CGMS-XIX-USA WP-27
Prepared by USA
Agenda Item: I/1
To be discussed in WG-1

SUMMARY OF THE 2000 SPACE FREQUENCY COORDINATION MEETING

Summary and Purpose of Document

This document summarizes the 2000 Space Frequency Coordination Group meeting held in Palm Cove, Australia, November 7-16, 2000. Discussed are areas that directly affect frequencies used by meteorological satellites.

Action Proposed: None

2000 Space Frequency Coordination Group Meeting

Overview:

The Commonwealth Scientific and Industrial Research Organization sponsored the twentieth meeting of the Space Frequency Coordination Group (SFCG-20) held at Palm Cove, Australia from 7-16 November 2000. Delegates from 14 countries met to discuss topics related to the allocation of radio frequencies for space activities. Of primary concern to NOAA is the use of frequencies for passive remote sensing and for transmission/receipt of telemetry, command and data to/from metsats.

The focus of SFCG 20 concerned the outcome of the World Radiocommunication Conference (WRC) that convened during May 2000 in Istanbul, Turkey as well as items concerning metsats found on the agenda for the next WRC scheduled for 2003 (see EUM-WP-13 for a summary of preparations for WRC-03). Other areas of interest to metsat operators include protection of passive sensing bands and use of communication links.

The attached report of Special Working Group 3 (SWG-3) from SFCG-20 summarizes the activities related to the Earth-exploration satellite service (EESS) and the meteorological satellite service (Metsats). Sections 8.3.2 (passive sensors) and 8.3.3 (EESS and metsat services) present the primary frequency management activities relevant to metsats.

Attachment: SFCG-20 SWG-3 Report

Summary of 2000 Space Frequency Coordination Group (SFCG)
Activities Related to Meteorological Satellites

8.3 Report of SWG-3: Earth-Exploration Satellites (EES) and Meteorological Satellites (Metsats)

The work of SWG-3 involved the following main topics:

- Active sensors
- Passive sensors
- EES and Metsat services
- Other information documents
- Review of actions from SFCG-19
- Review of SFCG Recommendations and Resolutions

A joint session was held with SWG-4 to discuss use of the 8 GHz band.

8.3.1 Active sensors

8.3.1.1 Allocations around 5.3 GHz

Several documents were presented to SWG-3 on the World Radiocommuinication Conference for 2003 (WRC-03) agenda item 1.5 (allocations around 5.3 GHz). NASA/JPL submitted documents SF 20-10/D, 12/D and 13/D. Document 10 discussed the potential interference from UN-II devices to synthetic aperture radars (SARs) in the band 5250-5350 GHz. The results indicated that a single outdoor transmitter would interfere with the SAR, unless it is of the type UN-113 (highly directional). In the discussion it was clarified that the signal reflection aspects were not taken into account in the analysis. This could also limit the compatibility of UN-113, for which the presence of multiple systems in the SAR footprint needs to be taken into account.

NASA earlier submitted document 12 to Working Party (WP) 7C in January. It presents a sharing analysis between SARs and various RLAN systems. The results of this study were already used by WP 7C to update the relevant Preliminary Draft New Recommendation (PDNR). The basic conclusion is that outdoor use of Radio Local Area Networks (RLANs) is incompatible with SARs.

Document 13 covered a sharing study between SARs and fixed wireless access (FWA) systems. The result indicates that a single FWA transmitter would leave only a 6 dB margin with respect to the SAR interference level. In the discussion which followed, it was noted that the polarization loss should not be counted as a mitigating factor and therefore, only 3 dB are left as margin. In other words, no more than 2 FWA transmitters could be active within a 100-sq. km. SAR footprint. SWG-3 unanimously agreed that sharing was not feasible under these conditions.

ESA presented document SF20-19/I, which provided an update on the regulatory situation for Hiperlan systems in Europe. It indicated that:

- Hiperlan 1 will not be deployed in EESS (active) bands

- In the band 5250-5350 MHz, Hiperlan 2 will have characteristics similar to the one requested in the WP 7C PDNR to achieve compatibility with EESS (active)
- In the band 5470-5570 MHz, Hiperlan 2 is planned to be deployed outdoors and with less stringent e.i.r.p. limits
- The interconnectio§ns among Hiperlan cells (Hiperlink) and to external remote networks (Hiperaccess) will not use the 5 GHz band, but other FS bands not shared with scientific services

ESA also presented document SF 20-20/D. The document is an attempt to present all the aspects of WRC-03 agenda item 1.5 related to EESS and to indicate the options available for each of them, with advantages and disadvantages. The document requested SFCG to choose a common position on all these issues. A long and complex discussion followed, leading to the following preliminary common positions:

- Support regulatory actions imposing the restrictions indicated in the relevant WP 7C PDNR (indoor use only, 200 mW max eirp, TPC and DFS) to RLANs to be operated in the bands 5250-5350 MHz and 5470-5570 MHz
- Oppose the allocation to FWA in the band 5250-5350 MHz in Region 3 unless studies show that compatibility exists
- If the characteristics of the radiolocation systems operating in the band 5350-5650 MHz will be similar to the systems already sharing with EESS (active) in the band 5250-5350 MHz, then SFCG should agree with the radiolocation service upgrade to primary in the band 5350-5650 MHz, but request at the same time the suppression of the footnotes S5.448A and S5.448B

Resolution 18-4R1 was reviewed on the basis of the above conclusions. SWG-3 also identified the studies required to complete the analysis. A new action item was defined to request the execution of these studies. CNES introduced document SF 20-44/I. The document proposes to SFCG to support the idea of providing an extension of the EESS (active) allocation from 5140 MHz to 5250 MHz, limited to altimeters only. This appears to be compatible with existing services currently allocated in the band and would permit a better regulatory framework to the sensor used by the Topex-Poseidon mission, already operating in the band 5140-5460 MHz. Caution was expressed by other space agencies in the discussion that followed, based on the fact that this element is not included in the agenda item and could further complicate the global picture. Nevertheless it was agreed to include this idea in the SFCG Resolution 18-4R1, with the agreement of reviewing it at the next SFCG meeting.

8.3.1.2 EESS (active) in the band 35.5-35.6 GHz

NASDA submitted document SF20-26/D indicating that the sharing between precipitation radars of the latest generation (to be used on TRMM follow-on missions) and radiolocation radars in the band 35.5-35.6 GHz is feasible. The simulation results show that the duration of possible interference events would be well below the radiolocation radars interference threshold. Consequently the current restrictions given by footnote S5.551A should be removed. SWG-3 agreed with the conclusions of the paper. ESA and NASA suggested complementing the information in the paper by adding the number of occurrences of interference events in the form of a histogram spanning a simulation of several days. This would be in line with the request made by WP 8B for similar sharing studies.

SWG-3 also decided to change the NASDA request for a specific SFCG resolution on this subject (NASDA document SF 20-25 Annex 1) into an input for SWG-1 for insertion into the SFCG objectives for WRC-03. This input proposes to support the suppression of footnote S5.551A.

8.3.1.3 Active sensors above 100 GHz

Document SF 20-45/I was presented by CNES. The document suggests an updating of Res. 19-6 to take into account the allocations given to the EESS (active) service above 100 GHz at the WRC-00. After some clarifications were given and some editorial changes were made to the proposed revision, the revised resolution was forwarded to the SFCG plenary.

8.3.1.4 Out-of-band emission mask for EESS (active) sensors

NASA/JPL presented document SF20-11/D on out-of-band (OOB) emission masks for active sensor transmitters. This document was already adopted by WP 7C in August as its input to Task Group (TG) 1/5 on the subject. The document proposes to adopt for EESS (active) the same masks proposed for generic primary radars. As for primary radars, the difficulty has been identified in the definition of a single boundary between the OOB emission region and the spurious emission region.

8.3.2 Passive sensors

8.3.2.1 Revision of ITU-R Recs. on EESS (passive) sensors

NASA presented document SF 20-17/D. The document provides information on parameters to be used for the revision of parts of International Telecommunication Union-Radiocommunication Bureau (ITU-R) recommendations SA.515, SA.1028 and SA.1029. On the same subject, NOAA presented document SF 20-34R1/D, suggesting a methodology to be implemented in the revision of these recommendations. More than on the documents themselves, the discussion concentrated on the work still needed for the completion of the revision exercise and on the support that SFCG member agencies should give to complete this exercise within WP 7C. The following was agreed on the structure of the various tables in the 3 recommendations.

In Rec. 515, oriented to the scientific needs only:
1st column: central frequency
2nd column: required bandwidth
3rd column: allocated bandwidth
4th and 5th columns: same as now
Only the required bands should be listed (independently of the allocation status).

In Rec. 1028:
1st and 2nd columns: same as in Rec. 515
3rd column: system temperature, Ts
4th column : integration time, t
5th column: ΔTe

In Rec. 1029:
1st column: same as in Rec. 515
2nd column: reference bandwidth

3rd column : ΔTe
4th column: resulting interference level
5th column: data availability

An attempt was made to start this revision exercise through a small working group, but the results were limited to the definition of the new action item describing in detail the steps to follow to arrive to the next WP 7C as well as all the required information.

8.3.2.2 Passive sensors allocations above 275 GHz

NASDA submitted document SF 20-25/D Annex 4. The annex proposed a new resolution calling for support of the introduction in the WRC-06 agenda of the item "allocations above 275 GHz". Considerable discussion followed this document. Some agencies questioned the fact that already there seems to be a need of changing the bands identified in footnote S5.565. NASDA clarified that this was not the case. Doubts were expressed about the advantages of expanding the allocation table above 275 GHz also to active services, as currently the footnote only identifies passive bands.

8.3.2.3 Sharing in the 60 GHz range

CNES document SF 20-46/1 aims to give information on the improved radiometric resolution achievable in the 60 GHz range. These improved values would still provide protection levels that are compatible with the current FS constraints in the shared band 55.78-56.26 GHz.

CSA commented that the simple technical feasibility of achieving higher resolution should not be the criterion for setting the instrument requirements; only the scientific requirements should be used. CNES agreed on the point and clarified that in fact the technical improvements are needed to achieve the better scientific performance required by the user community. The document will be submitted to WP 7C with clearer scientific justifications for the improved sensitivity.

8.3.2.4 Mobile Satellite Service (MSS) feeder links allocation near 1.4 GHz

ESA presented document SF20-2/D, an analysis of the interference that EESS (passive) sensors operating in the range 1.4-1.427 GHz could receive from out-of-band emissions of MSS feeder links for which allocations are proposed in nearby bands for WRC-03. The study used the parameters derived from ESA mission SMOS to characterize the EESS (passive) sensor. The study considered three possible orbital altitudes for the MSS satellites.

The results indicate that the proposed uplink for MSS in the band 1390-1393 MHz would require an attenuation of at least 80 dB for the out-of-band emissions of those feeder links. This is seen as difficult to achieve and surely far from the normal characteristics of these systems. It is to be considered that the preliminary draft new recommendation under preparation by SG 1 for out-of-band emission masks foresees an attenuation in the order of 35 dB for this kind of system, 45 dB away from the one required in this case. Higher altitude MSS satellites would further deteriorate the sharing scenario.

For the proposed downlink MSS allocation in the band 1439-1442 MHz, the interference levels appear to be satisfied, even if only by a few dB. MSS orbits lower than 1000 km or a relaxation of the MSS PFD limits as requested by the MSS community, would not satisfy the passive sensor interference criteria. In the discussion that followed, it was pointed out that the relatively low directivity of the

SMOS antenna could be not fully representative of other similar missions. The expected higher directivity (-20 dB higher) would worsen the sharing situation for main beam-to-main beam coupling. The value used in the study for the MSS receiving antenna on the spacecraft was questioned by CSA. ESA will further verify these points before submitting this paper to WP 7C and WP 8D. An action item was created requesting that member agencies provide information on other sensors under development to operate in this band and to also provide any additional information available on MSS systems characteristics. NASA also suggested to send the study to the newly created TG 1/7, which is in charge of studying the problem of protecting passive systems from out-of-band emissions. It was also agreed that agencies should perform simulation studies to analyze the percentage of data that would be lost because of this interference. Specific text was forwarded to SWG-1 for use in RES18-1 R1 (SFCG objectives).

8.3.2.5 Sharing criteria in the band 36-37 GHz

NASDA presented document SF 20-27/D, containing a work plan for performing sharing studies between EESS (passive) sensors operating in the band 36-37 GHz and the other allocated services (fixed (FS) and mobile (MS)) operating in the band. Information on the FS and MS characteristics to be used has already been requested by WP 7C from WP 9D and 8A. NASDA requested from the other SFCG agencies information about the scattering model to be used at this frequency and about the characteristics of other sensors similar to AMSR operating in the band. An action item was established to collect this information.

In the discussion that followed the NASDA presentation, NASA indicated that the mobile service is not currently using the band 36-37 GHz. Dr. Rochard from WMO indicated that he will be attending a special meeting in the UK discussing transfer models. There he will be able to obtain the requested scattering model information.

With respect to annex 2 of NASDA document SF 20-25/D, here too it was agreed not to generate a new dedicated resolution but to include all the necessary information in the text to be forwarded to SWG-1 for inclusion in Resolution 18-1R1 (SFCG objectives).

8.3.2.6 High Altitude Platform Systems (HAPS) allocation near 31 GHz

EUMETSAT introduced document SF 20-3/D, containing the compatibility analysis between EESS (passive) sensors operating in the band 31.3-31.5GHz and the out-of-band emission of HAPS for which an allocation is proposed for WRC-03 in the adjacent band 31-31.3 GHz. The study was based on a range of possible technical characteristics for HAPS and concluded that an out-of-band attenuation ranging from 92 to 114 dB would be required for HAPS systems to be compatible with EESS (passive). Given the typical values considered in TG 1/5 for these systems (35-50 dB) these results appear impossible to be reached, even with a significant amount of guard band. EUMETSAT also indicated that, based on this study, WP 4-9S is developing draft Conference Preparatory Meeting (CPM) text that suggests regulatory measures to limit the power out-of-band power density to values compatible with the EESS (passive) protection criteria. In the discussion that followed it was clarified that the study is based on the hypothesis of a fully deployed HAPS system with 400 channels. It was also noted that, despite the fact that the revised version of ITU-R Rec. SA.1029 is likely to contain more stringent protection criteria for the 31.3-31.5 GHz band, only the values in the currently applicable version of it can be used in the sharing studies. Specific text was forwarded to SWG-1 for inclusion in Resolution 18-1R1 (SFCG objectives).

On the same subject, WMO introduced document SF 20-47/1 on behalf of CNES. The document stresses the importance of the 31 GHz band for use as a calibrating window for oxygen measurements made around 60 GHz.

8.3.3 EESS and Meteorological satellites services

Document SF20-24 (Sharing of the 1683-1690 MHz Frequency Band between Geostationary Meteorological Satellite Earth Stations in the Meteorological Satellite Service and Mobile Satellite Earth Stations in the Mobile Satellite Service) was presented by CSIRO. It contains a preliminary examination of the possible impact on the Meteorological Satellite Service of a resolution made at WRC 2000 resulting from proposals at that conference for a new worldwide allocation to the Mobile Satellite Service in the 1683-1690 MHz band, currently used operationally for data dissemination transmissions by geostationary satellites in the Meteorological Satellite Service. WRC 2000 Resolution 227 calls for further studies on the feasibility of sharing between the Mobile Satellite and Meteorological Satellite Services in the band 1683-1690 MHz.

The document examines the feasibility of co-frequency sharing between these two services in Australia by ensuring adequate spatial separation between meteorological satellite receiving Earth stations and mobile subscriber Earth terminals based on the application of the theory described in ITU-R Recommendations SA.1160-2, SA.1022-1, SA.1158-2, P.526 and, importantly, ITU Radio Regulations Appendix S7. Its considerations relate specifically to GMS and Feng Yun-2 S-VISSR as well as future MTSAT HiRID reception in Australia.

Contrary to the predictions of coordination distances of 50 to 70 km made by Recommendation SA 1158 which are based mainly on free space and smooth Earth diffraction losses for main stations in shielded areas such as valleys, calculations based on the application of ITU-RR Appendix S7 which models probabilistic atmospheric ducting and tropospheric scatter propagation result in coordination distances of the order of 200 to 400 km. The conclusion is therefore drawn that sharing between LEO MSS Earth station mobile transmitters and geostationary meteorological satellite Earth stations receiving S-VISSR transmissions would be difficult to implement in practice.

It was agreed that this subject should be examined further and brought to the attention of ITU Working Parties 8D and 7C. A corresponding action item was issued.

During discussions related to GVAR and S-VISSR stations, the rapporteur from CGMS informed the group that CGMS has modified their band segmentation policy in order to recognize the continuous operations of GVAR and S-VISSR data dissemination from geostationary meteorological satellites. MetSat operators have indicated that these data dissemination services will be continued for at least the next 20 years. The original CGMS band segmentation, adopted by ITU-R and included in Resolution SA.1158, needs to be modified to reflect this new situation. An action item was issued to invite studies to support activities in ITU WP7C and 8D. Furthermore, existing studies shall be revisited and updated. REC 11-1R2 was modified in accordance with the new CGMS segmentation policy.

The CGMS rapporteur has informed the group on the envisaged use of the band 7750-7850 MHz by MetSat operators. It has been demonstrated that individual missions have bandwidth requirements exceeding 50 MHz. Considering that there is a total bandwidth of 100 MHz available, it is obvious that frequency separation is not feasible as means of interference avoidance. It was concluded that operations scenarios have to be agreed between the operators assuring that no interference occurs. It

was especially concluded that, in case of conflict, direct broadcast services in this band have to be interrupted during passes of main CDA stations for reception of globally stored data.

Resolution Res 19-7 was modified to reflect this situation.

8.3.4 Space Based Radio astronomy

Doc SF20-6 addressed the unclear definition of space-based radio astronomy (RA) in the ITU Radio regulations and contained a proposal for a new resolution to consider the term Space Research Service (SRS) to be applicable to systems used for research and exploration of celestial targets. It basically aimed at considering all SRS (passive) allocations to be potentially available to space-based radio astronomy.

During following discussions it was pointed out that this subject was discussed at WRC 1997 and that the plenary minutes clarified that RA is not restricted to terrestrial applications. It was further pointed out that a specific definition for space-based RA would encompass the danger that at the beginning there would be no allocations for this service available and that these would have to be implemented in a future competent WRC. In view of this it was decided not to consider a new resolution but modify the existing resolution 15-2.

Doc SF20-7 contained a proposal for co-allocation of all SRS (passive) bands with RA bands. It was noted that approximately half of the SRS (passive) bands are already co-allocated with RA.

Concerns were raised during the discussion regarding the necessity to co-allocate all bands, in particular, in view of different protection requirements for the two services. It was decided that this proposal would require further study on a band-by-band basis and a corresponding action item was established.

8.3.5 Other information documents

Doc SF20-39 was presented by Russian Space Agency. The document contained information on the use of radio frequencies by spacecraft developed at the Khrunichev Space Center for programs in the EES and SR services. The project makes use of small spacecraft using the generic space bus "Yacht" and launchers of the "Rokot" and "Angara-1" types. A list of frequencies to be used for these applications was attached to the document. Data transmissions of the Earth Observation mission are planned in the band 8025- 8400 MHz. The mission-related frequency bands are 7650 - 7750 MHz and 8500 - 8750 MHz.

Doc SF20-33 presented the results of the CEOS-13 meeting, which was hosted by EUMETSAT in association with the Swedish National Space Board. Dr. Maeda (NASDA) presented the SFCG objectives to CEOS. Resolution (CEOS/13/Doc/08/Res 4) was accepted, noting the SFCG report. It was decided to support SFCG positions, in particular, the worldwide primary allocation for space borne passive sensors using 18.6 - 18.8 GHz, the re-allocation of bands above 71 GHz and allocations above 200 GHz. Several agenda items for WRC 2003 were proposed.

It was noted that two further CEOS meetings, i.e. CEOS 14 and 15, will take place before the SFCG-21. CEOS 14 is scheduled for 8-9 November in Brazil (INPE) and CEOS 15 will take place in Japan in 2001. CEOS expressed their interest in a closer relationship with SFCG and requested Dr. Maeda to act as rapporteur.

Joint SWG-3/SWG-4 session on the use of the 8-GHz band

A joint session of SWG-3 and SWG-4 on the use of the band 8025 - 8400 MHz was conducted. The chairman of SWG-4 presented a summary of discussions in his group on this subject. The action item and the liaison statement to CCSDS as drafted in SWG 4 were confirmed by SWG-3.

8.3.6 Review of Action Items from SFCG-19

Al 19/8 No inputs received on the future use of 8025-8400 MHz and 25.5-27 GHz by the EESS. Action renewed by SWG 4.

Al 19/9 Registration of EESS/SRS active and passive sensor systems in the ITU. Procedure was implemented and announced by Circular Letter. Action closed.

Al 19/10 Action reissued as Al 20/6, to complete the collection of the missing elements for the preparation to the revision in the frame of WP 7C of the three ITU recommendations dealing with EESS passive sensor bands requirements, performance criteria and interference criteria.

Al 19/11 Action closed, but a new action item Al 20/5 has been established to cover the required sharing studies associated to the additional sharing scenarios introduced in the 5.3 GHz range by the rather complex WRC-03 agenda item 1.5

8.3.7 Review of SFCG Recommendations and Resolutions

RES 15-2R2 Resolution was modified to reflect that bands allocated to the Radio Astronomy Service can also be used by space-based radio astronomy.

RES 18-4R1 Resolution heavily revised to take into account the many sharing scenarios to be studied under WRC-03 agenda item 1.5. The resolution indicates the agreed common position on the various issues related to the allocations around 5.3 GHz and the studies to be completed.

RES 19-6 Resolution revised to take into account the results achieved at WRC-2000 in the field of EESS (active) allocations >100 GHz.

RES 19-7 Resolution was modified to invite users in the band 7750 – 7850 MHz to implement operating schemes to avoid interference between the services. In particular, the resolution stresses that direct broadcasts have to be interrupted in case of conflicts around major CDA stations for downlinks of stored sensor data.

REC 11-1R1 The recommendation defines separation of sub-bands to various modes of operations in the Meteorological Satellite Service. The recommendation was modified to reflect the existence of GVAR and S-VISSR reception stations operated in the reception area of GMS, GOES and FY satellite systems.

The Plenary adopted the proposed modifications to RESs and RECs with minor editorials.