

# Spectrum Illustrated

## A guide to major spectrum allocations in Australia

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The spectrum is a continuous range of electromagnetic radiation extending from the longest radio waves through infra-red, visible light, ultra-violet and X-rays to gamma-rays.

The radiofrequency spectrum is that part of the total spectrum which is used for transmitting radio waves. The radiofrequency spectrum is a natural resource that is used but not consumed. It is used by being occupied by a radiocommunications device and the efficiency of its use depends on coordination among users in order to minimise interference to each other.

The use of the radiofrequency spectrum has been, and will continue to be, a key economic, social and cultural enabler for the development of Australia.

The radiofrequency spectrum is divided into several broad frequency bands as follows:

|     |                          |                   |
|-----|--------------------------|-------------------|
| VLF | Very Low Frequency       | .....3-30 kHz     |
| LF  | Low Frequency            | .....30-300 kHz   |
| MF  | Medium Frequency         | .....300-3000 kHz |
| HF  | High Frequency           | .....3-30 MHz     |
| VHF | Very High Frequency      | .....30-300 MHz   |
| UHF | Ultra-High Frequency     | .....300-3000 MHz |
| SHF | Super-High Frequency     | .....3-30 GHz     |
| EHF | Extremely-High Frequency | .....30-300 GHz   |

Each of these bands is divided into sub-bands which are allocated to particular services such as land mobile radio, broadcasting, aeronautical, maritime or space services.

Most sub-bands are allocated to more than one service. Illustrated on this chart are the major allocations and high profile uses for each band. Not all allocations are shown. For more details of frequency allocations reference should be made to the Australian Radiofrequency Spectrum Plan available from the ACMA website ([www.acma.gov.au](http://www.acma.gov.au)).

Radio waves can be described by either frequency or wavelength. Frequency and wavelength are related by the speed of light; as the frequency increases, wavelength decreases. The wavelength of a radio wave affects the physical size of antennas needed to transmit and receive it. Longer wavelengths require larger antennas than shorter ones. The approximate wavelength at each broad frequency band edge is shown on the chart. This is

accompanied by a visual representation of the change in wavelength as frequency increases (note this does not correspond to the true wavelength).

Longer wavelength radio waves can also propagate further before becoming too weak for reception than radio waves with shorter wavelengths.

The interplay between frequency, wavelength, antenna size and propagation range results in certain services favouring certain frequency bands. For example, personal mobile communication services such as mobile phones or PDAs favour frequencies in the range of about 500 MHz to 3 GHz as this gives a good balance of propagation range with antenna sizes that can easily be built into a handheld or pocket sized device.



Australian Government



The Australian Communications and Media Authority (ACMA) is responsible for the regulation of broadcasting, the internet, radiocommunications and telecommunications.

### VLF

3 kHz  
100 km

Below 9 kHz not allocated

9 kHz



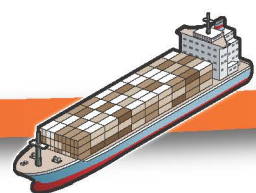
Radionavigation,  
Lightning detection

14 kHz



Defence

70 kHz



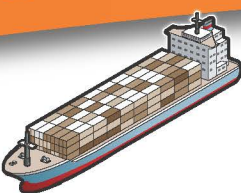
Maritime mobile,  
Radionavigation,  
Fixed services

160 kHz



Aeronautical  
radionavigation

190 kHz



Aeronautical and maritime  
radionavigation

### LF

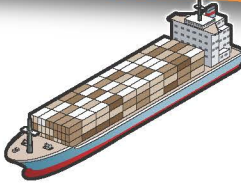
300 kHz  
1 km

### MF

300 kHz  
1 km

Aeronautical and maritime radionavigation,  
Maritime mobile

526.5 kHz

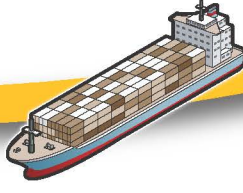


Analog radio (AM)

1605.5 kHz



Narrowcasting



Land mobile,  
Maritime mobile,  
Fixed services

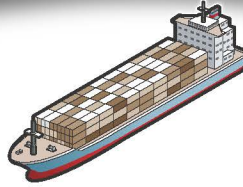


### MF

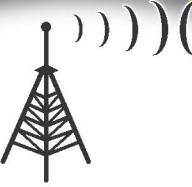
3 MHz  
100 m

### HF

3 MHz  
100 m



The High Frequency band (3 – 30 MHz) contains many narrow allocations.  
The major uses of this band are Defence, land mobile, maritime,  
aeronautical, fixed and amateur radio services.



### HF

30 MHz  
10 m

### VHF

30 MHz  
10 m



Land mobile,  
Fixed services,  
Defence



Land mobile  
74.8 – 75.2 MHz Instrument  
landing system (ILS)

70 MHz



Analog radio (FM)

87.5 MHz



108 MHz



Instrument landing  
system (ILS)

117.975 MHz



Aeronautical mobile

137 MHz



Meteorological  
services,  
Satellite to Earth

148 MHz



Land mobile,  
Fixed services

174 MHz



VHF Television  
202 – 209 MHz Digital radio

230 MHz



Defence

### VHF

300 MHz  
1 m

### UHF

300 MHz  
1 m



403 MHz



300 – 328.6 MHz and 335.4 – 399.99 MHz Defence  
328.6 – 335.4 MHz Instrument landing system (ILS)  
400.15 – 403 MHz Meteorological services

403 – 420 MHz Land mobile  
420 – 430 MHz Land mobile and Defence  
430 – 450 MHz Defence  
450 – 520 MHz Land mobile

520 MHz



UHF Television

694 MHz



Digital dividend

820 MHz



825 – 845 MHz  
870 – 890 MHz  
3G  
Mobile phones

890 MHz



890 – 915 MHz  
935 – 960 MHz  
GSM/3G  
Mobile phones

960 MHz



Aeronautical mobile and  
radionavigation

1164 MHz



Earth exploration satellite, Space research, Radio astronomy,  
Radiolocation, Radionavigation



Fixed,  
Radionavigation (GPS),  
Earth exploration satellite, Space research, Radio astronomy,  
Meteorological services



1710 MHz



1710 – 1785 MHz and 1805 – 1880 MHz  
GSM mobile phones  
1920 – 1980 MHz and 2110 – 2170 MHz  
3G mobile phones  
1900 – 1920 MHz Wireless broadband

2200 MHz



2200 – 2290 MHz Space operations,  
Earth exploration satellite, Space research  
2302 – 2400 MHz Wireless broadband  
2400 – 2483.5 MHz Bluetooth® and Wi-Fi  
2500 – 2690 MHz Wireless broadband and  
electronic news gathering

2700 MHz



Radiolocation

### UHF

3 GHz  
100 mm

### SHF

3 GHz  
100 mm



4.2 GHz



Fixed services, Defence,  
Earth exploration satellite, Space research, Radio astronomy,  
Radiolocation, Radionavigation, Satellite operations,  
Intelligent transport systems  
5.15 – 5.35 GHz, 5.47 – 5.6 GHz and 5.65 – 5.85 GHz Wi-Fi

5.925 GHz



Fixed services,  
Earth to satellite

6.7 GHz



Fixed services, Defence,  
Satellite operations, Meteorological services,  
Earth exploration satellite, Space research, Radio astronomy,  
Radiolocation, Radionavigation

10.7 GHz



Fixed services,  
Satellite to Earth

11.7 GHz



Fixed services, Defence,  
Satellite operations,  
Earth exploration satellite, Space research, Radio astronomy,  
Radiolocation, Radionavigation



### SHF

30 GHz  
10 mm

### EHF

30 GHz  
10 mm



Fixed services, Defence,  
Satellite operations, Meteorological services,  
Earth exploration satellite, Space research, Radio astronomy,  
Radiolocation, Radionavigation

Fixed services,  
Satellite operations,  
Earth exploration satellite, Space research, Radio astronomy,  
Radiolocation, Radionavigation

105 GHz



Earth exploration satellite,  
Space research,  
Radio astronomy

275 GHz



Above 275 GHz  
not allocated

### EHF

300 GHz  
1 mm