CGMS

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EUMETSAT REPORT ON FREQUENCY MANAGEMENT TOPICS

The agenda of the World Radiocommunication Conference 2012 (WRC-12) contains a number of issues of interest and concern to the meteorological satellite (MetSat) operators.

This contribution provides an overview of the status of the preparation for WRC-12 for the most important issues related to the MetSat service and the Earth Exploration Satellite Service (EESS), namely the

- **Allocation of additional spectrum for MetSat in the frequency band 7850 – 7900 MHz (Agenda Item 1.24);**
- **Revision of the bands above 275 GHz for use by EESS passive sensors (Agenda Item 1.6);**
- **Improvement of the recognition of the essential role and global importance of Earth observation applications and related radiocommunication services (Agenda Item 8.1.1, Issue C);**
- **Inclusion of out-of-band emission limits for the fixed service allocations neighbouring the passive sensing band 86 – 92 GHz in the Radio Regulations (Agenda Item 1.8);**
- **Proposals for agenda items for WRC-15/16 (Agenda Item 8.2).**

Furthermore, this contribution provides a summary of issues discussed at the 31st meeting of the Space Frequency Coordination Group (SFCG), held 7 – 16 June 2011, which could be of potential interest to CGMS.

EUMETSAT Report on Frequency Management Topics

1 INTRODUCTION

This contribution provides an overview of agenda items of the World Radiocommunication Conference 2012 (WRC-12) on issues of most relevance to the Meteorological Satellite Service (MetSat) and the Earth Exploration Satellite Service (EESS).

Furthermore, this contribution provides a summary of issues discussed at this year's meeting of the Space Frequency Coordination Group (SFCG-31), held 7 – 16 June 2011, which could be of interest to CGMS member agencies.

2 WRC-12 AGENDA ITEMS WITH RELEVANCE TO THE METSAT AND EESS SERVICES

WRC-12 agenda items of most relevance to MetSat and EESS are:

- Agenda Item 1.6 - Identification of frequency bands for passive sensing between 275 GHz and 3000 GHz;
- Agenda Item 1.8 - Fixed service in the range 71 – 238 GHz;
- Agenda Item 1.24 - Extension of the existing primary allocation for non-geostationary Meteorological Satellite Service (MetSat) at 7750 - 7850 MHz into the band 7850 - 7900 MHz;
- Agenda Item 8.1.1 (Issue C) - Resolution 673 (WRC-07) - Improve the recognition of the essential role and global importance of Earth observation radiocommunication applications;
- Agenda Item 8.2 – Proposals for agenda items for WRC-15/16.

2.1 WRC-12 Agenda Item 1.6 regarding frequency allocations for EESS (passive) in bands above 275 GHz

WRC-12 Agenda Item 1.6 calls for the revision of footnote 5.565 of the Radio Regulations in which currently a number of frequency bands are listed that can be used for passive sensing. The aim of this agenda item is to update the list of frequency bands for spectrum use by the passive services between 275 GHz and 3 000 GHz in order to better reflect the current and future planned use of passive sensors.

The identification of the most up-to-date and relevant frequency bands for passive sensing in the framework of SFCG and ITU-R Working Party 7C has been completed and resulted in ITU-R Report ITU-R RS.2194 on passive bands of interest to

EESS/SRS from 275 to 3000 GHz in which the current and future spectrum use and requirements for frequency bands above 275 GHz are listed.

The CPM-Text only contains one method to satisfy the agenda item which properly reflects the spectrum requirements as identified by SFCG and ITU-R Working Party 7C.

EUMETSAT supports the proposed revision of RR No. 5.565 as outlined in the CPM-Text to include all appropriate frequency bands within the range 275 to 3000 GHz to be used by systems belonging to the Earth exploration-satellite (passive), including those planned in the framework of EPS Second Generation (EPS-SG) in order to protect these bands for scientific applications now and in the future.

In this context it should be noted that the listing of frequency bands above 275 GHz for passive sensing are not to be considered as frequency allocations, they are currently and continued to be just an identification of spectrum use. Since there is a lack of knowledge of the spectrum requirements for active users of the spectrum, frequency bands above 275 GHz will not be allocated to different radiocommunication services (including passive services) until an appropriate time in future.

2.2 WRC-12 Agenda Item 1.8 (Fixed service in the range 71 – 238 GHz)

Under WRC-12 Agenda Item 1.8 technical and regulatory issues related to the fixed service between 71 and 238 GHz including sharing and adjacent compatibility with passive services under Resolution 731 (WRC-2000) are under consideration.

This frequency range 71 to 238 GHz covers a number of important EESS (passive) frequency bands, such as 86 - 92 GHz, 100 – 102 GHz, 114.25 122.25 GHz, 148.5 151.5 GHz, 155.5 158.5 GHz, 174.8 191.8 GHz, 226 231.5 GHz and 235– 238 GHz already in use by a number of instruments. All MHS channels (89 GHz, 157 GHz, 183.311 GHz and 190.311 GHz) and the AMSU 89 GHz channel on Metop are within this range. Furthermore, for the EPS-SG candidate missions MWS and MWI also channels within this frequency range are included.

So far, there were no proposals for fixed service regulations made at any level that could negatively influence the passive sensing bands in the range 71 – 238 GHz.

Within the European (CEPT) preparatory process for WRC-12 it was possible to use this agenda item to propose mandatory out-of-band emission limits on the fixed service allocations neighbouring the passive sensing band 86 – 92 GHz in line with a decision already taken within CEPT (ECC Report 124 on “Coexistence between Fixed Service operating in 71-76 / 81-86 GHz and the passive services”) to ensure the protection of sensors in this band from out-of-band emissions of the fixed service in bands operating below and above.

Since CEPT will be the only regional group to propose such mandatory limits, it will be virtually impossible to achieve this at WRC-12 against significant opposition from other regions.

Therefore, CGMS member agencies are invited to carry a similar request for mandatory out-of-band emission limits into their regional WRC-12 preparatory process in order to

increase the currently limited support for such mandatory limits within other regions than Europe. The aim would be to at least achieve at WRC-12 the adoption of recommended levels included in the Radio Regulations.

2.3 WRC-12 Agenda Item 1.24 (Extension of the MetSat allocation at 7750 – 7850 MHz by 50 MHz into the band 7850 – 7900 MHz)

WRC-12 Agenda Item 1.24 calls for consideration of extension of the existing allocation to the MetSat service in the band 7750 - 7850 MHz by 50 MHz to cover also the band 7850 - 7900 MHz, limited to non-geostationary meteorological satellites in the space-to-Earth direction.

The mission requirements for next generation non-GSO meteorological satellites in terms of observations, instruments and user-services clearly show a need to transmit higher data rates compared to current systems.

EUMETSAT supports the extension of the existing allocation of the 7750 - 7850 MHz band to the MetSat service (space-to-Earth) for use by non-geostationary satellites into the 7850-7900 MHz band and performed and introduced the necessary sharing studies in the relevant ITU-R Working Party 7B resulting in ITU-R Report SA.2164 on “Compatibility between the meteorological satellite and the fixed service in the band 7850 - 7900 MHz”.

From the results of the sharing studies which is taking into account the use of the band by MetSat for raw data dump and/or direct readout applications it can be concluded that the sharing scenarios in the frequency band 7850 - 7900 MHz are similar to the ones in the frequency band 7750 - 7850 MHz, thus MetSat could be operated under the same regulatory conditions like in the existing MetSat band.

In the CPM-Text only one method to satisfy the agenda item is provided which proposes the extension of the MetSat allocation 7750 – 7850 MHz to 7900 MHz. As there are no disadvantages to this method identified and nearly no negative views where expressed to this MetSat allocation extension, a positive outcome to this agenda item can be expected at WRC-12.

Considering the different concepts (i.e. data dump, direct readout services) for using this band by current and future polar-orbiting MetSat systems, such as FY-3, NPOESS (now JPSS), Metop and EPS-SG there is a certain potential to interfere with each other.

Thus, once the band 7850 – 7900 MHz is allocated to MetSat (at WRC-12) a coordinated approach for planning the long term use of the entire band 7750 – 7900 MHz would be necessary, taking into account SFCG RES 19-7R3.

2.4 WRC-12 Agenda Item 8.1.1, Issue C (Improve the recognition of the essential role and global importance of Earth observation radiocommunication applications (Resolution 673 (WRC-07))

Resolution 673 (WRC-07), adopted at WRC-07, highlights and recognises the importance of the essential role and global importance of Earth observation radiocommunication applications and calls for studies on possible means of improving this recognition and of increasing the knowledge and understanding of administrations regarding the utilization and benefits of these applications. Earth observation radiocommunication applications considered in this context are conducted under the EESS services (including active and passive sensors), the meteorological satellite service, the meteorological aids services (e.g. weather balloons) and radiolocation services (Meteorological radars and wind profilers).

For this purpose, a correspondence group within the framework of ITU-R Working Party 7C was established, which developed ITU-R Report RS.2178 on "The essential role and global importance of radio spectrum use for Earth observations and for related applications", focussing in particular on Earth Observation. EUMETSAT participated in this ITU-R Correspondence Group and contributed to the development of this ITU-R Report with the aim to improving the recognition of Earth observing systems and their benefits, including the possible protection of the frequency allocations that support such observations.

This agenda item provides a unique opportunity to improve on a general and global basis Earth Observation applications and related radiocommunication services in the framework of the Radio Regulations.

Within CEPT, a European Common Proposal (ECP) was adopted, which proposes a revision to Resolution 673 and stresses the need for recognition of the global importance of Earth observation systems through a proposal for a new Article in the Radio Regulations requesting ITU member states to recognise the importance of the Earth observation related radio services, taking into account Resolution 673 (Rev. WRC-12).

2.5 WRC-12 Agenda Item 8.2 (Proposals for agenda items for WRC-15/16)

One of the outputs of a World Radiocommunication Conference is to establish the agenda for the following conference. WRC-12 will therefore discuss and condude on the WRC-15/16 agenda and WRC-12 Agenda Item 8.2. This issue is very important as agenda items for WRC-15/16 could potentially negatively impact the future use and availability of frequency bands used or planned to be used by EUMETSAT systems.

The work on this agenda item within CEPT and the other regional preparatory groups is the last to be completed.

So far, information on potential agenda items proposed by the regional groups is very scarce. However, it can be expected that most regional groups (if not all) will propose an agenda item for the identification of additional spectrum for terrestrial mobile broadband

applications, including potentially additional frequency band allocations to the mobile service and identification of bands for International Mobile Telecommunications (IMT). It can be expected that the scope of such an agenda item will be kept open as wide as possible without specifying any target frequency bands in order to provide the outmost flexibility to satisfy the mobile broadband spectrum demand.

3 SUMMARY OF SFCG-31 issues of interest to CGMS

3.1 SFCG preparation for WRC-12

One of the major objectives of the SFCG-31 meeting, dealt with in a dedicated Special Working Group, was to address the preparation of agreed positions preferred by SFCG member agencies for the forthcoming WRC-12 and future WRC's as reflected in the final revision of Resolution SF28-1R3.

The SFCG objectives for the agenda items of most relevance to the Meteorological Satellite Service (MetSat) and the Earth Exploration Satellite Service (EESS) are in line with the position of EUMETSAT as described in section 2 of this document.

Besides the positions for the WRC-12 agenda items of interest and concern to SFCG member agencies, which are in line with the interests of the meteorological and meteorological satellite interests, SFCG identified the following objectives as potential agenda items for WRC-15/16:

Identification of frequencies for EESS (Earth-to-space) allocations to be associated with existing EESS (space-to-Earth) allocations in the band 8 025-8 400 MHz

Background: Currently EESS satellites can only use the allocation at 2 025-2 110 MHz (Earth-to-space) for the satellite commanding, because no other suitable Earth-to-space allocations are available at higher frequencies. On the other hand, only very few EESS satellites can accommodate their payload data downlink in the band 2 200-2 290 MHz (space-to-Earth), because of the very limited bandwidth available there for this purpose. All this requires EESS satellites to be equipped with 2 transponders: one operating around 2 GHz for TT&C and the other operating at higher frequencies for downlinking medium/high rate payload data, typically in the band 8 025-8 400 MHz.

If a suitable EESS Earth-to-space allocation can be found near the EESS (space-to-Earth) band at 8 025-8 400 MHz, these two bands could be used in combination for both purposes (satellite control and payload data downlink).

Revision of RR No. 5.268 with a view to examining the possibility for removing the 5 km distance limitation and allowing space research service (space-to-space) use for proximity operations by space vehicles communicating with an orbiting manned space vehicles

This issue is not relevant for MetSat operators.

To consider an extension of the current worldwide allocation to the Earth exploration satellite service (EESS) (active) in the frequency band 9 300 – 9 900 MHz by at least 600 MHz within the frequency range 8 700 – 10 500 MHz

Background: Very high resolution mapping and monitoring is required for example by the following applications that stipulate a substantial socio-economic benefit

- disaster relief and humanitarian aid,
- safety of energy supply and
- cadastre.

Today's weather independent radar satellites that could provide timely services are too limited in their resolution. For the above-mentioned applications, given the object characteristics to be observed, a resolution of 50 cm or below is required. Satellite technology around 9-10 GHz is well suited to meet this need, provided that a transmission bandwidth of up to 1 200 MHz can be authorised for use. The Earth Exploration-Satellite Service (EESS) has an allocation in the frequency band 9 300 – 9 900 MHz. To enable transmissions at 1 200 MHz bandwidth, additional and contiguous 600 MHz would be required extending this current allocation.

3.2 Variable and Adaptive Coding and Modulation (VCM/ACM)

SFCG adopted a liaison statement to CCSDS on VCM/ACM techniques, in order to inform CCSDS about the interest of SFCG for VCM and ACM techniques and invite CCSDS to develop standards in support to these techniques.

3.3 Coordinated use of DCS systems (Resolution SFCG 30-1)

In order to ensure international recognition at the level of ITU-R of the basic general partitioning and sharing conditions for the band 401 – 403 MHz for future long-term coordinated use of Data Collection Systems (DCS) on geostationary and non-geostationary MetSat and EESS systems as contained in Resolution SFCG 30-1, SFCG member agencies agreed to the proposal from CNES to propose to develop a corresponding ITU-R Recommendation in the framework of the responsible ITU-R Working Party 7B. CNES will provide such an input to the September meeting of WP7B.

3.4 MetSat characteristics for new ITU-R Recommendation

CMA introduced a planned input document to the forthcoming meeting of Working Party 7B in September 2011 regarding the working document toward a Preliminary Draft New Recommendation ITU-R SA.[EES/MET CHAR], providing characteristics of CMA satellite systems to be used for assessing interference to systems operating in the Earth exploration-satellite and meteorological-satellite services and for conducting sharing studies.

NOAA and EUMETSAT announced at SFCG-31 similar inputs to the September 2011 meeting of Working Party 7B. However, in order to have a complete set of parameters of existing and planned MetSat systems (GSO and NGSO), inputs from further MetSat operators to this ITU-R Recommendation under development will be necessary.

3.5 Passive Sensor Filter Characteristics

Following the latest interference events to passive sensors (AMSR-E, JASON, SMOS), already at SFCG-30 it was agreed that compiling information on passive sensors filter characteristics would ease the task of SFCG members in future discussions pursuant to solving these interference cases with their national radiocommunication authorities.

The limited response to an action on SFCG members has proven the difficulty to get hold of the sensor filter characteristics from manufacturers due to their data policies or legal issues. Currently only characteristics for SMOS, MHS and AMSU (on Metop) and MWR (on ENVISAT) are available which is not sufficient to have a representative set of filter characteristics for the different frequency bands available for passive sensing.

Therefore, SFCG members were still invited (SFCG Action 31-6) to gather information related to their sensors. Since it appears that there are sometimes difficulties to get the measured filters characteristics from industry, it was agreed that in those cases at least filter design specification should be made available.

In a second step, after a representative amount of passive sensor filter characteristics is available, a possible simplified/standardised way of presenting the various characteristics could be envisaged.

3.6 1400-1427 MHz RFI

ESA provided an updated worldwide overview of the interference environment in the 1400-1427 MHz passive band as observed by SMOS mission.

SMOS satellite carries a single payload on board, MIRAS, a Microwave Imaging Radiometer with Aperture Synthesis, which operates within the Earth exploration-satellite service (EESS) passive band at 1400-1427 MHz. Since its launch in November 2009, SMOS images have been strongly impacted by radio frequency interference (RFI) either from out-of-band emissions mainly of radars operating in neighbouring frequency bands or from illegal transmissions within the passive band.

RFI jeopardizes part of SMOS scientific retrievals in certain areas of the world, especially over continental areas in Europe, Southern Asia and the Middle-East. Areas affected by RFI might experience data loss or underestimation of soil moisture and ocean salinity retrieval values. To alleviate this situation the SMOS team has put in place strategies that, one year after launch, have already improved the RFI situation, mainly over Europe where half of the sources have been successfully localized and switched off.

The SMOS RFI issue has led to the adoption of mandatory limits within CEPT (ECC/DEC(11)01) to protect the passive band 1400-1427 MHz in line with the recommended levels as adopted at WRC-07.

3.7 1695 – 1710 MHz band availability for mobile broadband systems in the US

WMO highlighted its concern about new practices in the US to share L-Band frequencies of 1695-1710 MHz between the current meteorological services and mobile broadband operators. This affects in particular the real-time collection of satellite sounding data mainly from polar orbiting systems for Numerical Weather Prediction models which relies extensively on L-Band frequencies. It is argued that proposals to share the L-Band will have an adverse affect on many more users than regulators expect.

WMO requested SFCG members to review the impact of such initiatives in their country and to alert their radiocommunication and frequency management authorities to the likely impact of such an approach to their own environmental services. Members should also consider other environmental services that will be impacted by such decisions, including some radiosonde stations, which already share the L-Band frequencies.

3.8 Complementary Ground Component (CGC) in L-band (LightSquared)

EUMETSAT raised the issue of the impact of large deployment of L-band CGC systems (40000 base stations) in the US on the operation of passive radio occultation satellite sensors like the GRAS instrument operating on the Metop satellites. This subject generated a very animated discussion that went beyond the sensors protection issue to cover also other areas that may be affected:

Radionavigation Satellite Systems (RNSS) usage for satellite navigation (incl. ISS),
RNSS usage for terrestrial MetAids,
"Classic " RNSS terrestrial usage at Earth stations,
Existing and future RNSS systems (GPS, Galileo, etc…),
Search and Rescue satellite Earth stations,
Other MSS systems using the L-band in a purely satellite-based configuration, including aeronautical AMSS or AMS(R)S receivers.

NOAA gave a short presentation about the status of the studies in the USA on compatibility between CGC in L-band and GPS terminals. Although the studies were still on-going at the time of SFCG-31, the presentation gave a clear picture of the sharing scenarios under consideration and of the expected deployment CGC scenarios in the USA.

The meeting stressed that the decision of allowing CGC implementation in certain bands has to be taken at ITU-R level and not at national level, since the decision may affect international services. SFCG member agencies were invited to discuss this issue with their administrations in order to express the need for proper ITU-R studies to be made.

Meanwhile the test campaign requested by the FCC was completed in June 2011 with the result that terrestrial and space based GPS receivers would experience unacceptable interference in all studied cases and no identified interference mitigation technique would change the situation except relocating LightSquared to another frequency band.

The decision of the FCC on how to proceed in the LightSquared case is still pending.

In 2009, an attempt was made by LightSquared in Europe (at that time this company was called SkyTerra) to get permission for the introduction of a CGC network in L-Band.

The issue was studied in the Spectrum Engineering Project Team 40 of the Spectrum Engineering Working Group (WGSE) of CEPT. This Project Team has been extensively studying the potential impact of MSS CGC systems deployed in L-band. The preliminary results were showing that CGC in L-band would have a serious impact on other MSS systems that are purely satellite-based. These studies, and those on the CGC impact on systems of adjacent services (RNSS, Search and Rescue, etc.), were put on hold at the end of 2009 on request by the L-band CGC proponents (SkyTerra). They were indeed waiting for outcomes of RTCA in the US on compatibility between CGC and AMS(R)S in order to provide firm characteristics of CGC necessary to conduct compatibility studies. RTCA, Inc. which functions as a Federal Advisory Committee, is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management.

It was expected that the studies within CEPT would start again once these characteristics are available (these all dates back to Sept 2009). However, nothing has been provided so far and consequently WGSE decided to close the related work item earlier this year.

The same occurred in ITU-R WP 4C (see US contribution 4C/568). In reality these parameters are available, since they were used in the US to conduct the compatibility studies between CGC and GPS completed in June 2011. It seems that LightSquared did not want to progress the issue in Europe or at ITU level to avoid having final conclusions on the sharing studies, as they would be negative, so LightSquared stopped their international initiatives.