CGMS-51-CGMS-WP-01
V1A, 11 April 2023

Prepared by EUMETSAT
Agenda Item: 2.1
Discussed in WG I

SFCG report (including WRC-23 and WMO OSCAR/Space items)

The 41st annual meeting of the Space Frequency Coordination Group (SFCG) took place 19-27 July 2022.

The issues of relevance for CGMS that were discussed and progressed are:

- Update to SFCG Objectives for WRC-23 (extract in Attachment 1);
- SFCG process for gathering remote sensor information for updating the OSCAR/Space database (Attachments 2 & 3);
- Response from SFCG on CGMS activities regarding mechanisms for detection, long-term monitoring and mapping of RFI.

Regarding WRC-23, the SFCG Objectives (Status: February 2023) on WRC-23 agenda items of direct interest/concern to CGMS are provided in an extract in Attachment 1. For comparison with the SFCG Objectives, the positions of WMO (Status: October 2022) are also provided in Attachment 1, which are usually largely in line with each other.

The status of considerations on space weather under WRC-23 agenda item 9.1 Topic A is outlined in detail in CGMS-51-EUMETSAT-WP-06 (Frequency-related topics in support to space weather) to be presented to the Joint WGI-WGIV-SCWG session on 28 April 2023.

This paper also addresses the issues related to ITU-R Resolution 731 (Rev. WRC-19) which deals more generally with the consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz. This issue is related to WGI/A50.02. WRC-23 provides a mechanism to eliminate ambiguities through a revision of ITU-R Resolution 731 by means of the standing WRC agenda item 4.

Related to the activities for updating OSCAR/Space within SFCG, this document also responds to WGI/A50.04 which calls upon the SFCG Liaison Officer and WMO to propose a process for providing accurate and timely updates on satellite frequencies recorded in OSCAR/Space database. This process should ensure CGMS agencies inputs to the database to WMO are aligned with SFCG inputs and activities.

Action/Recommendation proposed: CGMS is invited to note this report, conclude on the responses to actions WGI/A50.02 and WGI/A50.04 and to provide feedback and information on its activities via the CGMS/SFCG Liaison Officer to SFCG-42 (June 2023) on any frequency related matter as appropriate.

SFCG REPORT (INCLUDING WRC-23 AND WMO OSCAR/SPACE ITEMS)

1 INTRODUCTION

The 41st annual meeting of the Space Frequency Coordination Group (SFCG) took place 19-27 July 2022.

The issues of relevance for CGMS that were discussed and progressed are:

- Update to SFCG Objectives for WRC-23 (extract in Attachment 1);
- SFCG process for gathering remote sensor information for updating the OSCAR/Space database (Attachments 2 & 3);
- Response from SFCG on CGMS activities regarding mechanisms for detection, long-term monitoring and mapping of RFI.

Regarding WRC-23, the SFCG Objectives (Status: February 2023) on WRC-23 agenda items of direct interest/concern to CGMS are provided in an extract in Attachment 1. For comparison with the SFCG Objectives, the positions of WMO (Status: October 2022) are also provided in Attachment 1, which are usually largely in line with each other.

The status of considerations on space weather under WRC-23 agenda item 9.1 Topic A is outlined in detail in CGMS-51-EUMETSAT-WP-06 (Frequency-related topics in support to space weather) to be presented to the Joint WGI-WGIV-SCWG session on 28 April 2023.

This paper also addresses the issues related to ITU-R Resolution 731 (Rev. WRC-19) which deals more generally with the consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz. This issue is related to WGI/A50.02. WRC-23 provides a mechanism to eliminate ambiguities through a revision of ITU-R Resolution 731 by means of the standing WRC agenda item 4.

Related to the activities for updating OSCAR/Space within SFCG, this document also responds to WGI/A50.04 which calls upon the SFCG Liaison Officer and WMO to propose a process for providing accurate and timely updates on satellite frequencies recorded in OSCAR/Space database. This process should ensure CGMS agencies inputs to the database to WMO are aligned with SFCG inputs and activities.

CGMS is invited to note this report, conclude on the responses to actions WGI/A50.02 and WGI/A50.04 and to provide feedback and information on its activities via the CGMS/SFCG Liaison Officer to SFCG-42 (June 2023) on any frequency related matter as appropriate.

2 UPDATE TO SFCG OBJECTIVES FOR WRC-23 (REVISED RESOLUTION SFCG 40-1R4) AND WMO POSITIONS FOR WRC-23

At the SFCG-41 meeting in July 2022, the SFCG objectives for WRC-23 were revised on the basis of a number of input contributions.

However, as the preparatory process for WRC-23 is getting into its final stages, the yearly interval of SFCG meetings does not correspond with the need to keep the SFCG objectives up-to-date and in-line with the milestones in the international WRC preparatory process. Therefore, the SFCG Objectives were further revised in a virtual meeting in February 2023, resulting in the fourth update of the corresponding Resolution SFCG 40-1R4.

WMO likewise developed and updates its position for WRC-23 in the yearly meeting of the Expert Team for Radio Frequency Coordination (ET-RFC). The updated WMO preliminary positions, carried out at the August/September 2022 meeting of ET-RFC, were circulated to CGMS members (WGI/A50.03) by the end of 2023 after being finally adopted by WMO.

The revised preliminary SFCG Objectives for WRC-23 in Resolution SFCG 40-1R4 are still basically in-line with the preliminary WMO positions to WRC-23.

It should be noted that by the time the CGMS WGI meeting, the final update of the WMO positions have just been carried out by the yearly meeting of WMO ET-RFC, held on 18-20 April 2023. It can be expected that the SFCG Objectives and the WMO positions will still be largely in line with each other.

An extract of the SFCG Objectives (Status: February 2023) and the WMO positions (Status: still pre the final update 18-20 April by ET-RFC) given in the boxes below the individual SFCG objectives of most relevant WRC-23 Agenda Items is provided in Attachment 1.

2.1 Discussion on some WRC-23 Agenda Items

Following, some WRC-23 agenda items are presented and the SFCG Objective (Status: February 2023) is provided in Attachment 1. For comparison with the SFCG Objectives, the positions of WMO (Status: October 2022, still pre the final update 18-20 April by ET-RFC) are also provided in Attachment 1, which are usually largely in line with each other. Both position papers will still be updated to its final version, WMO at the meeting of ET-RFC in its yearly meeting at 18-20 April 2023 and SFCG-42 in June 2023.

The WRC-23 agenda items of potential concern to CGMS members discussed in this document are:

- Agenda items 1.2, 1.4, 9.1 Topic C related to IMT (5G) systems.
- Agenda items 1.16, 1.17, 1.18 and 9.1 Topic D related to new frequency usage of commercial satellite systems.

Regarding WRC-23 agenda items of direct interest to CGMS, the status on 1.14 is presented. The objective of this agenda item is to ensure that passive microwave measurements in the frequency range 231.5-252 GHz are protected and the required spectrum is allocated to future passive microwave sensors, for example for the Ice Cloud Imager (ICI) instrument on Metop-SG satellites.

The status of considerations on space weather under WRC-23 agenda item 9.1 Topic A is outlined in detail in CGMS-51-EUMETSAT-WP-06 (Frequency-related topics in support to space weather) to be presented to the Joint WGI-WGIV-SCWG session on 28 April 2023.

WRC-23 will also determine the agenda for WRC-27. One possible new WRC-27 Agenda items, supported by WMO and SFCG, would be the following:

Agenda Item 1.xx: to consider, based on the results of ITU-R studies, possible regulatory measures regarding the protection of the Earth exploration-satellite service (passive) in frequency bands above 86 GHz from unwanted emissions of active services.

Background: Resolution 750, initially developed as the outcome of WRC-07 Agenda item 1.20, deals with the compatibility between the Earth exploration-satellite service (passive) and relevant active services. It basically provides unwanted emission levels of active service stations for the compatibility with EESS (passive) in adjacent bands, covered by RR No. 5.340.
This Resolution has been updated, as appropriate, in subsequent WRC (in particular WRC-19) to cover compatibility scenarios not previously addressed. The latest version of Resolution 750, approved by WRC-19, includes unwanted emission levels from the Fixed Service into the 86-92 GHz frequency band. However, unwanted emissions from other active services allocated in bands adjacent to the 86-92 GHz band are currently not included.
In addition, frequency bands allocated to EESS (passive) above 92 GHz and subject to RR No. 5.340, are not yet included in Resolution 750.
Thus, taking into account the technological developments since 2007, and the increased interests for bands above 71 GHz by active services, it might be an appropriate time to study the adjacent band compatibility between active services and EESS (passive) above 86 GHz and update Resolution 750, as appropriate.

Generally it should be noted that the proposals for WRC-27 from the individual regions/countries are still not formally finalised yet. Thus, an outlook on what might be on the agenda for WRC-27 cannot be provided at this stage.

2.2 ITU-R Resolution 731 currently addressed in ITU-R and proposed revision under WRC-23 Agenda Item 4

ITU-R Resolution 731 (Rev. WRC-19) deals with the consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz.

In this context, among other tasks, the ITU-R is invited:
1) *to continue its studies to determine if and under what conditions sharing is possible between active and passive services in the frequency bands above 71 GHz, such as, but not limited to, 100-102 GHz, 116-122.25 GHz, 148.5-151.5 GHz, 174.8-191.8 GHz, 226-231.5 GHz and 235-238 GHz*.

Unfortunately, the listed bands also include bands covered by RR footnote 5.340 (100-102 GHz, 148.5-151.5 GHz, 190-191.8 GHz and 226-231.5 GHz), stating that all emissions are prohibited, in order to protect these specific passive bands.

This is interpreted by some ITU member states as if sharing could be envisaged in these purely passive bands, even against the ITU Rules of Procedure, stating the following:
*"that for bands listed in FN 5.340, notification concerning any other use than those authorized in the band or on the frequencies concerned cannot be accepted even with a reference to No. 4.4; furtherm*ore the administration submitting such a notice is urged to abstain from such usage."

Broadband usage of active services (FS, MS, FSS) and applications (e.g. IMT and UWB) demand using higher frequencies in the future. Only frequency spectrum in the higher GHz range could provide such bandwidth. Thus, the pressure for using bands above 71 GHz, either in shared bands with EESS (passive) or even in purely passive bands (FN 5.340), is significantly increasing.

To preserve these unique spectrum resources, it will be important that CGMS members, in response to WGI/A50.02, urge their national regulatory authorities, when establishing new regulations for use of active services and applications, to appropriately taken into account the protection requirements of passive sensors and that the bands listed in RR FN 5.340 will not be opened for a shared use with active services.

WRC-23 provides a mechanism to eliminate the above described ambiguities through a revision of ITU-R Resolution 731 by means of the standing WRC agenda item 4. Attachment 1 contains the corresponding SFCG Objective and WMO position on this issue.

3 SFCG PROCESS FOR GATHERING OF REMOTE SENSING FOR UPDATING THE OSCAR/SPACE DATABASE

The SFCG has established a recurring action item requesting SFCG member agencies to provide information about their passive and active sensors, with the view of using that information to update the OSCAR/Space.

To capture the updates to be incorporated in OSCAR/Space, SFCG has developed and updated Report SFCG 40-1R1 that is revised at every meeting triggered by an individual action item, for SFCG-42 in June 2023 this is Action Item 41/14 (Attachment 2).

The information to be provided on passive and active sensors has been agreed with WMO and the individual data fields are explained in this Report SFCG 40-1R1. With highlighting of the updated information in a dedicated colour code, it is taken up by WMO and necessary updates are incorporated into OSCAR/Space.

Regarding this mechanism for OSCAR/Space database updates, SFCG agreed to propose to CGMS to use the same template as provided in SFCG Report 40-1R1 (Extract in Attachment 3).

To close the loop, WGI/A50.04 calls upon the SFCG Liaison Officer and WMO to propose to CGMS WGI a process for providing accurate and timely updates on satellite frequencies recorded in OSCAR/Space database. This process should ensure CGMS agencies inputs to the database to WMO are aligned with SFCG inputs and activities.

3.1 Process for providing updates to OSCAR/Space regarding remote sensors

3.1.1 Current process for OSCAR/Space updates

The current process for updating OSCAR/Space is based on the OSCAR/Space Support Team (O/SST) with the focal points nominated by CGMS Members in response to the request originally made in CGMS-45-WMO-WP-06. The present membership of O/SST is shown in the Table 1 below.

Agency	Focal Point
CMA	Feng Lu
CNES	Pierre Tabary, Adrien Deschamps
CNSA	Yong Gan
CSA	Ralph Girard
ECCC	Shannon Kaya, Christopher Linklater
ESA	Ivan Petiteville
EUMETSAT	Stephan Bojinski
IMD	A.K. Mitra
ISRO	Raj Kumar
JAXA	Toshiyuki Kurino
JMA	Takuya Sakashita
KMA	Dohyeong Kim
KARI	Lim Hyo-Suk
NASA	Charles Webb, Lacey McCarthy
NOAA	Natalia Donoho
ROSCOSMOS	Alexander Karelin
ROSHYDROMET	Sergey A. Uspensky

Table 1. The O/SST focal points (Status: May 2022)

The main mechanism for the WMO Space Programme Office to collect the relevant information is through templates submitted to the OSCAR/Space Support Team (O/SST) members, usually two to three times per year.

The template was first introduced in working paper CGMS-47-WMO-WP-17b. An updated version of the template is provided to O/SST focal points according to records missing or recognized obsolete.

O/SST focal points are expected to collect missing or outdate information within their respective organization or agency and to return the completed templates in a timely manner within the stated deadlines.

In addition to the information collected through templates, O/SST members are expected to provide short-term updates as necessary in accordance with the O/SST Terms of Reference.

3.1.2 Complement to current process for OSCAR/Space updates

Considering that the basic process for updating OSCAR/Space is already well established, it is proposed to complement this process with the same approach for providing updates to the remote sensor information in OSCAR/Space as established between the SFCG and WMO.

It is proposed to use the same template for providing the information as given in Report SFCG 40-1R1 (see Attachment 3) with the same colour code for the indication of necessary updates.

When taking the later approach for providing updates to the remote sensor information in OSCAR/Space through this existing process with the established O/SST focal points it should be ensured that these requests for updating particularly the remote sensor information are coordinated with the yearly update of this information through this yearly action in the framework of the SFCG (see Attachment 2) and that the with SFCG agreed templates are used. These templates for remote sensing frequency information could be made available online as for the other templates already used for updating OSCAR/Space.

Considering that the current process through O/SST foresees an update exercise of usually two to three times per year, it should be determined in which intervals the remote sensor information in OSCAR/Space should be checked and updated. Several times per year are certainly not necessary as the information on the remote sensors, once included in the database, do not change very often.

Furthermore, each agency has to ensure that the updates provided through SFCG and CGMS are aligned in order to not to present contradicting information to WMO.

Action: WMO to introduce the templates agreed with the SFCG for updating the remote sensor information in OSCAR/Space into the current procedure through the OSCAR/Space Support Team (O/SST).

The related action WGI/A50.04 can be closed.

4 RESPONSE FROM SFCG ON CGMS ACTIVITIES REGARDING MECHANISMS FOR DETECTION, LONG-TERM MONITORING AND MAPPING OF RFI

The Liaison Officer between SFCG and CGMS informed SFCG about the work of a Task Group established in the framework CGMS Working Group I, dealing with RFI detection, monitoring and mapping.

SFCG noted these developments in CGMS and will provide relevant information on this subject by means of the report of the Liaison Officer back to CGMS once there is something to report. However, SFCG is interest in the progress of this activity in the framework of CGMS.

Attachment 1

Extract from SFCG Objectives (Resolution SFCG 40-1R4) (Status: Feb 2023)

IMT (5G) related issues:

Agenda Item 1.2: to consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 245 (WRC-19);

From the SFCG point of view, the following elements have to be considered during the studies pertaining to WRC-23 AI 1.2:

- protection of EESS (active) in 10-10.4 GHz from IMT in 10-10.5 GHz in Region 2;
- protection of EESS (passive), SRS (passive), and RAS in 10.6-10.7 GHz from unwanted emissions of IMT in 10-10.5 GHz in Region 2;
- protection of SOS in 7100-7155 MHz (used in accordance with RR No. 5.459) from IMT in 7025-7125 MHz;
- compatibility between IMT in 7025-7125 MHz and SRS (deep space) in the band 7145-7190 MHz;

In relation to the operation of EESS (passive) in the bands 6 425-7 075 MHz and 7 075-7 250 MHz (RR No. 5.458), SFCG recognises that Resolution 245 limits the sharing and compatibility studies to the services allocated on a primary basis, which is not the case for EESS (passive) in the 6-7 GHz range. However, SFCG welcomes studies in WP 7C to understand the potential negative impact(s), due to possible active system deployments in the band 6 425-7 125 MHz on EESS (passive) sensors and consider possible alternatives for measuring sea surface temperature.

SFCG Objective on Agenda Item 1.2:
SFCG does not support an IMT identification in any of the 6425-7025 MHz, 7025-7125 MHz, or 10.0-10.5 GHz frequency bands.

However, if an identification to IMT is made in the band 10-10.5 GHz in Region 2, SFCG would support that appropriate technical and regulatory conditions should be applied to IMT in order to adequately protect:

- EESS (active) in the band 10-10.4 GHz (limits on IMT in-band power, sidelobe reduction technique);
- EESS (passive) in the band 10.6-10.7 GHz (current proposed limits on IMT unwanted emissions of -43.0 dBW in 100 MHz for IMT base station (BS) and of 41.0 dBW in 100 MHz for IMT user equipment (UE) are supported, pending finalization of the studies),
- and RAS in the band 10.6-10.7 GHz.

If an identification to IMT is made in the band 7025-7125 MHz, SFCG would support that it should adequately protect and should not impose any additional regulatory or technical constraints on:

- SOS in 7100-7155 MHz (in accordance with RR No. 5.459);
- SRS (deep space) in the band 7145-7190 MHz, for current and future operations of deep space earth stations.

SFCG supports continuing compatibility and sharing studies in ITU-R within WP 7C to assess the potential impact of IMT deployment, in addition to other active services, in the band 6425-7125 MHz on EESS (passive) sensors (operating under RR No. 5.458) with a view to identifying options to ensure continuity of sea surface temperature (SST) measurements in the EESS (passive) in the long term. In this respect, SFCG supports the continuation of studies towards potential new primary allocation, possibly through a new agenda item, to EESS (passive), in particular in the 4200-4400 MHz and 8400-8500 MHz bands for SST measurements.

WMO Position on WRC-23 agenda item 1.2 (Status: October 2022)

WMO is not in favour of an IMT identification in any of the 6425–7025 MHz, 7025–7125 MHz, or 10.0–10.5 GHz frequency bands. If an identification is made, WMO would support:

- the continued use of EESS (passive) in the 6425–7075 MHz and 7075–7250 MHz frequency bands. WMO understands that footnote RR **No 5.458** does not provide an allocation to this service. Nevertheless, due to prime importance of sea surface temperature measurements made in these frequency bands, WMO encourages Administrations to bear in mind the needs of the EESS (passive) service in their future planning of the bands 6425–7075 MHz and 7075–7250 MHz when considering identification for IMT in these frequency bands,
- the application of appropriate regulatory provisions in the 10.6–10.7 GHz frequency band, with necessary limits to protect EESS (passive) operations from unwanted emissions from IMT operating within the 10.0–10.5 GHz band,
- the application of appropriate regulatory provisions to protect EESS (active) operations in the 10–10.4 GHz band.

Agenda Item 1.4: to consider, in accordance with Resolution 247 (WRC-19), the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level;

This agenda item seeks to extend the opportunities for the use of high-altitude platform stations as IMT base stations (HIBS) in certain frequency bands below 2.7 GHz, or portions thereof, already identified for IMT. It contains two main aspects:

- sharing and compatibility studies to ensure protection of services to which the frequency band is allocated on a primary basis and adjacent services, as appropriate, in the bands 694-960 MHz, 1710-1885 MHz (1710-1815 MHz to be used for uplink only in Region 3) and 2500-2690 MHz (2500-2535 MHz to be used for uplink only in Region 3, except 2655-2690 MHz in Region 3).
- Review of the conditions set up for HIBS in RR Nos. 5.388A, 5,388B and in Resolution 221 (Rev.WRC-07) in the bands 1885-1980 MHz, 2010-2025 MHz and 2110-2170 MHz in Regions 1 and 3 and in the bands 1885-1980 MHz and 2110-2160 MHz in Region 2.

Concerning the potential new bands for HIBS, SFCG is interested in the protection of the MetSat service in the 1675-1710 MHz band from HIBS operated in the 1710-1785 MHz band. The use of the frequency band 1710-1785 MHz by HIBS would be in the uplink direction, consistent with Recommendation ITU-R M.1036 and only based on Frequency Division Duplex mode. Under the assumption that HIBS base stations will not transmit in the band adjacent to meteorological satellite (MetSat) operations in the 1670-1710 MHz band, interference from HIBS to MetSat Earth stations operating in adjacent frequency band is unlikely to be a problem.

Concerning the review of the conditions of the existing bands for HIBS, SFCG is interested in the protection of the 2110-2120 MHz band allocated to SRS (deep space, Earth-to-space) and in its licensing to SRS earth stations. Also, SFCG is interested in addressing possible impact into and protection of the EESS/SRS/SOS (Earth-to-space) services in the 2025-2110 MHz band.

SFCG Objective for Agenda Item 1.4:
SFCG acknowledges that IMT equipment are already authorized to operate in the 1710-1785 MHz band (uplink direction). In order not to change the interference environment for MetSat systems in the 1695-1710 MHz band, HIBS operation in the 1710-1785 MHz band would have to be limited to the uplink direction (HIBS receiving from IMT UE), for example through an appropriate revision of RR No.5.388A.
SFCG acknowledges that IMT equipment are already authorized to operate in the 2110-2170 MHz band (downlink direction). In order not to adversely impact SRS (deep space, Earth-to-space) in the 2110-2120 MHz band, as well as EESS/SRS/SOS services in the 2025-2110 MHz band, HIBS operation in the 2110-2170 MHz band would have to be limited to the downlink direction (HIBS transmitting to ground-based UE), for example through an appropriate revision of RR No.5.388A.

WMO Position on WRC-23 agenda item 1.4 (Status: October 2022)
WMO is not opposed to an HIBS identification if the following provisions are implemented in the Radio Regulations:

- In order not to change the interference environment for the MetSat systems in the 1675–1710 MHz band, HIBS operations in the 1710–1785 MHz band would have to be limited to the uplink direction (HIBS receiving from IMT UE),
- In order not to change the interference environment for EESS and SOS in the 2025–2110 MHz band, HIBS operations in the 2 110–2 170 MHz band would have to be limited to the downlink direction (HIBS transmitting to ground-based UE),
- Application of appropriate regulatory provisions for HIBS operations in the 2500–2690 MHz band, with necessary limits in the 2700–2900 MHz band to ensure protection of meteorological radar measurements. The development of these limits would have to take into account the spatial nature of meteorological radar measurements and their sensitive Minimum Detectable Signal (MDS) requiring that every scan direction (elevation and azimuth) be adequately protected.
- Moreover, the application of HIBS in the 2500-2690 MHz shall not impose extra limitations over the expansion of weather radars in the band 2700-2900 MHz. This is to avoid the situation with the current terrestrial based IMT systems, which impose limitations on meteorological radars.

Agenda Item 9.1 (Topic C): Study the use of International Mobile Telecommunication system for fixed wireless broadband in the frequency bands allocated to the fixed services on primary basis, in accordance with Resolution 175 (WRC-19)

Resolution 175 (WRC-19) invites ITU-R to conduct any necessary studies on the use of International Mobile Telecommunication systems for fixed wireless broadband in the frequency bands allocated to the fixed service on primary basis, taking into account the relevant ITUR studies, Handbooks, Recommendations and Reports.

SFCG Objective for Agenda Item 9.1 (Topic C):
SFCG is concerned by this item since any frequency band allocated to the fixed service is open for consideration for IMT use. Many FS bands are shared with or adjacent to space science services. This topic has the potential to change coexistence conditions, and impact a large number of frequency bands used by space science services (e.g. EESS, MetSat, SRS).

Protection of the space science services is to be ensured. Consequently, SFCG supports no change to the Radio Regulations, other than the suppression of Resolution 175 (WRC-19), under this agenda item.

WMO Position on WRC-23 agenda item 9.1 Topic c) (Status: October 2022)

WMO is concerned about this Topic c) under Agenda item 9.1 that is very broad in scope and could hence potentially affect many meteorological operations and applications, including EESS (passive) under footnote RR **No 5.340.**

Protection of the space science services needs to be ensured. Consequently, WMO supports no change to the Radio Regulations, other than the suppression of Resolution 175 (WRC-19), under this agenda item 9.1 topic.

New frequency usage of commercial satellite systems:

Agenda Item 1.16: to study and develop technical, operational and regulatory measures, as appropriate, to facilitate the use of the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7 20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by non-GSO FSS earth stations in motion, while ensuring due protection of existing services in those frequency bands, in accordance with Resolution 173 (WRC-19);

Within the frequency bands under consideration, the bands 17.7-18.6 GHz and 18.8-19.3 GHz are adjacent to the band 18.6-18.8 GHz, which is allocated to the Earth exploration-satellite service (passive) on a primary basis in all three Regions and to the space research service (passive) on a secondary basis in Regions 1 and 3 and on a primary basis in Region 2. The band 28.5-29.5 GHz is further allocated on a

secondary basis to the Earth exploration-satellite service in the Earth-to-space direction.

SFCG Objective for Agenda Item 1.16:
SFCG does not oppose the use of the bands 17.7-18.6 GHz and 18.8-19.3 GHz (space-to-Earth) for communications with non-GSO FSS ESIM, provided that appropriate provisions are developed to ensure the protection of EESS (passive) operations in the 18.6-18.8 GHz band.

SFCG supports the application of unwanted emissions PFD limits to non-GSO FSS operating in the 18.3-18.6 and 18.8-19.1 GHz bands to appropriately ensure protection of the EESS (passive).

SFCG is studying whether the unwanted emissions PFD levels derived from the studies under WRC-23 agenda item 1.17 might also provide adequate protection to EESS (passive) in 18.6-18.8 GHz under WRC-23 agenda item 1.16.

WMO Position on WRC-23 agenda item 1.16 (Status: October 2022)

WMO does not oppose the use of the bands 17.7–18.6 GHz and 18.8–19.3 GHz (space-to-Earth) for communications with non-GSO FSS ESIM provided that an appropriate out-of-band pfd limit at the Earth's surface is applied to ensure protection of the EESS (passive) in the band 18.6–18.8 GHz. Current studies show that a value of – 126.4 dBW/m^2/200 MHz might be suitable.

No studies have been conducted with respect to the MetSat service, however additional provisions may be required to ensure non-GSO FSS ESIM deployment will protect the co-frequency band MetSat allocation in the bands 18–18.3 GHz (ITU Region 2) and 18.1–18.4 GHz (ITU Regions 1 and 3).

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;

Within the frequency bands under consideration, the bands 18.1-18.6 GHz and 18.8-19.3 GHz are adjacent to the band 18.6-18.8 GHz, which is allocated to the Earth exploration-satellite service (passive) on a primary basis in all three Regions and to the space research service (passive) on a secondary basis in Regions 1 and 3 and on a primary basis in Region 2. The band 28.5-29.5 GHz is further allocated on a secondary basis to the Earth exploration-satellite service in the Earth-to-space direction, although there are currently no known or planned uses of this allocation by SFCG member agencies.

SFCG Objective for Agenda Item 1.17:
SFCG supports the development of technical conditions and regulatory provisions for satellite-to-satellite operations in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz, or portions thereof, as appropriate.

SFCG supports the completion of ITU-R studies that appropriately determine the authorized operations for the satellite-to-satellite transmissions. Specifically, SFCG supports that the space-to-space links should comply with the same directionality indicators as the existing FSS allocations (i.e., Earth-to-space = from lower altitude to higher altitude, space-to-Earth = from higher altitude to lower altitude), the use of the space-to-space links should not result in additional constraints to existing FSS applications that are used in support of scientific missions (e.g. feeder links).

SFCG does not support modification to the Table of Allocations in the frequency band 11.7-12.7 GHz under this agenda item due to the limited number of studies conducted in the band.

SFCG supports that if regulatory modifications are made to allow space-to-space links in the other bands, they do so using the “within the cone of coverage” concept outlined within the sharing studies.

SFCG supports the application of the following unwanted emission limits for the protection of the EESS (passive) in 18.6-18.8 GHz band:

- Non-GSO fixed-satellite space stations operating with an orbit apogee more than 2000 km and less than 20,000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz when communicating with a non-GSO space station of lower altitude shall not exceed a power flux-density produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band, of -118 dB(W/(m² · 200 MHz))
- Non-GSO fixed-satellite space stations operating with an orbit apogee less than 2000 km in the frequency bands 18.3-18.6 GHz and 18.8-19.1 GHz when communicating with a non-GSO space station of lower altitude shall not exceed a power flux-density produced at the surface of the oceans across the 200 MHz of the 18.6-18.8 GHz band, of -110 dB(W/(m² · 200 MHz)).

WMO Position on WRC-23 agenda item 1.17 (Status: October 2022)

WMO supports the development of technical conditions and regulatory provisions for satellite-to-satellite operations in the frequency bands 18.1–18.6 GHz, 18.8–20.2 GHz and 27.5–30 GHz, or portions thereof, as appropriate. Specifically, WMO supports the implementation of regulatory provisions which would ensure that the operation of satellite-to-satellite link transmissions will not lead to an increase interference to MetSat in the bands 18–18.3 GHz (ITU Region 2) or 18.1–18.4 GHz (ITU Regions 1 and 3),or to EESS (passive) in the band 18.6–18.8 GHz. In particular, WMO supports that an appropriate out-of-band pfd limit at the Earth’s surface is applied to ensure protection of the EESS (passive) in the band 18.6–18.8 GHz. Current studies show that a value of –126.4 dBW/m^2/200 MHz might be suitable.

Agenda Item 1.18: to consider studies relating to spectrum needs and potential new allocations to the mobile-satellite service for future development of narrowband mobile-satellite systems, in accordance with Resolution 248 (WRC-19);

This agenda item calls for studies for consideration of new allocations to the mobile-satellite service, for low-data rate systems for the collection of data from, and management of, terrestrial devices, in the following bands:
- 1 695-1 710 MHz in Region 2,
- 2 010-2 025 MHz in Region 1,
- 3 300-3 315 MHz, 3 385-3 400 MHz in Region 2;

Corresponding sharing and compatibility studies with existing primary services have to be carried out to determine the suitability of new allocations to the MSS, with a view to protecting the primary services, in and adjacent to the bands under consideration.

The frequency band 1695-1710 MHz is allocated to the MetSat service and is primarily used for non-GSO MetSat data downlinks to earth stations around the world, thus potentially affecting MetSat systems from other regions as well. Also, the frequency band 1695-1700 MHz is allocated to the Meteorological Aids on a primary basis in all three regions. Additionally, the adjacent frequency band 1670-1695 MHz is also allocated on a primary basis to the meteorological-satellite service (space-Earth).

The protection of the EESS (Earth-to-space and space-to-space), SOS (Earth-space and space-to-space) and Space Research (Earth-to-space and space-to-space) in the adjacent band 2025-2110 MHz also needs to be ensured.

SFCG Objective for Agenda Item 1.18:
SFCG supports NOC in the band 1695-1710 MHz in Region 2 due to the absence of ITU-R studies addressing the protection of current and future MetSat operations in the band 1695-1710 MHz and in the adjacent band 1670-1695 MHz from narrow-band MSS systems.

SFCG is of the view that any consideration of the band 2010-2025 MHz for narrow-band MSS systems in Region 1 should be supported by studies adequately addressing the protection of EESS, SOS, and SRS (Earth-to-space and space-to-space) in the band 2025-2110 MHz.

WMO Position on WRC-23 agenda item 1.18 (Status: October 2022)

WMO does not support any RR modifications under this WRC-23 agenda item due to the absence of ITU-R studies, addressing the protection of :

- current and future MetSat operations in the band 1695–1710 MHz and in the adjacent band 1670–1695 MHz from narrow-band MSS systems. It is important to ensure the protection of the downlink of the measured data as well as the global dissemination of the data directly to users
- EESS and SOS in the adjacent band 2025–2110 MHz.

Agenda Item 9.1 (Topic D): Protection of EESS (passive) in the frequency band 36-37 GHz from non-GSO FSS space stations.

Under studies considered for WRC-19 agenda item 1.6, a preliminary study on the protection of EESS (passive) sensors operating in the band 36-37 GHz from non-GSO FSS space stations in large constellations in the band 37.5-38 GHz was submitted to the ITU-R. This preliminary study indicated that it may be necessary to apply to FSS non-GSO space stations an unwanted e.i.r.p. limit of −34 dB(W/100 MHz), for all angles greater than 71.4 degrees from nadir. In addition, interference into the cold calibration channel of the EESS (passive) sensor operating in the frequency band 36-37 GHz was not studied.

On this basis, WRC-19 invited the ITU-R to conduct further study of this topic and develop Recommendations and/or Reports, as appropriate, and report back to WRC-23 to take action, if necessary. Furthermore, WRC-19 agreed that modifications to Resolution 750 (Rev.WRC-19) should not be considered under these studies since the frequency band 36-37 GHz is not referenced in RR No. 5.340.

Two study topics are under consideration:

- Impact on the EESS sensing channel from constellations operating at altitudes lower than the EESS satellites altitude.
- Impact on the EESS calibration channel from constellations operating at altitudes higher than the EESS satellites altitude.

SFCG Objective for Agenda Item 9.1 (Topic D):
SFCG supports the protection of EESS (passive) sensors (including for the cold-sky calibration) in the band 36-37 GHz from non-GSO FSS operations in 37.5-38 GHz.

Based on the current available studies, SFCG supports that the following conditions should apply to non-GSO FSS systems in the band 37.5-38 GHz: unwanted emission power limit of 31.0 dBW/100 MHz in the band 36-37 GHz. This would apply to non GSO FSS satellite beams operating within constellations of more than 1000 satellites.
Further consideration is required regarding the appropriate placement and implementation of corresponding regulatory provisions to protect EESS (passive) sensors.

WMO Position on WRC-23 agenda item 9.1 Topic d) (Status: October 2022)

WMO supports the protection of EESS (passive) sensors (including for the cold-sky calibration) in the band 36–37 GHz from non-GSO FSS operations in the band 37.5–38 GHz. To achieve this, WMO supports the relevant conditions identified in the results of the ITU-R studies performed under this agenda item and their appropriate implementation as regulatory provisions in the RR to protect EESS (passive) sensors.

Issues of direct interest:

Agenda Item 1.14: to review and consider possible adjustments of the existing or possible new primary frequency allocations to EESS (passive) in the frequency range 231.5-252 GHz, to ensure alignment with more up-to-date remote-sensing observation requirements, in accordance with Resolution 662 (WRC-19);

Resolution 662 (WRC-19) invites the ITU-R to:

- review the existing primary allocations to the EESS (passive) in the frequency range 231.5-252 GHz in order to analyse if these allocations are aligned with observation requirements of passive microwave sensors;
- study the impact that any change to the EESS (passive) allocations in the frequency range 231.5-252 GHz might have on the other primary services in these frequency bands;
- study, as appropriate, possible adjustments to the EESS (passive) allocations in the frequency range 231.5-252 GHz.

The main purpose of the agenda item is to align the EESS (passive) allocations with passive sensor design requirements by adjusting existing allocations or adding possible new allocations to the EESS (passive) in the 231.5-252 GHz frequency range. The allocations to the EESS (passive) were created 20 years ago at a time when operational requirements were unclear.

SFCG Objective for Agenda Item 1.14:
SFCG supports a new primary allocation to EESS (passive) in the frequency bands 239.2-242.2 GHz and 244.2-247.2 GHz in order to accommodate the requirements for ice cloud measurements.

In accordance with Method B of the draft CPM text, and in order to avoid undue constraints on the FS and MS in the band 239.2-241 GHz (1.8 GHz of bandwidth), SFCG also supports the shift of the existing FS and MS allocations to the band 235-238 GHz (3 GHz of bandwidth), associated with a limitation of the use of the existing EESS (passive) allocation in the band 235-238 GHz to limb sounding passive sensors only (Method B, option 1).

WMO Position on WRC-23 agenda item 1.14 (Status: October 2022)

WMO supports new primary allocations to EESS (passive) in the frequency bands 239.2–242.2 GHz and 244.2–247.2 GHz in order to accommodate the requirements for ice cloud measurements.

In order to avoid undue constraints on the FS and MS in the band 239.2–241 GHz (currently with an allocation of 1.8 GHz in bandwidth), WMO also supports the shift of the existing FS and MS allocations to the band 235–238 GHz (providing an allocation of 3 GHz in bandwidth).

In order to ensure that there would be no potential future impact to FS and MS in the band 235–238 GHz, WMO would accept limiting the existing allocation to EESS (passive) in the band 235–238 GHz for use by limb sounding passive sensors only.

Agenda Item 9.1 (Topic A): In accordance with Resolution 657 (Rev.WRC-19), review the results of studies relating to the technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services

Resolution 657 (Rev.WRC-19) calls for studies on technical and operational characteristics, spectrum requirements and appropriate radio service designations for space weather sensors with a view to describing appropriate recognition and protection in the Radio Regulations without placing additional constraints on incumbent services.

SFCG Objective for Agenda Item 9.1 (Topic A):
SFCG supports the results of ITU-R studies that provide WRC-23 with the necessary information to address appropriate recognition and future protection to space weather sensors, specifically regarding:

- designating space weather sensors (active and receive-only) as an application of the MetAids service;
- developing a space weather definition that could be included in RR Article 1;
- developing a definition of specific applications of space weather sensors that could be included in RR Article 4;
- developing a description of space weather sensor systems and their corresponding usage for inclusion in a new WRC Resolution on the importance of space weather sensor systems;
- identifying frequency bands and sensor systems used for providing data critical for space weather forecasting/warnings that will require recognition and protection.

SFCG also supports the continuation of ITU-R studies through a new agenda item for WRC-27, in particular to consider appropriate protection in the Radio Regulations for the MetAids service to support space weather operations.

WMO Position on WRC-23 agenda item 9.1 Topic a) (Status: October 2022)

WMO supports the definition proposed by WP7C for space weather and the approach regarding its recognition in the RR, through a subset of the MetAids service, called the MetAids (space weather).

WMO also supports the following actions:

- the recognition, at WRC-23, of space weather by modifications to RR Articles 1 and 4,
- the development of a new WRC-27 Agenda item on space weather to define regulatory provisions while not placing constraints on incumbent services.

ITU-R Resolution 731 currently addressed in ITU-R and proposed revision under WRC-23 Agenda Item 4:

Agenda Item 4: in accordance with Resolution 95 (Rev.WRC 19), to review the Resolutions and Recommendations of previous conferences with a view to their possible revision, replacement or abrogation;

This standing agenda item to the WRC deals with the review of WRC Resolutions and Recommendations contained in Volume 3 of the Radio Regulations, that are not related to any other agenda item of the conference.

SFCG reviewed the WRC Resolutions and Recommendations related to space science services and identified that actions are required in relation to Resolution 75 (Rev.WRC-12) and Resolution 731 (Rev. WRC-19).

SFCG Objective for Agenda Item 4:
SFCG supports that:

- Resolution 75 (Rev.WRC-12) (Development of the technical basis for determining the coordination area for coordination of a receiving earth station in the space research service (deep space) with transmitting stations of high-density applications in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands) be suppressed, recognising that studies have been completed;

- Resolution 731 (Rev. WRC-19) (Consideration of sharing and adjacent-band compatibility between passive and active services above 71 GHz) be modified to clarify that in band sharing studies cannot be performed in bands covered by RR No.5.340, stating that all emissions are prohibited.

WMO Position on Resolution 731 (Rev. WRC-19)

WMO highlights that bands above 71 GHz used by passive sensors are unique resources for atmospheric measurements. These passive bands are indispensable for meteorological forecasting and climate monitoring.

WMO is concerned that in the process of establishing the sharing conditions in bands above 71 GHz under *invites 1* of Resolution **731 (Rev. WRC-19)**, some frequency bands are included which are subject to footnote RR **No 5.340.** Studies carried out under Resolution **731 (Rev. WRC-19)** can only be performed for active services potentially operating in frequency bands not covered by footnote RR **No 5.340**.

WMO supports the revision of Resolution 731 (Rev. WRC-19) under WRC-23 agenda item 4, in order to clarify that in-band sharing studies cannot be performed in frequency bands subject to footnote RR **No 5.340**.

In addition, WMO is also of the view that any new studies under Resolution **731 (Rev. WRC-19**), related to the impact from active services into passive services, should only be undertaken when duly justified active services spectrum requirements are assessed.

WMO Position on WRC-19 Agenda item 4

With regards of Resolution 731 (Rev. WRC-19), WMO supports treating under this agenda item a revision of this WRC Resolution to clarify that in-band sharing studies cannot be performed in bands covered by RR No.5.340.

Attachment 2

SFCG ACTION ITEM No. 41/14

Update of SFCG Remote Sensing Information in OSCAR

SUBJECT: Update of SFCG Remote Sensing Information in OSCAR

SUPPORTING MATERIAL:

SFCG POSITION:

SFCG-40 developed a new report “SFCG Remote Sensing Information”. The goal of this report is to provide information to the WMO to be entered in their OSCAR database with up-to-date information.

At SFCG-41 further input contributions were provided on this topic. And a revision to Report SFCG 40-1 was proposed.

SFCG also recognized that contributions from SFCG members are necessary to maintain Report SFCG 40-1 and therefore the WMO OSCAR database.

ACTIONS TO BE TAKEN:

1. All SFCG member agencies should review the content of the WMO OSCAR database in relation to their current and future remote sensing missions. In this context, SFCG member agencies should also indicate if the information in the OSCAR database is still up-to-date.
2. Whenever discrepancies are found between the WMO OSCAR database and the most up-to-date sensor information, SFCG member agencies should indicate the correct parameters via an input contribution to SFCG. Those inputs should use a color coding to indicate parameters that are not currently included in OSCAR, or that are captured incorrectly in OSCAR. The reference to which the changes are to be indicated should be the OSCAR database and not Report SFCG 40-1.
3. After the SFCG-42 meeting, the Revised SFCG Report, in full or a subset of it (as decided by SFCG agencies), will be provided to the WMO for inclusion in the OSCAR database.

RESPONSIBLE PERSONS:

Action 1 and 2: All members
Action 3: Yan Soldo (ESA)

DUE DATES:

Action 1 and 2: 3 weeks prior to SFCG-42
Action 3: 2 weeks after the end of SFCG-42

Attachment 3

Extract of Report SFCG 40-1R1 - SFCG REMOTE SENSING INFORMATION

Explanation of fields in the Annex:

Column 1: *Agency* – Name of the space agency

Column 2: *Satellite*

Column 3: *Instrument* – Acronym of the instrument name

Column 4: *Instrument type* – The user will need to select one of the options listed below. If the type of instruments is not listed below, "Other (see comments)" will need to be used.

- Radar altimeter
- Imaging radar (SAR)
- Scatterometer
- Precipitation radar
- Cloud profile radar
- Radiometer
- Other (see comments)

The last option implies that more information will need to be added about the sensor in the "Comments" column.

Column 5: *Scanning mode* – The user will need to select one of the options listed below. If the scanning mode of the instrument is not listed below, "Other (see comments)" will need to be used.

- Nadir-looking
- Cross-track scan
- Conical scan
- Limb sounding
- Push-broom
- Other (see comments)

The last option implies that more information will need to be added about the sensor in the "Comments" column.

Column 6: *Sensing mode* – This field can be only "Active" or "Passive".

Column 7: *Frequency [GHz]* – Center frequency. Entries such as "57.290344 ± 0.217" or "57.290344 ± 0.3222 ± 0.048" should be used whenever relevant

Column 8: *Bandwidth [MHz]* – Bandwidth. Entries such as "2x78" or "4x36" should be used in the examples given above for Column 7. For sensors with variable bandwidths (e.g. SAR), the maximum bandwidth of the sensor should be included.

Column 9: *Launch* – For existing missions, the format "yyyy-mm-dd" should be used. For planned missions, the format "□ yyyy" should be used.

Column 10: *EOL* – End of Life. The format "□ yyyy" should be used.

Column 11: *Date of last update (doc reference)* – Date in which the information was provided. Whenever applicable, the reference of the document containing the information should also be provided.

Column 12: *Comments*

Extract from "Table with Characteristics of remote sensing instruments" in order to illustrate the concept

Agency	Satellite	Instrument	Instrument type	Scanning mode	Sensing mode	Frequency [GHz]	Bandwidth [MHz]	Launch [yyyy-mm-dd] or [≥ yyyy]	EOL [yyyy-mm-dd] or [≥ yyyy]	Date of last update (doc reference)	Comments
Yellow	indicates what needs to be added in OSCAR with regard to satellites/instruments/frequencies operated by ESA, EUMETSAT or NASA.										
Orange	indicates what needs to be modified in OSCAR with regard to satellites/instruments/frequencies operated by ESA, EUMETSAT or NASA.										
ESA	CIMR	CIMR	Radiometer	Conical scan	Passive	6.875	400	≥ 2028	≥ 2033	Jul 2022 (SF41-35/D)	
ESA	CIMR	CIMR	Radiometer	Conical scan	Passive	10.65	100	≥ 2028	≥ 2033	March 2022 (SF40-65/D)	
ESA	CIMR	CIMR	Radiometer	Conical scan	Passive	18.7	200	≥ 2028	≥ 2033	March 2022 (SF40-65/D)	
ESA	CIMR	CIMR	Radiometer	Conical scan	Passive	36.5	300	≥ 2028	≥ 2033	March 2022 (SF40-65/D)	
ESA	CRISTAL	IRIS	Radar altimeter	Nadir-looking	Active	13.5	500	≥ 2027	≥ 2032	March 2022 (SF40-65/D)	
ESA	CRISTAL	IRIS	Radar altimeter	Nadir-looking	Active	35.75	500	≥ 2027	≥ 2032	March 2022 (SF40-65/D)	
ESA	CRISTAL	AMR-CR	Radiometer	Nadir-looking	Passive	18.7	200	≥ 2027	≥ 2032	Jul 2022 (SF41-35/D)	
ESA	CRISTAL	AMR-CR	Radiometer	Nadir-looking	Passive	23.8	400	≥ 2027	≥ 2032	Jul 2022 (SF41-35/D)	
ESA	CRISTAL	AMR-CR	Radiometer	Nadir-looking	Passive	34	700	≥ 2027	≥ 2032	Jul 2022 (SF41-35/D)	
