CGMS-XXVIII
USA WP-16
Agenda Item: I.1

SUMMARY
OF
THE 1999 SPACE FREQUENCY COORDINATION MEETING

Summary and Purpose of Document

This document summarizes the 1999 Space Frequency Coordination Group Meeting held in Noordwijk, Netherlands, September 8-15, 1999. Discussed are areas that directly affect frequencies used by meteorological satellites.

Action Proposed: None

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Summary of Space Frequency Coordination Group 1999 Meeting Special Working Group (SWG) on Earth Exploration and Meteorological Satellites

This document provides a summary of the Special Working Group 3 (SWG-3) of the Space Frequency Coordination Group (SFCG) 1999 activities. The summary emphasizes the use of frequencies by active and passive sensors, telecommunication links and notification of satellite systems with the International Telecommunication Union (ITU).

Presentation of Input Documents

A.1 Active sensors

A.1.1 Active sensors above 100 GHz

NASA/JPL presented information indicating the usefulness of cloud radar measurements above 100 GHz (around 200 GHz), to achieve complementary information to the 94 GHz channel when cloud reflectivity is in the range of –40 dBz (thin clouds). ESA added information about requirements for radar altimeter measurements around 130 GHz when horizontal resolutions of the order of 1 km are required (the current systems give ~20-km resolution). Both agencies stressed the fact that new technology not available previously is now making active sensing above 100 GHz possible.

On the basis of the above presentations, SWG-3 drafted a new resolution asking member agencies to urge their administrations to consider the possibility to insert, under the World Radiocommunication Conference 2000 (WRC-00) agenda item 1.1.6, an allocation of 500 MHz in the range 126-134 GHz and 100 MHz in the range 195-240 GHz to EESS (active). This allocation could be coupled with Radiolocation/Radionavigation allocations, since the services are known to be compatible.

A.1.2 Active sensors around 5 GHz

NASA/JPL submitted a sharing study showing that the technical parameters recently provided by wireless Local Area Networks (LAN) producers would not allow sharing with Synthetic Aperture Radars (SARs) in the 5250-5350 MHz band. The most critical element appears to be the outdoor use of these systems, where no building attenuation is available.

ESA provided the current draft European decision on the general issue of the introduction of wireless LANs in the 5 GHz area. For the band 5250-5350 MHz, Europe will limit wireless LANs to indoor use and 200 milliwatts peak power, plus other operational limitations. This appears to give a much more favorable sharing condition for our SARs than the current Federal Communications Commission ruling. On the basis of the above, the use of outdoor Wireless LAN equipment is seen as a potential serious problem for the operation of C-band SARs.

SWG-3 revised an existing resolution to indicate that studies have shown that many types of outdoor wireless LANs will generate interference to SARs and therefore member agencies should favor national legislation that prevents such outdoor use. This should be opposed, in particular, where it is oriented to provide fixed links for data exchange at medium/long distances as opposed to the original wireless LAN concept for short-range mobile office connections.

A.1.3 Sharing between L-band SARs and space-to-space RNSS.

NASA/JPL submitted a sharing study that demonstrates the feasibility of sharing between L-band SARs and space-to-space Radio Navigation Satellite Service in the band 1215-1260 MHz. The study covers all the 3 navigation systems (GPS, GLONASS, Galileo). The margins for the protection of both services appear very large. Tests on GPS receivers also gave a practical demonstration of the tolerance of these receivers to the typical interference signals from the SAR systems.

A.2 Passive sensors

A.2.1 18 GHz

NASA submitted a paper that gives the U.S. position on this WRC-00 agenda item. This position has also been endorsed by Europe. ESA gave a verbal report of the latest European evolution. In general it can be said that there is an “unofficial” convergence of the Europe position in the direction of the American (and SFCG) position, but “officially” the distance has not changed (6 dB in the pfd limit for the FSS and 3 dB in the transmitter output power for the Fixed Service). The risk to be avoided is that the limits proposed by the EESS community are mistakenly considered as a starting point for negotiation when, in fact, they are the minimum constraints required for meaningful operation of the EESS sensors.

The rather strong unfavorable position taken by the Japanese administration is also considered a negative element in the search for a solution. ESA also expressed concerns that nothing in the ITU regulations can prevent non-geostationary orbit (NGSO) Fixed Satellite Service (FSS) to use this band as well, even if the two known NGSO FSS systems do not intend to use it. After some debate it was concluded that it was advisable not to discuss this issue for now, since such discussions could further complicate the path to an agreement.

A.2.2 Revision of ITU-Radiocommunication Bureau (ITU-R) Recs SA.515-3, SA.1028-1 and SA.1029-1

ESA submitted 3 documents proposing draft revisions of the 3 ITU Recs associated with the passive sensors characterisation and protection (ITU-R Recs SA.515-3, SA.1028-1 and SA.1029-1). The revision, initially aimed simply at updating the list of frequency bands required for sensors above 71 GHz requires, in reality, a major rewrite, given the fact that the data contained in the current version of the 3 recommendations are out of date. Even the parameter definitions, as currently defined, appear to require some rethinking, in particular, because of the introduction of multi-channel atmospheric sounders in the higher frequency bands.

After a long discussion the following was agreed:

- The 3 Recs need extensive revision; a long process, but one which must be started now.
- Rec 515-3 shall only address the frequency bands required for EESS passive sensing and the purpose of each band. It should not address the performance requirements. Therefore, Annex 2 and its table (in Rec 515-3) should be moved to Rec 1028-1.
- All required bands and bandwidths should be listed in Rec. 515-3, not only those that have an allocation in the ITU tables.
- An action item requests all SFCG member agencies provide the necessary up-to-date information to fill the modified recommendations as detailed below.
- The required information for each element of table 1 in Rec 515-3 is: frequency, necessary bandwidth (the upper and lower limits in case of multichannel sounders), the type of measurement of the sensor (nadir, limb, both, others), and the physical parameters to be measured.
- The required information for each element of the table in Rec 1028-1 is: radiometric resolution, system noise temperature, spectral resolution (per individual channel), integration time, spatial resolution (i.e. pixel size).
- The required information for each element of the table in Rec 1029-1 is: data availability required (in %), permissible interference level and reference bandwidth (this last should, in principle, coincide with the spectral resolution).
- Where needed, a range of values can be given for certain parameters related to a given frequency, if they differ from sensor to sensor. The most demanding value will be used to calculate the permissible interference level.

A.2.3 Passive sensing above 71 GHz

Several documents were submitted on the subject :

- NASA presented the current U.S. position on this WRC-00 agenda item.

- NIVR presented the current Europe position on this agenda item. Particular relevance was given to two proposed new European resolutions in this document: one calls for ITU sharing studies between terrrestrial active services and EESS (passive) in some bands that will be proposed for now without allocation to these active services at WRC 2000; the other calls for ITU sharing studies between various active services. Both resolutions indicate that these studies will be possible only when the technical and operational characteristics of the active services will be known.

- NASA presented a study comparing the atmospheric attenuation for the bands currently allocated to FSS (space-to-Earth) versus the new bands proposed for this service in the U.S. proposal. This very useful document will also be submitted to the Conference Preparatory Meeting (CPM).

- NASA provided a list of bands required for EESS passive sensing above 275 GHz.

- NASDA presented the requirements for ground based passive sensing above 200 GHz.

- NASDA presented, *inter alia*, a proposal for inserting under WRC-00 Agenda item 1.16 a number of allocations to Radiolocation (passive), to provide for ground-based passive sensing.

The discussion in SWG-3 concentrated mainly on the first two documents. The group was pleased to note the very high degree of commonality between the European and the US proposals, with only minor discrepancies. By using a summary table to highlight these discrepancies, all the differences were discussed and the following agreements were reached at SFCG level (to be reported to the relevant administrations) :

- The secondary allocation to Space Research (SR) in the band 81-84 GHz should become a bidirectional allocation to allow also deep space uplink for space-based radioastronomy.

- The bands 100-102 GHz, 200-209 GHz and 235-238 GHz should not contain allocations to terrestrial active.

- The footnote proposed by the radioastronomy community to indicate the need for coordination with EESS (active) cloud radars around 94 GHz was agreed (although the exact final text was not available to the SFCG).

- The two EESS (active) bands (500 MHz in 126-134 GHz and 100 MHz in195-240 GHz) should be proposed for inclusion in the position of the various administrations.

- The band 167-168 GHz should maintain the SR (passive) allocation with the footnote limiting its use to space-based radioastronomy (as was requested last year in Kyoto).

- The two new resolutions proposed by Europe are agreeable to the various space agencies in SFCG.

The only point on which agreement could not be reached (also due to lack of time) was how to cover the issue of ground-based passive sensing. Europe has decided to propose the insertion, wherever appropriate, of a footnote identifying the bands used for this purpose, deferring the discussion for a better ITU identification of the service to a later date. NASDA proposed to define this service as Radiolocation (passive) and introduce an allocation of this type wherever appropriate, already under agenda item 1.16 at WRC-2000.

While the final objective was agreable to everybody, the best tactical approach was controversial. The clear risk identified was to complicate the discussions under agenda item 1.16 at WRC-2000 and therefore increase the risk of a failure. At a later stage NASDA submitted a proposal for a new resolution on this subject, that could not be discussed in SWG-3 because of lack of time and was therefore deferred to the Plenary.

A.3 EESS and Meteorological Satellites Data Services

A.3.1 Future use of the band 8025 – 8400 MHz

NASA proposed to introduce segmentation into the band 8025 – 8400 MHz and to introduce a bandwidth limitation of 50 MHz within the band. Discussion showed that segmentation at this time is not feasible. There are many systems operating in this band with typical bandwidths around 100 MHz.

It was concluded that the band is already overcrowded with many new missions planned in the near future. SWG3 concluded that SFCG members shall be invited to use the band 25.5 – 27 GHz for future wide band applications. It was requested to prepare a recommendation on this subject at SFCG-20. Input documents on this subject were invited. The inputs shall contain proposals for a maximum data rate within the 8 GHz band, the implementation date of the new recommendation, indication of methods for efficient use of the bands and potential compatibility with frequency plans of SNIP.

A.3.2 Use of the 7750 – 7850 MHz band by NGSO Meteorological Satellites

The band 7750 – 7850 MHz was allocated to the Meteorological Satellite Service at WRC-97. The use of the band is restricted to NGSO spacecraft. The allocation would allow the use of the band for direct broadcasts and data dumps to CDA stations. Interference between the two types of systems could only be avoided by frequency separation. Due to experience with other bands in the vicinity of 8 GHz it can be expected that the band will be used by many systems in the near future. Conscientious frequency management is therefore required to make the most efficient use of the band.

A new resolution (attached in **Annex**) was approved urging SFCG members to develop concepts for the efficient use of the band and making assignments in this band beginning at the band edges.

A.4 Notification of Active and Passive Sensors with the ITU/BR

SFCG-18 had issued an action to contact ITU to clarify which formats, methods and procedures could be used for registration of spacecraft passive and active sensors. The SFCG Executive Secretary circulated a letter with attached examples for future data sheets. The data sheets were designed by ESA. ENVISAT examples were included to demonstrate the suitability of the forms for SFCG purposes.

SWG-3 discussed the content of data sheets and agreed on the final form of the sheets. The addition of a free text field with a maximum size of 200 characters was approved.

A new action item requests A. Nalbandian ITU/Radiocommunication Bureau to submit the data sheets for transformation into a format, which permits electronic capture and publication in APIs (for satellites on which these sensors are flown) and finally in the International Frequency Register.

It was proposed that at the occasion of the CPM (November 1999), the action co-ordinator and SFCG members available at the meeting to meet with IUT staff in order to agree on the data formats.

A.5 Other documents considered by SWG-3

A.5.1 ROCSAT-2

The National Space Program Office of Taiwan presented a document containing preliminary information on the ROCSAT-2 satellite network. It was announced that the ROCSAT-2 mission is to acquire and monitor the terrestrial and marine environment and resources throughout Taiwan. Satellite characteristics and operational concepts were presented. The candidate frequency bands include S-band and X-band. Payload data will be transmitted to Earth at 8093-8332 MHz, with a bandwidth of 135 MHz. Since the ITU cannot accept the filing information for the spacecraft, NSPO plans to perform co-ordination directly with administrations in a manner similar to that done for ROCSAT-1.

A.5.2 Three new space programs from the Canadian Space Agency

The Canadian Space Agency (CSA) gave a presentation on three new space programs, i.e. RADARSAT 2A and 2B, MOST-1, and SCISAT-1 (ACE). Description of the individual missions, frequency and satellite design information were given. RADARSAT spacecraft will carry the Advanced Synthetic Aperture Radar instrument. Communication frequency bands will be S-band for TC and HK-TM, mission data will be downlinked at frequencies between 8105 and 8312.5 MHz. The bandwidth of each downlink channel will be either 60 MHz or 100 MHz.

The MOST-1 (Microvariability and Oscillation of Stars) satellite carries an optical telescope. The mission data downlink is in S-band. The bandwidth is 170 kHz. The MOST-1 spacecraft also carries an amateur satellite package using S-band.

SCISAT-1 carries the Cryogenic Atmospheric Sensor. Mission data downlinks are in S-band.

It was noted that the three Canadian spacecraft shared use of S-band frequencies.

A.5.3 Indian Remote Sensing Satellite IRS-P6

ISRO presented a document on the IRS-P6 (Resource Sat) mission, which is envisaged as a continuity mission to IRS-1C/1D but with enhanced capabilities, both in payload and the platform. The satellite will carry three payloads, i.e. the High Resolution Multispectral Camera (LISS-4), the Linear Imaging Self-Scanner LISS-3, and Advanced Wide Field Sensor (AwiFS). Mission data downlinks will be at 8125 and 8300 MHz with a bandwidth of 105 MHz each.

A.5.4 CEOS

Dr. Maeda (NASDA) represented SFCG at the 12th CEOS Plenary meeting hosted by Indian Space Research Organization in Bangalore, India from 10-12 November 1998. A total of 82 delegates from 18 Members, 13 Associates and 9 other organisations participated at the meeting. A report on Spectrum Management Co-ordination was given at CEOS pointing especially on the major SFCG positions. The CEOS plenary agreed on a resolution to urge members to advise their national authorities to protect passive and active sensors. CEOS members were encouraged to urge national authorities to support proposals for WRC-2000 related to Earth observations. It was concluded that Dr. Maeda should also represent SFCG at the next CEOS meeting, planned for November 10-12 1999 in Stockholm, Sweden. The meeting will be hosted and chaired by EUMETSAT.

ANNEX

SPACE FREQUENCY
COORDINATION GROUP

Resolution 19-7

USE OF THE 7750-7850 MHz BAND BY NON-GSO METEOROLOGICAL SATELLITES

The SFCG,

CONSIDERING

a) that sensors onboard Meteorological Satellites (Metsats) are an increasingly important tool for monitoring the Earth and its environment;

b) that such sensors are becoming more complex with resultant increased data rates;

c) that the ITU Radio Regulations allocate the band 7750-7850 MHz to Metsats in non-geostationary orbits on a primary basis with PFD limits as listed in table S21-4 of the RR; and that this band will be the prime band for many decades;

d) that various Metsat operators are developing plans to use the band to transmit such vital meteorological and environmental data to a limited number of ground stations, including direct read-out and CDA stations;

e) that only conscientious frequency management of the 7750-7850 MHz band will satisfy the future requirements of MetSats of numerous operators;

RESOLVES

that space agencies developing and operating Metsats develop concepts for efficient use of the 7750-7850 MHz band that allows interference-free reception of vital meteorological and environmental data;

INVITES

Members to assign frequencies in this band in such a way to facilitate its optimal use by making assignments beginning at the band edges.