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| A close up of a sign  Description automatically generated | **World Radiocommunication Conference (WRC-23) Dubai, 20 November - 15 December 2023** | |  |
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| PLENARY MEETING | | **Document 110-E** | |
|  | | **29 October 2023** | |
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| China (People's Republic of)/Samoa (Independent State of) | | | |
| PROPOSALS FOR THE WORK OF THE CONFERENCE | | | |
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| Agenda item 9.1 | | | |

9 to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the ITU Convention;

9.1 on the activities of the ITU Radiocommunication Sector since WRC‑19:

By its Plenary Document [550](https://www.itu.int/md/R16-WRC19-C-0550/en), WRC-19 invited ITU Radiocommunication Sector (ITU-R) to study, as a matter of urgency, the RR No. 21.5issue. Immediately after WRC-19, CPM23-1 identified Working Party (WP) 5D as the responsible group for this issue. WP 5D has studied the RR No. 21.5 issue in the period between February 2020 and June 2023 and, as indicated in the [final note](https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-1776!H7!MSW-E.docx) from this WP to the Director of the Radiocommunications Bureau (BR) (see section 7.2 of the WP 5D Chairman’s Report), several aspects and approaches regarding the studies were discussed, but no consensus was reached. The BR Director also addresses the issue – see section 4.3.2 of Document WRC23/4([Add.1](https://www.itu.int/dms_pub/itu-r/md/23/wrc23/c/R23-WRC23-C-0004!A1!MSW-E.docx)) – *Part 1: Activities of the Radiocommunication Sector in the period between WRC-19 and WRC-23* of the BR Director’s Report.

# 1 Introduction

The topic of RR No. 21.5 was brought to the attention of CPM23-1 and it was established that the study should be performed in ITU-R by WP 5D. This does not specifically request action or reporting to WRC-23 so is not included in the topics under WRC-23 agenda item 9.1 in Annex 7 to Circular Letter [CA/251](https://www.itu.int/dms_pub/itu-r/md/00/ca/cir/R00-CA-CIR-0251!!MSW-E.docx).

On this basis, ITU-R WP 5D, as the responsible group, was invited to carry out the requested study as a matter of urgency and to report the results of the study to the BR Director to be considered as the Director deems appropriate. Up to its 42nd meeting, WP 5D had been working on developing a Note to the BR Director. A compilation of input documents is attached to the Chairman’s Report (Document 5D/1555, [Annex 4.5](https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-1555!H4-N4.05!MSW-E.docx)). At its 44th meeting, WP 5D finalised the note to the BR Director, noting that no consensus was reached.

# 2 Discussion

Based on Document WRC-19/550, the main three topics are as below.

1) applicability of the limit specified in RR No. 21.5 for stations utilizing an active antenna system (AAS);

2) necessary updates to RR Table **21-2**;

3) verification of RR No. 21.5 regarding the notification.

As pointed out in the BR Director’s Report, one of the points of discussion is the method of notification of the power delivered to the antenna, i.e. data item 8AA of RR Appendix 4, which is mandatory for submission to the BR. In the WP 5D discussions, some administrations favoured this data item as the power delivered by a single active element of the AAS in an IMT station or by a single “transmitter”. Some other administrations believed that total radiated power (TRP) by all active elements of the AAS, or by all “transmitters” of an IMT station, should be the parameter to be notified as data item 8AA.

## 2.1 Notification of a frequency assignment and Verification of RR No. 21.5

Based on the existing guidelines for the submission and notification of frequency assignments, one frequency assignment can support multiple transmitting antennas. In the multiple transmitting antenna [notice](https://www.itu.int/en/ITU-R/terrestrial/tpr/Documents/FXM/T12-multi_ant.txt) of a T12, every transmitting antenna has its own item identifiers, including the power delivered to the antenna (8AA), radiated power (8B), antenna gain (9G) and direction (9A). The first three item identifiers satisfy the mathematical equation, 8AA + 9G = 8B. The BR verifies that the power delivered to the antenna does not exceed the limit prescribed by RR No. 21.5.

Generally, different transmitting antennas under the frequency assignment of a notice represent different individual antennas, typically each radiating in a different direction in a different sector. Multiple transmitter units may operate in a sector working at the same frequency assignment. Practically these transmitter units are treated as an integrated transmitter to be notified in a frequency assignment of a notice. An AAS that consists of multiple active elements is a system with multiple transmitter units which act together to form a single beam and a single communication channel. If one transmitter unit occupies the total power of the AAS antenna, no power is left and available for all other transmitter units. Therefore, these active elements in an AAS shall be treated as an integrated transmitter.

When notifying a frequency assignment of an IMT station that uses AAS operating in frequency band 24.45-27.5 GHz, the necessary bandwidth (7AB) of the frequency assignment may be 50 MHz, 100 MHz, 200 MHz based on standard IMT characteristics, or a customized bandwidth. The power delivered to the antenna (8AA) over the notified channel is defined by a central frequency (1A) and the necessary bandwidth. The value provided in 8AA should be the TRP of the AAS antenna. We can see accordingly that the BR shall check that the power delivered to the antenna does not exceed the RR No. 21.5 limit in the same way as for other antenna types.

The notification data should be provided consistently by different administrations, so that the BR can check compliance with the characteristics.

## 2.2 Applicability of the limit specified in RR No. 21.5 to stations using an AAS

The founding principle and significance of RR No. 21.5 are referred to the Recommendation [ITU-R SF.355](https://www.itu.int/rec/R-REC-SF.355-4-199203-W/en) (the first version was approved in 1963), which stipulates, *inter alia*, “Outside its main beam, the gain of a terrestrial-station antenna is largely independent of the in-beam gain. Consequently, when the satellite is not in the main beam, the interference may be controlled by limiting the total power fed to the antenna rather than by limiting the e.i.r.p. The total interference entering the main beam of the satellite antenna therefore depends upon the number of terrestrial stations within the coverage area and the average of their antenna gains in the direction of the satellite”. RR No. 21.5 was therefore developed as a provision to protect satellite receivers by limiting the total power fed to the antenna of a terrestrial station concerning each notified frequency assignment, and it is also valid for an AAS antenna.

TRP can be used as the power fed to the antenna, noting the difficulty of the measuring the input power conducted to the antenna in an AAS. The limitation in RR No. 21.5 applies to the TRP.

This contribution proposes to clarify further the application of RR No. 21.5 for AAS antenna usage based on developing Rules of Procedure, retaining the applicability of existing RR No. 21.5.

## 2.3 The update of RR Table 21-2

At WRC-19, the frequency bands 24.75-25.25 GHz (Region 1) and 24.45-25.25 GHz (Region 2) were allocated to mobile service except for aeronautical mobile as a primary basis, and these bands became sharing frequency bands between terrestrial service and space service and shall be listed in RR Table **21-2**.

# 3 Proposals

## 3.1 No Change to RR No. 21.5

ARTICLE 21

Terrestrial and space services sharing frequency bands above 1 GHz

Section II − Power limits for terrestrial stations

NOC CHN/SMO/110/1

21.5 3) The power delivered by a transmitter to the antenna of a station in the fixed or mobile services shall not exceed +13 dBW in frequency bands between 1 GHz and 10 GHz, or +10 dBW in frequency bands above 10 GHz, except as cited in No. 21.5A.    (WRC‑2000)

**Reasons:** The limits in RR No. 21.5 continue to apply to fixed and mobile stations, including an AAS antenna usage.

## 3.2 Instruction to the Radio Regulations Board

It is proposed that WRC-23 invites the BR Director and the Radio Regulations Board to develop a Rule of Procedure to clarify the application of RR No. 21.5 regarding terrestrial stations that use an AAS antenna in the frequency range of 24.45-29.5 GHz. The Rule of Procedure should be based on the following:

1) the TRP of the AAS shall be used as the “power delivered by a transmitter to the antenna of a station in the fixed or mobile services” in the application of RR No. 21.5;

2) the current limits in RR No. 21.5 apply to the TRP;

3) this clarification applies to fixed and mobile stations operating in the frequency bands identified in RR Table **21-2**, irrespective of whether such stations are notified;

4) for the notification of stations, the TRP value shall be filed in Item identifier 8AA, which shall be directly checked against the limits stipulated in RR No. 21.5.

The following may be considered as an example of text to form the basis of new Rules of Procedure: “For stations in the mobile service, including IMT stations, and the fixed service that uses an antenna that consists of an array of active elements and transmit in the frequency range 24.45-29.5 GHz, ‘the power delivered by a transmitter to the antenna of a station’ in No. 21.5 shall be interpreted as the ‘total radiated power’ (TRP), which is understood as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere”.

The above proposal could be implemented by text to be included in the minutes of the plenary meeting or a new WRC Resolution.

## 3.3 Update RR Table 21-2

MOD CHN/SMO/110/2

TABLE **21-2**     (Rev.WRC‑23)

|  |  |  |
| --- | --- | --- |
| Frequency band | Service | Limit as specified in Nos. |
| 1 427-1 429 MHz 1 610-1 645.5 MHz (No. 5.359) 1 646.5-1 660 MHz (No. 5.359) 1 980-2 010 MHz 2 010-2 025 MHz (Region 2) 2 025-2 110 MHz 2 200-2 290 MHz 2 655-2 670 MHz 5 (Regions 2 and 3) 2 670-2 690 MHz 5 (Regions 2 and 3) 5 670-5 725 MHz (Nos. 5.453 and 5.455) 5 725-5 755 MHz 5 (Region 1 countries listed in Nos. 5.453 and 5.455) 5 755-5 850 MHz 5 (Region 1 countries listed in Nos. 5.453 and 5.455) 5 850-7 075 MHz 7 145-7 235 MHz[[1]](#footnote-1)\*  7 900-8 400 MHz | Fixed-satellite Meteorological-satellite Space research Space operation Earth exploration-satellite Mobile-satellite | 21.2, 21.3, 21.4 and 21.5 |
| 10.7-11.7 GHz 5 (Region 1) 12.5-12.75 GHz 5 (Nos. 5.494 and 5.496) 12.7-12.75 GHz 5 (Region 2) 12.75-13.25 GHz 13.75-14 GHz (Nos. 5.499 and 5.500) 14.0-14.25 GHz (No. 5.505) 14.25-14.3 GHz (Nos. 5.505 and 5.508) 14.3-14.4 GHz 5 (Regions 1 and 3) 14.4-14.5 GHz 14.5-14.8 GHz 51.4-52.4 GHz | Fixed-satellite | 21.2,21.3and21.5 |
| 17.7-18.4 GHz 18.6-18.8 GHz 19.3-19.7 GHz 22.55-23.55 GHz 24.45-29.5 GHz | Fixed-satellite Earth exploration-satellite Space research Inter-satellite | 21.2**,** 21.3**,** 21.5and21.5A |

**Reasons:** To keep consistency with the Table of Frequency Allocations in the frequency band 24.45-29.5 GHz.

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1. \* For this frequency band only the limits of Nos. **21.3** and **21.5** apply. [↑](#footnote-ref-1)