1. SCOPE

Free TV Operational Practice OP 69 is a guideline for use of radio frequency spectrum bands for electronic news gathering (ENG) and television outside broadcast (TVOB) in areas not covered by specific capital city region Operational Practices 63 to 68 and 70.

It has been developed to assist those involved in ENG and TVOB operations in rural and remote areas with relevant instructions for access to and coordination of the bands assigned by the Australian Communications and Media Authority for ENG and TVOB operations as specified in ACMA's Radiocommunications Advisory Licensing instruction (RALI) FX 21.

2. FREQUENCY BAND ASSIGNED and LICENSED to ENG and TVOB

This Operational Practice applies in the rural and remote areas outside of the red zones shown in Figure 1 (the "red zones"). These zones are the capital city regions where Operational Practices 63 to 68 and 70 apply.

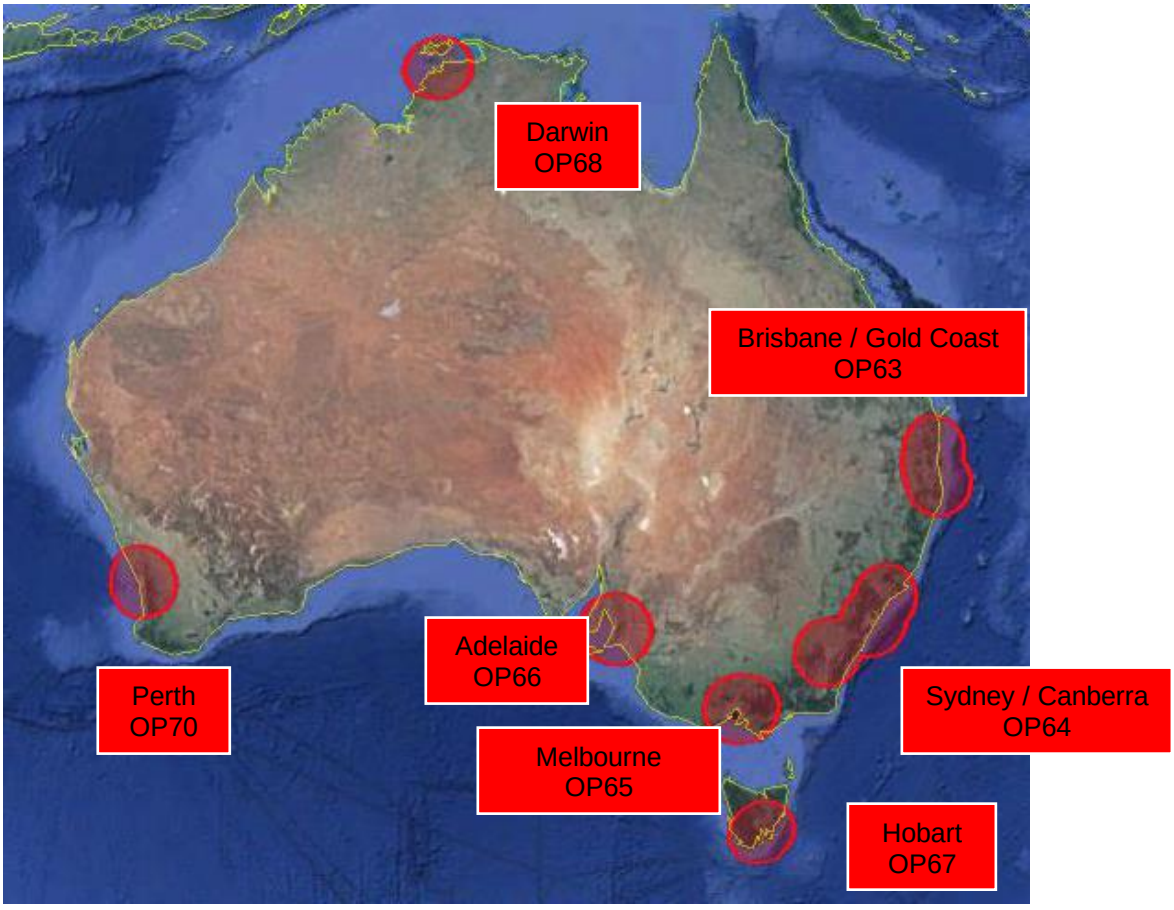

Figure 1 Capital City Area Definitions

Channel arrangements for TOB services in the frequency bands 2010 - 2110 MHz and 2200 - 2300 MHz are illustrated in Figure 2. Each channel in the raster is identified by a three or four character code used by broadcasters for coordination and planning.

Since 31 January 2016, the sub-band 2268-2300 MHz has been available for use by FOX Sports, which coordinates the subscription television (STV) use of this sub-band.

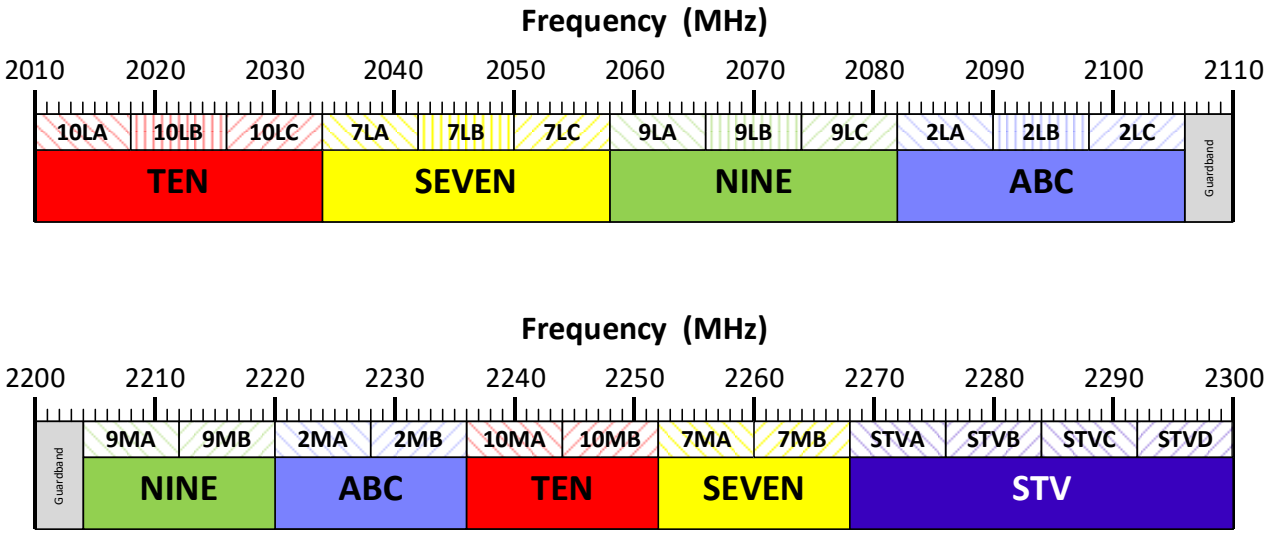

Figure 2: 2 GHz and 2.2 GHz TOB channeling arrangements

3. PERMISSABLE EQUIPMENT SPECIFICATIONS FOR ENG and TVOB OPERATIONS

Across the bands in which TVOB and ENG are permitted to operate, there are a range of power, height and equipment type limits that apply in various band segments. These are shown in Table 1. The figures provide for effective isotropic radiated power (EIRP) radiated within an 8 MHz channel. Wireless cameras are nominally operated at 2 metres above the local ground height.

Table 1 TOB Equipment Permitted in the 2 GHz and 2.2 GHz Bands

Frequency Range (MHz)	Wireless Cameras	TVOB Vans and Temporary Links	Helicopters and other airborne links
	EIRP	EIRP	EIRP
2010 -2110	26 dBm	62.5 dBm	62.5 dBm
2200 -2268	26 dBm	62.5 dBm	**Not permitted**
2268 - 2300	26 dBm	62.5 dBm	**Not permitted**

4. SPECTRUM SHARING AND CO-ORDINATION IN THE 2GHz BAND

4.1 Overview

The band 2010 – 2110 MHz is shared with fixed point-to-point microwave link systems (in two different channel rasters) uplinks to satellite systems and downlinks from satellite systems as shown in Figure 3. TOB and ENG operations are more likely to interfere with fixed link systems and earth station downlinks, whereas earth station uplinks would be considered interferers to TOB / ENG receivers.

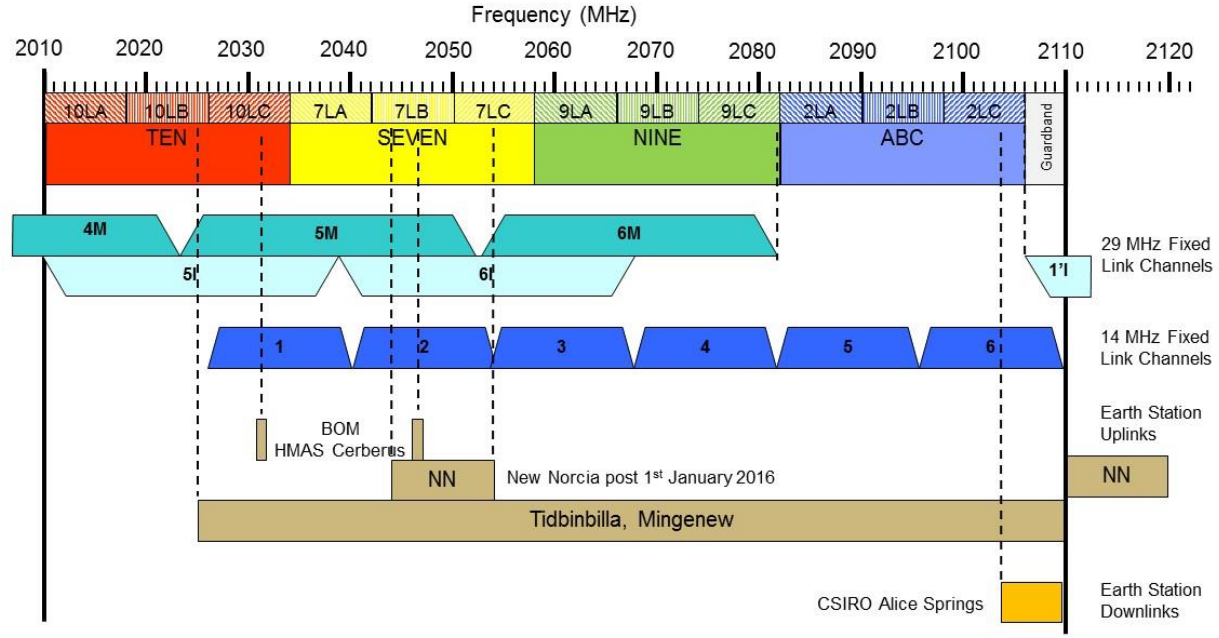

Figure 3 Systems in the 2 GHz Band

For certain other services with which TOB / ENG shares the band 2010 – 2110 MHz, there are various clearance, embargoed and exclusion zones. These are shown in Figure 4.

To support the Square Kilometre Array (SKA), an international radioastronomy facility, the ACMA has placed limits on transmitters to create a radio quiet zone (RQZ) in remote Western Australia, near Boolardy station, centred 26.704167 South, 116.658889 East (GDA94 datum). TOB transmitters must not operate within 150 km of this location as shown by the purple area in Figure 4.

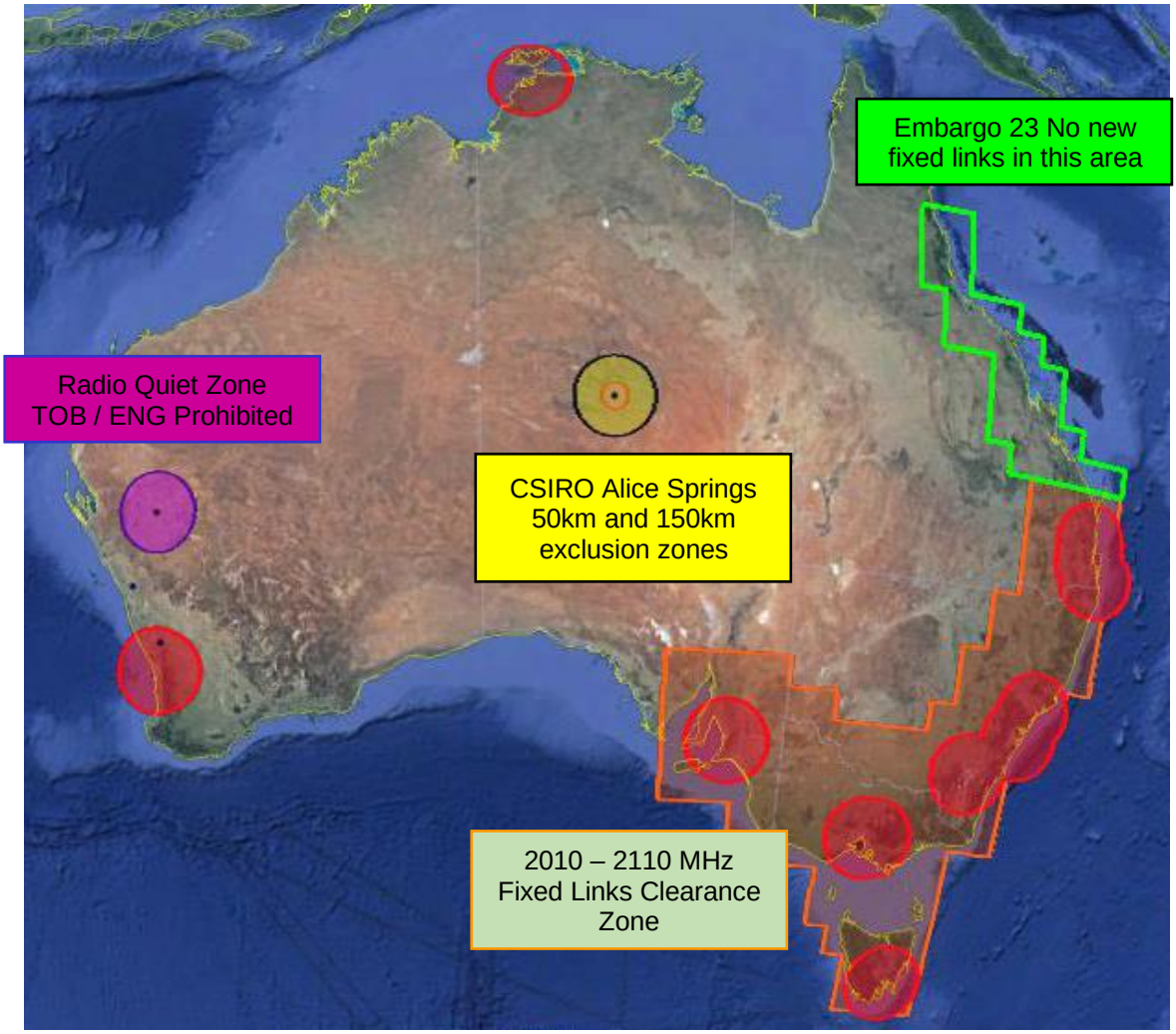

Figure 4 Co-ordination and Clearance Zones in the 2 GHz Band

4.2 Co-ordination with Shared Services

4.2.1 Channel Selection Procedure

Although TOB / ENG shares with many other services in remote areas, it is likely that interference to and from other services will be avoided by careful channel selection in the 2 GHz band. The following procedure should enable a suitable channel to be found. However, when significant events occur which require extensive concentrated deployment of ENG facilities, careful co-ordination will be required.

Simple Channel Selection Procedure

1. Check in Figure 4 for co-ordination zones with other services in the area where the proposed TOB / ENG deployment will occur.
2. If the TOB / ENG transmitter is **in** the orange zone in Figure 4, fixed links have been cleared and there is no need to co-ordinate with other services, so select a channel from within the broadcaster's licenced channels.
3. If additional channels are required and cannot be found in Step 2, arrange with another broadcaster to temporarily share their channel.
4. If deployment is **outside** the orange zone in Figure 4, contact the broadcaster's control centre, which will assign a channel after undertaking additional co-ordination procedures with fixed links as described in Section 4.2.2.
5. If the ENG receiver will be near New Norcia or Mingenew Earth stations, check the requirements of Section 4.2.3.
6. If the deployment is within 150 km of the CSIRO Alice Springs earth station, check the requirements of Section 4.2.7, which affects channel 2LC.

4.2.2 Fixed Links

Fixed microwave links occupy both the 2 GHz and 2.2 GHz bands in rural and remote areas. These are allocated according to the ACMA RALI FX-3, which provides two band plans:

- The '2.1 GHz Band Plan', which provides for 12 duplex channels in a main (M) and interleaved (I) channel raster based on a channel spacing of 29 MHz. The main and interleaved channels are offset by 14.5 MHz. Channels in this plan are shown in Figure 3 and Figure 5 as '29 MHz Fixed Link Channels'.
- The '2.2 GHz Band Plan', which provides for 6 duplex channels in a channel raster based on a channel spacing of 14 MHz. Channels in this plan are shown in Figure 3 and Figure 5 as '14 MHz Fixed Link Channels'.

No frequency coordination is required between TOB transmitters and fixed links receivers within the 2 GHz fixed link clearance areas (the orange zone in in Figure 4), therefore no co-ordination is required when operating within the orange zone which covers most of regional south eastern Australia. There should be no interference to TOB / ENG receivers from fixed links in the orange zone.

In other rural and remote areas, co-ordination needs to be undertaken by examining the installed links within 200 km of the proposed TOB transmitter location and avoiding the channels used by these links. Generally one of the broadcaster's channels will be available at a location. If additional channels are required, contact another broadcaster and arrange to temporarily share their channels.

4.2.3 Protected Satellite Earth Station Uplinks

TOB / ENG receivers are not protected from interference from 2 GHz satellite earth station uplinks at two sites affecting TOB operations in Regional and Remote Western Australia. The New Norcia earth station is located at New Norcia (31.049444°S, 116.190000°E) and operates between 2044 – 2054 MHz (affects channels 7LA and 7LB). The Mingenew earth station is located at 29.046989°S,

115.347197°E[1] and operates between 2025 - 2110 MHz (affects channels 10LB (part) 10LC, 7LA, 7LB, 7LC, 9LA, 9LB, 9LC, 2LA, 2LB and 2LC). In the unlikely event TOB / ENG receivers are located near these uplinks, operation in these frequencies should be avoided.

4.2.4 Mingenew Earth Station, WA

TOB Network licensees have agreed to Fixed Earth licences in 2025-2110 MHz at two additional locations, Kojarena and Mullewa, within the Mingenew Exclusion Zone. The (2025) standing agreement with the site operator was subject to the following provisos:

a) The earth station operator should routinely notify TOB operators (or their representative, Free TV), of future applications for licences that would make use of TOB spectrum at either of the two sites, including the technical characteristics of the proposed services.
b) Broadcasters reserved the right to withdraw the standing agreement, if any of the five TOB Network licensees so request.
c) The following User Defined Special Conditions should be added to Fixed Earth licences:

> 1. The licence is on the condition that no interference is caused to television outside broadcast services and that operation is to cease on being advised of interference to television outside broadcast services.
>
> 2. Earth stations are monitored 24/7 remotely by the licensee for the band 2010-2110 MHz. Turn off to be achieved within 3 hours of interference being reported for any frequency range in the band 2010 to 2110 MHz.

4.2.5 Unprotected Satellite Earth Station Uplinks

TOB licensees have accommodated increasing space industry interest in accessing 2025-2110 MHz spectrum for earth station uplinks at further locations, on terms compatible with primary use of the band by TOB. Broadcasters have reached coordination agreements with earth station uplink providers at a number of sites that are shielded, by distance and/or terrain from day-to-day TOB operations. Uplink licences are granted on the condition they do not cause interference to TOB and cease causing interference if notified by TOB operators. The ACMA requires intending uplink operators to obtain the agreement of the broadcaster (or broadcasters) directly affected by each proposed uplink.

Satellite earth station uplinks operating subject to agreement with the TOB operator/s to whom the spectrum is licensed are found at the sites shown in Table 2. Apparatus licences authorizing these uplinks commonly carry the following conditions:

> The licence is on the condition that no interference is caused to television outside broadcast services and that operations are to cease on being advised of interference to television outside broadcast services.
>
> Earth stations are monitored 24/7 remotely by *[licensee]* for the band 2010 to 2110 MHz. Turn off to be achieved within 3 hours of interference being reported for any frequency range in the band 2010 to 2110 MHz.

[1] All coordinates in this and the following section use the ADG66 geodetic systems

Full details of all unprotected fixed earth licences issued, including how to contact the site operator in the event of interference to TOB, are available to TOB licensees via SharePoint from Free TV Australia.

Table 2 Locations of unprotected satellite earth station uplinks

Location	Location (Latitude; Longitude)	Licensee
Alice Springs, NT	-23.759075; 133.88076194	ViaSat Inc
Brocklehurst, NSW	-32.175507; 148.616374	Artsada Properties LLC
Kapooka, NSW	-35.154288; 147.284285	Department of Defence
Katherine, NT	-14.4611; 132.2635	University of Melbourne
Melton Mowbray, TAS	-42.430794; 147.288128	Skykraft PTY LTD
Peterborough, S Aust	-32.961980; 138.849493	Nova Systems Consulting PTY LTD
Truro, S Aust.	-34.436000; 139.16700	Fleet Space Technologies

4.2.6 Sharing with nomadic Earth Exploration Satellite Service (EESS) activities

TOB Network licensees have also entered into a coordination agreement with a provider of nomadic earth station uplinks for Earth Exploration Satellite Service (EESS) activities in the earth-to-space direction in the frequency range 2025-2045 MHz, in all areas of Australia apart from agreed exclusion zones surrounding the 26 TOB fixed receive sites. The exclusion zones are outside the scope of the agreement and any EESS activities proposed to take place within the exclusion zones must be the subject of individual approaches from the EESS operator to the relevant TOB licensee/s. The agreement also makes provision for a prior notification scheme in relation to a small number of other areas that are routinely subject to scheduled TOB activities. These areas ('notification zones') are found in and around Cairns and Townsville (Qld); Bathurst (NSW); Winton and Stawel (Vic); Launceston and Symmons Plains Raceway (Tas).

4.2.7 Protected Satellite Earth Station Downlinks

The CSIRO Earth station Alice Springs (23.761351°S, 133.881068°E) receives signals in the band 2103.406-2109.406 MHz so no TOB / ENG facilities are allowed to operate on these frequencies within 50 km of the site. Only wireless cameras are allowed to operate between 50 km and 150 km from the site on these frequencies. Channel 2LC is the only impacted TOB /ENG channel.

5. SPECTRUM SHARING AND CO-ORDINATION IN THE 2.2GHz BAND

5.1 Overview

The band 2200 – 2300 MHz is shared with fixed point-to-point microwave link systems (in two different channel rasters), aeronautical mobile telemetry, uplinks and downlinks from satellite systems and radio-astronomy.

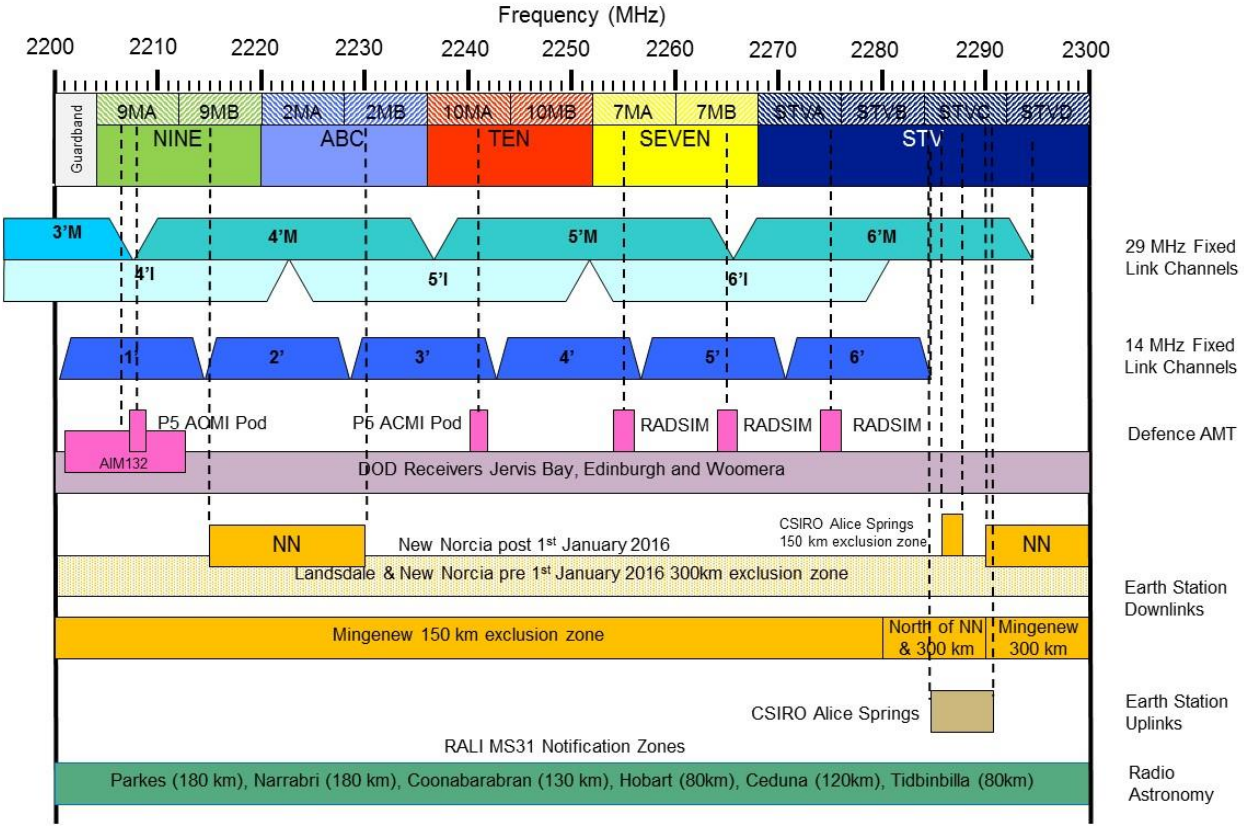

Figure 5 Systems in the 2.2 GHz Band

For each other service that TOB / ENG shares the band 2200 – 2300 MHz, there are various clearance, embargoed and exclusion zones. These are shown in Figure 6.

Supporting the Square Kilometre Array (SKA), the ACMA has placed limits on transmitters in support of the radio quiet zone (RQZ) in remote Western Australia, near Boolardy station, centred 26.704167 South, 116.658889 East (GDA94 datum). TOB transmitters must not operate within 150 km of this location as shown by the purple area in Figure 6.

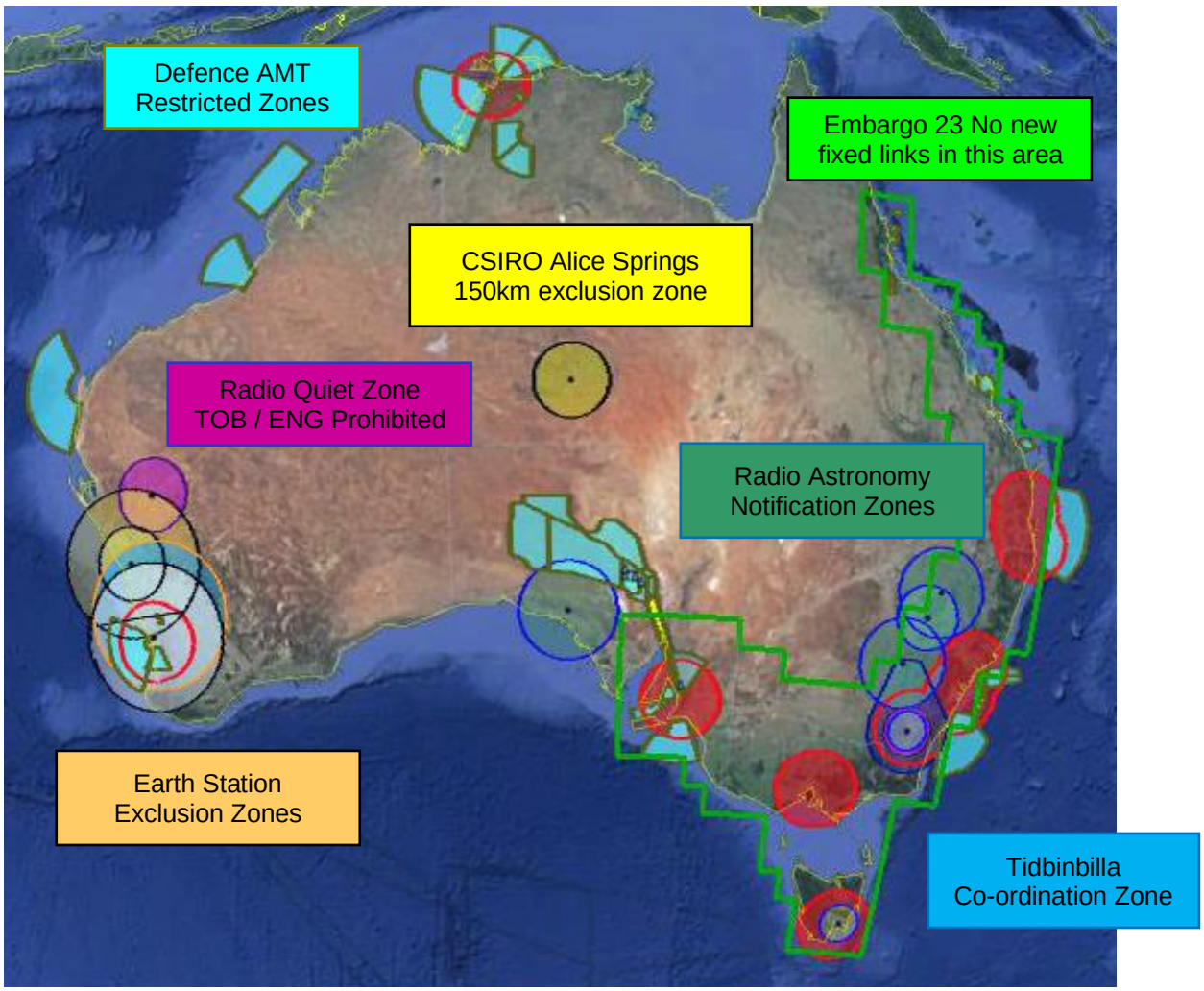

Figure 6 Co-ordination and Clearance Zones in the 2.2 GHz Band

5.2 Co-ordination with Shared Services

5.2.1 Channel Selection Procedure

In remote areas more co-ordination is required with other services in the 2.2 GHz band than in the 2 GHz band. Therefore use of the 2.2 GHz band should be considered only if the TOB / ENG deployment cannot be satisfied by using channels in the 2 GHz band.

In many areas it is likely that interference to and from other services will be avoided by careful channel selection. The following procedure should enable a suitable channel to be found. However, when significant events occur which require extensive concentrated deployment of ENG transmitters and receivers, careful co-ordination will be required.

Simple Channel Selection Procedure

1. Check in Figure 6 for co-ordination zones with other services in the area where the proposed TOB / ENG deployment will occur.
2. Undertake the co-ordination procedure for fixed links as shown in Section 5.2.2.
3. If the TOB / ENG receiver deployment is near a Restricted Area as shown in cyan in Figure 6, check for Defence AMT notifications as detailed in Section 5.2.3.
4. If the TOB / ENG receiver will be near the CSIRO Alice Springs earth station, avoid using channel STVC. See Section 5.2.4.
5. If the TOB / ENG transmitter deployment is within the earth station exclusion zones in Section 5.2.5, channels as listed in Table cannot be used.
6. If the TOB / ENG transmitter deployment is within the Tidbinbilla earth station co-ordination zones in Figure 7, follow the requirements of Section 0.
7. If the TOB / ENG transmitter deployment is within the radio observatory notification zones in Table 5, follow the requirements of Section 5.2.10.

5.2.2 Fixed Links

Co-ordination needs to be undertaken by examining the installed links within 200 km of the proposed TOB transmitter location and avoiding the channels used by these links. Generally one of the broadcaster's channels will be available at a location. If additional channels are required, contact another broadcaster and arrange to temporarily share their channels. Note that within the Embargo 23 area from North Queensland to the Spencer Gulf (shown bounded in green in Figure 6), as the population of fixed links will not change, this procedure may be undertaken once to determine available TOB / ENG channels in an area and this may be noted for rapid response to future ENG requirements.

5.2.3 Defence Aeronautical Mobile Telemetry (AMT)

Under RALI FX-21 the Department of Defence has the responsibility to:

- provide standing advice to TOB operators for, regular use in Defence training/operating areas, the broad technical and geographic characteristics of ongoing AMT activities, and
- for irregular, short duration and location specific AMT activities, Defence will notify their usage of the band on an as needed basis. This will include, where appropriate, time and area of operation and TOB channels affected.

Defence currently holds licences shown in Table 3.

Table 3 Defence AMT Licences

Defence System	ACMA Licence Number	Carrier Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	Max EIRP spectral density (dBm/MHz)	Affected TOB Licensee
RADSIM	1231884	2255	2254	2256	44	Seven
RADSIM	1231885	2265	2264	2266	44	Seven
RADSIM	1231886	2275	2274	2276	44	ABC (until 1/8/15), other FTA (until 31/1/16), STV after 31/1/16
P5 ACMI Pod	1958149	2208	2207.2	2208.8	32.7	Nine
P5 ACMI Pod	Not on register	2241	2240.2	2241.8	32.7	Ten
AIM132	Not on register	2206.5	2200.65	2212.35		Nine

AMT transmissions shall occur only while within the restricted areas or transit zones.

5.2.4 Satellite Earth Station Uplinks

TOB / ENG receivers are not protected from interference from satellite earth station uplinks. The CSIRO Earth station Alice Springs (23.761351°S, 133.881068°E) transmits signals in the band 2284.5 – 2290.5 MHz so use of TOB / ENG receivers on channel STVC in the Alice Springs area should be avoided.

5.2.5 Satellite Earth Station Downlinks

To protect specified earth station receivers, the ACMA has stipulated various TOB / ENG exclusion zones around licensed earth station facilities as shown in Table 4.

Table 4 Earth Station Exclusion Zones in the 2.2 GHz Band

Earth Station	Location (Latitude, Longitude) [2]	Frequency Range (MHz)	Exclusion Zone Distance (km)	Notes	Affected TOB Licensee / Channel
Tidbinbilla Earth station (CDSCC)	-35.402497°, 148.981394°	2200 - 2300	Varies. Refer TOB licensees for more details		All
Landsdale Earth station	-31.809444°, 115.886111°	2200 - 2300	300	Until 1st January 2016, no co-ord required after this date	All
New Norcia Earth station	-31.049444°, 116.190000°	2200 - 2300	300	Until 1st January 2016	All
		2215 – 2230 2290 - 2300	300	After 1st January 2016	9MB, 2MA, 2MB, STVC, STVD
Mingenew Earth station	-29.046989°, 115.347197°	2200 - 2280	150		All except STVB - D
		2280 - 2290	North of New Norcia and within 300km		STVB, STVC
		2290 - 2300	300		STVC, STVD
CSIRO Earth station Alice Springs	-23.761351°, 133.881068°	2286.5 – 2288.5	150		STVC

5.2.6 CDSCC Tidbinbilla Earth Station

Satellite earth station downlinks are required to be protected at the CDSCC at Tidbinbilla. As these are links from satellites in deep space, they are receiving extremely low signal levels (often requiring post-reception computer processed correlation to extract signals from noise) so RALI FX-21 imposes a large coordination zone for this band.

The coordination area for TOB wireless cameras is based on the power and height restrictions of 23dBm/8MHz and 2m respectively and is shown in Figure 7 as the purple circle. The coordination area for TOB news vans is based on the power and height restrictions of 56 dBm/8MHz and 10m respectively and is shown in Figure 7 as the blue area. TOB operations above these power / height levels need to be co-ordinated with the Tidbinbilla earth station.

[2] All coordinates use the ADG66 geodetic systems

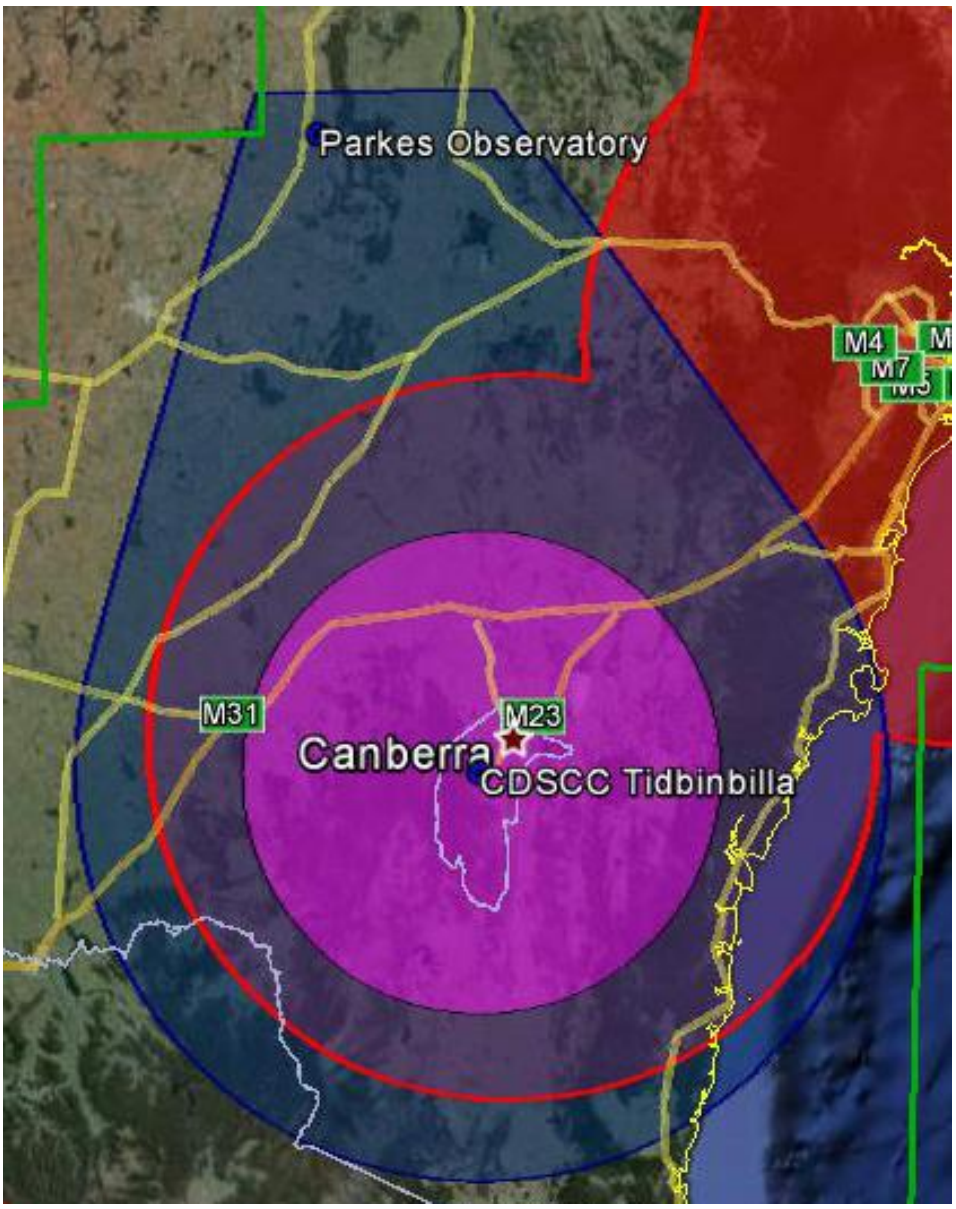

Figure 7 Tidbinbilla Co-ordination Zones in the 2.2 GHz Band

5.2.7 Mingenew Earth Station, WA

TOB Network licensees have agreed to Earth Receive licences in 2200-2300 MHz at two additional locations, Kojarena and Mullewa, within the Mingenew Exclusion Zone. The standing agreement was subject to the following provisos:

d) The earth station operator should routinely notify TOB operators (or their representative, Free TV), of future applications for licences that would make use of TOB spectrum at either of the two sites, including the technical characteristics of the proposed services.
e) Broadcasters reserved the right to withdraw the standing agreement, if any of the five TOB Network licensees so request.
f) The following User Defined Special Conditions should be added to Earth Receive licences:

1. No protection to the operation of this earth station receiver may be claimed from interference from television outside broadcast services operating in accordance with Radiocommunications Assignment and Licensing Instruction FX 21.
2. This earth station is only authorised to communicate with space station(s) if the power flux density of the transmission from the space station(s) at the Earth's surface does not exceed the limits given in Article 21.16 of the ITU Radio Regulations.

5.2.8 Unprotected satellite earth station downlinks

Satellite earth station downlinks operating subject to agreement with the TOB operator/s to whom the relevant spectrum is licensed are found at several locations in regional and remote Australia, including some of the sites shown at Table 2, above. Apparatus licences authorizing these downlinks commonly carry the following condition:

> No protection to the operation of this earth station receiver may be claimed from interference from television outside broadcast services operating in accordance with Radiocommunications Assignment and Licensing Instruction FX 21, nor from aeronautical telemetry systems.

5.2.9 Coordination arrangements for Bowen rocket launch site, Abbot Point, Queensland

In 2022, Gilmore Space Technologies (GST) entered into a coordination agreement with ABC and the Nine Network for scheduled access to 2210-2215 MHz and 2220-2225 MHz for S-Band links carrying telemetry health data from rockets launched from GST's Abbot Point facility, 14 km west of Bowen township, into low-earth orbit. Under the agreement, GST and all TOB licensees using 2200-2300 MHz spectrum are expected to exchange scheduling details of upcoming events where spectrum access is required. GST will provide an annual schedule of launch operations by 31 January each year covering the 12-month period commencing 1 February the following year. After TOB operators have reviewed and agreed the annual schedule, GST will apply to the ACMA for licences for launcher operations for the specific missions listed in the annual schedule. 30 days prior to each launch event in the annual schedule, GST will provide the relevant TOB licensees with an email request for final confirmation of access to the frequency range of the affected TOB licensee.

The agreement makes different provision for scheduled and unscheduled TOB use. If a broadcaster learns of scheduled TOB requirements that are incompatible with a launch event scheduled in an agreed annual launch schedule, it must notify GST as soon as possible to give adequate time to make alternative arrangements if required. The agreement also recognises that on rare occasions TV network news coverage may necessitate unscheduled TOB operations. In this situation GST is not protected from interference from TOB and is required to cease operations that would otherwise interfere with TOB. This dispensation for TOB operators is limited to unforeseen circumstances, such as major breaking news stories, but does not extend to TOB coverage of the rocket launch itself.

Details of the agreement and relevant notifications from GST are available via SharePoint from Free TV Australia.

5.2.10 Radio Astronomy

RALI MS31 has established "Radio Sensitive Zones" around key Australian radio astronomy facilities and provides details of “notification zones” for areas where operation of other links might impede the operation of key radio astronomy facilities. RALI FX21 acknowledges that RALI MS31 does not apply to radiocommunications systems that operate in an itinerant fashion (such as TOB transmitters operating under area wide licenses), but encourages TOB licensees to notify when operating near an Observatory.

Table 5 Radio Astronomy Notification Zones in the 2.2 GHz Band

Observatory	Location (Latitude, Longitude) [3]	Notification Zone (km radius)
Parkes Observatory	32° 59' 59.9" S 148° 15' 44.4" E	180
Paul Wild Observatory Narrabri	30° 18' 52.0" S 149° 32' 56.3" E	180
Mopra Observatory Coonabarabran	31° 16' 4.5" S 149° 5' 58.7" E	130
Mount Pleasant Observatory Hobart	42° 48' 12.9" S 147° 26' 25.9" E	80
Ceduna Observatory	31° 52' 08.8" S 133° 48' 35.4" E	120
Canberra Deep Space Communication	35° 23' 54.0" S 148° 58' 40.0" E	80

6. REFERENCES FOR SPECTRUM USAGE FOR ENG AND TVOB OPERATIONS

RALI FX-21 Television Outside Broadcasting Services in the Bands 1980-2110 MHz and 2170-2300 MHz.

RALI FX-21 can be found on the ACMA's website, here .

RALI FX-3 Microwave fixed Services Frequency Coordination

RALI FX-3 can be found on the ACMA's website, here.

EMBARGO 23. An embargo on new assignments to support television outside broadcast and future replanning activities.

EMBARGO 23 is included in ACMA's RALI MS-03. It can also be found as a standalone document on the ACMA's website, here.

[3] All coordinates use the ADG66 geodetic systems