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Radiofrequency Interference (RFI):
Spectrum Allocation and Regulation

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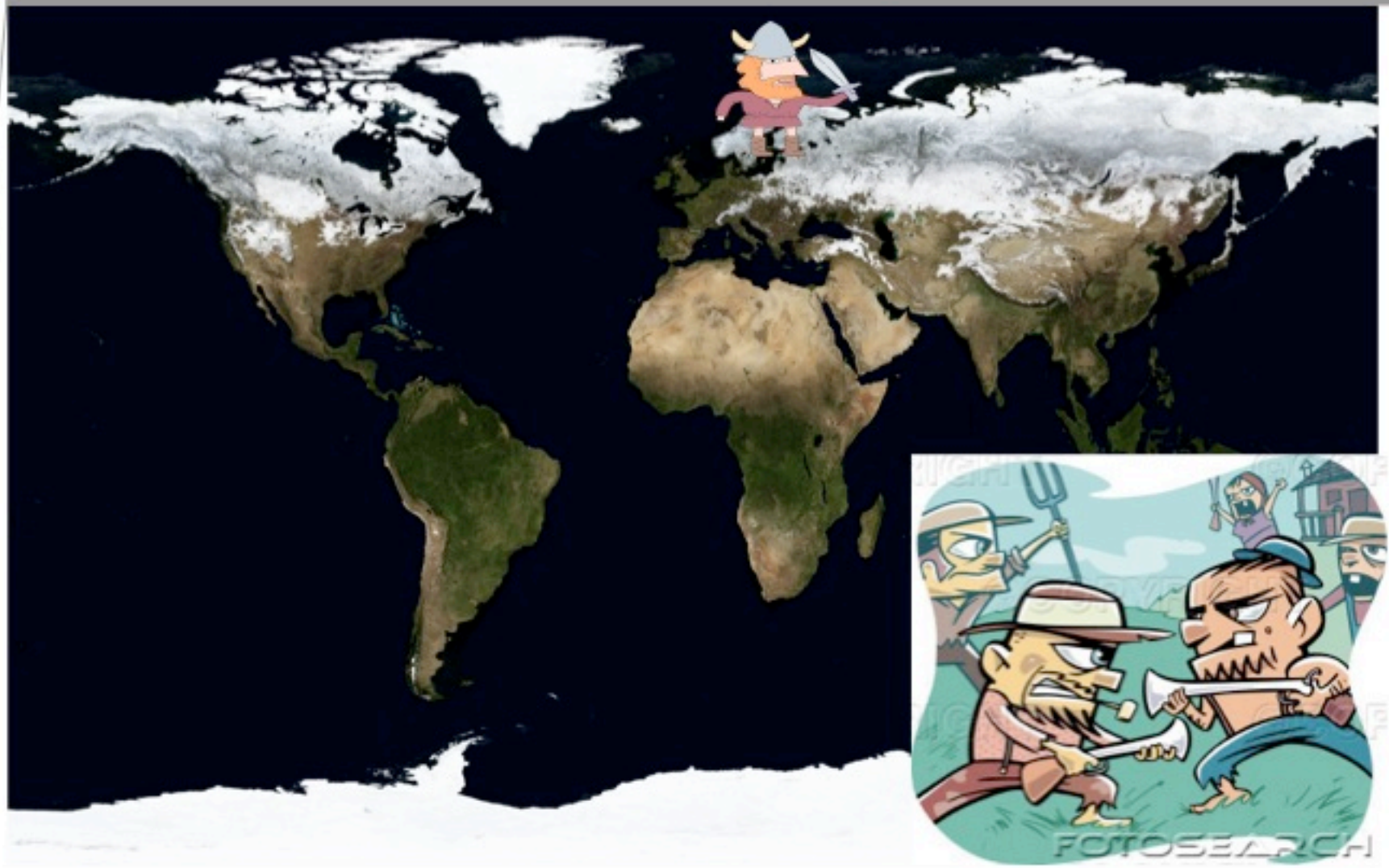
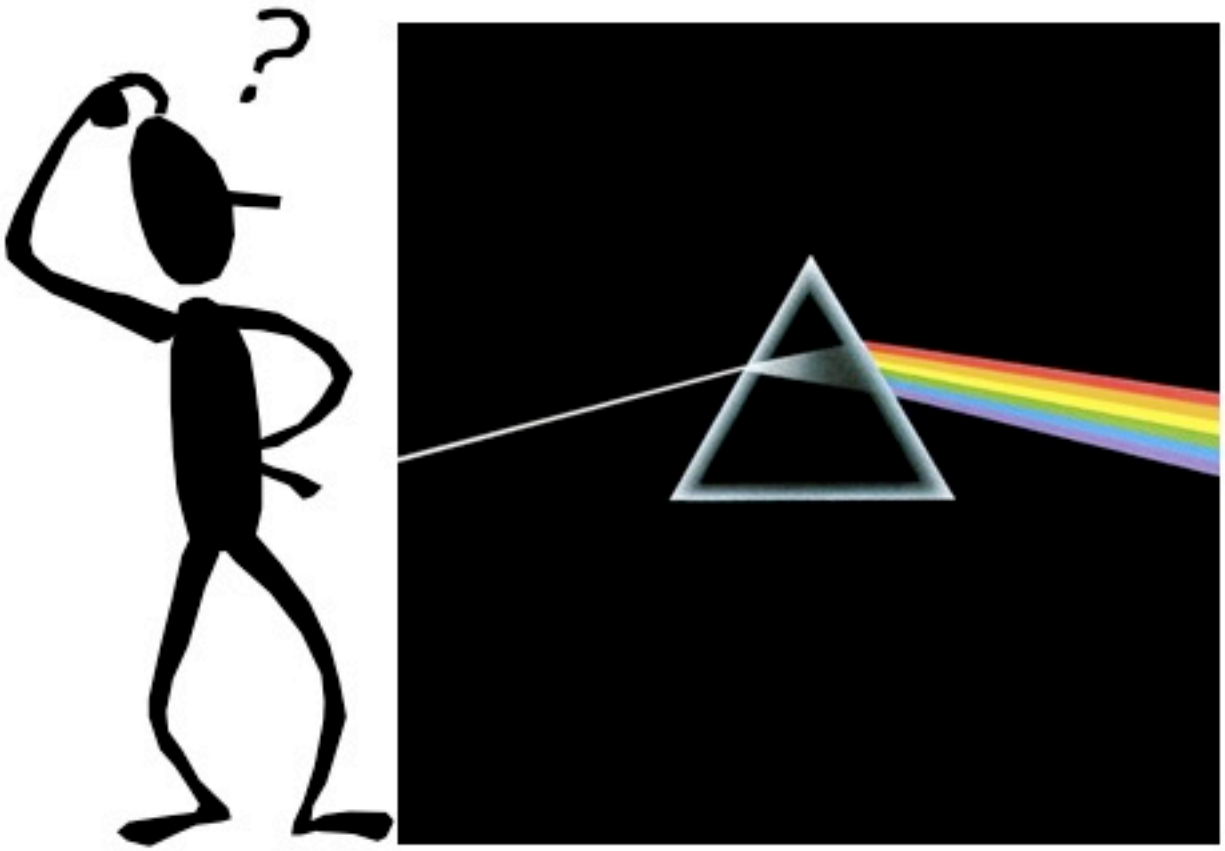
CSIRO

OK lets start from outer space… the creatures on this planet evolved from apes and…

.. traded, pillaged and fought over the natural resources of the planet for countless centuries...

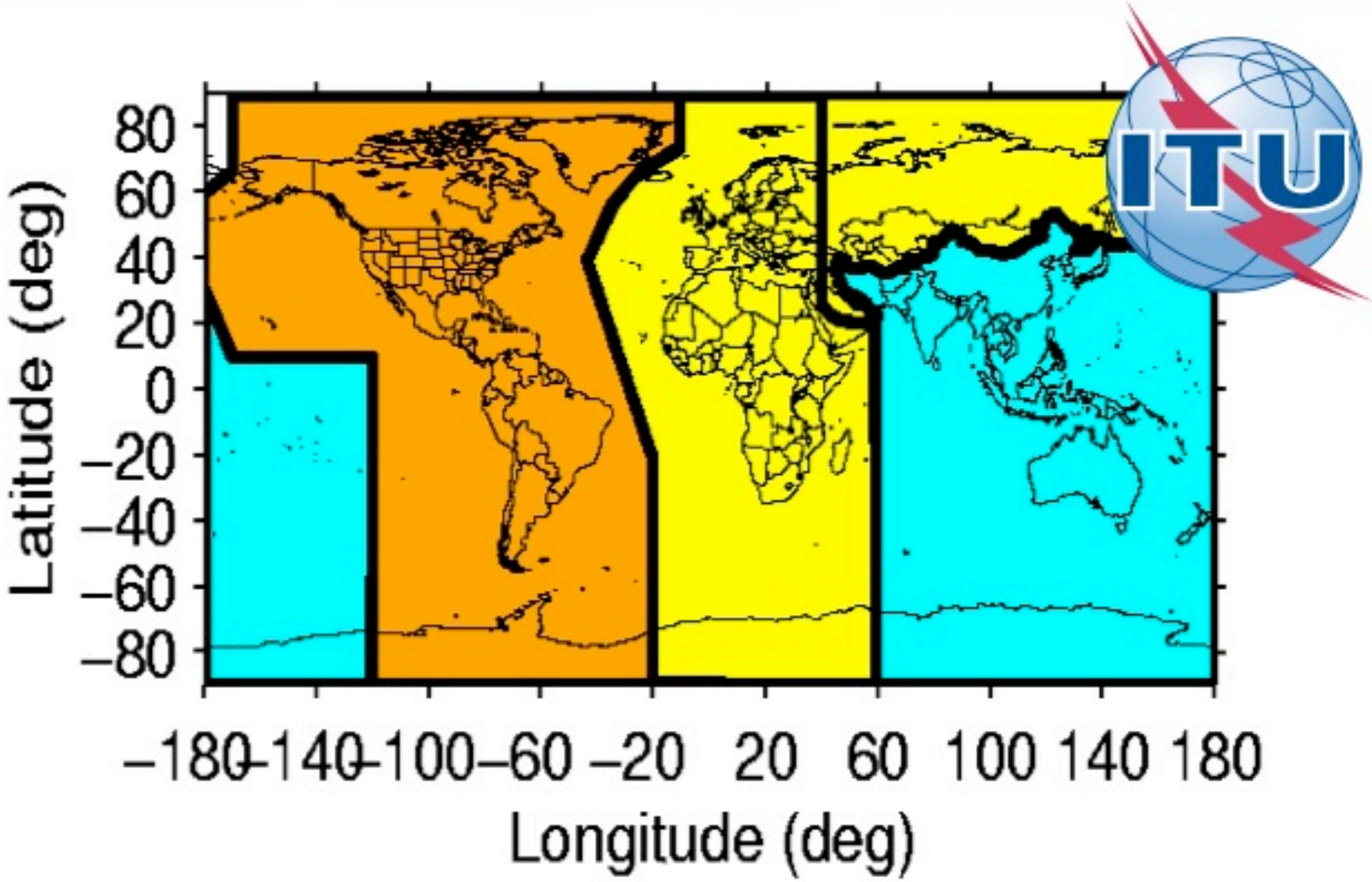


… then a new commodity (radio) "**Spectrum**" entered the market, weightless, invisible, fully recyclable…



The former PM and Treasurer just loved $pectrum!

In 1922, Australia signed a treaty and joining an international spectrum use co-operative – the ITU.

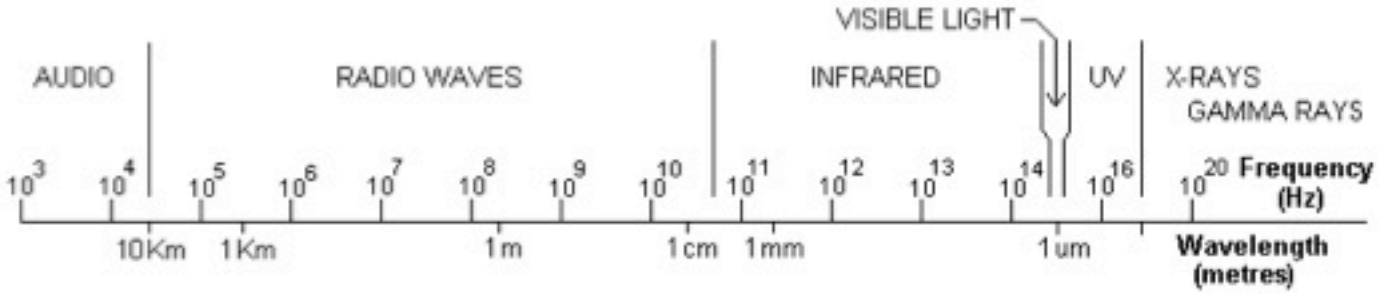


Spectrum Management Legal Framework

As in most countries, Australian allocation and RFI management is based on the ***ITU Radio Regulations*** – a treaty level instrument.

The Australian legal framework for spectrum allocation and interference management is based on the ***Radiocommunications Act 1992***.

The radiofrequency spectrum is legally defined by the ***Australian Radiofrequency Spectrum Plan*** as the frequencies in the range 9kHz up to 420 THz.



The Radiofrequency Spectrum Plan

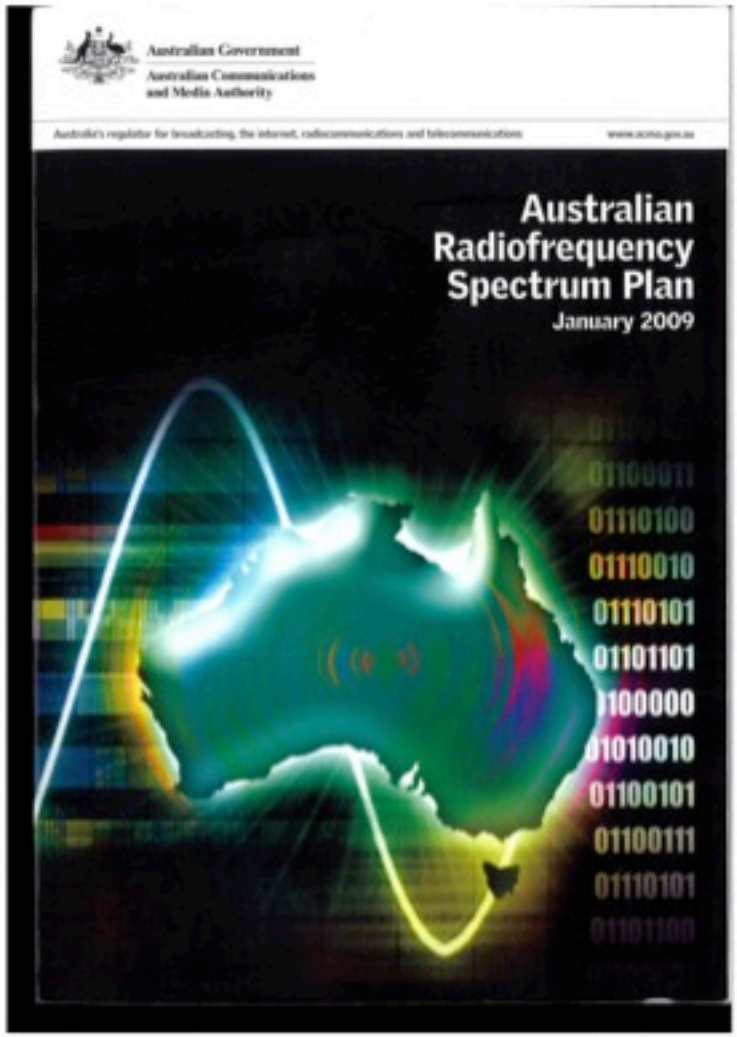
Allocates blocks of spectrum to services:

•PRIMARY (FIXED, MOBILE, **RADIO ASTRONOMY**) allocations

•Secondary (Fixed, Mobile, **Radio Astronomy**) allocations

•Footnotes:
- ITU (eg. **340**, 341)
- national (eg. **AUS87**, 63)

• 9kHz to 420 THz, in practice unallocated above 275 GHz *(but have a look at footnote 565, on page 251)*



Example 1400-1427 MHz

MHz
1 400 – 1 492

Column 1: ITU Radio Regulations Table of Allocations			Column 2: Australian Table of Allocations
Region 1	Region 2	Region 3	
1 400 – 1 427 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 340 341			**1 400 – 1 427** EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 340 341 AUS87
1 427 – 1 429 SPACE OPERATION (Earth-to-space) FIXED MOBILE except aeronautical mobile 338A 341			**1 427 – 1 429** SPACE OPERATION (Earth-to-space) FIXED MOBILE except aeronautical mobile 338A 341 AUS87
1 429 – 1 452 FIXED MOBILE except aeronautical mobile 338A 341 342	**1 429 – 1 452** FIXED MOBILE 343 338A 341		**1 429 – 1 452** FIXED MOBILE AUS3 338A 341 AUS87
1 452 – 1 492 FIXED MOBILE except aeronautical mobile BROADCASTING 345 BROADCASTING- SATELLITE 208B 345 341 342	**1 452 – 1 492** FIXED MOBILE 343 BROADCASTING 345 BROADCASTING-SATELLITE 208B 345 341 344		**1 452 – 1 492** BROADCASTING 345 BROADCASTING-SATELLITE 208B 345 FIXED MOBILE AUS3 341 AUS87

Example (1) 1400-1427 MHz

International Footnotes: { p.199-200 }

340 *All emissions are prohibited in the following bands: 1400-1427 MHz, 2690 – 2700 MHz, except those….*

341 *In the bands 1400 – 1727 MHz, 101 – 120 GHz and 197 – 220 GHz, passive research is being conducted by some countries in a programme for the search for intentional emissions of extraterrestrial origin.*

National (AUS) Footnote: { p.158 }

AUS87 *Radio astronomy facilities operated by the CSIRO at the Paul Wild Observatory Narrabri, the Parkes Observatory, the Mopra Observatory, Mt Pleasant Observatory Hobart, Ceduna Observatory and at CDSCC, conduct passive observations in the frequency bands 1250-1780 MHz, 2200-2550 MHz, 4350-6700 MHz, 8000-9200 MHz and 16-26 GHz using receivers that are highly sensitive to interference.*

Example (2) 2655-2690 MHz

MHz
2 655 – 2 690

Column 1: ITU Radio Regulations Table of Allocations			Column 2: Australian Table of Allocations
Region 1	Region 2	Region 3	
2 655 – 2 670 FIXED 410 MOBILE except aeronautical mobile384A BROADCASTING-SATELLITE 208B 413 416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 149 412	**2 655 – 2 670** FIXED 410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 415 MOBILE except aeronautical mobile 384A BROADCASTING-SATELLITE 413 416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 149 208B	**2 655 – 2 670** FIXED 410 FIXED-SATELLITE (Earth-to-space) 415 MOBILE except aeronautical mobile 384A BROADCASTING-SATELLITE 413 416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 149 208B 420	**2 655 – 2 670** FIXED 410 FIXED-SATELLITE (Earth-to-space) 415 MOBILE except aeronautical mobile 384A BROADCASTING-SATELLITE 413 416 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 149 208B 420
2 670 – 2 690 FIXED 410 MOBILE except aeronautical mobile 384A Earth exploration-satellite (passive) Radio astronomy Space research (passive) 149 412	**2 670 – 2 690** FIXED 410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 208B 415 MOBILE except aeronautical mobile 384A Earth exploration-satellite (passive) Radio astronomy Space research (passive) 149	**2 670 – 2 690** FIXED 410 FIXED-SATELLITE (Earth-to-space) 415 MOBILE except aeronautical mobile 384A MOBILE-SATELLITE (Earth-to-space) 351A 419 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 149	**2 670 – 2 690** FIXED 410 FIXED-SATELLITE (Earth-to-space) 415 MOBILE except aeronautical mobile 384A MOBILE-SATELLITE (Earth-to-space) 351A 419 Earth exploration-satellite (passive) Radio astronomy Space research (passive) 149

Example (2) 2655 - 2690 MHz

International (Allocation) Footnotes: **149, 208B, 420**

International (Service) Footnotes: **410, 415, 384A, 413, 416, 419, 351A**

National (AUS) Footnote: { NONE }

Interference Management

- Spectrum is not 'consumed' but, its utility is diminished by interference.
- Intentional radio transmissions vs unintentional emissions (EMC)
- In practice, **the purpose of licensing spectrum use is to implement procedures for interference management of intentional emissions**.
- Interference management ~ Quality of Service (**QoS**) or impact of 'harmful interference'.
- Decisions about spectrum use are linked to QoS and licensing

Licensing Toolkit

The *Radiocommunications Act 1992* provides the following tools:

- **Apparatus Licensing** ('Command & Control')
- **Class Licensing** (the 'Spectrum Commons')
- **Spectrum Licensing** ('Private Spectrum')

Licensing Frameworks

Type	Interference management	Operational overhead	Quality of Service (QoS)	Spectrum sharing
Apparatus	*Device-based, shared*	*High*	*High*	*Good*
Class	*Generic, shared*	*Low*	*No guarantee, relies on luck*	*Excellent*
Spectrum	*Parameter based property right*	*Low (varies)*	*Absolute*	*Not shared, but 'traded'.*

What about my observations?

- What do I do if my observations suffer from systematic terrestrial interference?
  - Identify source, terrestrial, airborne, nomadic, sporadic..
  - Identify emission characteristics, bandwidth..
  - Check *Spectrum Plan*, what is the band allocated to? Footnotes?
  - Licensed radiocommunication service, or local EMC problem?
  - Report details of RFI to ATNF staff.
- Countermeasures:
  - Site-based regime deals with locally generated EMC
  - ACMA may investigate in response to ATNF complaint, need to demonstrate that interference is unlawful/due to faulty equipment.
  - If the emission is from a secondary services, a PRIMARY radio astronomy may claim protection from secondary service interferers
  - Need to be systematic with ACMA & other spectrum users.

Future/Evolving Issues

- Issues for radio astronomy services
  - The 'Digital Dividend' – future of the 50 cm band.
  - More services 'sharing' spectrum, particularly ~500 MHz – 5 GHz
  - More wireless broadband..
  - National Broadband Network (NBN)
- The Radio Quiet Zone (RQZ)
  - Established through Spectrum Embargo and RALI mechanism
  - Government working group looking at enhancements
  - ASKAP and Australia's SKA bid
  - Questions?…
- Now the Special Prize Draw….

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Thank you

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