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| U.S. Radiocommunications Sector  Fact Sheet | |
| **Working Party:** ITU-R WP-5B | **Document No:** USWP5B34-08 |
| **Ref:** Annex 26 to Document 5B/216-E | **Date:** 10 February 2025 |
| **Document Title:** **PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R M.[24.45-24.65\_GHz\_ARNS]** - Characteristics of and protection criteria for radars operating in the aeronautical radionavigation service in the frequency band 24.45-24.65 GHz | |
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| **Purpose/Objective:** The purpose of this contribution is to develop a new recommendation for radionavigation systems, including unmanned aircraft systems (UAS) Detect and Avoid (DAA) radar systems, in the 24.45-24.65 GHz band. This contribution will update and/or address comments on the technical parameters of DAA radars in Table 1 as applicable. Due to the stability of the technical characteristics data for the airborne and ground based DAA system this contribution proposes to upgrade the Working Document into Preliminary Draft New Recommendation. This contribution will be an update to the new report found in Annex 26 of the Chairman’s Report of the 28 November 2025 Document 5B/216-E meeting. | |
| **Abstract:** This contribution is a new recommendation for UAS Detect and Avoid (DAA) systems that operate in the 24.45-24.65 GHz Radionavigation Service allocation. This contribution contains characteristics and protection criteria for DAA radar that can be used both on airborne and grounds based unmanned aircraft. | |

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| **Radiocommunication Study Groups** |  |
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| English only |
| **United States of America**  CHARACTERISTICS OF AND PROTECTION CRITERIA FOR RADARS  OPERATING IN THE RADIONAVIGATION SERVICE IN  THE FREQUENCY BAND 24.45-24.65 GHz  Introduction  This document proposes new Recommendation with characteristics and protection criteria for radionavigation systems, including unmanned aircraft (UA) detect and avoid (DAA) radar system operating in the radionavigation service (RNS) in the frequency band 24.45-24.65 GHz. These technical and operational characteristics are to be used as a guideline in analyzing compatibility between radars operating in the radionavigation service and systems in other services within this band.  Proposal  The United States proposes that ITU-R Working Party (WP) 5B consider the updates to the working document towards a preliminary draft New Recommendation [ITU-R M.[24.45-24.65\_GHz\_RNS]](https://www.itu.int/dms_ties/itu-r/md/23/wp5b/c/R23-WP5B-C-0216!N26!MSW-E.docx) attached to the Chairman’s Report. The proposed updates seek to address the editor’s notes and square brackets in this document.  The United States proposals are highlighted in bright Green. It is also proposed to elevate the status of this document to Preliminary Draft New Recommendation.  **Attachment:** 1  ATATCHMENT | |
| **ATTACHMENT**  Working document towards a preliminary draft new  Recommendation ITU-R M.[24.45-24.65\_GHz\_ARNS] | |
| Characteristics of and protection criteria for radars operating in the  radionavigation service in the frequency band 24.45-24.65 GHz | |

(202X)

Scope

This document specifies the characteristics and protection criteria of radars operating in the radionavigation service (RNS) in the frequency band 24.45-24.65 GHz. The technical and operational characteristics should be used in analysing compatibility between radars operating in the radionavigation service and systems in other services.

Keywords

24.45-24.65 GHz, radar, characteristics, protection.

Abbreviations/Glossary

RNS radionavigation service

CDMA Code-division multiple access

DAA Detect and avoid

e.i.r.p. Effective isotropically radiated power

ESA Electronically scanned array

FDMA Frequency division multiple access

FMCW Frequency-modulated continuous wave

LFM Linear frequency modulation

PSD Power spectral density

RCS Radar cross-section

RR Radio Regulations

SNR Signal-to-noise power ratio

TDMA Time-division multiple access

UA Unmanned aircraft

UAS Unmanned aircraft system

Related ITU Recommendations, Reports

Recommendations

[ITU-R M.1372](https://www.itu.int/rec/R-REC-M.1372/en) *Efficient use of the radio spectrum by radar stations in the radiodetermination service*

Report

[ITU-R M.2204](https://www.itu.int/pub/R-REP-M.2204) *Characteristics and spectrum considerations for sense and avoid systems use on Unmanned Aircraft Systems (UAS)*

The ITU Radiocommunication Assembly,

considering

*a)* that the technical characteristics of detect and avoid radars operating in the radionavigation service (RNS) are driven by the performance requirement and depend on the frequency band;

*b)* that the performance characteristics of receivers should be adequate to ensure that they do not suffer from interference due to transmitters situated at a reasonable distance and which operate in accordance with the Radio Regulations,

recognizing

*a)* that the frequency band 24.45-24.65 GHz is allocated on a primary basis to the radionavigation, fixed, mobile except aeronautical mobile, and inter-satellite services in ITU‑R Region 2;

*b)* that the frequency band 24.45-24.65 GHz is allocated on a primary basis to the radionavigation, inter-satellite, fixed, and mobile services in ITU-R Region 3;

*c)* that the radionavigation service is a safety service as specified by No. **4.10** of the Radio Regulations (RR);

*d)* Techniques for suppression of low-duty cycle pulsed interference between two or more pulsed system are contained in Recommendation ITU-R M.1372 – Efficient use of the radio spectrum by radar stations in the radiodetermination service;

*e)* that the inter-satellite service operating in the frequency band 24.45-24.65 GHz shall not claim protection from harmful interference from airport surface detection equipment stations of the radionavigation service according to RR No. **5.533**;

*f)* that the frequency band 24.45-24.65 GHz is not allocated to radionavigation service in Region 1;

*g)* that this frequency band is harmonised for IMT in large number of countries in Region 1;

*h)* that based on *recognizing* *f)* and *g)* it is not possible to have a worldwide airborne DAA application in the frequency band 24.45-24.65 GHz;

*i)* that this frequency band is used for Airport Surface Detection Equipment Radar in some countries in Region 3,

recommends

1 that the technical and operational characteristics of detect and avoid radars operating in the radionavigation service described in the Annex should be considered representative of those operating in the frequency band 24.45-24.65 GHz and used in studies of compatibility with systems in other services;

2 that, the criterion of interfering signal power to radar receiver noise power level (*I*/*N)* of −6 dB, should be used as the required protection level for detect and avoid radars, and that this represents the aggregate protection level if multiple interferers are present.

Annex  
  
Technical and operational characteristics of radars operating in the  
radionavigation service in the  
frequency band 24.45-24.65 GHz

# A-1 Introduction

RNS system operates in Regions 2 and 3 on a primary basis in the frequency band 24.45‑24.65 GHz. This Annex presents the technical and operational characteristics of representative RNS radars operating in this frequency band.

RNS systems are installed in unmanned aircraft (UA) or on the ground to detect non-cooperative aircraft as a component of an UA Detect and Avoid (DAA) system. These radars are used for collision avoidance on-board UA and can be used as a part of the integration of unmanned aircraft system (UAS).

# A-3 Characteristics of radionavigation detect and avoid radar

The technical parameters are provided in Table 1.

TABLE A-1

[Editor’s note: to consider also similar technical comments as the ones in the WDPDraft new 15.4-15.7GHz\_ARNS also under consideration by WP 5B].

[Editor’s note: The highlights and edit marks in the table and associated notes below need to be maintained in order to facilitate the ongoing work of populating this table.]

Technical parameters of detect and avoid radar

| Parameter | Units | Radar 1 | Radar 2 | Radar 3 |
| --- | --- | --- | --- | --- |
| Platform  (Note 1) |  | Airborne/Ground | Airborne/Ground | Airborne/Ground |
| Platform height  (Note 1) | km | Up to 3 / 20 | Up to 3 / 20 | Up to 3 / 20 |
| Radar type |  | FMCW | FMCW | FMCW |
| Operating range (Note 2) | km | 6 | 6 | 3.5 |
| Maximum number of drones within the same operating area |  | 3 to 8 | 3 to 10 | 3 to 10 |
| Relative Air speed  (Note 2) | m/s | 120 | 120 | 40 (for typical waveform) |
| Target speeds (max) | m/s | 200 | 200 | 94 (for typical waveform) |
| **Transmitter** | | | | |
| Frequency tuning range  (Note 3) | GHz | 24.45-24.65 | 24.45-24.65 | 24.45-24.65 |
| Channel selection method between radars(Note 4) |  | SW selectable | SW selectable | SW selectable |
| RF bandwidth | MHz | 45 | 10 to 50 (Note 4) | 20 or 40 |
| Pulse width | μs | 200 | 50 to 200 (Note 5) | 33 (chirp time) |
| Pulse rise and fall times | μs | 1 | 1 | 0.1 |
| RF emission bandwidth at   −3 dBc  −20 dBc  −40 dBc | MHz | 47.1 55 75 | 47.1 55 75 | 37 40.75 42.9 |
| Pulse repetition frequency | kHz | 4.7 | 2 to 10 | 30.3 |
| Pulse repetition interval | μs | 5 (Note 6) | 5  (Note 6) | 33 |
| Average transmitter power | W | 2 | 3.2 | 0.8 |
| Out-of-band emission characteristics | dBc | Measured at 84 dBuV/m at 3m through 4th harmonics. | Measured at 84 dBuV/m at 3m through 4th harmonics. | 70 |
| Spurious emission characteristics  (conducted) | dBuV/m in 1MHz BW  [Editor’s note: to be expressed in dBm] | 65 | 65 | 84 |
| Receiver | | | | |
| Receiver IF bandwidth  −3 dB  −20 dB  −60 dB | MHz | 9.8 20 60 | 9.8 20 60 | 48.5 65 78 |
| Sensitivity (MDS) (at RX input. SNR = 12 dB) | dBm | -131 | -131 | −141 |
| Receiver noise figure | dB | 6 | 6 | 6.5 |
| Calculated Rx noise power (Note 7) | dBW | −131 | −134 | −121 |
| Saturation level | dBm | −40 | −40 | −50 |
| **Antenna** | | | | |
| Antenna type |  | ESA (Note 8) | ESA (Note 8) | Phased array  (Note 8) |
| Antenna placement  (Note 1) |  | Fixed (internally sealed package) Pointing to be indicated | Fixed (internally sealed package) Pointing to be indicated | Front panel, integrated in the module  (internally sealed package |
| Antenna gain | dBi | 21 | 21 | 17 |
| Antenna pattern | N.A. | N/A | N/A | N/A |
| Antenna pointing | N/A | N/A | N/A | N/A |
| First TX antenna sidelobe | dBi | 16 | 16 | 5 |
| Horizontal beamwidth (2-way at 0,0) | degrees | 12 degrees one-way | 12 degrees one-way | 28 |
| Vertical beamwidth (2-way at 0,0) | degrees | 12 degrees one-way | 12 degrees one-way | 28 |
| Polarization |  | Horizontal | Horizontal | Vertical |
| Field of Regard | degrees | -40/40 el  -60/60 az | -40/40 el  -60/60 az | ±118 |
| Horizontal antenna scan (from boresight) | degrees | ±60 | ±60 | ±45 |
| Vertical antenna scan (from boresight) | degrees | ±40 | ±40 | ±45 |
| Protection criteria (aggregate) *I/N* | dB | −6 | −6 | −6 |
| Notes:  1 In some cases a UAS is unable to equip with airborne DAA. These radars can also be deployed on the ground in order to provide the intended DAA functions.  2 These radars have similar detection range on the same aircraft even if it flies at a different speed as long as the radar tracking software is expecting and designed for the correct aircraft speeds. What matters is radar cross section (RCS, i.e. “size”) of the target.  3 Utilized bandwidth - Inclusive of frequency-channel guard-bands.  4 Channel selection is purely SW-defined and can be changed on-the-fly. Some settings may allow radar to self-configure based on detected spectrum-conflict.  5 Waveform is software-defined on a CPI-by-CPI basis, and optimized for targets, and spectral environments.  6 The radar is dynamic/cognitive radar and the PRI/PRR can be changed dynamically based on a number of characteristics (terrain,   target, etc.). The PRR/PRI can be higher with future software revisions for specific mission sets.  7 Compressed bandwidth before processing gain.  8 High T/R ESA RF beamforming on both transmit and receive. | | | | |
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