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|  | ASIA-PACIFIC TELECOMMUNITY | Document No: |
| **The 6th Meeting of the APT Conference Preparatory**  **Group for WRC-23 (APG23-6)** | **APG23-6/OUT-29**  **(Rev.1)** |
| 14 – 19 August 2023, Brisbane, Australia | 19 August 2023 |

Working Party 4

**APT VIEW and Preliminary APT Common Proposal on WRC-23 agenda item 1.17**

**Agenda Item 1.17:**

*to determine and carry out, on the basis of the ITU-R studies in accordance with Resolution 773 (WRC 19), the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate.*

**1. Background**

In accordance with Resolution **773 (WRC-19)**,WRC-23 agenda item 1.17 invites the ITU-R Sector to carry out study of technical and operational issues, and regulatory provisions for satellite-to-satellite links in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz.

Working Party (WP) 4A, as the responsible group in accordance with the results of CPM23-1, has considered sharing and compatibility studies and finalized the CPM text.

The 8th WP 4A meeting produced four documents (Hybrid meeting in-person with remote participation from 27 June to 6 July 2023)

* Supporting material that was developed to address WRC-23 agenda item 1.17 ([Document 4A/978/Annex 15](https://www.itu.int/dms_ties/itu-r/md/19/wp4a/c/R19-WP4A-C-0978!N15!MSW-E.docx))
* Annex 1 to Supporting materials on WRC-23 agenda item 1.17([Document 4A/978/Annex 16](https://www.itu.int/dms_ties/itu-r/md/19/wp4a/c/R19-WP4A-C-0978!N16!MSW-E.docx))
* Annex 2 to Supporting materials on WRC-23 agenda item 1.17([Document 4A/978/Annex 17](https://www.itu.int/dms_ties/itu-r/md/19/wp4a/c/R19-WP4A-C-0978!N17!MSW-E.docx))
* Annex 3 to Supporting materials on WRC-23 agenda item 1.17([Document 4A/978/Annex 18](https://www.itu.int/dms_ties/itu-r/md/19/wp4a/c/R19-WP4A-C-0978!N18!MSW-E.docx))

The finalized CPM text includes two methods to satisfy this agenda.

* **Method A:** No changes to the Radio Regulations and suppression of Resolution **773** **(WRC-19)**.
* **Method B:** proposes a Resolution to address the regulatory mechanisms to operate the satellite-to-satellite links in 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz. This method also supports no change (NOC) for the band 11.7-12.7 GHz. Within Method B there are several options that should be considered within each of the alternatives pertaining to some of the regulatory mechanisms to ensure the protection of incumbent services.

**2. Documents**

* Input Documents: [INP-14](https://www.apt.int/sites/default/files/2023/07/APG23-6-INP-14_Cambodia_WP4__PACP_for_WRC-23_Agenda_Items.docx) (CBG), [INP-20](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-20_India_WP4_PACP_WRC-23_Agenda_Items.docx) (IND), [INP-26](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-26_Bangladesh_WP4_PACP_WRC-23_Agenda_Items_0.docx) (BGD), [INP-38](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-38_Japan_WP4_Views_and_Proposals_WRC-23_Agenda_Items.docx) (J), [INP-50](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-50_Indonesia_WP4_PACP_WRC-23_Agenda_Items.docx) (INS), [INP-56](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-56_Singapore_WP4_PACP_WRC-23_Agenda_Items_0.docx) (SNG), [INP-61](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-61_Thailand_WP4_PACP_WRC-23_Agenda_Items.docx) (THA), [INP-68](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-68_Iran_WP4_Preliminary_Views_on_WRC-23_Agenda_Items.docx) (IRN), [INP-83](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-83_Australia_WP4_PACP_WRC-23_Agenda_Items.docx) (AUS), [INP-90](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-90R1_KOR_WP4_PACP_WRC-23_Agenda_Items.docx) (KOR), [INP-94](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-94_Philippines_WP4_PACP_WRC-23_Agenda_Items.docx) (PHL), [INP-106](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-106_China_WP4_PACP_WRC-23_Agenda_Items.docx) (CHN), [INP-112](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-112_Malaysia_WP4_PACP_WRC-23_Agenda_Items.docx) (MLA), [INP-120](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-120_VietNam_WP4_PACP_WRC-23_Agenda_Items.docx) (VTN), [INP-127](https://www.apt.int/sites/default/files/2023/08/APG23-6-INP-127_Multicountry_WP4_PACP_WRC-23_Agenda_Item_1.17.docx) (SMO/TON)
* Information documents: [INF-16](https://www.apt.int/sites/default/files/2023/07/APG23-6-INF-16_Brief_on_AI_1.17.docx) (DG Chair), [INF-25](https://www.apt.int/sites/default/files/2023/01/APG23-5-INF-01_WMO_Position_on_WRC-23_Agenda.docx) (ICAO), [INF-45](https://www.apt.int/sites/default/files/2023/02/APG23-5-INF-39_Status_of_CEPT_preparation_for_WRC-23_and_RA-23.pdf) (RCC), [INF-46](https://www.apt.int/sites/default/files/2023/02/APG23-5-INF-43_CITEL_preparation_for_WRC-23.pdf) (CEPT), [INF-52](https://www.apt.int/sites/default/files/2023/08/APG23-6-INF-52_CITEL_preparation_for_WRC-23.pdf)(CITEL)

**3. Summary of discussions**

**3.1 Summary of APT Members’ views**

**3.1.1 Cambodia (Kingdom of)** - **Document APG23-6/INP-14**

* Cambodia supports **Method B** to address the regulatory mechanisms required for the operation of satellite-to-satellite links in the frequency ranges 18.1-18.6 GHz and 18.8-20.2 GHz (from GSO or non-GSO service providers to non-GSO space stations at lower altitudes), as well as 27.5-30 GHz (from non-GSO space stations at lower altitudes to GSO or non-GSO service providers), all within the framework of an FSS allocation.
* Regarding the concept of operation, Cambodia holds the viewpoint that user space stations should be positioned “within the cone” of coverage provided by the service provider space station. Cambodia prefers sharing mechanisms with non-GSO FSS systems to be established through Hard Limits.

**3.1.2 India (Republic of) - Document APG23-6/INP-20**

* India supports enabling the operation of satellite-to-satellite links and the development of regulatory framework and technical conditions to ensure protection of incumbent services in the relevant frequency bands and in the adjacent frequency bands without imposing any new constraints as currently provided in the RR.
* India also proposes the following regulatory measures:

i. the protection of NGSO FSS using a set of hard limits.

ii. the satellite-to-satellite operations using “within the cone” concept.

* Further, India supports a new ISS allocation with a footnote that recognizes inter-satellite links as part of the Inter Satellite Service in the relevant bands.

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**3.1.3 Bangladesh (People's Republic of) - Document APG23-6/INP-26**

* In Bangladesh, a portion of the 11.7-12.7 GHz band has already been utilized by broadcasting satellite service, and the other frequency bands proposed in this agenda item such as 18.1-18.6 GHz and 18.8-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space) are heavily utilized for the fixed service (fixed microwave links). These bands are also planned/allocated for the fixed satellite service (FSS) in the national frequency allocation table. In order to protect and not to impose any additional constraints on future development of the BSS in the band 11.7-12.2 GHz in Region 3, Bangladesh administration supports method A of the CPM report to WRC-2023 i.e., no change to the radio regulations.
* However, Bangladesh would like to prefer the development of technical conditions and regulatory provisions that establish a harmonized framework which facilitates the use of satellite-to-satellite operations in the 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz frequency bands subject to the protection and not to impose any additional regulatory or technical constraints on the services to which these frequency bands are currently allocated on a primary basis. Moreover, such regulatory procedure for the intersatellite service shall in no way produce an unacceptable interference to nor claiming protection from FSS as well as not creation and restriction of the current and future use of FSS.

**3.1.4 Japan - Document APG23-6/INP-38**

* Japan supports ITU-R studies on the sharing and compatibility as well as to develop technical conditions and regulatory provisions for the use of satellite-to-satellite links operations in the 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz frequency bands in accordance with Resolution 773 (WRC-19), and such the use shall ensure protection of primary services allocated in the bands and in the adjacent bands.
* From the above point of the view, Japan support Method B including following Alternatives;

・Alternative FSS

・Alternative GSO within cone

* Japan is also of the view that the technical conditions and regulatory provisions developed under WRC-23 Agenda item 1.17 shall ensure not causing unacceptable interference to the terrestrial services operating in the frequency band 27.5-29.5 GHz.
* Therefore, in the view of proper protection terrestrial services, Japan proposes to support Option 2 as described the pfd mask in Annex 2 of DRAFT NEW RESOLUTION [A117-B] (WRC-23).
* Japan also proposes draft PACP based on relevant Radio Regulation articles and the DRAFT NEW RESOLUTION [A117-B] (WRC-23) to help to develop the Preliminary APT Common Proposal for WRC-23. The proposed portions (reason/Japan’s note part) are indicated with turquois color highlights in the draft PACP proposal document.



**3.1.5 Indonesia (Republic of) - Document APG23-6/INP-50**

* The ITU Radio Regulations allocate the frequency spectrum in the range of 18.1-18.6 GHz (space-to-Earth), 18.8-20.2 GHz (space-to-Earth), and 27.5-30 GHz (Earth-to-space) for fixed-satellite service. Concurrently, Indonesia has operational satellites using those frequency bands and will continue to utilize the allocation in the future, especially for the multifunctional Ka-Band satellite services. Therefore, Indonesia has the urgency to protect incumbent services.
* Furthermore, the WP4A study results show that several issues remained unclear including requirements to affect coordination for frequency assignments to inter-satellite links of a GSO space station communicating with non-GSO space stations. Therefore, Indonesia supports Method A: No Change to the Radio Regulations.

**3.1.6 Singapore (Republic of) - Document APG23-6/INP-56**

Singapore is of the following views:

* Singapore supports a new Inter-Satellite Service (ISS) allocation with a footnote that recognizes satellite-to-satellite operations, while limiting the applications solely to certain application types. In particular, the “within the cone” concept of operations is also supported to allow transmission between non-GSO to non-GSO (different altitude) and non-GSO to GSO;
* Singapore supports limiting the use to space research, space operation and/or Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space;
* For the protection of terrestrial services in 27.5-29.5 GHz, Singapore is of the view that a PFD mask based on Article 21 in 17.7-19.7 GHz for the protection of terrestrial services from space emissions could be applied. Alternatively, Singapore could also consider Option 2-2 in the CPM text (i.e. same pfd mask used for A-ESIM operating above an altitude of 3 km as defined in Annex 3 to Res 169 (WRC-19) with a reference bandwidth of 14 MHz);
* For the protection of EESS (passive) in 18.6-18.8 GHz, Singapore supports Option 1 in the CPM-23 text indicating that the pfd produced in the band 18.6-18.8 GHz by satellites above 2000 km of altitude shall not exceed -118 dBW/m²/200 MHz and the pfd produced by satellites below 2000 km of altitude shall not exceed -110 dBW/m²/200MHz while noting that the provisions under Annex 3 do not apply to non-GSO systems that meet certain criteria[[1]](#footnote-1);
* Considering the potential interference and hardware damage that could occur to the non-GSO space stations receivers, Singapore is supportive of the following maximum EIRP spectral density limits under Annex 4 for non-GSO space-to-space links in the frequency band 27.5-30.0 GHz:

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| --- | --- |
| **Transmissions between:** | **Max EIRP Spectral Density Limit** |
| Non-GSO to GSO | -17.5 dBW/Hz\* |
| LEO to MEO | -20 dBW/Hz |
| LEO to LEO | -28 dBW/Hz |

\* It is noted that other reference bandwidths may be considered.

* At present, Singapore supports Annex 4 Option 1. However, Annex 4 Option 2 may be considered at a later stage if there are further studies that have been conducted and validated to ensure protection of non-GSO satellites operating in this altitude.
* Singapore also supports the off-axis antenna provision in Annex 4 Item d to ensure that non-GSO FSS (Earth-to-space) systems operating in the 27.5-29.1 GHz and 29.5-30 GHz frequency bands are protected from harmful interference.
* The upper limit of 1290 km may require further discussion to accommodate operational requirements.
* In relation to protection of GSO space stations, Singapore supports the current approach under Annex 5.

**3.1.7 Thailand (Kingdom of) - Document APG23-6/INP-61**

* Thailand is of the view that there is a need of a new WRC Resolution to define the technical, operational and regulatory conditions for the satellite-to-satellite links in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or portions thereof, while ensuring protection of allocated services. Such satellite-to-satellite operation should be allowed through the FSS (space-to-space) allocations under the “within the cone of coverage” concept of operation. Therefore, Thailand supports Method B together with Alternative FSS and Alternative GSO within the cone in the CPM Report.

**3.1.8 Iran (Islamic Republic of) - Document APG23-6/INP-68**

This Administration has the view of that:

1. Satellite-to-satellite link transmissions should comply with the same directionality indicators as in the existing FSS allocations (Earth-to-space = from user space station to service provider space station, space-to-Earth = from service provider space station to user space station).
2. The use of these bands for satellite-to-satellite links needs to fully protect the FSS in these bands, taking into account that the parts of these frequency bands studied under the agenda item are the core FSS bands which are used for telecommunication infrastructure in many countries, in particular, in the developing and least developed countries. The following should therefore be included in the corresponding Resolution relating to GSO FSS:

* 2.1 The assignments pertaining to ISS subject to this agenda item, if concluded at WRC-23, shall not cause unacceptable interference to nor claim protection from the assignments to GSO FSS currently operating and/ or planned to be operated in future for the implementation of the above-mentioned Resolution the following course of actions are required
* 2.2 The notifying administration of the inter-satellite assignments submitting Appendix 4 information / data elements shall also send a firm objective, measurable, enforceable and actionable commitment to undertake:

1. that in case of reported unacceptable interference shall immediately cease the interference or reduce it to an acceptable level.
2. to this effect the Bureau shall send a reminder and requests that the notifying administration of ISS assignments to comply with the requirements referred to in commitment
3. Should the interference continued to persists 30 days after the dispatch date of the above- mentioned reminder, the Bureau shall submit the case to the subsequent meeting of the RRB for review and eventual suppression from the date base of the Bureau and inform the notifying administration accordingly

* 2.3 Significant additional work is required to develop a practical regulatory regime that will enable viable space-to-space operations (between both GSO and non-GSO service provider space stations and associated user non-GSO space stations) while at the same time ensuring that the space-to-space operation shall not cause unacceptable interference to other space services and nor claim protection from FSS.
* 2.4 Currently there is no coordination procedure to protect other services, in particular FSS, from inter-satellite link, composed of GSO and non-GSO links. See Rules of Procedure in this regard.
* 2.5 Supports satellite-to-satellite transmissions “within the cone of coverage” concept of operations.
* 2.6 With respect to the studies carried out under this agenda, as contained in the report of CPM23-2, supports the exclusion of 11.7-12.2 GHz in Region 3 for this agenda item.
* 2.7 The technical conditions and regulatory provisions developed under WRC-23 agenda item 1.17 shall ensure not causing unacceptable interferencee and nor claim protection from the terrestrial services operating in the frequency band 27.5-29.5 GHz.
* 2.8 The notifying administration of satellite-to-satellite transmissions when submitting Appendix 4 data elements to the Bureau shall also send a firm commitment undertaking that in case of any interference to FSS or terrestrial services, shall immediately cease emission or reduce it to the acceptable level to the interfered assignments.

**3.1.9 Australia - Document APG23-6/INP-83**

* Australia supports the development of technical conditions and regulatory provisions that establish a harmonised framework which facilitates the use of satellite-to-satellite operations in the 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz frequency bands. Such use shall protect and impose no additional regulatory or technical constraints on services to which the frequency band is currently allocated on a primary basis in accordance with Resolution **773 (WRC-19)**.
* Regulatory recognition of satellite-to-satellite operations under this agenda item should be conditional on these operations being contained within the cone of coverage towards earth of the FSS GSO/non-GSO service provider space station and further restricted to ensure that in the FSS (E-s) allocated portions of the band transmissions from a user space station to a service provider space station only occurs when the users apogee is lower than the service provider’s minimum operational altitude, and that for the FSS (s-E) portions of the band transmissions from a service provider space station to a user space station only occurs when the user space station apogee is lower than the service provider’s station minimum operational altitude.
* Australia could support changes to the Table of Frequency Allocations to include space-to-space operation under the FSS allocation associated with appropriate regulatory measures within a draft new Resolution. In relation to the regulatory Methods in the CPM report, Australia supports Method B on the proviso that the inter-satellite link application is limited to the relay of data associated with space research, space operation and/or Earth exploration-satellite applications or the transmissions of data originating from industrial and medical activities in space, recognising the fact that those applications were the subject of ITU-R studies and the related results are reflected in the CPM Report.
* Australia proposes a Preliminary APT Common Proposal as follows:



**3.1.10 Korea (Republic of) - Document APG23-6/INP-90**

* As the Republic of Korea supports the technical conditions and regulatory provisions for inter-satellite links in the bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or portions thereof within the FSS allocations with an additional indicator “space-to-space” limited to the links operating in the same direction of transmission as provided in the current FSS allocations for “within the cone” concept of operation, Alternative FSS and Alternative GSO within cone of Method B described in the CPM Report can be supported.
* The Republic of Korea is of the view that the transmitting non-GSO space stations shall not cause unacceptable interference to the terrestrial services in the frequency band 27.5-29.5 GHz. Therefore, the Republic of Korea supports Option 2-1 for the pfd masks in 27.5-29.5 GHz and that the mask should be included in Annex 2 of the Resolution in the CPM Report.
* The proposals of the modifications of Radio Regulations for the agenda item 1.17 are embedded in this document as follows.



**3.1.11 Philippines (Republic of the) - Document APG23-6/INP-94**

* Philippines is aware that this Agenda Item paves the way for additional satellite applications that could resolve existing issues highlighted in Section 1 above and augment real time data feed (e.g. live Earth Observation video from satellites, etc.).
* On that note, Philippines expresses preference for Method B to support the need for a regulatory framework under this Agenda Item.
* As part of Method B, Philippines supports the following options:

1. Inter-Satellite Service (ISS) allocation as it accords greater clarity with minimal or no ambiguity in relation to this space-to-space transmission;
2. Limiting satellite-to-satellite operations solely to space research, space operation and/or Earth Exploration Satellite applications and also transmissions of data originating from industrial and medical activities in space;
3. For the protection of terrestrial services by non-GSO space stations transmitting in the frequency bands 27.5-29.1 GHz and 29.1-29.5 GHz, Option 2-2 can be used (i.e., PFD mask of A-ESIM operating above 3 km in Resolution **169 (WRC-19)** with a reference bandwidth of 14 MHz).
4. For protection of non-GSO FSS space stations from non-GSO inter-satellite links in the 27.5-30 GHz (Annex 4 of the draft new Resolution), Philippines supports:
5. Emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with GSO FSS network shall not exceed -17.5 dBW/Hz;
6. Option 1 of Annex 4;
7. A maximum on-axis EIRP spectral density of -28 dBW/Hz in the case of emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude lower than 2000 km.
8. For protection of GSO space stations, emissions of non-GSO space stations shall not produce a PFD at any point in the GSO arc greater than the power flux-density produced by earth stations associated with satellite network/system with which they communicate.

**3.1.12 China (People's Republic of) - Document APG23-6/INP-106**

* This administration supports Method B for the development of the technical conditions and regulatory provisions to enable the operation of satellite-to-satellite links in the 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz bands, or parts thereof, while ensuring protection of existing primary services in the same frequency bands and adjacent bands.
* This administration is also of the following view:
* Supports the operation of satellite-to-satellite links under the fixed-satellite service (FSS) allocation in the 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz bands, or parts thereof, to ensure protection of existing primary services in the relevant frequency bands and in the adjacent bands without imposing new constraints to incumbent services to protect satellite-to-satellite links from interference.
* The satellite-to-satellite link transmissions should comply with the same directionality indicators as in the existing FSS allocations (Earth-to-space = from user space station to service provider space station, space-to-Earth = from service provider space station to user space station).
* The emissions of a non-GSO space station transmitting in the space-to-space direction in the frequency band 27.5-30 GHz shall remain within the envelope of the notified/recorded characteristics of the associated transmitting FSS earth stations of the GSO FSS network or non-GSO FSS system;
* The emissions of a space station transmitting in the space-to-space direction in the frequency bands 18.1-18.6 GHz and 18.8-20.2 GHz or parts thereof, shall remain within the envelope of the notified/recorded characteristics of transmitting GSO FSS or non-GSO FSS towards its associated FSS earth stations;
* To protect GSO networks in the fixed satellite service operation in the frequency band 27.5-30 GHz, the emissions of this non-GSO space station shall comply with the provisions contained in Annex 5 to the Resolution.
* This administration proposes to include above views in the PACP for WRC-23 Agenda Item 1.17.

**3.1.13 Malaysia - Document APG23-6/INP-112**

* Summary of Country n’s views based on the direct extract from Country A’s input contribution. Malaysia supports no change to the 11.7-12.7 GHz frequency band as the studies conducted did not support use of the band for space-to-space links.
* In addition, Malaysia supports the development of a regulatory framework to enable viable space-to-space operations (between both GSO and non-GSO service provider space stations and associated user non-GSO space stations) within the FSS allocation in the 18.1-18.6 GHz, 18.8-20.2 GHz (space-to-Earth) and 27.5-30 GHz (Earth-to-space) frequency bands, or parts thereof, while ensuring protection of, and not imposing additional constraint to the existing services in the same and adjacent frequency bands.
* Malaysia is also of the view that the introduction of space-to-space transmissions must ensure the same level of protection for GSO and non‐GSO as currently provided in the Radio Regulations and must not impose new constraints on GSO networks and non‐GSO systems to protect the inter-satellite links from interference.
* Considering the above, Malaysia is considering **Method B** to satisfy this agenda item.

**3.1.14 Vietnam (Socialist Republic of) - Document APG23-6/INP-120**

* Sharing studies were performed with all incumbent services for all configurations of operations considered under this agenda item (i.e. operations limited within the cone of coverage of the FSS space station or operations feasible outside this cone of coverage). These studies have shown that some incumbent services could be severely impacted by satellite-to-satellite operations. Therefore, Viet Nam supports method A.

**3.1.15 Samoa (Independent State of)/Tonga (Kingdom of) - Document APG23-6/INP-127**

Tonga/Samoa is of the following views:

* Tonga/Samoa support an ISS allocation (*Alternative ISS*). Satellite-to-satellite link transmissions will comply with the same directionality indicators as in the existing FSS allocations (Earth-to-space = from user space station to service provider space station, space-to-Earth = from service provider space station to user space station)
* Tonga/Samoa support satellite-to-satellite links “within the cone” concept of operations for transmissions of non-GSO to non-GSO (lower to higher altitude) and non-GSO to GSO (*alternative GSO within the cone*);
* Tonga/Samoa support a hard limit to address sharing with non-GSO FSS systems (*Alternative non-GSO hard limits*) given the need to protect incumbent systems and the potential added complexity of coordinating incumbent systems with satellite-satellite operations. Tonga/Samoa is of the view that ISS links should be limited to space research, space operation and/or Earth exploration-satellite applications, and also transmissions of data originating from industrial and medical activities in space
* For the protection of terrestrial services by non-GSO space stations transmitting in the frequency bands 27.5-29.1 and 29.1-29.5 GHz, Option 1 in Annex 2 of the draft new Resolution referring to Article 21 PFD mask can be used. Alternatively, Option 2-2 may also be considered (i.e. PFD mask of A-ESIM operating above 3km in Resolution 169 (WRC-19) with a reference bandwidth of 14 MHz.
* For the protection of EESS (passive) in 18.6-18.8 GHz, Tonga/Samoa support that no specific measure is required for non-GSO systems operating in LEO orbits that make use of frequency reuse schemes employing at least three colours as mentioned in the footnote of Annex 3.
* For protection of non-GSO FSS space stations from non-GSO inter-satellite links in the 27.5-30 GHz (Annex 4 of the draft new Resolution):
* Emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1GHz and 29.5-30 GHz to communicate with GSO FSS network shall not exceed -17.5 dBW/Hz;
* Non-GSO space stations transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz shall not operate at orbital altitudes greater than or equal to 900 km and less than [1290]/[1350][[2]](#footnote-2)km
* In the case of emissions from any non-GSO space station transmitting in the frequency bands 27.5-29.1 GHz and 29.5-30 GHz to communicate with a non-GSO system with a minimum operational altitude lower than 2000km, the maximum on-axis EIRP spectral density of -28 dBW/Hz and the following total e.i.r.p. shall not be exceeded:

|  |  |
| --- | --- |
| **Transmitting non-GSO space station operational altitude (km)** | **Maximum total e.i.r.p. (dBW)** |
| altitude < 450 | 60 |
| 450 ≤ altitude < 600 | 58 |
| 600 ≤ altitude < 750 | 55 |
| 750 ≤ altitude < 900 | 53 |
| altitude ≥[1290]/[1350][[3]](#footnote-3) | N/A |

* For protection of GSO space stations, emissions of non-GSO space stations shall not produce a PFD at any point in the GSO arc greater than the power flux-density produced by earth stations associated with satellite network/system with which they communicate (i.e. support operation within the envelope of the typical Earth Stations as per Resolves 2.5 Option 1 of the draft new Resolution repeated below)

*Resolves*

*2.5 Option 1: the emissions of this non-GSO space station shall not produce a power flux density at any point in the GSO arc greater than the power flux-density produced by earth stations associated with satellite network/system with which they communicate;*

* In addition, Tonga/Samoa support the continued discussion on the protection of GSO space stations under Annex 5 as referenced in *Resolves* 2.5 Options 2 and 3. In particular, Tonga/Samoa is of the view that further discussions are required regarding the maximum pfd value proposed in Annex 5 (*-163/-165dBW/m2 in any 40 kHz band produced at any point in the GSO arc by a non-GSO space station*).
* Tonga/Samoa have developed the PACP as shown in the embedded doc below:



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

The following concerns were expressed and discussed at the meeting:

* Some APT Members support Method B for the development of the technical conditions and regulatory provisions to enable the operation of satellite-to-satellite links in the 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz bands, or parts thereof, while ensuring protection of existing primary services in the same frequency bands and adjacent bands.
* Some APT Members support Method A, considering that several issues remained unclear including requirements to affect coordination for frequency assignments to inter-satellite links of a GSO space station communicating with non-GSO space stations.
* Some APT Members are the view of that such satellite-to-satellite operation should be allowed through the FSS (space-to-space) allocations while some APT Members are considering an ISS allocation.
* Concerns on aspects of interference manage system(s) and monitoring facilities (NCMC) are expressed by some APT Members.
* APT members have not yet reached consensus on the pfd mask(s) included in Annex 2 of the new draft Resolution to protect terrestrial services.
* Further discussions are required regarding the relevant e.i.r.p/pfd values included in the Annex 4 and 5 to the draft Resolution to protect non-GSO and GSO systems, respectively.

**4. APT View(s)**

* APT Members are considering Method A under agenda item 1.17.
* APT Members also agreed ona Preliminary APT Common Proposal on Method B under the condition that issues raised in the draft Resolutions attached to this PACP are successfully resolved and agreed by the Conference.

**5. Preliminary APT Common Proposal**



**6. Issues for Consideration at APG Coordination Meeting at WRC-23**

Further discussions are required on the following:

* on Alternatives of allocation for the satellite-to-satellite operations.
* on interference management system(s) and monitoring facilities (NCMC).
* on the pfd mask(s) to protect terrestrial services included in Annex 2 of the new draft Resolution.
* on the relevant e.i.r.p/pfd values included in the Annexes 4 and 5 to the draft Resolution to protect non-GSO and GSO systems, respectively.

**7. Views from Other Organisations**

**7.1 Regional Groups**

**7.1.1 RCC - Document APG23-6/INF-45**

* Use of «S-to-S» links in the bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz does not correspond to the FSS definition and imposes additional restrictions on existing and future FSS systems/networks.
* For the band 11.7-12.7 GHz support a “No change” to the ITU Radio Regulations.
* Usage of «S-to-S» links shall ensure protection of existing primary services allocated in the same frequency bands or adjacent bands, including passive services, and shall not impose additional restrictions on the use of current and future systems of these services.
* The RCC Administrations considers the following conditions of Method B of the CPM Report: “ISS allocation” and “GSO within the cone”.
* RCC administrations tend to Method B from the CPM Report.

**7.1.2 CEPT - Document APG23-6/INF-46**

* CEPT supports the operation of satellite-to-satellite links under a new inter-satellite service allocation in the frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, under conditions to ensure the protection of existing services in the same frequency bands and adjacent bands.
* CEPT supports that the introduction of satellite-to-satellite transmissions must ensure the same level of protection for GSOs and non-GSOs as currently provided in the RR and must not impose new constraints on GSOs and non-GSOs to protect satelliteto-satellite links from interference.
* CEPT supports that the introduction of satellite-to-satellite transmissions must ensure the same level of protection for terrestrial services as currently provided in the RR and must not impose new constraints on terrestrial services to protect satellite-to-satellite links from interference. CEPT does not support establishing a pfd mask to protect secondary terrestrial services operated in conformity with No. **5.542**.
* CEPT supports a NOC for the 11.7-12.7 GHz frequency bands.
* CEPT supports an ISS allocation. The hard limits or coordination procedures to protect terrestrial services and/or other satellite networks/systems will not be tied to the type of allocation.
* CEPT supports a limitation to space research, space operation and Earth exploration-satellite applications and also transmissions of data originating from industrial and medical activities in space.
* CEPT supports the operations under the “expanded cone” concept of operations, limited to the LEO-GSO links.
* CEPT supports the development of an envelope provisions where no additional coordination would be required for the user and service provider space stations if sat-to-sat emissions fall within in the envelope of the operational characteristics of the service provider.
* For the protection of GSO systems, CEPT supports a pfd approach in the epfd bands for non-GSO service providers, and a under the envelope approach for coordinated bands (for both non-GSO and GSO service providers).
* For the protection of non-GSO systems, CEPT supports the development of hard limits in the bands 19.3-19.7 GHz, 27.5-29.1 GHz and 29.5-30 GHz, and CEPT is still considering hard limits or coordination in the band 29.1-29.5 GHz.
* CEPT proposes that space stations that plan satellite-to-satellite transmissions should be governed by the following preliminary guiding principles:

1. Satellite-to-satellite link transmissions will comply with the same directionality indicators as in the existing FSS allocations (Earth-to-space = from user space station to service provider space station, space-to-Earth = from service provider space station to user space station);
2. Non-GSO user space stations will operate in a manner that should resemble typical Earth stations of the FSS service provider system;
3. The equivalent power flux-density, epfd↑, produced at any point in the geostationary-satellite orbit by emissions from all combined operations of inter-satellite and typical Earth station transmissions shall not exceed the limits given in Table 22-2;
4. The equivalent power flux-density, epfd↓, at any point on the Earth’s surface visible from the transmitting satellite system, produced by emissions from all the space stations of the non-geostationary-satellite system shall not exceed the limits given in Tables 22-1A to 22-1E, where applicable.
5. The higher altitude to lower altitude link transmissions in 18.1-18.6 GHz and 18.8 20.2 GHz from the GSO or non-GSO FSS service provider space station to the non-GSO user space station would be identical in technical characteristic to the transmissions from GSO or non-GSO service providers to any ground-based user in the service provider’s network;
6. CEPT supports the protection of EESS (passive) sensors in the frequency band 18.6-18.8 GHz through an unwanted emission pfd limit over the oceans of -118 dBW/m²/200 MHz for MEO satellites and -110 dBW/m²/200 MHz for LEO satellites communicating with non-GSO space stations. In addition, CEPT supports that no specific measure is required for non-GSO systems operating in LEO orbits that make use of frequency reuse schemes employing at least three colours.

**7.1.3 CITEL - Document APG23-6/INF-52**

* Some Administrations propose to add a new footnote, 5.A117, in RR Article 5, frequency bands 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz), pointing to a new Resolution, also proposed, that provides the technical conditions for the operation of satellite-to-satellite links through an inter-satellite service (ISS) allocation where such operations would use the “within the cone” concept.
* Some Administrations support a hard limit to address sharing with non-GSO FSS systems given the need to protect incumbent systems and the potential added complexity of coordinating incumbent systems with satellite-satellite operations.
* Some Administrations further propose no change (NOC) to the Radio Regulations for the frequency band 11.7-12.7 GHz due to lack of sufficient ITU-R studies necessary to demonstrate the requisite protection of incumbent services in order to support satellite-to-satellite link operations in this frequency range.
* Some Administrations propose suppression of Resolution 773 (WRC-19).

**7.1.4 ASMG**

* None.

**7.1.5 ATU**

* None.

**7.2 International Organisations**

**7.2.1 ICAO- Document APG23-6/INF-25**

* To ensure that, given the overlap in frequency bands, any radio regulatory action taken as a result of this agenda item does not adversely affect the protection of the GSO stations in the frequency bands listed in Resolution **155 (Rev.WRC-19)**.

**7.2.2 IARU**

* None.

**7.2.3 IMO**

* None.

**7.2.4 WMO**

* None.

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1. Annex 3 provisions do not apply to non-GSO systems using orbits with an apogee less than 2000 km that employ frequency reuse schemes of at least three colors. [↑](#footnote-ref-1)
2. The upper limit requires further discussion to accommodate operational requirements [↑](#footnote-ref-2)
3. The upper limit requires further discussion to accommodate operational requirements [↑](#footnote-ref-3)