



Submission: Review of the 2.5 GHz band spectrum licence technical framework

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SUMMARY OF MATTERS IDENTIFIED5

Background

CSIRO, Australia’s national science agency, welcomes the opportunity to provide input to the Australian Communications and Media Authority (ACMA) on its consultation Review of the 2.5 GHz band spectrum licence technical framework (June 2026). CSIRO’s interest in this consultation is the protection of radio astronomy observations conducted in and adjacent to the 2.5 GHz band.

CSIRO’s Australia Telescope National Facility (ATNF) operates radio astronomy facilities that conduct sensitive observations in and adjacent to the 2.5 GHz band, including the Australia Telescope Compact Array (ATCA) at the Paul Wild Observatory near Narrabri, NSW, and Murriyang, our Parkes radio telescope, at Parkes Observatory, NSW. Both facilities are listed in footnote AUS87 of the Australian Radiofrequency Spectrum Plan (ARSP) and conduct passive observations in the band 2.2–2.7 GHz using receivers that are highly sensitive to interference.

CSIRO also operates Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory in Western Australia, which lies within the Australian Radio Quiet Zone Western Australia (ARQZWA) and currently hosts instruments including CSIRO’s ASKAP radio telescope and the international SKA Observatory’s SKA-Low telescope. The Australian Radiofrequency Spectrum Plan (2025 Update) records, at page 9, that “(SKAO) is planned to operate over the frequency range of 50 MHz to 25.25 GHz”. This planned range encompasses the 2.5 GHz band. Radio astronomy use of the 2.6 GHz range at the Western site is therefore anticipated in the future, in addition to the observations currently undertaken at the operational East Coast facilities.

The radio astronomy service (RAS) is recognised in and immediately above the 2.5 GHz spectrum-licensed band as follows:

Table 1 Radio astronomy recognition in and adjacent to the 2.5 GHz band. RAS: radio astronomy service; EESS: Earth exploration-satellite service; SRS: space research service.

2500–2550 MHz	RAS observation band (AUS87 sites)	AUS87, 5.149
2655–2690 MHz	RAS (secondary)	5.149, AUS87
2690–2700 MHz	RAS / EESS (passive) / SRS (passive) — all primary; all emissions prohibited	RR No. 5.340, AUS87

The relevant footnotes are:

AUS87 Radio astronomy facilities operated by the CSIRO at the Paul Wild Observatory Narrabri and the Parkes Observatory (among others) conduct passive observations in the frequency bands 1.2–1.8 GHz, 2.2–2.7 GHz, 4.5–6.7 GHz, 8–10 GHz and 16–26 GHz using receivers that are highly sensitive to interference.

5.149 Administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference when making assignments to other services to which the band 2655–2690 MHz (among others) is allocated.

5.340 All emissions are prohibited in the band 2690–2700 MHz (among others).

In summary, the 2690–2700 MHz band immediately above the 2.5 GHz spectrum-licensed band is a primary radio astronomy allocation and an internationally recognised passive band in which all emissions are prohibited (RR No. 5.340). CSIRO's comments below relate to the protection of radio astronomy observations and, in particular, this passive band.

CSIRO's comments on the proposed changes

From a radio astronomy perspective, CSIRO identifies no concerns with Proposals 1, 2 and 4–10. CSIRO notes that the retention of the existing EIRP-based unwanted-emission limit for non-AAS transmitters in 2490–2615 MHz and 2700–2800 MHz (Proposal 5) maintains the existing interference environment for adjacent services, and that the proposed additions to the RAG Tx provide clearer coordination guidance for radiolocation services.

CSIRO's remaining comments concern the change the consultation paper identifies as the only substantive change affecting radio astronomy: the proposed unwanted-emission limits in 2690–2700 MHz (Proposal 3, Tables 3 and 4). The comments are offered as technical information bearing on the effect of the proposed changes on incumbent services (Question 3).

Effect of the proposed limits in 2690–2700 MHz

Under Proposal 3, the AAS unwanted-emission limit applying within the 2690–2700 MHz passive band would be set at -4 dBm/MHz TRP per cell/sector at offsets of 3–10 MHz (Table 4), with higher levels permitted at smaller offsets. This is approximately 9 dB above the current limit (equivalent to -13 dBm/MHz), and for AAS transmitters the increase applies across essentially the whole of the 2690–2700 MHz band. CSIRO notes that the consultation paper's statement that the modifications "meet the existing limits at offsets greater than and equal to 3 MHz" describes the non-AAS (conducted) case shown in Figure 1; for AAS transmitters the proposed limit sits about 9 dB above the current mask across the band.

The consultation paper concludes that the impact on radio astronomy is "negligible" on the basis that the geographic and coordination protections — compliance with ITU-R RA.769-2, coordination typically within 100 km of the AUS87 sites, and the 70 km exclusion area around the ARQZWA — remain unchanged. CSIRO observes that the cited coordination distances derive from historical ACMA studies that predate AAS deployment and were calculated under the current (9 dB lower) emission mask, and that the consultation paper does not set out an AAS-specific analysis underpinning the negligible-impact conclusion. CSIRO offers the following technical information regarding this point.

Illustrative calculation

The following illustrative calculation indicates why the effect of the proposed limits hinges on the coordination analysis rather than on the emission mask. The assumptions are:

- A single AAS cell radiating at the proposed limit of -4 dBm/MHz TRP, integrated over the 10 MHz passive band: -4 dBm/MHz + $10 \log(10) = +6$ dBm = -24 dBW total radiated power (9 dB above the -33 dBW permitted under the current mask).
- Free-space, line-of-sight propagation with isotropic spreading.
- ITU-R RA.769-2 continuum threshold for 2695 MHz (10 MHz bandwidth, 2000 s integration, 0 dBi side-lobe reception): $\text{pfd} = -177$ dB(W/m²), equivalently spectral $\text{pfd} = -247$ dB(W/(m²·Hz)).

At the 100 km distance cited by the ACMA as the typical coordination trigger, the free-space pfd from a single cell would be -24 dBW – $10 \log(4\pi \times (10^5)^2) = -135$ dB(W/m²), which exceeds the ITU-R RA.769-2 threshold by approximately 42 dB. Under line-of-sight free-space conditions a single cell does not meet the RA.769-2 threshold at any terrestrial distance; the protection of radio astronomy in this band is therefore achieved through terrain shielding and diffraction loss beyond the radio horizon.

This estimate assumes the cell radiates its total radiated power isotropically. As an AAS can beamform, any focusing of unwanted emissions toward an observatory would increase the received pfd above this estimate by up to the array's directivity in that direction; conversely, terrain shielding and diffraction beyond the radio horizon would reduce it. The figure is therefore illustrative only.

Two observations follow.

- Because protection in 2690–2700 MHz is determined by the coordination-distance (terrain/diffraction) calculation rather than by the emission mask, a 9 dB increase in the mask moves the coordination contour outward. CSIRO notes that the coordination distances around the ATCA and Parkes sites cited in the consultation paper were derived under the current mask, and it is not evident from the paper whether they have been recalculated for the proposed limits.
- The calculation considers a single cell. AAS/5G deployments comprise many simultaneously transmitting cells, and the ITU-R RA.769-2 thresholds apply to the aggregate power flux-density at the observatory. The cumulative effect of dense AAS deployment is most appropriately characterised using an aggregate (e.g. epfd-style) method, consistent with § 2.2 of ITU-R RA.769-2, rather than a single-entry assumption.

CSIRO is not asserting that harmful interference will necessarily result — that depends on the coordination analysis. The purpose of the above is to identify that the effect on radio astronomy in this passive band hinges on the coordination and aggregation analysis rather than on the emission mask alone. CSIRO would be pleased to assist the ACMA with the relevant coordination and aggregation modelling.

Radio astronomy in Western Australia and the applicable coordination zone

The consultation paper's assessment of the effect on radio astronomy is directed at the operational East Coast facilities (ATCA and Parkes) and refers to a 70 km exclusion area around the ARQZWA. CSIRO notes two related points for completeness. First, as set out above, the SKAO is planned to operate over a range (50 MHz to 25.25 GHz) that encompasses the 2.5 GHz band at

Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory in Western Australia; radio astronomy use of the 2.5 GHz range at the Western site is therefore anticipated in the future and is relevant to the protection considerations for this band. Second, the 70 km exclusion area is not the full extent of the protection arrangements: the coordination zone applicable to the 2.5 GHz band extends to 120 km from the centre of the Observatory. CSIRO provides this information so that the record reflects both the future Western use of the band and the extent of the applicable coordination zone.

Protection basis for radio astronomy in the RAG Tx

CSIRO notes that the variation instrument accompanying this consultation amends subsection 17(6) of the RAG Tx to state an explicit protection level (–119 dBm/MHz) and coordination approach for fixed radiolocation receivers, including Bureau of Meteorology weather radars, in 2700–2900 MHz. The protection basis for the radio astronomy service in the adjacent 2690–2700 MHz passive band is not stated in equivalent terms. CSIRO observes that an equivalent explicit statement of the applicable ITU-R RA.769-2 protection level and the coordination methodology for the AUS87 sites would make the basis for protecting the passive band transparent, particularly given that 2690–2700 MHz is a No. 5.340 band in which all emissions are prohibited and that the SKAO is planned to operate across this range in Western Australia. CSIRO would be glad to provide the relevant ITU-R RA.769-2 parameters.

Lower- and mid-band ranges (2500–2550 MHz and 2655–2690 MHz)

CSIRO notes that no material change is proposed to unwanted-emission levels in 2500–2550 MHz (AUS87), and that the modest increase to in-band and unwanted-emission limits in 2620–2690 MHz remains below the current in-band emission level. CSIRO identifies no radio astronomy concerns with the arrangements proposed for these ranges and has no further comment on them.

Summary of matters identified

In summary, CSIRO draws the following matters to the ACMA's attention in relation to the effect of the proposed changes on radio astronomy (Question 3):

- The consultation paper does not set out an AAS-specific basis for the negligible-impact conclusion in 2690–2700 MHz. An AAS-specific, aggregate (epfd-style) assessment of compliance with ITU-R RA.769-2 at the ATCA (Paul Wild Observatory) and Murriyang (Parkes Observatory) sites listed in AUS87 would address this.
- It is not evident from the paper whether the coordination trigger distances around the AUS87 sites have been recalculated for the proposed (9 dB higher) AAS emission mask, or whether the existing coordination and exclusion arrangements remain sufficient under that mask.
- Per the Australian Radiofrequency Spectrum Plan (2025 Update, p.9), the SKAO is planned to operate over 50 MHz to 25.25 GHz—a range that encompasses the 2.5 GHz band—at Inyarrimanha Ilgari Bundara, the CSIRO Murchison Radio-astronomy Observatory in Western Australia. The coordination zone applicable to the 2.5 GHz band extends to 120 km from the

centre of the Observatory, beyond the 70 km exclusion area referred to in the consultation paper.

- The RAG Tx states an explicit protection basis for radiolocation services (subsection 17(6)) but not for the radio astronomy service in the adjacent 2690–2700 MHz passive band; an equivalent explicit statement of the ITU-R RA.769-2 protection level and coordination methodology would clarify the basis for protecting that band.
- CSIRO is willing to assist the ACMA with the interference modelling and to provide the relevant ITU-R RA.769-2 parameters and site information.

CSIRO thanks the ACMA for the opportunity to comment and would welcome further engagement on the matters raised in this submission.

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sustainable and secure future.**

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