



Australia's National
Science Agency

CSIRO submission to consultation on updating the spectrum plan

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Executive Summary

In order to bring the Australian Radio Spectrum Plan (ARSP) in line with the latest World Radio Conference results, ACMA are proposing to update the ARSP. CSIRO would like to take this opportunity to propose updates to some of the text in the ARSP to reflect the current state of radio astronomy facilities in Australia by way of modifying Chapter 1 section 14, and by updating Australian footnote AUS103.

Introduction

CSIRO welcomes the opportunity to provide input to the Australian Communications and Media Authority (ACMA) consultation on an update to the Australian Radiofrequency Spectrum Plan (ARSP).

CSIRO's spectrum management activities have represented Australian scientific users of radio spectrum for many decades. The Australia Telescope National Facility (ATNF) is part of CSIRO, Australia's national science agency, and is the preeminent operator of radio astronomy (RAS) facilities in Australia, and a global leader in research and development of RAS receiver systems. CSIRO also operates radioastronomy facilities on behalf of the Australian government, such as the Square Kilometre Array (SQA).

The update to the ARSP reflects the negotiated outcomes of the last World Radio Conference 2023 and applies these to the national spectrum plan. ACMA is proposing to amend portions of Chapter 1 and Chapter 2 of the ARSP.

Apart from the ARSP, Australia has specific legislative instruments - radio licensing instructions (RALIs) - that work in conjunction with the ARSP to regulate spectrum use in Australia. RAS is the subject of two RALIs, MS31 and MS32, containing specific frequency bands requiring coordination around selected RAS sites. This imposes limitations on the frequency bands which can be included in the ARSP footnotes with regulatory impact, and this is reflected in our proposed update to Australian footnote AUS103.

The same regulatory consideration prevents us from further proposing an update to Australian footnote AUS87 to reflect the actual frequency bands in use by the facilities mentioned therein. In order to retain visibility of the operational frequency bands of all Australian RAS facilities, CSIRO proposes updating the text in Chapter 1 section 14 as outlined below.

CSIRO response to the questions

Question 1: Comment on Chapter 1 – General information

Suggested amendments to section 14 of Chapter 1 to better reflect the current operational state and capabilities of Radio Astronomy and dependent disciplines.

ATNF is a global leader in technological innovation for Radio Astronomy (RAS) receiver systems. RAS observatories in Australia and globally therefore undergo constant technological evolution to remain world leading facilities. The information contained in section 14 appears to reflect past radio astronomy capabilities. Since these capabilities have significantly evolved in recent years, it

would be timely to update this section to reflect the state-of-the-art technology in use by radio astronomical observatories in Australia.

CSIRO therefore recommends replacing the text in section 14, from the second paragraph onwards, with the following text:

Within the Spectrum Plan, there are specific radio astronomy allocations covering parts of the spectrum that are of particular importance to astronomy, such as molecular line emissions. These allocations cover only a small part of the spectrum, whereas cosmic radio emissions of equal importance occur over the whole radio spectrum due to the laws of physics. Hence, to meet their science goals, radio astronomy facilities often operate in bands not specifically allocated to radio astronomy.

In Australia there are many radio astronomy facilities. Observatories at several of these facilities (listed in detail below) make passive observations in the frequency bands 50 – 350 MHz, 700 – 4032 MHz, 4.5 to 6.7 GHz, 8 to 12 GHz, 16 to 27 GHz, 30 to 50 GHz, and 75 to 116 GHz using receivers that are highly sensitive to interference. Often, many of these observatories operate simultaneously as a Very Long Baseline Interferometry (VLBI) network known as the Long Baseline Array (LBA), to achieve very high resolution. Some of the VLBI observations are critical to obtaining the Earth Orientation Parameters (EOP) by way of measuring the Celestial Reference Frame (CRF) and Terrestrial Reference Frame (TRF). EOP measurements are essential for positioning, navigation, and timing (PNT) functions of the Global Navigation Satellite Systems (GNSS), precise time keeping, space mission planning, geodetic measurements, and astronomical observations.

The facilities in Australia are:

- *the Australia Telescope National Facility (ATNF), operated by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and comprising:*
 - *the Paul Wild Observatory, Narrabri (latitude 30° 18' 46.40" S, longitude 149° 33' 0.44" E), which operates in the bands 1.1 to 3.1 GHz, 3.9 to 12 GHz, 16 to 26 GHz, 30 to 50 GHz and 75 to 115 GHz*
 - *the Parkes Observatory (latitude 32° 59' 54.25" S, longitude 148° 15' 48.65" E), which operates in the bands 432 to 448 MHz, 700 to 4032 MHz, 5.9 to 7 GHz, 8 to 9 GHz, and 16 to 26 GHz*
 - *the Mopra Observatory, Coonabarabran (latitude 31° 16' 04.12" S, longitude 149° 05' 58.72" E), which operates in the bands 1.3 to 3 GHz, 4.5 to 6.7 GHz, 8 to 9.2 GHz, 16 to 27 GHz, 30 to 50 GHz, and 76 to 116 GHz*
 - *ASKAP (latitude 26° 41' 49.20" S, longitude 116° 37' 53.13" E) uses state-of-the-art Phased Array Feeds (PAF) to survey a large area of the sky. It operates in the frequency band 700 to 1800 MHz.*
- *Facilities operated by the University of Tasmania:*
 - *the Mount Pleasant Observatory (latitude 42° 48' 12.92" S, longitude 147° 26' 25.86" E), which operates in the bands 1.1 to 3.1 GHz, 2.2 to 2.6 GHz, 4.6 to 5 GHz, 8.2 to 8.7 GHz, 12 to 12.4 GHz, and 19.8 to 20.2 GHz*
 - *the Ceduna Observatory (latitude 31° 52' 03.69" S, longitude 133° 48' 35.40" E), which operates in the bands 1.2 to 1.8 GHz, 2.2 to 2.6 GHz, 4.6 to 5 GHz, 8.2 to 8.7 GHz, 12 to 12.4 GHz, and 19.8 to 20.2 GHz*

- the AuScope network, which observes in the space research service bands at 2.3 GHz and 8.4 GHz as well as using broadband receivers throughout from 2 to 14 GHz. It is used by the International VLBI Service (IVS) for geodetic and astrometric VLBI observations. The antennas are located at Hobart (latitude 42° 48' 20.06" S, longitude 147° 26' 17.31" E), Yarragadee (latitude 29° 02' 49.72" S, longitude 115° 20' 44.26" E) and Katherine (latitude 14° 22' 31.67" S, longitude 132° 09' 08.54" E). These antennas also join the Australian LBA for astronomy VLBI observations.
- the Canberra Deep Space Communication Complex (latitude 35° 23' 54.46" S, longitude 148° 58' 39.66" E), which is also used for radio astronomy observations in the bands 1.4 to 1.9 GHz, 2.2 to 2.3 GHz, 8.2 to 8.6 GHz, 17 to 27 GHz and 31.8 to 32.3 GHz
- The Square Kilometre Array Observatory (SKAO) is planned to operate over the frequency range of 50 MHz to 25.25 GHz. The initial implementation of SKA1-Low is located at latitude 26° 49' 29.0" S, longitude 116° 45' 52.0" E, within the bounds of Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radioastronomy Observatory (latitude 26° 42' 10.4" S, longitude 116° 39' 37.0" E) and operates in the frequency band 50–350 MHz
- The Murchison Widefield Array (MWA) (latitude 26° 42' 11.95" S, longitude 116° 40' 14.94" E) is operated by a consortium of research institutes. Its antennas are optimised for the 80 to 300 MHz frequency range and is located within the bounds of Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radioastronomy Observatory (latitude 26° 42' 10.4" S, longitude 116° 39' 37.0" E)
- The Experiment to Detect the Global Epoch of Reionization Signature (EDGES) (latitude 26° 42' 53.49" S, longitude 116° 36' 12.52" E) is operated by a consortium of research institutes and operates from 50 to 100 MHz and is located within the bounds of Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radioastronomy Observatory (latitude 26° 42' 10.4" S, longitude 116° 39' 37.0" E)
- the Learmonth Solar Observatory (LSO) operated by the Bureau of Meteorology (latitude 22° 13' 9" S, longitude 114° 6' 11" E) conducts passive observations above the sun's background level in the frequency bands 232-257 MHz, 389-441 MHz, 602-618 MHz, 1407-1423 MHz, 2681-2708 MHz, 4900-5100 MHz, 8700-8900 MHz and 15300-15500 MHz, using receivers that are highly sensitive to interference.

Note: All geographic coordinates in this document are given using the Geocentric Datum of Australia 1994 (GDA94).

Question 2: Comment on Chapter 2

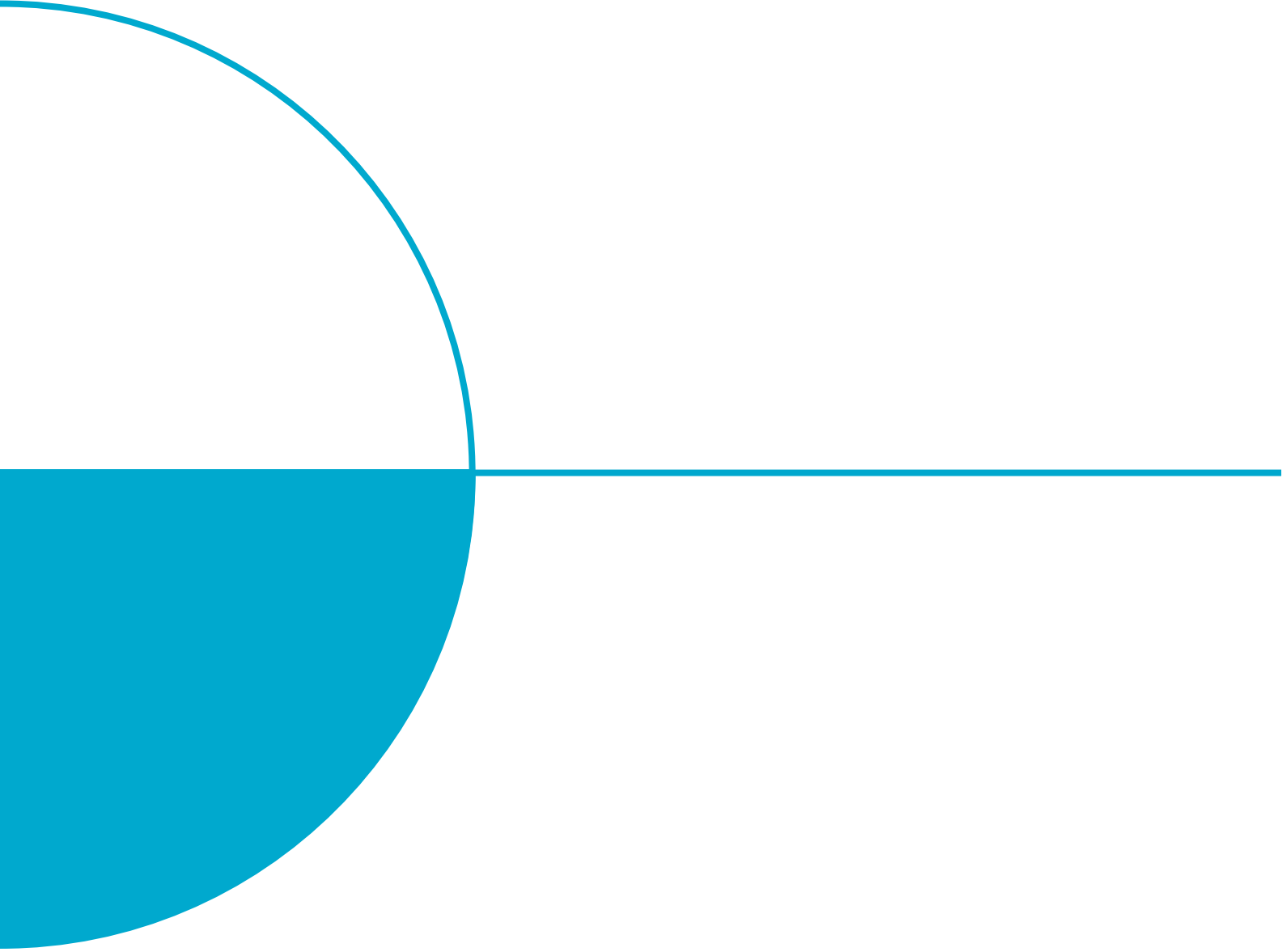
Suggested amendment to Australian footnote AUS103 to reflect all the currently operational facilities in the relevant frequency bands and updating the name of the site.

Australian footnote AUS103 currently makes reference to only two facilities operating at Inyarrimanha Ilgari Bundara, our Murchison Radioastronomy Observatory. CSIRO proposes that ACMA consider updating AUS103 to reflect the contemporary name for the site, as well as modifying the list of operational facilities at the site by adding SKAO and EDGES. Even though SKAO and EDGES operate from 50 MHz upwards, in the proposed regulatory text of footnote AUS103 the lower limits of 70 MHz as per RALI MS32 are indicated, as discussed with ACMA prior

to providing this input. The full range of operation is given in the Chapter 1 section 14 text on Radio Astronomy. The proposed text for the footnote reads as follows.

AUS103

Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radioastronomy Observatory (latitude 26° 42' 10.4" S, longitude 116° 39' 37.0" E) hosts ASKAP operating in the frequency band 700–1 800 MHz, MWA operating in the frequency band 80–300 MHz, SKAO operating in the frequency band 70–350 MHz, and EDGES operating in the frequency band 70–100 MHz



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