR calculations in the second adjacent channel (0-5 MHz separation)

Orange highlight = -56 dBm/5MHz blocking level dominates FDR calculations (5-10 MHz separation)

Red highlight = -44 dBm/5MHz blocking leveldominates FDR calculations (≥10 MHz separation)

Based on the results of the study an FDR in the order of 80 dB is required to ensure a high level of coexistence. However, such a high FDR is unlikely to be achievable by IMT UEs.

Taking into account 3GPP minimum standards for IMT UEs regarding ACLR, ACS and blocking performance, FDRs in the order of 30-60 dB are considered to be practically achievable (if it is assumed IMT UE characteristics dominate FDR calculations). Generally speaking, FDR increases with greater frequency separation. This is an important factor to consider since operation of IMT UEs and fixed links in the same area is far more difficult to manage than an IMT BS – owing to the mobile nature of the IMT UEs.

If it is assumed that IMT UE characteristics dominate FDR calculations, then for operation within the 1800 MHz band, the best FDR is achieved when in-band blocking levels are considered. 3GPP standards define two minimum in-band blocking levels for IMT UEs. Irrespective of the channel bandwidth these are achieved at 5 MHz and 10 MHz from the from the channel edge. With the highest level, an unwanted signal level of -44 dBm/5 MHz, being achieved at 10 MHz separation.

Although the ACLR achievable by an IMT UE is the same for different operating bandwidths the nominal centre frequency of where it falls is different for different band. This varies further if carrier aggregation is implemented. However, although a 20 MHz IMT UE channel is the largest possible (ignoring carrier aggregation), it is considered low probability that a single user will be allocated this much spectrum while be outdoor and operating with maximum EIRP at the same time. For this reason a 5 MHz IMT UE bandwidth may be considered as being more representative when developing coexistence arrangements.

Document 3GPP TS 36.101 specifies that the spurious emission domain for a 5 MHz IMT UE starts at 10 MHz from the edge of the channel bandwidth. Emissions from IMT UEs in this range must not be greater than -30 dBm/MHz. It is likely that most IMT UEs perform better than this minimum requirement. Assuming the UE spurious emissions dominate the results of an FDR calculation, this results in an FDR of 46 dB (for a maximum UE transmitter power of 23 dBm/5MHz).

If 10 MHz and 20 MHz IMT UE channels are considered, then the FDRs achieved for a 10 MHz guard band are in the order of 40 dB and 30 dB respectively. Please note this assumes the UE is operating at maximum EIRP and that the IMT UE out-of-band emissions dominate FDR calculations. The same results as for a 5 MHz channel apply to larger channels when considering spurious emissions. The spurious domain for 10 MHz and 20 MHz channels start at 15 MHz and 25 MHz offsets from the respective channel edge.

### Conclusion of study

Based on the outcomes of the study in Annex B, it would appear that:

* A minimum 10 MHz guard band should be employed between IMT services and fixed links operating in the same area;
* A minimum blocking level that is 110 dB higher than -108 dBm/5MHz (i.e. 2 dBm/5 MHz) should apply at frequency separations greater than or equal to 10 MHz from the channel edge of registered receivers (both IMT BS and fixed link receivers).[[2]](#footnote-2) This is considered to already be covered by the notional receiver performance level defined in the RAG-Rx.
* No additional protection can be afforded to fixed link receivers from interference caused by IMT UEs.
* No additional protection can be afforded to IMT UEs from interference caused by fixed link transmitters.

The measures outlined above go a long way to managing interference between fixed links and IMT services. However, they will not manage interference in every situation. Additional measures are also required.

One simple measure is to not allow high-sited transmitters to be registered in the 1710-1785 MHz band in defined areas of high mobile use. This also resolves the interference issue between fixed links and IMT UEs in those areas. Refer to the discussion in section 3.2 for more information.

There are also numerous other measures that could assist in the coexistence of services. ACMA staff do not consider it is practical to list them all here (or in a legislative instrument) and the most appropriate measure(s) to implement needs to be considered on a case-by-case basis. Consideration of such measures can be achieved by requiring licensees to work with each other to find practical solutions that will enable compatibility/coexistence between fixed links and IMT systems. In most cases any measures implemented will largely apply to the service deployed second-in-time (typically considered during the planning stage). However, there are some measures that can be implemented by existing services. For example the use of RF filtering to manage out-of-band emissions – which should be the responsibility of the licensees operating the transmitter to install.

It is acknowledged that despite the best efforts of licensees, there will still be circumstances where coexistence cannot be achieved. In such cases the device that was registered first-in-time has priority.

Do TLG members have any comments on the interference study and conclusions drawn by the ACMA?

## Areas of high mobile use

Areas of high mobile use are defined in Schedule 4 of the S145 Determination. High-sited transmitters are not permitted to be deployed in the 1710-1785 MHz band in these areas. The currently defined areas of high mobile use include Adelaide, Brisbane, Canberra, Darwin, Hobart, Melbourne, Sydney and Perth. These are displayed in Figure 2.

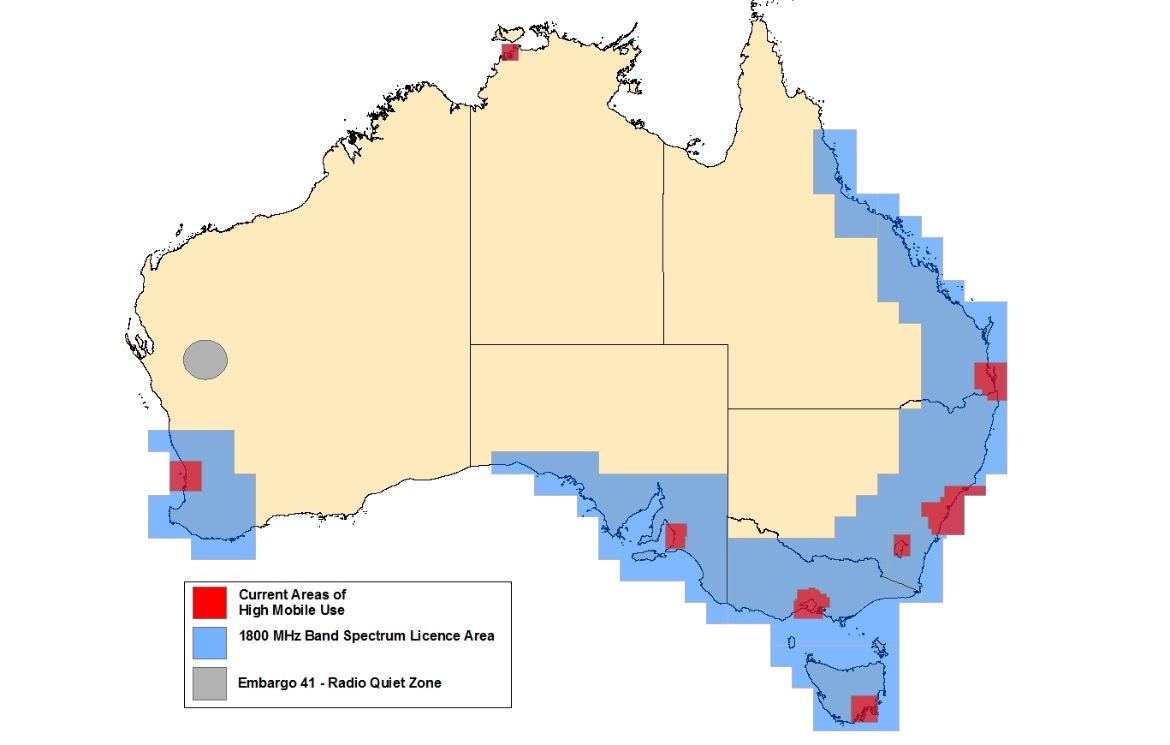


Figure : Currently defined areas of high mobile use (red areas) overlayed with those areas subject to spectrum licencing in the 1800 MHz band (blue and red areas)

The study in section 3.1 suggests there is a high probability for interference to occur to/from fixed links deployed in areas where there is (or will be) medium-to-high density IMT deployments. This is a particular concern when considering compatibility between IMT UEs and fixed links. Areas of significant population are considered to be most at risk. As a result it is considered likely that there will be significant spectrum denial in these areas for one type of service (depending on which is deployed first).

To avoid complications while also managing interference and spectrum denial in areas with significant population, it is proposed that the locations that high sited transmitters are not permitted to deploy in the 1710-1785 MHz band be increased. To enforce such a condition it would be necessary to amend the areas of high mobile use defined in Schedule 4 of the S145 Determination.

It is proposed that all cities with a population greater than 30,000 as defined in the 2011 census data, be included in the definition for areas of high mobile use. In addition to the locations already defined, this includes: Albury, Ballarat, Bathurst, Bendigo, Bundaberg, Bunbury, Cairns, Coffs Harbour, Dubbo, Gladstone, Hervey Bay, Launceston, Mackay, Orange, Port Macquarie, Rockhampton, Shepparton, Sunshine Coast, Tamworth, Toowoomba, Townsville, Wagga Wagga. These areas are defined at Annex B. The combination of these newly proposed areas with the existing areas of high mobile use is displayed in Figure 3.

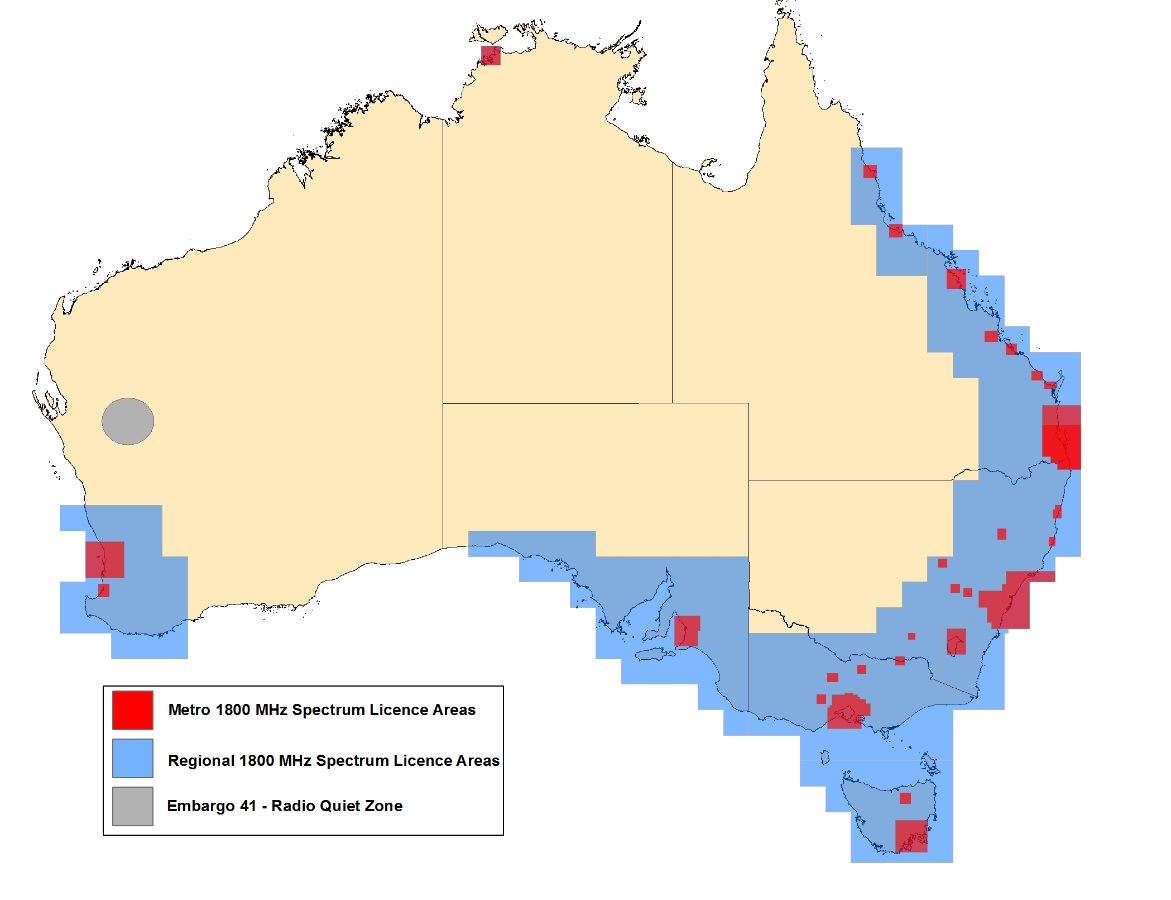


Figure : Proposed definition for all areas of high mobile use (red areas) overlayed with those areas subject to spectrum licencing in the 1800 MHz band (blue and red areas)

Do TLG members agree that schedule 4 of the S145 Determination should be amended to include the areas defined in Annex B?

Are the areas in Annex B too large or too small?

Should more or less areas be included to the defined areas of high mobile use?

# Proposed New Arrangements

The aim of this TLG is to develop arrangements that will enable the operation of fixed links under 1800 MHz band spectrum licences in regional Australia. These arrangements need to provide certainty to licensees by managing interference between fixed links and IMT services while minimising the potential for spectrum denial caused by deploying disparate services.

In chapter 2, those aspects of the 1800 MHz band TF that require change to meet this objective were identified. Chapter 3 analysed the level of FDR (or other mitigation) required to manage interference between IMT systems and fixed links. Arrangements for managing interference where also proposed.

This chapter summarises the arrangements proposed to facilitate the deployment of fixed links under 1800 MHz band spectrum licences in regional Australia while managing interference and spectrum denial. Based on the proposed arrangements, draft updates to relevant legislative instruments that form the 1800 MHz band TF are also provided.

## Overview of proposed new arrangements

In order to allow fixed links to operate, the following arrangements are proposed:

***Proposed Transmitter Arrangements***

* Outside defined areas of high mobile use, allow high-sited transmitters to be registered in the 1710-1785 MHz band provided there is a minimum 10 MHz guard band with adjacent spectrum licences in the same area. No guard band is required if the frequency adjacent spectrum is subject to apparatus licensing.
* Outside defined areas of high mobile use, licensees can operate high-sited transmitters in the 1710-1785 MHz band within the 10 MHz guard band on a ‘no interference basis’.
* Redefine areas of high mobile use to include the areas detailed in Annex B.
* No changes are proposed to the core-conditions of 1800 MHz band spectrum licences.
* Licensees will be required to work with each other to find and implement practical solutions that will enable compatibility/coexistence between fixed links and IMT service. (i.e. implement additional RF filtering or consider other mitigation techniques).
* In the event coexistence is not possible the device registered first-in-time has priority.
* Other than the arrangements proposed above, no additional protection will be afforded to IMT UEs from interference caused by high-sited transmitters operating in the 1710-1785 MHz band.
* Licensees are free to negotiate and come to agreement to implement alternative arrangements. This can include supporting operation within the 10 MHz guard band.

***Proposed Receiver Arrangements***

* Provide protection to high-sited receivers registered in the 1805-1880 MHz band that have a minimum 10 MHz guard band with adjacent spectrum licences in the same area. No guard band is required if the frequency adjacent spectrum is subject to apparatus licensing.
* Licensees can operate high-sited receivers in the 1805-1880 MHz band within the 10 MHz guard band on a ‘no protection basis’.
* Existing notional receiver specifications including the receiver blocking requirement and RF filtering requirements mean a receiver should be able to accept an unwanted signal (with a minimum 10 MHz guard band) of at least -2 dBm/5MHz. This increases to 27 dBm/5 MHz for guard bands greater than 20.5 MHz. Therefore no changes are required to the definition of the notional receiver.
* Licensees will be required to work with each other to find and implement practical solutions that will enable compatibility/coexistence between fixed links and IMT service. (i.e. implement additional RF filtering or consider other mitigation techniques).
* In the event coexistence is not possible the device registered first-in-time has priority.
* Other than the arrangements proposed above, no additional protection will be afforded to high-sited receivers operating in the 1805-1880 MHz band from IMT UE transmitters.
* Licensees are free to negotiate and come to agreement to implement alternative arrangements. This can include supporting operation within the 10 MHz guard band.

Please note that in this section the following definitions apply:

* High-sited means a device with an effective antenna height for greater than 10 metres
* A guard band is measured from the lower and upper frequency limits of the occupied bandwidth of the wanted signal.
* Areas of high mobile user are defined in Schedule 4 of the S145 Determination.

Do TLG members have any comments to the proposed new arrangements to enable the operation of fixed links under 1800 MHz spectrum licences in regional Australia?

Are there any alternative proposals?

## Changes to legislative instruments

To implement the proposed arrangements detailed in section 4.1 changes need to be made to the following legislative instruments:

* [*Radiocommunications (Unacceptable Levels of Interference – 1800 MHz Band) Determination 2012*](http://www.comlaw.gov.au/Details/F2012L02045)
* [*Radiocommunications Advisory Guidelines (Additional Device Boundary Criteria - 1800 MHz Lower Band) 2012*](http://www.comlaw.gov.au/Details/F2012L02046)
* [*Radiocommunications Advisory Guidelines (Managing Interference to Spectrum Licensed Receivers - 1800 MHz Band) 2012*](http://www.comlaw.gov.au/Details/F2012L02047)

Draft updates to these instruments are available in Annex C, D and E.

Do TLG members have any comments on the proposed draft updates to legislative instruments contained in Annex C, D and E.

# Annex A – Interference Study

## A.1 STUDY METHODOLOGY

This Annex contains the results of a simple study performed by the ACMA to determine the frequency dependant rejection (FDR) required at different separation distances to enable coexistence between fixed links and IMT systems (based on LTE).

The study produces a solution to the equation below for different separation distances and using the system parameters defined in this annex.

Where:

= Frequency Dependant Rejection (or other mitigation) [dB]

= Effective Isotropic Radiated Power of the Transmitter [dBm/5MHz]

= Receiver Antenna Gain [dBi]

= Interference Threshold [dBm/5MHz]

= Feeder and other System Losses [dB]

= Antenna Discrimination (dB from the main lobe) [dB]

=Propagation loss [dB]

The following assumptions are made:

* Fixed links are protected to an I/N of -6 dB rather than the protection ratio criteria defined in RALI FX3. In many circumstances this may result in a more conservative interference threshold. Therefore the interference threshold used is considered to be a worst case assumption.
* Representative macro rural base station parameters are used to model IMT systems. Parameters for urban and suburban systems may vary.
* Power control is not taken into account for IMT UEs. Instead they are assumed to operate at a maximum EIRP of 23 dBm/5MHz, this is a worst case assumption. ITU-R Recommendation M.2292 indicates an average EIRP for IMT UEs of -9 dBm for macro urban/suburban environments and 2 dBm for macro rural environments. Consequently the results for the worst case scenario could also be considered to be a simplistic indication of aggregate interference from multiple IMT UEs.
* Three antenna discrimination values were assumed in the study: 0 dB, 20 dB and 45 dB. There representative of discrimination of a fixed link antenna at boresight, the first side lobe and at rear of the dish. These values are derived from licence data for fixed links contained on the RRL and the notional antenna pattern for the 1800 MHz band defined in Appendix 10 of RALI FX3. It would also not be unreasonable to assume a few decibels of additional discrimination due to IMT antenna downtilt.

## A.2 INTERFERENCE STUDY: IMT BS and FIXED LINK

### Study Parameters

Table : Summary of IMT BS and Fixed link parameters used in the study

|  |  |  |
| --- | --- | --- |
| **Parameters Used in Study** | **Lower Band** | **Upper Band** |
| Frequency (MHz) | 1800 | 1800 |
| EIRP (dBm/5 MHz) | 70[[3]](#footnote-3) | 60 |
| GRx (dBi) | 17 | 35[[4]](#footnote-4) |
| Antenna discrimination (dB) | 0/20/45 | 0/20/45 |
| Feeder Losses (dB) | 3 | 3 |
| I/N (dB) | -6 | -6 |
| Interference Threshold  (dBm/5 MHz) | -108 | -108 |
| Propagation Model | Free Space Loss | |

### Results

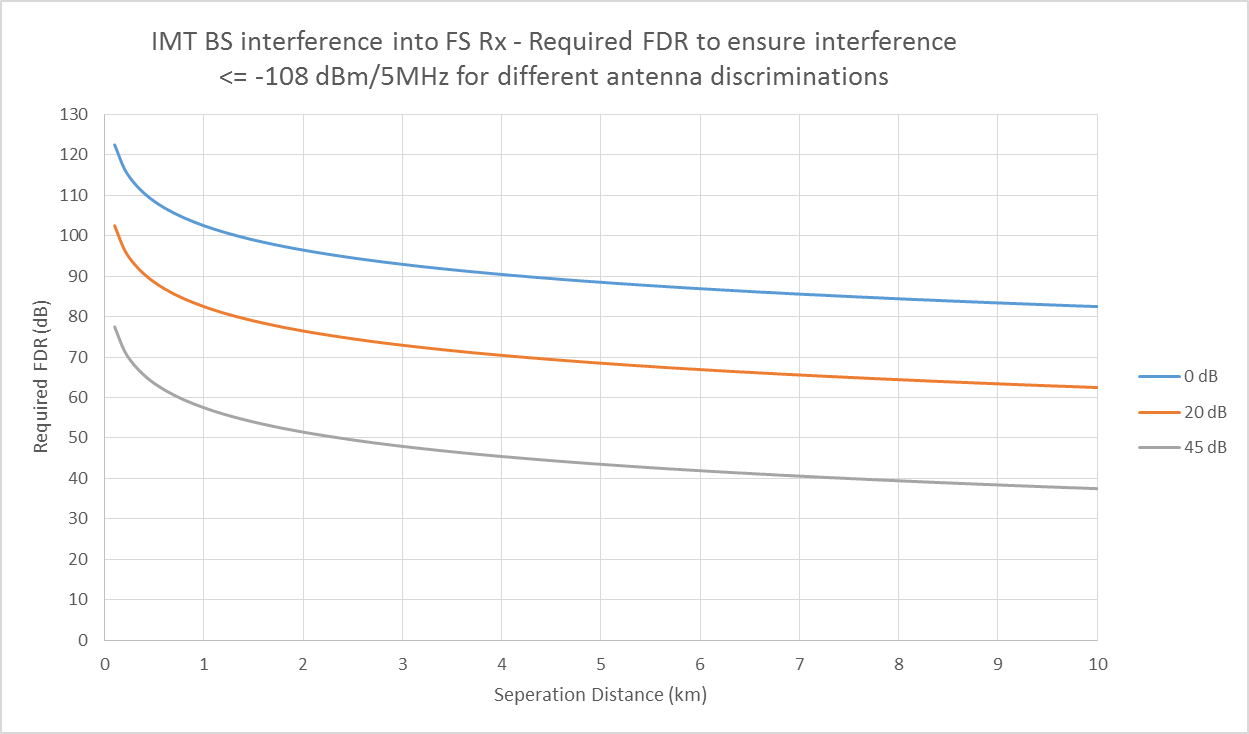


Figure : IMT BS 🡪 Fixed Link Receiver - Required FDR (or other mitigation) for various separation distance and different antenna discriminations to avoid interference.

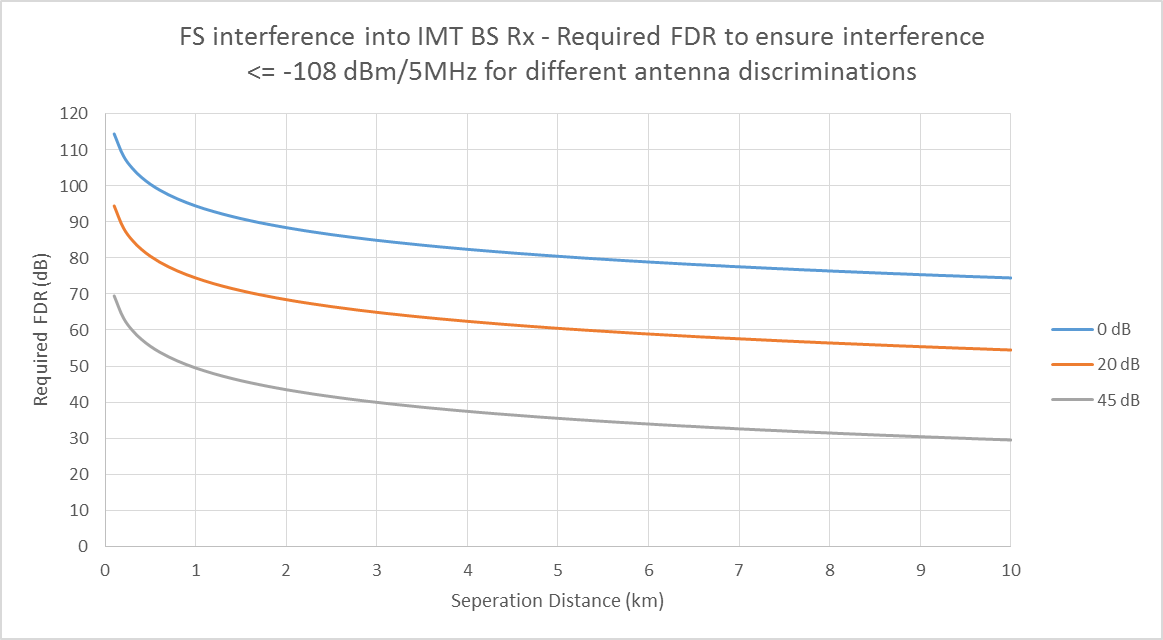


Figure : Fixed Link 🡪 IMT BS Receiver - Required FDR (or other mitigation) for various separation distance and different antenna discriminations to avoid interference.

## A.3 INTERFERENCE STUDY: IMT UE and FIXED LINK

### Study Parameters

Table : Summary of IMT UE and Fixed link parameters used in the study

|  |  |  |
| --- | --- | --- |
| **Parameters Used in Study** | **Lower Band** | **Upper Band** |
| Frequency (MHz) | 1800 | 1800 |
| EIRP (dBm/5 MHz) | 23 | 70[[5]](#footnote-5) |
| GRx (dBi) | 35 | 0 |
| Antenna discrimination (dB) | 0/20/45 | 0/20/45 |
| Feeder Losses (dB) | 3 | 3 |
| I/N (dB) | -6 | -6 |
| Interference Threshold  (dBm/5 MHz) | -108 | -105 |
| Tx Height (m) | 2 | 100 |
| Rx Height (m) | 100 | 2 |
| Propagation Model | Suburban Modified Hata[[6]](#footnote-6) | |

### Results

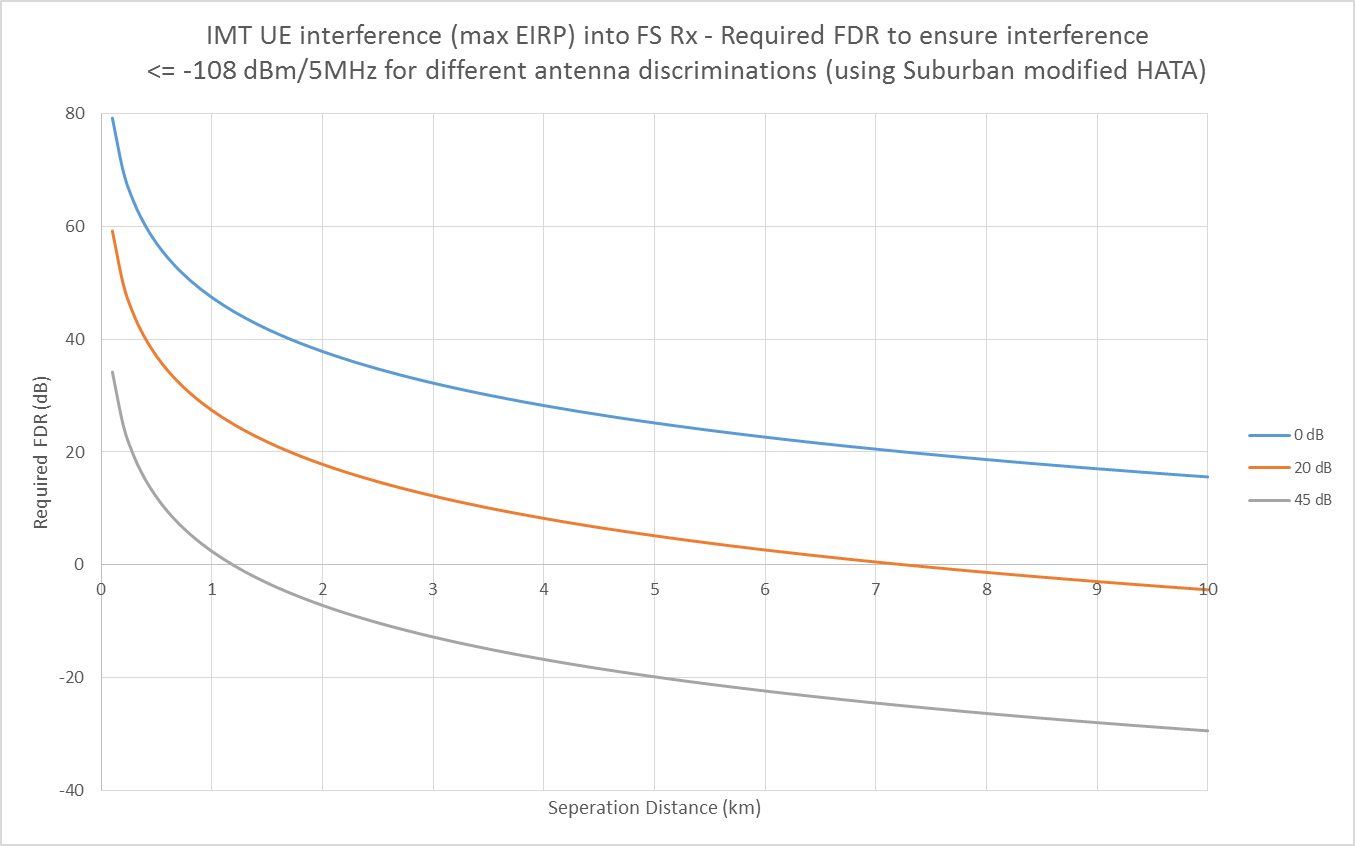


Figure : IMT UE 🡪 Fixed Link Receiver - Required FDR (or other mitigation) for various separation distance and different antenna discriminations to avoid interference.

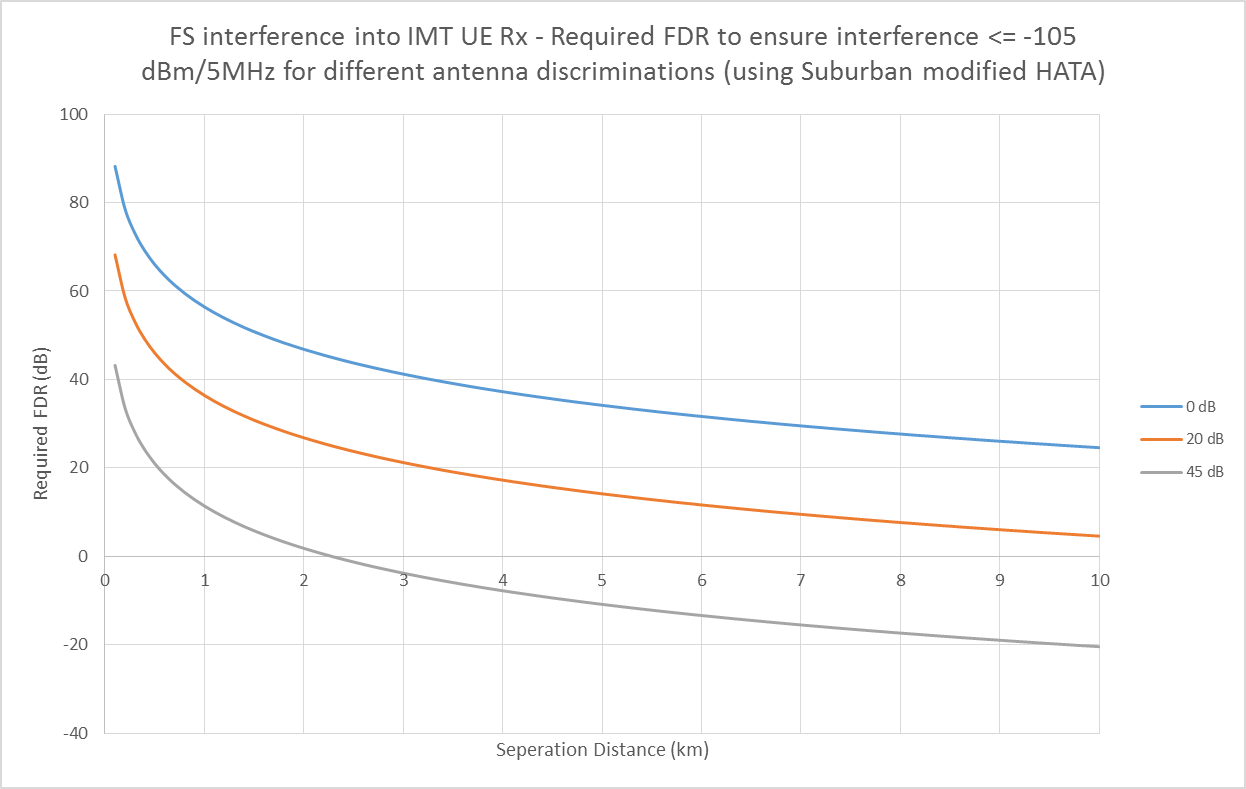


Figure : Fixed Link 🡪 IMT UE Receiver - Required FDR (or other mitigation) for various separation distance and different antenna discriminations to avoid interference.

# Annex B – Additional Areas of high mobile use

**Description of Area**

(1) The additional areas of high mobile use are the areas of land described in Column 1 of the tables below.

(2) Areas can be determined by the aggregation of block areas referenced by HCIS identifiers used to describe it which are specified in the corresponding Column 2 of the tables below. Refer to the *Australian Spectrum Map Grid 2012* for a complete description of the naming convention referred to as the HCIS.

Note: The ACMA has developed an online tool that converts HCIS into a Placemark viewable in Google Earth – see <http://cbrlic01vt.internal.govt/speclic/hcis_to_kml2.shtml>

**ALBURY**

|  |
| --- |
| **HCIS Identifiers** |
| LW8D, LW5P7, LW5P8, LW5P9, LW6M7, LW9A1, LW9A4, LW9A7 |

**BENDIGO**

|  |
| --- |
| **HCIS Identifiers** |
| KW9I5, KW9I6, KW9I8, KW9I9, KW9M2, KW9M3, KW9M5, KW9M6, KW9N1, KW9N2, KW9N3, KW9N4, KW9N5, KW9N6, KW9J4, KW9J5, KW9J6, KW9J7, KW9J8, KW9J9 |

**BALLARAT**

|  |
| --- |
| **HCIS Identifiers** |
| KX2L, KX2G9, KX2H7, KX2H8, KX2H9, KX2K3, KX2K6, KX2K9 |

**BUNDABERG**

|  |
| --- |
| **HCIS Identifiers** |
| NS8N, NS8M2, NS8M3, NS8M5, NS8M6, NS8M8, NS8M9, NT2A2, NT2A3, NT2B1, NT2B2, NT2B3 |
|

**BUNBURY**

|  |
| --- |
| **HCIS Identifiers** |
| BV7G, BV7C4, BV7C5, BV7C6, BV7C7, BV7C8, BV7C9, BV7D4, BV7D5, BV7D7, BV7D8, BV7H1, BV7H2, BV7H4, BV7H5, BV7H7, BV7H8, BV7K1, BV7K2, BV7K3, BV7L1, BV7L2 |
|

**CAIRNS**

|  |
| --- |
| **HCIS Identifiers** |
| LQ1O, LQ1P, LQ1K7, LQ1K8, LQ1K9, LQ1L7, LQ1L8, LQ1L9, LQ4C1, LQ4C2, LQ4C3, LQ4C4, LQ4C5, LQ4C6, LQ4D1, LQ4D2, LQ4D3, LQ4D4, LQ4D5, LQ4D6 |
|
|

**COFFS HARBOUR**

|  |
| --- |
| **HCIS Identifiers** |
| NU9A, NU9E, NU8D9, NU8H3, NU8H6, NU8H9 |
|

**HERVEY BAY**

|  |
| --- |
| **HCIS Identifiers** |
| NT2C8, NT2C9, NT2D7, NT2D8, NT2D9, NT2G2, NT2G3, NT2G5, NT2G6, NT2H1, NT2H2, NT2H3, NT2H4, NT2H5, NT2H6 |
|

**LAUNCESTON**

|  |
| --- |
| **HCIS Identifiers** |
| LY6E, LY5H3, LY5H6, LY5H9, LY5L3, LY5L6, LY6F1, LY6F4, LY6F7, LY6I1, LY6I2, LY6I3, LY6I4, LY6I5, LY6I6, LY6J1, LY6J4 |
|
|

**MACKAY**

|  |
| --- |
| **HCIS Identifiers** |
| MR8A, MR5M7, MR5M8, MR5M9 |
|

**ROCKHAMPTON**

|  |
| --- |
| **HCIS Identifiers** |
| MS6F, MS6G, MS6B7, MS6B8, MS6B9, MS6C7, MS6C8, MS6C9, MS6J1, MS6J2, MS6J3, MS6K1, MS6K2, MS6K3 |
|

**SUNSHINE COAST**

|  |
| --- |
| **HCIS Identifiers** |
| NT5G, NT5H, NT5K, NT5L, NT6E, NT6F, NT6G, NT6H, NT6I, NT6J, NT6K, NT6L, NT5C4, NT5C5, NT5C6, NT5C7, NT5C8, NT5C9, NT5D4, NT5D5, NT5D6, NT5D7, NT5D8, NT5D9, NT5O1, NT5O2, NT5O3, NT5P1, NT5P2, NT5P3, NT6A4, NT6A5, NT6A6, NT6A7, NT6A8, NT6A9, NT6B4, NT6B5, NT6B6, NT6B7, NT6B8, NT6B9, NT6C4, NT6C5, NT6C6, NT6C7, NT6C8, NT6C9, NT6D4, NT6D5, NT6D6, NT6D7, NT6D8, NT6D9,NT6M1, NT6M1, NT6M2, NT6M3, NT6N1, NT6N2, NT6N3, NT6O1, NT6O2, NT6O3, NT6P1, NT6P2, NT6P3 |
|

**TOOWOOMBA**

|  |
| --- |
| **HCIS Identifiers** |
| NT7H, NT7L, NT8E, NT8F, NT8I, NT8J, NT7G2, NT7G3, NT7G5, NT7G6, NT7G8, NT7G9, NT7K2, NT7K3, NT7K5, NT7K6, NT7K8, NT7K9, NT7O2, NT7O3, NT7O5, NT7O6, NT7P1, NT7P2, NT7P3, NT7P4, NT7P5, NT7P6, NT8M1, NT8M2, NT8M3, NT8M4, NT8M5, NT8M6, NT8N1, NT8N1, NT8N2, NT8N3, NT8N4, NT8N5, NT8N6 |
|
|

**TOWNSVILLE**

|  |
| --- |
| **HCIS Identifiers** |
| LR2C, LR2D, LR2G, LR2H |

**WAGGA WAGGA**

|  |
| --- |
| **HCIS Identifiers** |
| LW6B |
|

# Annex C – Draft Section 145(4) Determination

Refer to Attachment

# Annex D – Draft RAG—Additional Device Boundary Criteria

Refer to Attachment

# Annex E – Draft RAG—Managing interference to spectrum-licensed receivers

Refer to Attachment

1. This consultation will be conducted in combination with consultation on a Marketing Plan for the market based allocation of 1800 MHz band spectrum licences. [↑](#footnote-ref-1)
2. Note: As with all parameters of the ‘notional receiver’ it is not a requirement for all receivers deployed to meet the minimum requirements defined. However, in the event of interference, a receiver will not be afforded protection unless it meets or exceeds the performance of the ‘notional receiver’. [↑](#footnote-ref-2)
3. An EIRP density of 70 dBm/5MHz is equal to or greater than that employed by 96% of fixed links currently licensed to Telstra in the 1800 MHz band. [↑](#footnote-ref-3)
4. A gain of 35 dBj is assumed for fixed link receivers. This is equal to or greater than that employed by 99% of fixed links currently licensed to Telstra in the 1800 MHz band. [↑](#footnote-ref-4)
5. An EIRP density of 70 dBm/5MHz is equal to or greater than that employed by 96% of fixed links currently licensed to Telstra in the 1800 MHz band. [↑](#footnote-ref-5)
6. The Suburban Modified HATA model is defined in ITU-R Report SM.2028 [↑](#footnote-ref-6)