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| **The 4th Meeting of the APT Conference Preparatory**  **Group for WRC-23 (APG23-4)** | **APG23-4/OUT-11** |
| 15 – 20 August 2022, Bangkok, Thailand | 20 August 2022 |

Working Party 1

**PRELIMINARY VIEWs 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 eight WP 5D meetings and one Spectrum Working Group meeting of WP5D 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. In the latest WP 5D meeting, the working document ([[1361] Chapter 4 - Annex 4.5](https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-1361!H4-N4.05!MSW-E.docx)) and workplan ([[1361] Chapter 2 - Annex 2.24.7](https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-1361!H2-N2.24.07!MSW-E.docx)) are attached to the Chairman’s Report.

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 APG23-4/[INP-07](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-07_J-1_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1.C_and_RR_No.21.5.docx) (J), [14](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-14_AUS_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1Topic_c_and_No21.5.docx) (AUS), [34](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-34_KOR_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4__9.1Topic_c_and_No.21.5.docx) (KOR), [40](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-40_China_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) (CHN), [51](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-51_NZL_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.5_9.1_Topic_c_and_No.21.5.docx) (NZL), [55](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-55_SNG_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_9.1Topic_c_and_No.21.5.docx) (SNG), [58](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-58_Samoa_WP1_Article_21.5.docx) (SMO), [61](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-61_India_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.2_1.3_1.4_1.5_9.1Topic_c_and_No.21.5.docx) (IND)
* Information Documents APG23-4/[INF-03](https://www.apt.int/sites/default/files/2022/07/APG23-4-INF-03_WMO_Positions.docx) (WMO), [04 (Rev.1)](https://www.apt.int/sites/default/files/2022/08/APG23-4-INF-04Rev.1_Brief_on_RR_No.21.5.docx) (DG chair), [21](https://www.apt.int/sites/default/files/2022/08/APG23-4-INF-21_ASMG_Preparation_for_WRC-23.pdf) (ASMG), [29](https://www.apt.int/sites/default/files/2022/08/APG23-4-INF-29_Views_on_studies_on_RR_No._21.5.docx) (Ericsson Vietnam, *et al.*), [44](https://www.apt.int/sites/default/files/2022/08/APG23-4-INF-44_Status_of_RCC_preparation_to_the_World_Radio_Conference_and_Radio_Assembly_2023.pdf) (RCC), [48](https://www.apt.int/sites/default/files/2022/08/APG23-4-INF-48_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 APG23-4/INP-**[**07**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-07_J-1_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1.C_and_RR_No.21.5.docx)

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

Among the approaches being studied by ITU-R, Japan supports the following approach:

* In the case of an IMT station using AAS, the total radiated power (TRP) (i.e., the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere) should be used as an alternative measure and be filled in the data element 8AA in Table 1 of Appendix **4** of RR, instead of the “power delivered to the antenna.
* When the BR examines the data element 8AA in terms of the conformity with the “+10 dBW” limit stipulated in RR No. **21.5**, introduction of a reference bandwidth with 200 MHz would be useful to avoid an unnecessary restriction to IMT stations using the necessary bandwidth of over 200 MHz.

Japan is of the view that:

* 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 transmitter to the antenna of an IMT station may impact the protection of satellite services. In this approach, the protection of the satellite receivers is not ensured depending on the value of the power delivered by a single transmitter and the number of transmitters of that IMT station.

Furthermore, Japan supports discussing a possible way forward on this RR No. **21.5** issue through the on-going ITU-R studies to reconcile the different views.

**3.1.2 Australia** - **Document APG23-4/INP-**[**14**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-14_AUS_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1Topic_c_and_No21.5.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.

**3.1.3 Korea** - **Document APG23-4/INP-**[**34**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-34_KOR_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4__9.1Topic_c_and_No.21.5.docx)

While this subject is not the WRC-23 Agenda Item nor a topic under Agenda Item 9.1, any modification of RR No. **21.5** or addition to RR No. **21.5** would impact both satellite systems and IMT in the future.

It is proposed that APT Preliminary View developed at the previous APG meeting could be modified to reflect this aspect or leave it as it was until APT members could provide input to the next APG meeting.

It is also proposed that APG23-4 be an opportunity to discuss any alternative solution(s) which would resolve the two concerns, which are satellite protection and IMT deployment and development, including any possible update of existing WRC Resolution(s).

It is further proposed that any possible modification or addition to No. **21.5** should be considered after thorough study on how Radio Regulations could address the use of AAS which are used not only for IMT BS but also for satellite systems including ESIM and some radar systems in order to maintain the integrity of Radio Regulations.

**3.1.4 China** - **Document APG23-4/INP-**[**40**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-40_China_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)

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

China supports on-going studies conducted by ITU-R WP 5D on the applicability of the limitation stipulated in RR No. **21.5**.

China is also of the view that

For the notification of an 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 (AAS) or the “Total Radiated Power (TRP[[1]](#footnote-1)) of that antenna (AAS) in the notified frequency assignment.

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**.

This correction factor will be calculated based on a reference bandwidth or maximum bandwidth in which the limitation stipulated in RR No. **21.5** applies.

**3.1.5 New Zealand** - **Document APG23-4/INP-**[**51**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-51_NZL_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.5_9.1_Topic_c_and_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.

**3.1.6 Singapore** - **Document APG23-4/INP-**[**55**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-55_SNG_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_9.1Topic_c_and_No.21.5.docx)

Singapore supports the studies on the use of total radiated power of an IMT station using AAS in the 26 GHz band with an appropriate reference bandwidth for the application of No. **21.5** for IMT stations using active antenna systems. The application of Article **21.5** should ensure satellite protection while not constraining the use of IMT in the 26 GHz band.

**3.1.7 Samoa** - **Document APG23-4/INP-**[**58**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-58_Samoa_WP1_Article_21.5.docx)

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.

For IMT stations with AAS operating in the band 24.25-27.5 GHz, Samoa supports using a total radiated power within a defined reference bandwidth to capture the "power delivered to the antenna of a station” as per Article **21.5**.

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

**3.1.8 India** - **Document APG23-4/INP-**[**61**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INP-61_India_WP1_Preliminary_Views_on_WRC-23_Agenda_Items_1.2_1.3_1.4_1.5_9.1Topic_c_and_No.21.5.docx)

India would continue to participate in the ITU-R Working Party 5D meetings with a view to support the approach which will ensure appropriate protection to satellite services and give opportunities for IMT growth and innovation in active antenna system.

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

The following issues were identified during the APG23-4 meeting.

1. What reference bandwidth should apply in the TRP approach, which is related to the bandwidth adjustment factor being discussed in the current WP 5D studies?
2. Should the approach, “the power delivered by a single transmitter to the antenna of an IMT station” be used, what would be the impact of that to the space services?

The following elements need to be discussed further:

* Value of the power delivered by a single transmitter and its relationship with the number of transmitters of that IMT station,
* Antenna gain in the direction of satellite.

1. Should the TRP approach be used, what would be the effect of that approach on the terrestrial services including IMT and space services, as appropriate?
2. Are there any alternative solution(s)?

**4. APT Preliminary View(s)**

* 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 invited to submit contributions taking into account the issues being raised in section 3.2.

**7. Views from Other Organisations** (as provided in the information documents to

APG23-4)

**7.1 Regional Groups**

**7.1.1 ASMG** - **Document APG23-4/INF-**[**21**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INF-21_ASMG_Preparation_for_WRC-23.pdf)

ASMG supports No change to the RR No. **21.5**.

**7.1.2 CEPT** - **Document APG23-4/INF-**[**48**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INF-48_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 GHz, 48.2 - 50.2 GHz, 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).

**7.1.3 RCC** - **Document APG23-4/INF-**[**44**](https://www.apt.int/sites/default/files/2022/08/APG23-4-INF-44_Status_of_RCC_preparation_to_the_World_Radio_Conference_and_Radio_Assembly_2023.pdf)

**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** and consider the need to add the following bands: 40-40.5 GHz; 42.5-47 GHz; 47.2-50.2 GHz; 50.4-51.4 GHz; 66-71 GHz.

**7.2 International Organisations**

**7.2.1 WMO** - **Document APG23-4/INF-**[**03**](https://www.apt.int/sites/default/files/2022/07/APG23-4-INF-03_WMO_Positions.docx)

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)