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| **The 3rd Meeting of the APT Conference Preparatory Group for WRC-23 (APG23-3)** | **APG23-3/OUT-11** |
| 8 – 13 November 2021, Virtual/Online Meeting | 13 November 2021 |

Working Party 1

**PRELIMINARY VIEWs on STUDIES ON RR NO. 21.5**

**Studies on RR No. 21.5:**

*– From* [*WRC-19 Document 550*](https://www.itu.int/md/R16-WRC19-C-0550/en) *– “ITU‑R is invited to study, as a matter of urgency, the applicability of the limit specified in No.****21.5*** *of the Radio Regulations to IMT stations, that use an antenna that consists of an array of active elements, with a view to recommend ways for its possible replacement or revision for such stations, as well as any necessary updates to Table* ***21-2*** *related to terrestrial and space services sharing frequency bands. Furthermore, the ITU-R is invited to study, as a matter of urgency, verification of No.****21.5*** *regarding the notification of IMT stations that use an antenna that consists of an array of active elements, as appropriate.” (Responsible Group: WP 5D)*

**1. Background**

At WRC-19, two contributions ([WRC-19 Documents 12!A13](https://www.itu.int/md/R16-WRC19-C-0012/en), [128](https://www.itu.int/md/R16-WRC19-C-0128/en)) in relation to RR No. **21.5** were submitted. This topic was extensively discussed under WRC-19 agenda item 1.13 and the results of discussions were included in WRC-19 [Document 550](https://www.itu.int/md/R16-WRC19-C-0550/en). The text set out in the annex to the [Document 550](https://www.itu.int/md/R16-WRC19-C-0550/en) was approved as a decision of the conference and included in the minutes of twelfth Plenary meeting (WRC-19 Document [573](https://www.itu.int/md/R16-WRC19-C-0573/en)).

This outcome of WRC-19 on RR No. **21.5** was brought to the attention of CPM23-1 that requests study be performed in ITU-R. 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 [CA/251](https://www.itu.int/md/R15-CPM19.02-R-0001/en). However, ITU-R WP 5D, as the responsible group, is invited to carry out the requested study as a matter of urgency and to report the results of the study to the Director of the Radiocommunication Bureau to be considered as the Director deems appropriate.

There have been six WP 5D meetings after CPM 23-1, in which the topic of RR No. **21.5** was discussed. At the 37th WP 5D meeting, the Note from the Chairmen of Study Group 4 and 5 in Document [5D/407](https://www.itu.int/md/R19-WP5D-C-0407/en) was considered as the guidance of its future work. At the 38th WP 5D meeting, based on the template provided by the SWG Chair, the meeting developed a new working document towards a draft Note to the Director of BR which contains materials of the input documents, the provided results of studies were grouped into two approaches, i.e., “TRP with a reference bandwidth” and “Conducted power delivered by a single transmitter” in section 2 of the new working document. At the 39th WP 5D meeting, after extensive discussions in DG, SWG, WG and Plenary levels, it was decided to carry forward all input documents to the next meeting and attach the working document ([[716] Chapter 4 - Annex 4.5](https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-0716%21H4-N4.05%21MSW-E.docx)) to the Chairman’s Report for further consideration.

The objective of Article 21 is to ensure terrestrial and space services sharing frequency bands above 1 GHz to operate in a satisfactory manner.

**2. Documents**

* Input Documents:

APG23-2/INP-[10 (Rev.1)](https://www.apt.int/sites/default/files/2021/04/APG23-2-INP-10Rev.1.docx) (J), [20](https://www.apt.int/sites/default/files/2021/04/APG23-2-INP-20_Samoa_input_on_RR_21.5.docx) (SMO), [21](https://www.apt.int/sites/default/files/2021/04/APG23-2-INP-21_New_Zealand_input_to_WP1_-_AIs_1.1_1.2_9.1_Topic_C_Art._No_21.5.docx) (NZL), [24](https://www.apt.int/sites/default/files/2021/04/APG23-2-INP-24_AUS_contribution_for_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1Topic_c_and_No._21.5.docx) (AUS), [30](https://www.apt.int/sites/default/files/2021/04/APG23-2-INP-30_WP1_kor.docx) (KOR), [44](https://www.apt.int/sites/default/files/2021/04/APG23-2-INP-44_PRELIMINARY_VIEWS_ON_WRC-23_AGENDA_ITEMS_1.1_1.2_1.3_AND_NO.21.5.docx) (CHN)

APG23-3/INP-[07](https://www.apt.int/sites/default/files/2021/10/APG23-3-INP-07_AUS_contribution_for_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1Topic_c_and_No._21.5_v2.docx) (AUS), [20](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-20_New_Zealand_input_to_WP1_AIs_1.1_1.2_1.3_1.5_9.1_Topic_C_Art._No_21.5.docx) (NZL), [24](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-24_WP1_Kor_1.1_1.2_1.4_9.1Topic_C_21.5.docx) (KOR), [28](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-28_J-1_WP1_PRELIMINARY_VIEWS_ON_WRC-23_AGENDA_ITEMS_1.1_1.2_1.3_1.4_AND_RR_NO._21.5.docx) (J), [39](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-39_Samoa_-_Article_21.5.docx) (SMO), [41](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-41_China_WP1.docx) (CHN)

* Information Documents:

APG23-2/INF-[13](https://www.apt.int/sites/default/files/2021/03/APG23-2-INF-13_Briefing_on_RR21.5.docx) (DG Chair), [35](https://www.apt.int/sites/default/files/2021/04/APG23-2-INF-35_Status_of_CEPT_Preparation_for_WRC-23_and_RA-23.docx) (CEPT), [36](https://www.apt.int/sites/default/files/2021/04/APG23-2-INF-36_RCC_Preparation_to_the_World_Radio_Conference_and_Radio_Assembly_2023.docx) (RCC)

APG23-3/INF-[01](https://www.apt.int/sites/default/files/2021/10/APG23-3-INF-01_Preliminary_WMO_Position_on_WRC-23_Agenda.docx) (WMO), [04](https://www.apt.int/sites/default/files/2021/10/APG23-3-INF-04_Briefing_on_RR_No.21.5.docx) (DG Chair), [20](https://www.apt.int/sites/default/files/2021/11/APG23-3-INF-20_Status_of_CEPT_Preparation_for_WRC-23_and_RA-23.pdf) (CEPT)

**3. Summary of discussions**

**3.1 Summary of APT Members’ views**

**3.1.1 Japan** - **Document APG23-3/INP-**[**28**](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-28_J-1_WP1_PRELIMINARY_VIEWS_ON_WRC-23_AGENDA_ITEMS_1.1_1.2_1.3_1.4_AND_RR_NO._21.5.docx)

Japan support the on-going ITU-R studies on the applicability of the limit specified in No. **21.5** of the Radio Regulations to IMT stations that use an antenna that consists of an array of active elements and the verification of No. **21.5** regarding the notification of these IMT stations.

Japan is of the view that

– in the case of an IMT station using AAS, the value of total radiated power (TRP) (i.e., the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere) with a reference bandwidth of 200 MHz should be used as an alternative measure instead of the “power delivered to the antenna”

– the interpretation “the power delivered by a transmitter to the antenna of a station” in RR No. **21.5** as the power delivered by a single transceiver to the antenna of an IMT station, will not be a workable solution to reach consensus in terms of not impacting the protection of satellite services

**3.1.2 Samoa** - **Document APG23-3/INP-**[**39**](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-39_Samoa_-_Article_21.5.docx)

1. It is proposed that APG focus on using the TRP as the parameter equivalent to “power delivered by a transmitter to the antenna of a station” in the application of No. **21.5** for AAS antennas.

2. APG should ensure that all approaches considered on this issue include an assessment of the impact on interference to satellite systems.

**3.1.3 New Zealand** - **Document APG23-3/INP-**[**20**](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-20_New_Zealand_input_to_WP1_AIs_1.1_1.2_1.3_1.5_9.1_Topic_C_Art._No_21.5.docx)

New Zealand is of the view that the sharing and compatibility studies performed for agenda item 1.13 (WRC-19) should not be revisited nor should those assumptions be used as a basis for the addressing [WRC-19 Document 550](https://www.itu.int/md/R16-WRC19-C-0550/en). It is clear that the inclusion of RR No. **21.5** in the 1960s and 1970s did not envisage IMT stations using AAS nor was there a relationship to the studies performed under agenda item 1.13 (WRC-19). Studies should also stay within the scope of [WRC-19 Document 550](https://www.itu.int/md/R16-WRC19-C-0550/en) and only consider the 24.45-27.5 GHz band.

ITU-R studies should continue to consider an appropriate reference bandwidth based on the common radio systems and reference bandwidths in the 1960s and 1970 and assess how this applies today. It was previously considered that “the concept of defining e.i.r.p. and transmitter power on the basis of power per unit bandwidth merits further consideration by the C.C.I.R”.

It is noted that The Radio Regulations commonly uses power prescribed in a 4 kHz bandwidth below 15 GHz and a 1 MHz bandwidth above 15 GHz. It is proposed that regarding notification of IMT stations using Advanced Antenna Systems (AAS), RR No. 21.5 should be applied as a power spectral density limit of +10 dBW per 1 MHz. For the purpose of notification Power supplied to the antenna = TRP.

**3.1.4 Australia** - **Document APG23-3/INP-**[**07**](https://www.apt.int/sites/default/files/2021/10/APG23-3-INP-07_AUS_contribution_for_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1Topic_c_and_No._21.5_v2.docx)

Australia supports studies being conducted to address the applicability of No. **21.5** to clarify its operation in order to provide regulatory certainty for the deployment of IMT stations using active antenna systems (AAS).

For IMT stations with AAS operating in the band 24.25-27.5 GHz, Australia supports using a total radiated power within a defined reference bandwidth to capture the "power delivered to the antenna of a station” in No. **21.5**. Australia has not yet formed a view on what reference bandwidth should apply.

**3.1.5 Korea (Republic of)** - **Document APG23-3/INP-**[**24**](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-24_WP1_Kor_1.1_1.2_1.4_9.1Topic_C_21.5.docx)

The Republic of Korea is of the preliminary views that taking into account the agreed guidance above by the Chairmen of SGs 4 and 5, the APT Members are encouraged to participate actively WP 5D to develop the study results.

It is of the view that Republic of Korea does not see any necessity to modify Article No.**21.5**, which provide regulatory provisions/measures for the operation of terrestrial IMT and space services and their future development in a balanced and fair manner.

As explained in these attachments, it is also of the view that there is no need to provide any additional information for the notification of IMT stations that use an antenna that consists of an array of active elements given the data items already provided in RR Appendix **4** (i.e. data item 8B)

ATTACHMENTS: 1 and 2

 

**3.1.6 China (People’s Republic of)** - **Document APG23-3/INP-**[**41**](https://www.apt.int/sites/default/files/2021/11/APG23-3-INP-41_China_WP1.docx)

Chinese preliminary views are as follows:

1. China is of the view that the final study result of this issue shall not cause harmful interference to, or constrain the development of space services, while take into full consideration of the development of IMT.
2. China is also of the preliminary view that

For the notification of IMT station that uses an antenna which consists of an array of active elements operating in the frequency band 24.45 - 27.5 GHz, the Item Identifier 8AA “Power delivered to the antenna” (see RR Appendix **4** Table 1) shall be the value of an integrated power delivered by all active elements of that antenna or the “Total Radiated Power (TRP[[1]](#footnote-1)) of that station.

For the verification of RR No. **21.5** regarding the notification of IMT station operating in the frequency band 24.45-27.5 GHz that uses an antenna which consist of an array of active elements, it may be necessary to introduce a correction factor to verify the value of Item Identifier 8AA in the RR APP **4**

1. China supports APT to formulate common views as early as possible subject to discussion and agreement.

**3.2 Summary of issues raised during the meeting**

* Regarding the verification of No. **21.5** for the notification of IMT stations operating in the frequency band 24.45-27.5 GHz, which use an antenna that consists of an array of active elements, some APT Members are of the view that the value of total radiated power (TRP) within a reference bandwidth should be used as an alternative measure instead of the “power delivered to the antenna”. Further study is necessary to determine an applicable reference bandwidth.
* It was raised during the meeting that the term "reference bandwidth" is not clear. Further study is necessary to study further the proper wording of “reference bandwidth”, such as, an applicable reference bandwidth, applied as a scaling or adjustment factor/adjustment factor/bandwidth factor/correction factor.
* There is a view that there is no need to provide any additional information for the notification of IMT stations that use an antenna that consists of an array of active elements given the data items already provided in RR Appendix 4 (i.e. data item 8B).
* Some APT Members are of the view that the concept of the term “reference bandwidth” above is similar to the one used in RR No. **21.16**. It should be included in the APT Preliminary Views section.
* The notification method was also discussed. It was mentioned that a document for notification method was submitted to this meeting.
* It was also pointed out by APT Members that clear understanding of the terms of “transceiver unit” from ITU-R Report M.2334 and “transmitter” from RR No. **21.5** would help the discussion.
* APT Members recognize the guidance of note from the Chairmen of Study Group 4 and Study Group 5 in Document 5D/407. Some APT Members support and follow the guidance provided by the note from the Chairmen of Study Group 4 and Study Group 5 in Document 5D/407 with reference to the protection of satellite services.
* It was raised that Appendix 4 (on page AP4-43) addresses the bandwidth unit.

**4. APT Preliminary Views**

APT Members support the on-going ITU-R studies on the applicability of the limits specified in RR No. **21.5** to IMT stations using active antenna systems (AAS) and the verification of RR No. **21.5** regarding the notification of these IMT stations, in accordance with the scope mentioned in Document 550 of WRC-19 and the guidance provided by the Chairmen of ITU-R Study Group 4 and 5.

APT Members are of the view that the ITU-R studies should address the matters being raised so far and prepare solutions which provide regulatory provisions/measures for the operation of terrestrial IMT and space services and their future development in a balanced and fair manner.

**5. Other View(s) from APT Members**

Regarding the verification of No. **21.5** for the notification of IMT stations operating in the frequency band 24.45-27.5 GHz, which use an antenna that consists of an array of active elements, some APT Members are of the view that the value of total radiated power (TRP) within a reference bandwidth should be used as an alternative measure instead of the “power delivered to the antenna”.

**6. Issues for Consideration at Next APG Meeting**

* APT Members are encouraged to submit their contributions to future APG meetings taking into account progress of ITU-R studies.

**7. Views from Other Organisations** (as provided in the information documents to APG23-2 and APG23-3)

**7.1 Regional Groups**

**7.1.1 CEPT** - **Document APG23-3/ INF-**[**20**](https://www.apt.int/sites/default/files/2021/11/APG23-3-INF-20_Status_of_CEPT_Preparation_for_WRC-23_and_RA-23.pdf)

Issue A:

CEPT is considering whether the same approach as for Issue B could be applied in frequency bands used for reception by space stations, though not excluding alternative solutions. Any solution should ensure that it does not impact the protection of satellite reception.

Issue B (verification of No. **21.5**):

For the purpose of verification of RR No. **21.5** in the notification of IMT stations that use an array of active elements under the provision of RR 2020 Edition (i.e. in the frequency band 24.45‐27.5 GHz), CEPT is of the view that the "power delivered to the antenna of a station” in RR No. **21.5** can be considered as the “total radiated power” (TRP). An adjustment factor to the TRP needs to be applied depending on the bandwidth being considered in the RR No. **21.5** limit. TRP is defined as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere. A remark could be added in the assignment record to indicate the need to review the finding with the WRC‐23 decision.

Issue C:

CEPT considers to develop the updates of Table 21‐2 of RR Article 21 to include the following frequency bands, where reception by space stations is to be protected when these bands are shared with equal rights with the fixed and mobile services:

• 24.45‐27.5 GHz, 40‐40.5 GHz, 42.5‐43.5 GHz, 45.5‐47 GHz, 47.2‐48.2 GHz, 66‐71 GHz, which are identified for IMT and might be used by stations with AAS, and

• 43.5‐45.5, 48.2‐50.2, 50.4‐51.4 GHz

CEPT will assess whether the limit in 21.5 has to be adapted for the frequency bands above 29.5 GHz (see Issue A).

**7.1.2 RCC** - **Document APG23-2/INF-**[**36**](https://www.apt.int/sites/default/files/2021/04/APG23-2-INF-36_RCC_Preparation_to_the_World_Radio_Conference_and_Radio_Assembly_2023.docx)

Issue A - Notification of IMT station with AAS

Temporarily, unless modified by WRC-23, Item 8AA in Table 1 of RR Appendix 4 "the power delivered to the antenna" for notification of the IMT stations with ASS shall be the value of the “total radiated power” (TRP), defined as in Resolution 243 (WRC-19) and Resolution 750 (Rev. WRC-19).

Issue B - Verification of notifying IMT station with AAS

Keep unchanged the limit of power level in RR Article 21 No. **21.5** with adjustment factor regarding the bandwidth of the IMT station with AAS.

Issue C - Table 21-2 of RR Article 21

Add frequency band 24.45-27.5 GHz allocated to the mobile service by WRC-19 to the Table 21-2 of RR Article 21.

**7.2 International Organisations**

**7.2.1 WMO** - **Document APG23-3/INF-**[**01**](https://www.apt.int/sites/default/files/2021/10/APG23-3-INF-01_Preliminary_WMO_Position_on_WRC-23_Agenda.docx)

WMO Position on WRC-23 agenda item 9 on Article 21

WMO supports studies to ensure that no impact will occur in the band 25.5-27 GHz on EESS (space-to-Earth) operations due to the future deployment of co-frequency IMT systems that use an antenna that consists of an array of active elements. Regarding the notification of such IMT systems, WMO Supports that a temporary approach be developed for the notification and verification for IMT stations with AAS with respect to RR **No 21.5** in the frequency band 25.5-27 GHz before an appropriate competent WRC decision will be taken.

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1. The concept of TRP can be referred to as “*the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere*” in Resolution **243 (WRC-19)** and Resolution **750 (Rev.WRC-19)** [↑](#footnote-ref-1)