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| **The 5th Meeting of the APT Conference Preparatory**  **Group for WRC-23 (APG23-5)** | **APG23-5/OUT-10**  **(Rev.1)** |
| 20 – 25 February 2023, Busan, Republic of Korea | 25 February 2023 |

Working Party 1

**PRELIMINARY VIEWs on RR No.21.5**

**Studies on RR No. 21.5:**

The following text set out in the Annex to [WRC-19 Document 550](https://www.itu.int/md/R16-WRC19-C-0550/en) was approved and included in the minutes of the meeting as a decision of the conference ([WRC-19 Document 573](https://www.itu.int/md/R16-WRC19-C-0573/en))

***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***

*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 ten 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, a short preliminary note was drafted and agreed to be sent to the Director of the Radiocommunication Bureau. Meanwhile, it was agreed that WP 5D will continuously work on this issue at the June 2023 meeting. The working document ([[1555] Chapter 4 - 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)) and workplan ([[1668] Chapter 2 - Annex 2.24.9](https://www.itu.int/dms_ties/itu-r/md/19/wp5d/c/R19-WP5D-C-1668!H2-N2.24.09!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: APG23-5/[INP-14](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-14_Japan-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1C_and_RR_NO.21.5.docx) (J), [INP-26](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-26_India_WP1-Preliminary_Views_on_WRC_23_Agenda_Items_1.2_1.3_1.4_1.5_9.1Topic_c_and_RR_No.21.5.docx) (IND), [INP-46](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-46_Singapore-WP1-Preliminary_Views_on_WRC_23_Agenda_Items_1.1_1.2_9.1Topic_c_and_RR_No.21.5.docx) (SNG), [INP-56](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-56_Australia-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1Topic_c_and_RR_No.21.5.docx) (AUS), [INP-63](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-63_Rep_of_Korea-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.4_9.1Topic_c_and_RR_No.21.5.docx) (KOR), [INP-73(Rev.1)](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-73Rev.1_New_Zealand-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.5_9.1Topic_c_and_RR_No._21.5.docx) (NZL), [INP-88](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-88_China-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_and_RR_No.21.5.docx) (CHN)
* Information Documents: APG23-5/[INF-01](https://www.apt.int/sites/default/files/2023/01/APG23-5-INF-01_WMO_Position_on_WRC-23_Agenda.docx) (WMO), [INF-13](https://www.apt.int/sites/default/files/2023/02/APG23-5-INF-13_Brief_on_RR_No._21.5.docx) (DG Chair), [INF-24](https://www.apt.int/sites/default/files/2023/02/APG23-5-INF-24_Views_on_WRC-23_for_mobile.docx) (GSMA), [INF-39](https://www.apt.int/sites/default/files/2023/02/APG23-5-INF-39_Status_of_CEPT_preparation_for_WRC-23_and_RA-23.pdf) (CEPT), [INF-45](https://www.apt.int/sites/default/files/2023/02/APG23-5-INF-45_Status_of_RCC_preparation_to_the_WRC-23.pdf) (RCC)

**3. Summary of discussions**

**3.1 Summary of APT Members’ views**

**3.1.1 Japan** - **Document APG23-5/INP-**[**14**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-14_Japan-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1C_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 (AAS) 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:

* A solution for verification of RR No. **21.5** for the notification of IMT stations operating in the frequency band 24.25-27.5 GHz should be developed with priority.
* 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.
* Considering the diverging views on ITU-R studies, it would be appropriate to develop an interim solution regarding the applications for notification of IMT stations using AAS to be included in the Rules of Procedure. As necessary, it would be appropriate to conduct further discussion at future WRC(s) to resolve the issues.

**3.1.2 India - Document APG23-5/INP-**[**26**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-26_India_WP1-Preliminary_Views_on_WRC_23_Agenda_Items_1.2_1.3_1.4_1.5_9.1Topic_c_and_RR_No.21.5.docx)

India supports the ongoing work at the ITU-R Working Party 5D for approaches which will ensure appropriate protection to satellite services and give opportunities for IMT growth and innovation in active antenna system.

**3.1.3 Singapore (Republic of)** - **Document APG23-5/INP-**[**46**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-46_Singapore-WP1-Preliminary_Views_on_WRC_23_Agenda_Items_1.1_1.2_9.1Topic_c_and_RR_No.21.5.docx)

Singapore supports the studies on the use of total radiated power (TRP) parameter of an IMT station using AAS in the 26 GHz band as the main parameter with a reference bandwidth of 200 MHz, for application of No. **21.5** for IMT stations using AAS. The application of Article **21.5** should ensure satellite protection while not constraining the use of IMT in the 26 GHz band.

Singapore supports the application of a bandwidth adjustment factor, to take account of IMT base stations that use higher and lower bandwidth. As a first step, the outcome of the work should address the verification of compliance with No. **21.5** for the notification of IMT AAS stations.

**3.1.4 Australia - Document APG23-5/INP-**[**56**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-56_Australia-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_9.1Topic_c_and_RR_No.21.5.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.

**3.1.5 Korea (Republic of)** - **Document APG23-5/INP-**[**63**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-63_Rep_of_Korea-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.4_9.1Topic_c_and_RR_No.21.5.docx)

Korea proposes that APG23-5 discusses following issues in order to in order to get a better understanding of this study, in particular, whether existing ITU Recommendation/Report are good enough to specify the characteristics of AAS (Antenna that consists of array of active elements) for any possible modification of No.**21.5** and its associated Table **21-2**.

1. Some Reports and/or Recommendations of ITU-R, which describe some parts of characteristics of the antenna that consists of an array of active elements being used in IMT, would not be sufficient to be a common ground of this study.
2. Frequency range for study in Document 550 needs to be kept as indicated in the title of document 550
3. the current BR guidelines for notification of terrestrial stations apply to IMT stations using an antenna that consist of an array of active elements
4. further discussions on the consideration of alternative approaches which do not require a modification of No. 21.5 or reopen the compromises and decisions of WRC-19 (e.g. Resolution 242 (WRC-19))
5. If there is a proposal to make a new Agenda Item on this study, first it should be studied under Agenda Item 6 to invite such a generic study among various Study Groups, given the wide ranging application of AAS in terrestrial systems and satellite system, including ESIM.

Korea also proposes that APG23-5 opposes any expansion of frequency bands besides WRC-19 Document 550 and the output document of APG23-5 describes any findings for further discussion at the APG23-6 meeting.

**3.1.6 New Zealand - Document APG23-5/INP-**[**73(Rev.1)**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-73Rev.1_New_Zealand-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.5_9.1Topic_c_and_RR_No._21.5.docx)

New Zealand does not support changes to the Radio Regulations to address [WRC-19 Document 550](https://www.itu.int/md/R16-WRC19-C-0550/en) and does not support the continuation of this discussion into the next study cycle or at WRC-27 (e.g. new agenda item).

Only the 24.25 – 27.5 GHz is within scope of [WRC-19 Document 550](https://www.itu.int/md/R16-WRC19-C-0550/en) and proposals /solutions should not extend to other frequency bands outside the 24.25 – 27.5 GHz frequency range.

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.

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).

**3.1.7 China (People’s Republic of) - Document APG23-5/INP-**[**88**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INP-88_China-WP1-Preliminary_Views_on_WRC-23_Agenda_Items_1.1_1.2_1.3_1.4_1.5_and_RR_No.21.5.docx)

1. 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.
2. China supports on-going studies conducted by ITU-R WP 5D on the applicability of the limitation stipulated in RR No. **21.5**.
3. China is also of the view that

All transmitter units in an AAS should be treated as an entire transmitter antenna.

When notifying a frequency assignment 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 transmitter units of that antenna (AAS) over the notified necessary bandwidth. Practically the “Total Radiated Power (TRP[[1]](#footnote-1)) of that antenna (AAS) over the notified necessary bandwidth can be used to fill the Item Identifier 8AA

The necessary bandwidth of a frequency assignment 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 depends on the technical specifications used by that IMT station.

When verifying a frequency assignment compliance to 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, the value filled in the Item Identifier 8AA in the RR APP **4** shall be verified directly.

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

The following issues were raised during the meeting.

* Proposals were received by APG23-5:

*“the frequency range for study in Document 550 needs to be kept as indicated in the title of document 550.”*

There was a discussion that this matter needs to be addressed by WRC.

* Some Reports and/or Recommendations of ITU-R, which describe some parts of characteristics of the antenna that consists of an array of active elements being used in IMT, would not be sufficient to be a common ground of this study.

If there is a proposal to make a new Agenda Item on this study, first it should be studied under Agenda Item 6 to invite such a generic study among various Study Groups, given the wide ranging application of AAS in terrestrial systems and satellite system, including ESIM.

As for the second issue above, the following two comments were provided:

1. Comment on the ITU-R Report is outside the mandate of APG;
2. New Agenda Item is outside the scope of Working Party 1, and it could be discussed in Working Party 5.

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

APT Members are of the view 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 are inconclusive at this stage. Therefore, APT Members are of the view that possible and practical alternative approaches/solutions merit to be considered.

APT Members are of the view that appropriate regulatory provisions/measures for the operation of terrestrial IMT and space services and their future development in a balanced and fair manner are necessary.

APT Members are of the view that change to RR No.**21.5** may not be necessary at this stage to address the issues raised in Document 550 of WRC-19.

**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 follow up conclusion in CPM23-2 with a view to contribute to APG 23-6 on this matter.

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

**7.1 Regional Groups**

**7.1.1 ASMG** - **Document** [**WRC-23-IRW-22/5**](https://www.itu.int/md/R19-2WSHWRC23-C-0005/en)

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

**7.1.2 ATU- Document** [**WRC-23-IRW-22/3**](https://www.itu.int/md/R19-2WSHWRC23-C-0003/en)

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 [CA/251](https://www.itu.int/md/R15-CPM19.02-R-0001/en).

**7.1.3 CEPT** - **Document APG23-5/INF-**[**39**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INF-39_Status_of_CEPT_preparation_for_WRC-23_and_RA-23.pdf)

*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*

Interim solution: proposed approach for notification and verification of stations in the mobile service, including IMT stations, and the fixed service that use an array of active elements in the frequency range 24.45‐29.5 GHz

For the purpose of verification of RR No. 21.5 in the notification of stations in the mobile service, including IMT stations, and the fixed service, that use an antenna that consists of an array of active elements in the frequency range 24.45‐29.5 GHz, CEPT is of the view that the notification field 8AA ("power delivered by a transmitter to the antenna of a station”) in RR No. 21.5 can be considered as the “total radiated power” (TRP), which is defined as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere (noting it is mathematically equivalent to the sum of conducted powers from all internal transmitters, minus ohmic losses).

For this interim solution, the limit 8AA <= 10 dBW for notification of base stations that use an antenna that consists of an array of active elements would remain unchanged. The following other fields would have to be documented in every notification:

* 9G = maximum gain of the AAS
* 8B = 8AA + 9G
* 7AB = necessary bandwidth of the IMT transmission (currently 50, 100, 200 or 400 MHz)

A remark could be added in the assignment record to indicate the need to review the finding with the WRC‐23 decision.

CEPT is of the view that no change to RR No. 21.5 is needed in order to implement the above interim solution; instead, a rule of procedure should be developed.

*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*

Review of RR No. 21.5 and possible actions by a WRC

CEPT is considering whether the same approach as for the interim solution 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 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 above).

**7.1.4 RCC - Document APG23-5/INF-**[**45**](https://www.apt.int/sites/default/files/2023/02/APG23-5-INF-45_Status_of_RCC_preparation_to_the_WRC-23.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 APG23-5/INF-**[**01**](https://www.apt.int/sites/default/files/2023/01/APG23-5-INF-01_WMO_Position_on_WRC-23_Agenda.docx)

WMO supports the approach 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)