Internal management of Murchison Shire RQZ

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5th Summer School in Spectrum Management for Radio Astronomy

2 – 6 March 2020, Stellenbosch

Outline of presentation

- National regulations
- Site requirements
- Management processes
- RFI Site monitoring

National regulations

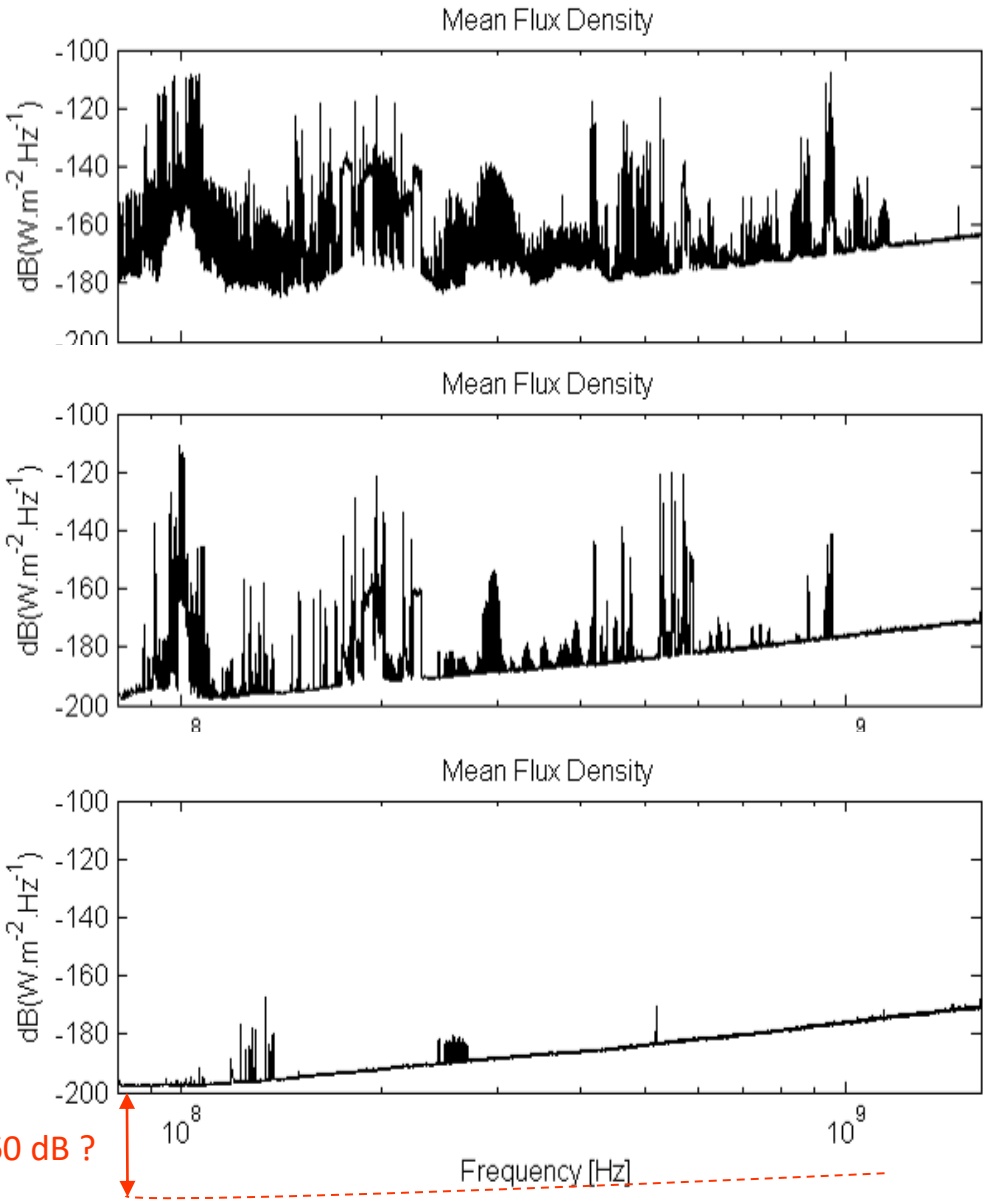
Finding a quiet spot first

Sydney
Pop. 4 million

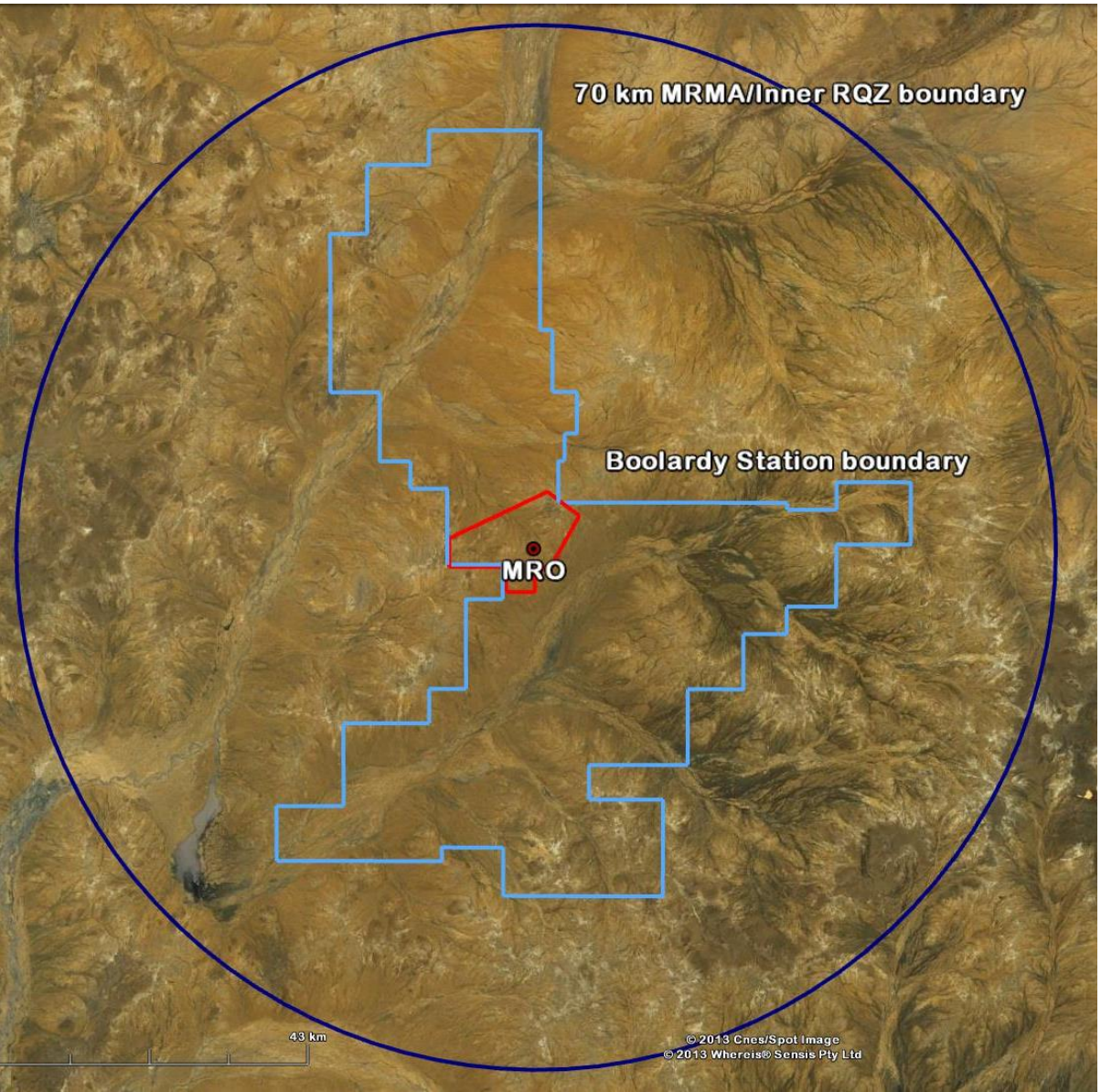
Measurements with a swept spectrum analyser

Narrabri
Pop. 6,000

Murchison
Pop. 4
9 nano-persons/km²



Murchison Radioastronomy Observatory at Boolardy Station, WA



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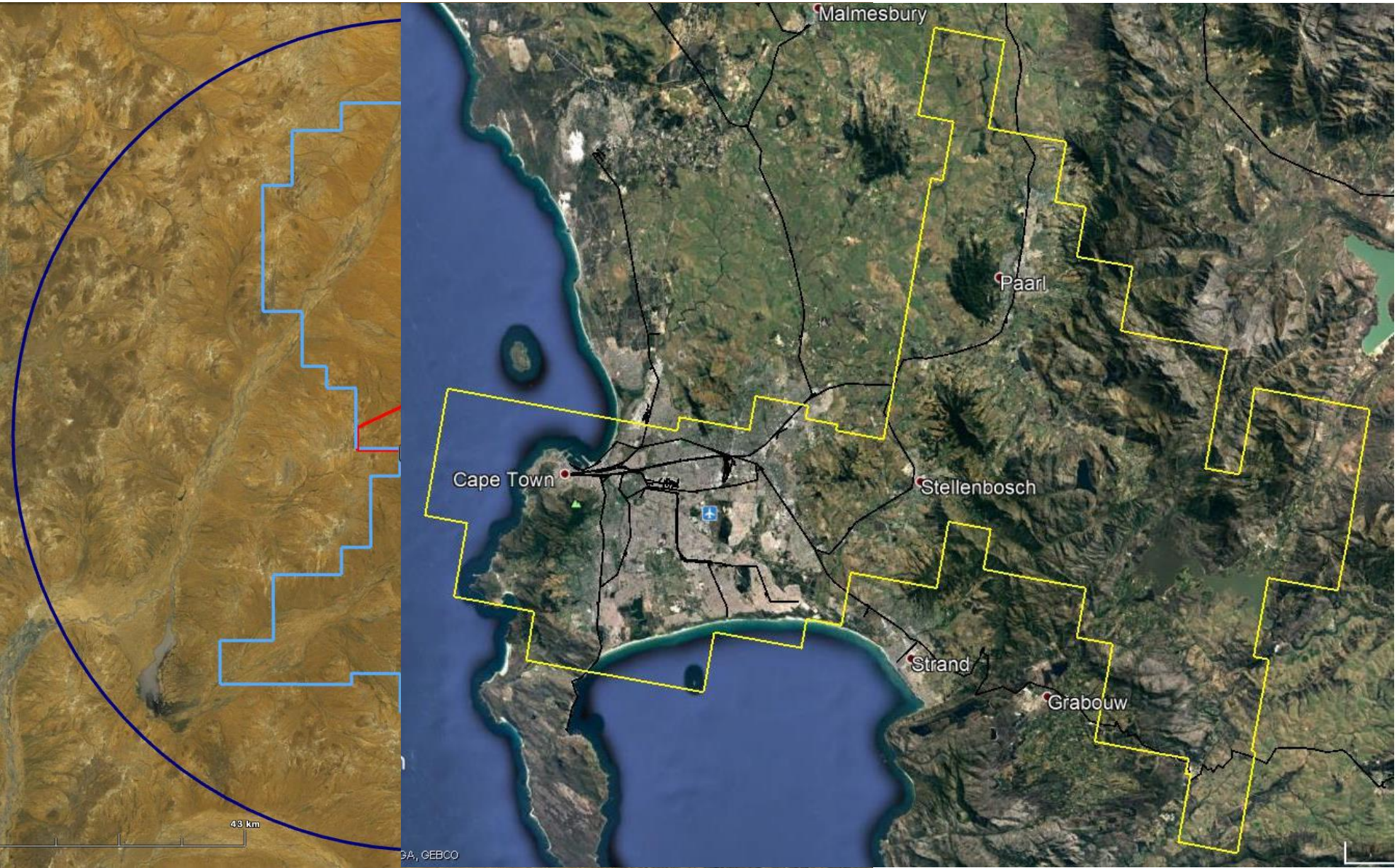
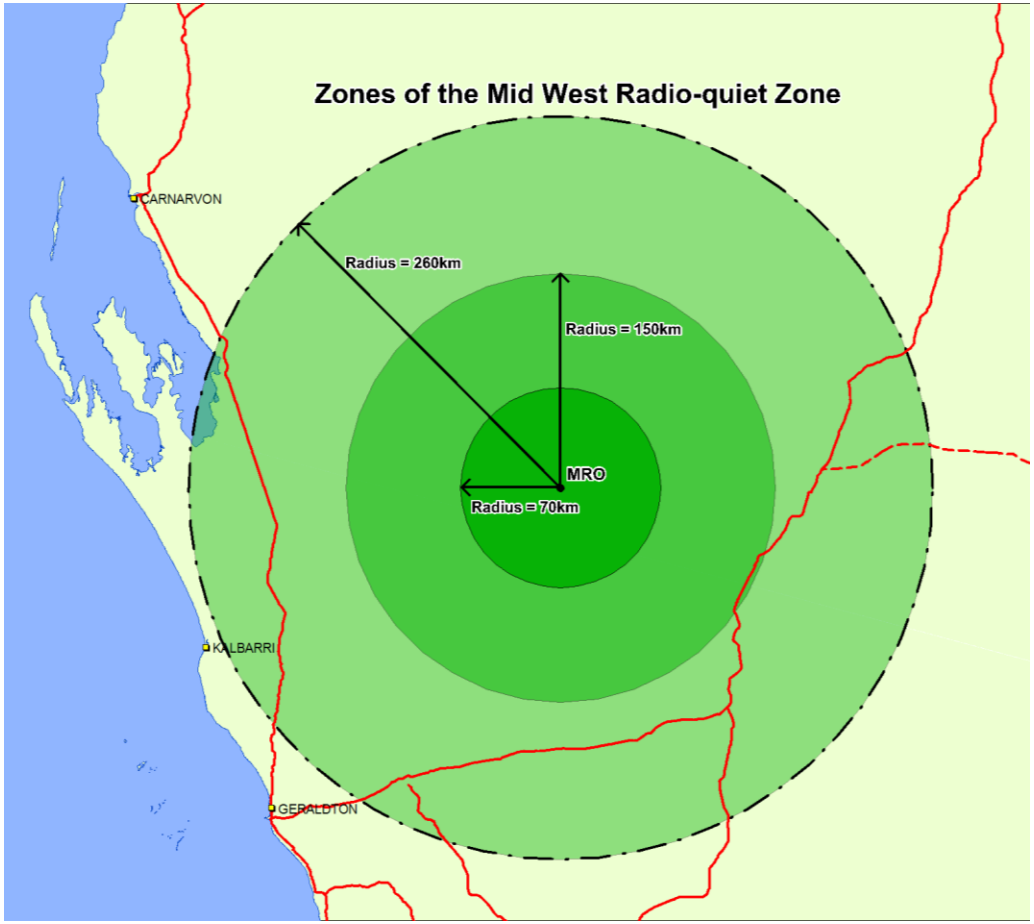


Mid West RQZ Frequency Band Plan, ACMA, 2011



- Within 70 km, radioastronomy is primary user over any other spectrum user
- Within 70 km, no interference allowed from class-licensed devices (satphones, CB, etc)
- Between 70 and 150 km, consultation with CSIRO required over new apparatus licences
- Restrictions on spectrum-licensed (eg mobile telephone base station) transmitters in various ways.

RALI MS 32 distances and thresholds

Frequency Range (MHz)	Coordination Radius (km)	Threshold at ARQZWA centre (dBm/Hz)	Maximum allowable power level within 50 kilometres (dBm)
70-100	260	-211	-90
100-230	260	-214	-90
230–400	180	-222	-95
400–520	165	-224	-95
520–694	190	-224	-95
694–1000	145	-228	-95
1000–2300	140	-230	-95
2300–6000	120	-232	-95
6000–10000	100	-232	-95
10000–25250	100	-236	-95

- **Within 70 km, Radioastronomy is primary user of spectrum**
- **Between 70 km and coordination radius, applicants must assess power spectral density at centre and power over area 50 km in radius**
- **<u>These “RALI levels” are the basis of our on-site requirements.</u>**

Site requirements

Initial self interference thresholds (c. 2010)

Distance (km)	Target emissions	Means of compliance	Comments
d>10	Less than or equal to levels defined in Military standard MIL-STD-461F category RE102, Navy Mobile and Army (Figure RE102-4)	Equipment should be tested to MIL-STD-461F, and if required, additional screening provided to meet target emissions level.	
10>d>1	Less than or equal to 20 dB below Military standard MIL-STD-461F.	Equipment should be tested to MIL-STD-461F, and if required, additional screening provided to meet target emissions level.	Need to take great care with equipment connections to maintain RFI screening between tested components
d<1	Less than or equal to 80 dB below Military standard MIL-STD-461F.	Equipment should be tested to MIL-STD-461F, and if required, additional screening provided to meet target emissions level.	Only permitted on a case-by-case basis with careful testing

New self interference requirements (c. 2019)

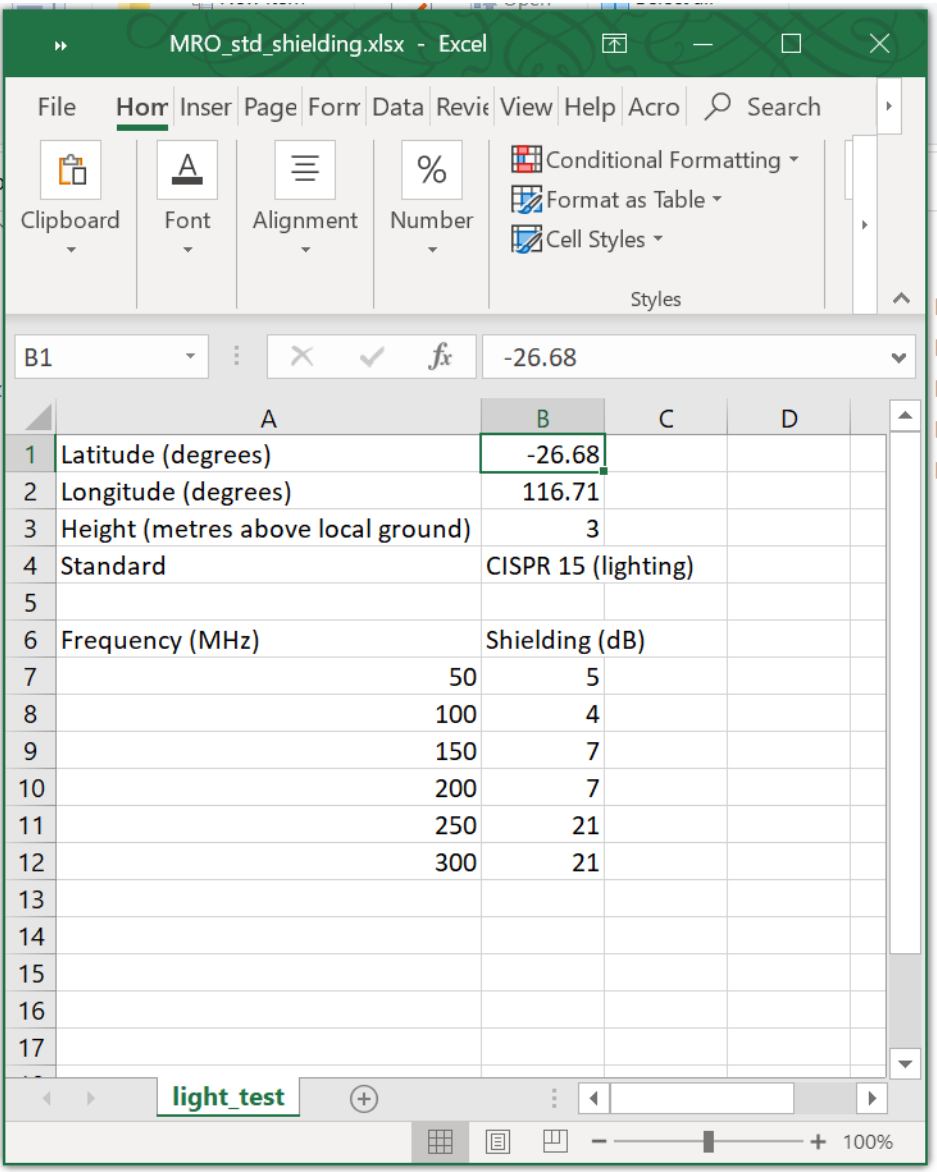
- Licensed radio transmitters: National regulations must be met.
- Class-licensed devices allowed on a case-by-case basis. (eg CB radios)
- Inter-telescope interference: Incidental or deliberate emissions from equipment brought on site must not exceed the levels specified ACMA RALI MS 32, at the site of another existing radio astronomy receiver. Software available to evaluate.
- Intra-telescope interference: responsibility of the telescope operator.

Software example

C:\Users\wil033\Documents\MATLAB\compiled apps\MRO_emi_std\for_redistribution_files_only\MRO_emi_std.exe

```
  Enter location of proposed equipment in decimal degrees
  Latitude should be specified as a negative value between -25 and -30

  Enter latitude of equipment   -26.68

  Enter longitude of equipment as a positive value between 115 and 120   116.71

  Enter height of equipment, in metres above local ground   3

1 :   EN61000-6-3
2 :   EN61000-6-4
3 :   CISPR 11 (ISM)
4 :   CISPR 12 (vehicles and internal combustion engines)
5 :   CISPR 13 (radio and TV receivers)
6 :   CISPR 14 (household appliances or tools)
7 :   CISPR 15 (lighting)
8 :   CISPR 22 or 32 (IT or multimedia equipment)
9 :   MIL-STD-461F (or later), RE 102, 'Navy, Mobile and Army'

 With which standard above does the equipment comply?
  Enter the relevant number (1 to 9) from the list.   7

  Enter name for output file (to be used in for spreadsheet page name and image file)   light_test

 File already exists.  Overwrite previous version (y/n)?      y

 Please wait.  This may take a few minutes
 10 percent finished
 20 percent finished
 40 percent finished
 60 percent finished
 70 percent finished
 90 percent finished
```

Output



	A	B	C	D
1	Latitude (degrees)	-26.68		
2	Longitude (degrees)	116.71		
3	Height (metres above local ground)	3		
4	Standard	CISPR 15 (lighting)		
5				
6	Frequency (MHz)	Shielding (dB)		
7	50	5		
8	100	4		
9	150	7		
10	200	7		
11	250	21		
12	300	21		
13				
14				
15				
16				
17				

Output

MRO_std_shielding.xlsx - Excel

File Hom Inser Page Form Data Revie View Help

Clipboard Font Alignment Number Conditic Format Cell Styl

B1 -26.68

	A	B
1	Latitude (degrees)	-26.68
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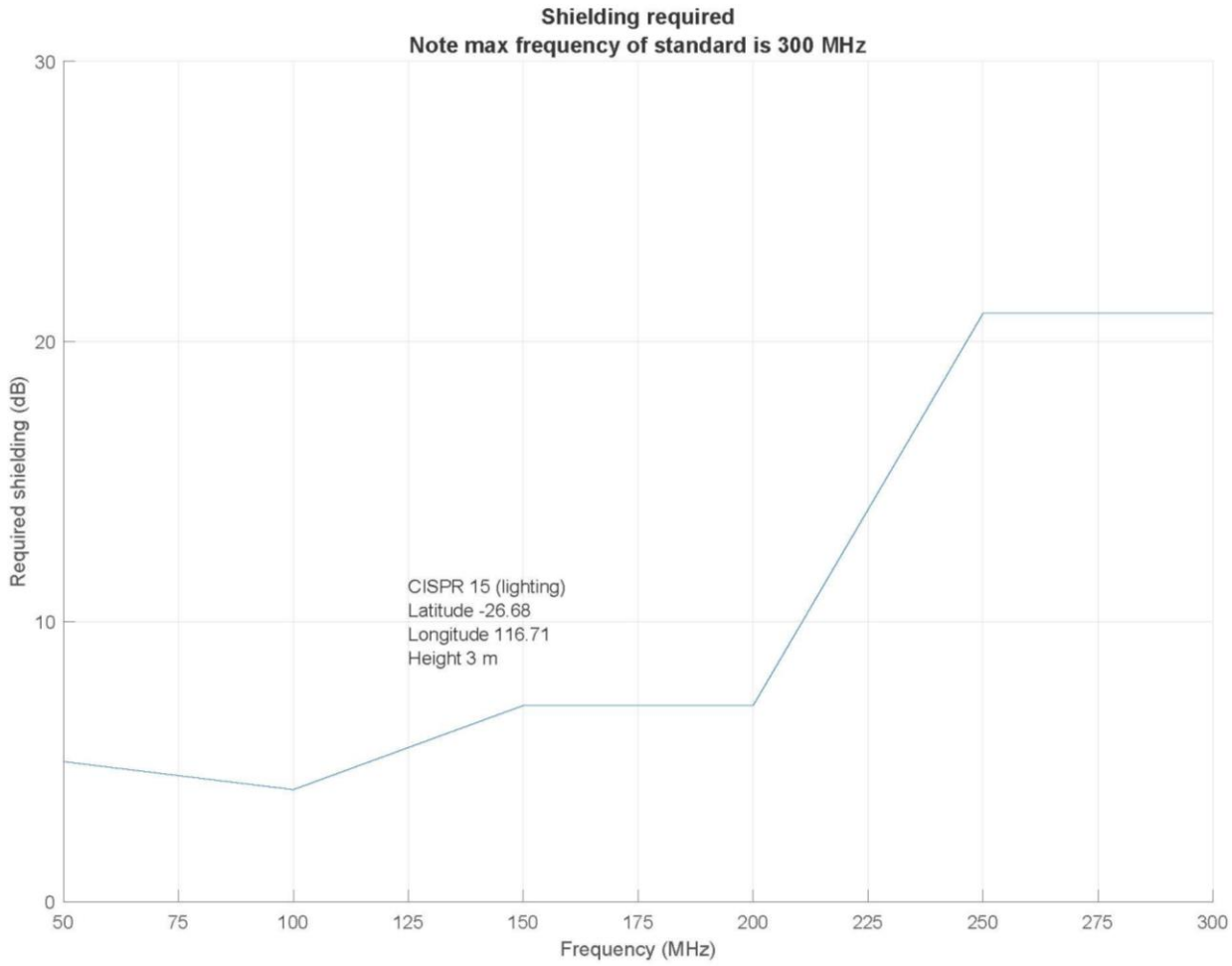
16		
17		

light_test

100%



Management processes

Practical controls of self-interference

- In house testing of equipment deployed to MRO
- Design and shielding of telescope components
- Design of shielded MRO control building (2 x 100 dB)

- *“Radio Emissions Management Plan” for specific activities*
- *Staff policies on use of devices on site*
- *RFI monitoring (for self-compliance and external interference)*

MRO control building

- Double shielded building
- Complete metal construction
- Airlock-style RFI doors
- Waveguide-beyond-cutoff insertions
- Goal 80 dB per layer; achieved > 100 dB per layer

Radio Emissions Management Plan

- For any activity on site in excess of “normal astronomy”, eg commissioning, construction, maintenance, site visits, etc.
- Form is required to describe when (and how long), where, what equipment.
- Potential for excess RFI evaluated by RQZ team at CSIRO.
- Consultation with science teams for all telescopes.
- Advice from management on whether and when activity can proceed.

Site entity roles

- Work with ACMA and WA gov’t on legislation
- Advise ACMA on impact to radio astronomy
- Respond to external applicants under the RALI process
- Respond to mining companies under WA legislation
- Educate local stakeholders about class-licence and other radio quiet issues
- Represent radio astronomy interests in national spectrum management processes (for example, ITU preparation).
- Manage staff and visitor RFI controls

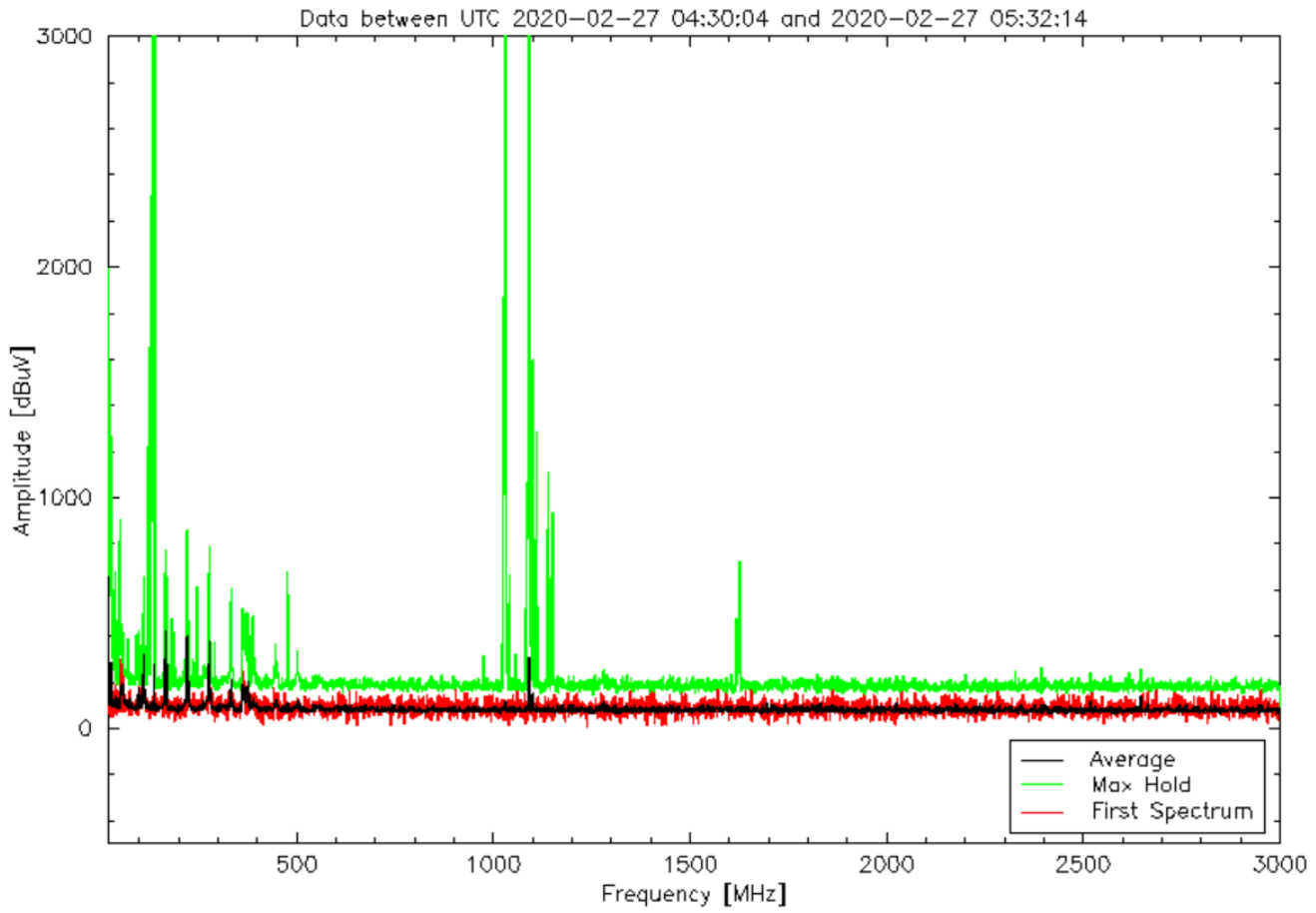
RFI monitoring

Real time monitoring at ASKAP site

ATNF RFI Monitor Network - MRO Station

Latest Spectra

(Time in UTC)

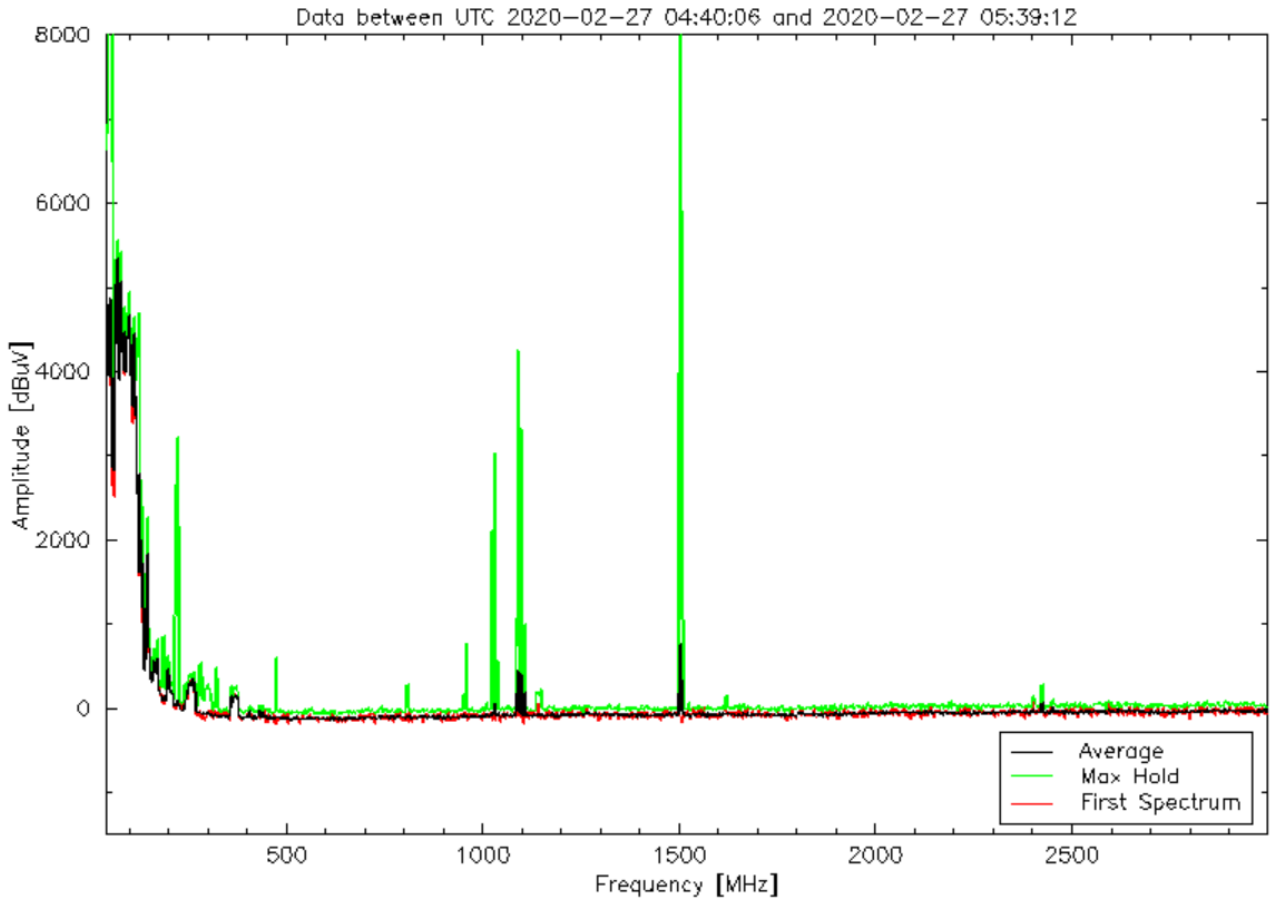


Real time monitoring at Boolardy homestead

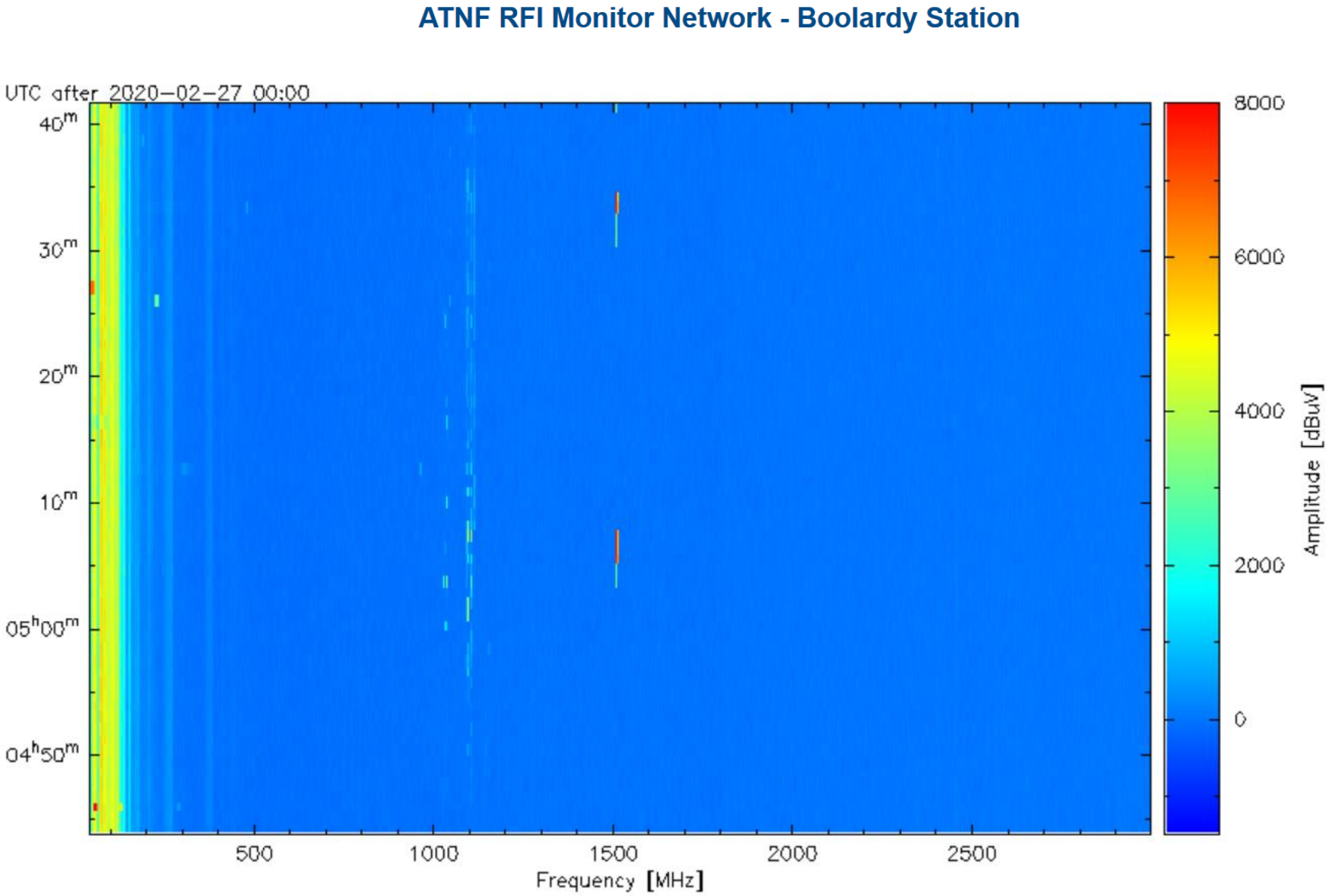
ATNF RFI Monitor Network - Boolardy Station

Latest Spectra

(Time in UTC)



Real time monitoring at Boolardy homestead



Thank you!

Questions?

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