

SWG-3 REPORT: Earth Exploration-Satellite and Meteorological Satellite Services

(Presented by R. Wolf and E. Marelli)

The work of Special Working Group-3 involved the following topics:

Passive Sensors Frequencies

Active Sensors Frequencies

Earth Exploration-Satellite and Meteorological Satellites Data Transmission Frequencies

Review of Actions from SFCG-17

Review of SFCG Recommendation and Resolutions

1 Passive sensors

1.1 Passive sensing > 71 GHz (WRC 2000 agenda item 1.16)

8 input documents were available on this subject.

NIVR (Dutch Radiocommunication Agency) presented document 9 entitled “Allocations in the range 71-275 GHz.” The work on WRC 2000 agenda item 1.16 (“to consider allocation of frequency bands above 71 GHz to the earth exploration-satellite (EES) (passive) and radio astronomy services...”) is being considered in the CEPT framework by the FM PT-33 Working Group. Document 9 reflects the preliminary output of this CEPT WG (although it is not yet an official CEPT document).

Mr. Van Diepenbeek explained the basic principles that have driven the work of the group and the resulting new proposed table of allocations. This table is meant to cover the EES (passive), space research (SR) (passive) and radio astronomy needs and to implement the consequential changes to the other services, with the objective to maintain the overall existing balance of allocated spectrum to each service. The current version of the table presents a net result close to this “balance” target .

Document 9 limits its analysis to 275 GHz, corresponding to the actual International Telecommunication Union (ITU) table limit, since this is recognized as the first priority.

The discussion that followed resulted in the following conclusions:

- There is a general agreement on the EES (passive) needs between 71 and 275 GHz among all SFCG members.
- The boundaries for the bands proposed shall be defined purely on the basis of the scientific requirements and therefore will be expressed, when needed, in fractions of

GHz (e.g. 174.8-191.8 GHz). In a second phase it is likely that these numbers will be rounded to simplify the structure of the ITU Table of Frequency Allocations.

- SFCG shall limit itself to support changes required by EES (passive) and SR (passive); this last one includes space based radio astronomy.
- SFCG shall not propose consequential changes elsewhere in the Table to reallocate other services displaced during this passive sensing reallocation exercise.
- Studies have shown that sharing between terrestrial active services and EES (passive) is not practical in a number of bands.
- Studies have shown that sharing in the bands 116-122.25 GHz and 174.8 to 191.8 GHz between EES (passive) and Inter-Satellite Service (ISS) is feasible only if the ISS is limited to satellites operating in geostationary orbits with suitable power flux density (pfd) limits.

EUMETSAT indicated that they are presently implementing operations of the Microwave Humidity Sounder (MHS) instrument using the frequency band 155.5-158.5 GHz and that it will be necessary to ensure the availability and protection of this primary allocation until the year 2018 by introduction of a corresponding footnote to the Radio Regulations.

It should be noted that the proposed reallocations offer the possibility of increasing the total available bandwidth to the active terrestrial services in the range 71-275 GHz.

On the basis of all the agreements above, Resolution 18-3-1 was created. It provides information on the scientific needs for the various passive bands and on how they can be satisfied. A table was annexed to the resolution to summarize the proposed changes and to provide further details on the rationale.

The European Space Agency (ESA) presented Document 10 (“EES Passive Sensing: Atmospheric Limb Sounding from 200 GHz to 506 GHz”) that provides detailed requirements for the bands needed for atmospheric chemistry limb sounding. The technical characteristics of the sensor under development by ESA were also provided in the document.

WMO presented Document 12 (Susceptibility of Microwave Limb Sounders to Interference Produced by Ground Terminals of Fixed Service) from METEO France that provides a preliminary assessment of the sharing scenario between fixed services and passive limb sounders operating in the frequency range 200-275 GHz. The conclusion is that co-frequency sharing may only be feasible under stringent conditions and therefore may not be practical.

The discussion that followed centered on the important difference in radiometric resolution requirements for limb sounding given in Documents 10 (0.1 K) and

12 (0.001 K). Since the current instruments provide an intrinsic noise level of 1 K, it was agreed that studies should not indicate requirements that exceed foreseeable future improvements of instruments. WMO agreed to revise the study for the next ITU Working Party (WP) 7C meeting, using a provisional value of 0.02 K to be reassessed in the future.

During the discussion the following aspects of the study were also clarified:

- The selection of the antenna pattern model is not very important since the interference analysis concentrates on the main beam interference.
- The atmospheric models used, although not the official ITU models, are accepted as valid in other ITU studies (e.g. for the 50-60 GHz reallocation studies).
- Even important changes in the radiometric resolution requirements are not likely to change the conclusions.

NASDA presented Document 27 rev. 1 (Space Station-borne Sub-millimeter Wave Limb Emission Spectrometer for Sounding Stratospheric Minor Constituents) that provides a description of the bands required for their atmospheric limb sounder (SMILES). The radiometric resolution requirements were also discussed.

NASDA presented Document 24 (Outline of Protection Criteria of Spectrum for Passive/Active Sensor and Data Transmission in Earth Observation) that provides a full table of protection requirements for passive and active sensors. This information will be used to update the relevant chapters of the WMO Handbook.

WMO presented the information Document 35 (Atmospheric Absorption in the Frequency Range 1-600 GHz) from METEO France.

NASA presented Document 41 (Response to Action Item “Passive Bands above 71 GHz) which provides a list of requirements for passive allocations. The list also extends above 275 GHz. For the range 71-275 GHz the list was cross-checked by Special Working Group-2 (SWG-2) against Document 9.

The resulting consolidated list of requirements is contained in RES 18-3-1 (attached).

For the passive sensing requirements above 275 GHz, it was agreed that further information is still needed before the SFCG can consolidate the requirements as was done for the range 71-275 GHz. Action item 18-3-2 was generated to collect this information. Documents 10, 24, 27 and 41 will be used as a starting point.

1.2 EESS (Passive) in the 18.6-18.8 GHz Band

NASDA presented document SF18-26 describing the characteristics and frequency requirements for AMSR instrument, stressing, in particular, the importance of data obtained in the 18.6-18.8 GHz channel.

Document SF18-37 from CNES was introduced by ESA. It reports on the results of a special ITU meeting between WP7C and WP4A held in July 1998. No significant progress was made on the issue. Proposals for reducing the range of pfd limit to be considered were ejected.

NASA announced that the results of new simulation studies will be available in time for next spring's (1999) meeting of WP7C. These results will permit the assessment of the absolute maximum limit that we can accept for the FSS pfd in the band and the impact on the percentage of data loss percentage. All participants stressed the importance of having these data as soon as possible in an attempt to remove the impasse. A draft Conference Preparatory Meeting (CPM) text will be proposed by NASA to WP 7C.

1.3 Upgrade of EESS (passive) in the 4.2-4.4 GHz Band

NASDA presented document SF18-25, Rev.1, which provides a sharing analysis between EESS (passive) and aeronautical radionavigation systems in the band 4.2-4.4 GHz. The document concludes that sharing is feasible. This conclusion is reflected in the relevant paragraph of RES 18-1-1.

1.4 Study of the Relative Scientific Properties of the Bands 31.3-31.8 GHz and 36-37 GHz for Passive Sensing

On the basis of documents 24 and 26 and of the indications by WMO representative, SWG-3 concluded that sufficient information had been collected to generate a recommendation on the subject. The new provisional Recommendation 18-3-1 explains how each band has a unique, distinguishable scientific purpose and therefore both allocations should be maintained. It also recommends that if, in the future, the 36-37 GHz band is reduced in size, the reduction should be accomplished by maintaining 36.5 GHz as the center frequency.

2 Active Sensors

2.1 Active Sensors around 5.3 GHz

CNES presented document 18-11 that identifies the need for a minimum of 320 MHz for space radio altimeters. The document also indicates that the extension to the current

allocation (5250 - 5460 MHz) should be in the upper end of the band (>5460 MHz) given the difficult sharing situation in the band 5150 - 5250 MHz. A revision of AI 17/18 was generated taking into account this new information (AI 18-3-4). The AI calls for sharing studies above 5460 MHz. A resolution was also generated to call for further studies and for promotion of this agenda item for a future conference (RES 18-3-2). SWG-3 identified also the practical problem encountered so far for these sharing studies: the need for parameters related to the radionavigation and maritime radionavigation systems that are supposed to operate in the range 5460 - 5650 MHz are not available.

The existence of such systems in the band was questioned. It was also noted that the addition of radiolocation services in part of this band should be added as an agenda item for the next WRC. It is therefore suggested to perform sharing studies also with systems of this service.

NASA presented Document 40 that provides a sharing analysis between wireless LAN and SAR's in the band 5250 – 5350 MHz. NASA indicated that the parameters used in the study may not be up to date and therefore the positive conclusion about sharing may need to be revised.

In fact, in the ESA document 45 important differences were identified with respect to the NASA hypotheses. These new values are based on parameters provided in Europe by the wireless LAN (Hiperlan) technical experts themselves and therefore have a high degree of reliability. In particular the following parameters need to be modified:

- Maximum output power from –6 dBW to 0 dBW
- Active/passive duty cycle from 1% to 5%
- Outdoor use from 1% to 15%

Clarifications on the maximum antenna gain of the wireless LANs are still needed.

In addition the Hiperlan system density of a typical office building is estimated to be 1200 systems. This very high density is still well below the self-limiting density intrinsic to the system design, thanks in particular to the channel hopping technique adopted. The European Hiperlan experts give a minimum requirement of 14 x 23.5 MHz channels. This translates into a band requirement of 330 MHz total. For this reason CEPT is investigating the allocation possibility in the entire C-band region and not only in the 5250 – 5350 MHz band.

Resolution 18-3-2 was therefore modified by SWG-3 to cover not only the request for studies to extend the current EESS (active) allocation in C-band, but also to request studies on the sharing situation in the currently allocated bands, based on the new parameters available.

Action Item 17-9 was reissued as AI 18-3-3 with some modifications. SWG-3 expressed also the wish to raise at the SFCG Plenary level the problem created by the practice of Administrations to authorize the use of “unlicensed” (i.e. non-licensed) systems in bands

where EESS sensing takes place. Steps at the ITU level are needed to solve this serious problem.

2.2 Wind profilers

NASDA presented Document 28 that proposes some editing of Resolution 15-5R1 to take into account the WRC-97 results. In addition the document provides an annex giving a description of a Japanese wind profiler operating in the range 1300-1375 MHz.

SWG 3 agreed to edit this resolution, but not to add the annex to the resolution itself.

2.3 P-band SAR.

In the absence of any specific input documents, Resolution 15-6R2 was edited to take into account the WRC-97 results.

2.4 Active sensors, general.

CNES presented Document 36 that invites SFCG member agencies to study the needs for allocations above 71 GHz to EESS (active) based on long-term projections. AI 18-3-1 was generated to respond to this request. If needs are identified, member agencies shall promote the introduction of this item on the agenda of a future Conference.

NASA presented Document 43 that represents a draft version of the WMO Handbook chapter discussing the frequency requirements for active sensing. The document was accepted and will be submitted to WP 7C next spring. A preliminary final version will be available for further comments early next year.

Resolution 13-2R4 was proposed for deletion since all the listed bands have either received the required upgrade at WRC-97, are no longer of interest, or are the subject of specific resolutions.

3 Earth Exploration and Meteorological Satellites Data Services

Document 29

The SFCG representative to CEOS, Dr. Maeda from NASDA, presented his report related to CEOS activities. The 11th CEOS plenary took place at CNES, Toulouse, France on 19 to 24 November 1997. The SFCG relation with CEOS was reviewed and accepted. A resolution related to the importance of frequency allocations for EESS was drafted and several actions were distributed to CEOS members. The SFCG representative provided a

report on WRC-97 results and an outlook to WRC-00 to the CEOS plenary. Dr. Maeda will also participate in the next CEOS plenary in Bangalore, India (10-12 November 98) and will represent the SFCG at this meeting.

Document 3

EUMETSAT presented the results of a study on “Sharing Considerations regarding the Meteorological Satellite Service and the Mobile Satellite Service in the band 1698 – 1710 MHz.” This study, which was also distributed and discussed at ITU WP 7C and 8D, is related to aspects of time sharing between these services. The study clearly indicated, due to the many operational problems, the very limited feasibility of sharing and the impossibility of performing such time-shared operation. The SFCG was informed that a corresponding revision of ITU-R Recommendation SA. 1158 was forwarded to the next session of WPs 7C and 8D. NOAA informed the meeting that there will be an input document provided to these working parties which indicates that sharing in the 1675 – 1690 MHz band is not feasible due to the operations of Met Aides and geostationary (GSO) satellite direct read-out stations in this band.

REC 17-1

NOAA provided new information parameters required for calculating the coordination distance around an earth station operating in the EESS and Met SS with GSO or non-GSO space stations. These new parameters were approved at WP 7C and have been used to update Rec.17-1.

4 Review of Actions from SFCG-17

AI 17/8 : EESS sharing considerations for spaceborne active sensors in the 5 GHz band.

Status : On-going action. Revised contents on the basis of Document 11 (new AI established)

AI 17/9 : Sharing between EESS (active) and wireless LAN. Information provided on new systems.

Status : On-going action. Revised contents on the basis of Document 45 (new AI established).

AI 17/10 : Collection of requirements for EESS (passive) above 100 GHz.

Status : Closed. (Note : A new action item established to collect EES (passive) requirements above 275 GHz)

AI 17/11 : Collection of requirements for EESS (active) sensor protection

Status : Closed. Inputs prepared for the relevant chapter of the WMO Handbook.

AI 17/13 : Study of the relative scientific properties of the bands 31.3-31.8 GHz and 36-37 GHz for passive sensing.

Status : Closed. Provisional recommendation 18-3-1 generated as a result of the action.