

RADIO FREQUENCY MATTERS

(Submitted by WMO)

Summary and purpose of document

The document provides information on the activities and outcomes of the WMO/CBS/Steering Group on Radiofrequency Coordination, including the draft WMO position in preparation to the World Radiocommunication Conference 2007 (WRC-07).

ACTION PROPOSED

CGMS is invited to take note of the information and provide comments on the draft WMO position for WRC-07.

Appendix: World Meteorological Organisation (WMO); Preliminary WMO Position on World Radiocommunication Conference 2007 Agenda

DISCUSSION

1. A WMO Workshop on Radio Frequencies for meteorology was held in WMO Headquarters (Geneva, March 2006) with the participation of experts from NMHSs and several international organizations. Two sessions (*Passive and active remote sensing, Meteorological satellites communications*) were dedicated to meteorological and environmental satellites, with the participation of EUMETSAT, CNES, NASA. (see <http://www.wmo.int/web/www/TEM/RF-W-2006/workplan.html>)

2. The agenda of the forthcoming World Radiocommunication Conference 2007 (WRC-07, October-November 2007) includes several items of serious importance for WMO and CGMS. The CBS/Steering Group on Radio-Frequency Coordination (SG-RFC), at its last session (Geneva, March 2006) (see <http://www.wmo.int/web/www/TEM/SG-RFC06/documents.html>) consolidated the preliminary WMO position in preparation of WRC-07, which has been submitted to relevant ITU-R groups; the document is included in the Appendix. The preliminary WRC-07 WMO's position will be distributed by mid-November 2006 to WMO Members and relevant International Organizations, with a view to facilitating an effective preparation of national WRC-07 positions favourable for the WMO related issues. The SG-RFC will meet in January 2007 (Boulder, 16-18 January) to finalize the WRC-07 WMO position and submit it to the ITU-R Conference Preparatory Meeting (CPM, Geneva, 19 February-2 March 2007).

3. The SG-RFC, in coordination with ITU-R WP7C is finalizing the update of the joint ITU-WMO publication "*Handbook on use of radio spectrum for meteorology*", and the updated information would be posted on the WMO and ITU Web sites. The revised handbook would be an important reference documentation in preparation and for WRC-07.

4. The SG-RFC activities are also an important contribution to GEO task AR-06-11 (SG-RFC Chairman, Philippe Tristant, is the lead POC). The task has been revised as follows for the GEO Workplan 2007-2009:

"Assess the potential impact of interference on Earth Observations applications and in particular Satellite measurements necessary for the GEOSS and prepare a series of appropriate coordinated advocacy activities in association with Member countries, including representations to the International Telecommunication Union (ITU) and other bodies in charge of frequency management. This also include a support to GEO Members in influencing their national and regional frequency management bodies. In particular, the case of passive bands, essential for Earth observations, will be monitored with the highest care (For example, evaluation of challenges presented by the automotive short-range radars (SRR 24 GHz) applications and their implications). To this respect, it is also important to link with Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science (IUCAF)."

5. The CGMS may also wish to note the proactive involvement of several SG-RFC members, and especially its Chairman (who is also the EUMETFREQ Programme manager), in the development by the European Commission of the draft Report and Opinion on "A coordinated EU Spectrum approach for scientific use of radio spectrum". The document, which has been finalized and submitted for final adoption on 25th October 2005, provides a very satisfactory approach of WMO-related scientific use of radio spectrum.

World Meteorological Organisation (WMO)

**PRELIMINARY WMO POSITION ON
WORLD RADIOCOMMUNICATION CONFERENCE 2007 AGENDA**

Introduction

This document reflects the preliminary position of the World Meteorological Organisation (WMO) on the World Radiocommunication Conference 2007 (WRC-07) agenda as given in Resolution **802 (WRC-03)**.

Among WRC-07 agenda items, 7 items concern frequency bands or issues of prime interest for Meteorology :

- **agenda item 1.2** : Extension of the 18 GHz METSAT allocation and protection of the 10.7 and 36 GHz EESS (passive) bands
- **agenda item 1.3** : Upgrading and protection of radiolocation in the 9 GHz range, and 200 MHz extension of the Earth exploration satellite service (EESS) allocation at 9500-9800 MHz
- **agenda item 1.4** : Impact on meteorological radars related to future frequency bands for IMT-2000
- **agenda item 1.12** : Coordination and notification procedures for Earth Exploration Satellite Service (EESS) (active and passive) sensors
- **agenda item 1.17** : Protection of the 1.4 GHz EESS (passive) band
- **agenda item 1.20** : Unwanted emissions in EESS (passive) bands
- **agenda item 7.2** : WRC-10 agenda

In addition, several agenda items do not directly concern Meteorological interests but, due to their wide open scope in terms of frequency ranges under study, might have an impact on frequency bands used for meteorological purposes.

- **agenda item 1.5** : Possible additional allocations for aeronautical telecommand and high bit-rate aeronautical telemetry between 3 and 30 GHz
- **agenda item 1.6** : Additional allocations for Aeronautical Mobile Service between 108 MHz and 6 GHz
- **agenda item 1.8** : High Altitude Platform Stations (HAPS) in the 28 and 31 GHz band
- **agenda item 1.18** : Pfd limits for Highly Elliptical Orbit (HIO) satellites in the frequency band 17.7-19.7 GHz
- **agenda item 1.19** : Internet satellite applications

General comments

Radio-frequencies represent scarce and key resources for the meteorological community to either collect the observation data upon which its predictions are based or processed, and disseminate weather information and warnings to the public. It should be understood that all related frequency applications are related and represent a global meteorological system.

WMO hence stresses the fact that any lack of any of this system's radio components, either related to observation or data dissemination, is able to put at risk the whole meteorological process and, as expressed in the attached Resolution 3 (Cg-XIV), appeals to the International Telecommunication Union and its Member Administrations:

- to ensure the availability and absolute protection of the radio-frequency bands which, due to their special physical characteristics, are a unique natural resource for spaceborne passive sensing of the atmosphere and the Earth surface,
- to give due consideration to the WMO requirements for radio frequency allocations and regulatory provisions for meteorological and related environmental operations and research

Agenda items of prime interest for the Meteorological community Agenda item 1.2

“to consider allocations and regulatory issues related to the Earth exploration-satellite (passive) service, space research (passive) service and the meteorological satellite service in accordance with Resolutions 746 (WRC-03) and 742 (WRC-03)”

a) Issue 1 : Resolution 742 (WRC-03) on protection of the passive band 36-37 GHz

As part of global passive measurements, the band 36-37 GHz is vital for the study of global water circulation since this band is able to monitor rain, snow, ocean ice and water vapour for ocean and land surfaces. Observations in the band for sensing the melting of snow near the surface are of very high interest. A number of passive sensors and radio altimeters are already using or are planning to use this frequency band in the near future (e.g. CMIS, MIMR, AMSR, AMSR-E, AMR, SMMR, SSM/I, SSMI/S, TMI, MEGHA-TROPIQUE and MWRS) for such measurements. These measurements are fully operational (regular use of the data, continuity of service, several usable data products) and are used on a world-wide basis. The retrieved data are used and exchanged between the meteorological organisations in all regions. The retrieved parameters are actually derived from a set of measurements performed at five frequencies which are interrelated (6, 10, 18, 24 and 36.5 GHz).

WMO supports the protection of the 36-37 GHz passive band and believes that, identification of the maximum e.i.r.p and power for fixed and mobile links could provide a means to ensure such a protection.

b) Issue 2 : Resolution 746 (WRC-03) on METSAT allocation at 18 GHz

This issue addresses the requirement for bandwidth exceeding 200 MHz as currently given in RR footnote 5.519 (18.1 -18.3 GHz) for the next generation geostationary meteorological satellite, to be launched in the time frame 2015-2020.

The higher bandwidth requirements are mainly determined by the use of IR and UV sounding units and high-resolution imagers with an higher repetition rate of measurements and the number of spectral channels and the geographic resolution will also be significantly increased compared to the current generation of geostationary meteorological satellites.

WMO is of the view that such extension will not constrain existing services provided that the same regulatory conditions as in the 18.1-18.3 GHz band (e.g. Article 21 pfd limits) are applied. WMO does not favour one of the options over the other (18-18.1 GHz

band or 18.3-18.4 GHz band) but believes that a worldwide allocation in a single band would be preferred.

c) Issue 3 : Resolution 746 (WRC-03) on protection of the passive band 10.6-10.68 GHz

As part of global passive measurements, the band 10.6-10.7 GHz is of primary interest to measure rain, snow, sea state and ocean wind for ocean and land surfaces. A number of sensors are already using or are planning to use this frequency band in the near future (e.g. CMIS, MIMR, AMSR, AMSR-E and TMI) for such measurements. These measurements are fully operational (regular use of the data, continuity of service, several usable data products) and are used on a world-wide basis. The retrieved data are used and exchanged between the meteorological organizations in all regions and are actually derived from a set of measurements performed at five interrelated frequencies (6, 10, 18, 24 and 36.5 GHz).

WMO supports the protection of the 10.6-10.68 GHz passive bands (the band 10.68-10.7 GHz is covered under RR footnote 5.340). It should, however, be stressed that current deployments of FS links in certain administrations already create significant levels of passive measurement degradation in this band. Additional constraints on the 10.6-10.68 GHz passive band would hence not be acceptable and therefore, WMO strongly encourages the identification of the maximum power and eirp for fixed and mobile services that would protect EESS (passive) in the 10.6-10.68 GHz band.

Agenda item 1.3

“in accordance with Resolution 747 (WRC-03), consider upgrading the radiolocation service to primary allocation status in the bands 9 000-9 200 MHz and 9 300-9 500 MHz and extending by up to 200MHz the existing primary allocations to the Earth exploration-satellite service (active) and the space research service (active) in the band 9 500-9 800 MHz without placing undue constraint on the services to which the bands are allocated”

Meteorological radars in the 9300-9500 MHz are currently seen as the adequate solution to improve the coverage of the radar networks deployed in the 2.8 and 5.6 GHz bands in a number of areas where precipitation detection is not satisfactory or even not manageable, due in particular to the relief.

Ground based meteorological radars operate in the band 9300-9500 MHz under the secondary radiolocation allocation and with the additional provision in Radio Regulations (RR) footnote 5.475 stating that *“In the band 9300-9500 MHz, ground-based radars used for meteorological purposes have priority over other radiolocation devices”*

It should also be noted that, even though secondary, meteorological radars in this band have already been successfully deployed without any adverse impact on any Radionavigation service applications. An upgrade of the radiolocation service to primary status in the band 9300-9500 MHz will allow meteorological radar operations to operate under a primary frequency allocation.

On this basis, WMO supports the upgrade to primary of Radiolocation Service in the band 9 300-9 500 MHz on an equal footing with Radionavigation Service retaining (either in the current or new footnote) the provisions of RR 5.475 that addresses meteorological radars.

With regards to the possible extension by up to 200 MHz of the EESS (active) and the space research service (active) allocations, either into the band 9 300-9 500 MHz or the band 9800-10000 MHz, initial studies recently performed within ITU-R show that SAR systems in the EESS services may interfere with meteorological radars in the lower band. Further detailed studies are necessary to determine whether the highly varying nature of the potential interference could help ensuring compatibility between EESS (active) and meteorological radars. These studies are currently underway in ITU Working Parties 7C and 8B for SAR systems but a cautious approach is needed with regard to a possible global EESS and space research service (active) allocations.

Subject to final studies showing that the potential interference impact to meteorological radar operations is insignificant, WMO could support extension to the band 9 300-9 500 MHz of the EESS (active) and the space research service (active) allocations. The present RR footnote 5.476A would also need to be extended to this band. Also, WMO is of the view that, to limit the risk of interference, such extension should be limited to EESS (active) systems that need a bandwidth higher than the current 300 MHz allocation. Should EESS (active) and space research service (active) allocations not be possible in the lower band, WMO could also support such allocations in the 9800-10000 MHz band.

Agenda item 1.4

“to consider frequency-related matters for the future development of IMT-2000 and systems beyond IMT-2000 taking into account the results of ITU-R studies in accordance with Resolution 228 (Rev. WRC-03)”

Under agenda item 1.4, WRC-07 is requested to study spectrum requirements and potential frequency ranges suitable for the future development of IMT-2000 and systems beyond IMT-2000.

Focus is currently made on bands below 6 GHz in which a number of meteorological applications are currently operated, and in particular in the 2700-2900 MHz (meteorological radars) and the 5250-5650 MHz bands (EESS and meteorological radars).

2700-2900 MHz band

About 40 administrations have been identified that operate meteorological radars in the band 2700-2900 MHz for both airport surveillance and meteorological radar operations that play a crucial role in the immediate meteorological and hydrological alert processes and represent the first line of defence against loss of life and property in flash flood events.

While some administrations have low numbers of systems in operation, the associated geographical area of some of these countries is small and use in neighbouring countries must be considered as well when determining the availability of spectrum. For many administrations that currently do not use band or use the band lightly, loss of spectrum may also limit implementation of additional airport surveillance radars and meteorological radars as the requirements for deployment of additional systems is growing.

Numerous ITU-R studies have already been undertaken in preparation for WRC-2000 and WRC-2003 on the compatibility between radars and IMT-2000 and IMT-Advanced like systems, showing that the utilization of the 2700-2900 MHz band by IMT-2000 systems is not feasible. This conclusion was confirmed by WRC-2000 when the decision was made to not allocate this band to the mobile service for use by IMT-2000, and when WRC-2003 removed the band from further consideration for use by IMT-2000.

WMO sees little value in initiating a new study effort that will duplicate the previous efforts and obviously provide similar results and recommends that the 2700-2900 MHz band be removed from the list of candidate bands for IMT-2000 and systems beyond.

5250-5650 MHz band

There are currently several hundreds of meteorological radars worldwide in the 5470-5650 MHz band that play a crucial role in the immediate meteorological and hydrological alert processes and represent the first line of defence against loss of life and property in flash flood events.

Also, the data from the EESS (active) sensors in the 5250-5570 MHz band are currently assimilated in meteorological models.

It appears that the 5 GHz band is currently under study for possible IMT-2000 identification for nomadic/local wireless access, taking advantage of the brand new allocation to Mobile Service decided at the last WRC-03. It should be noted that this new allocation has only been made to

cover RLAN applications under strong regulatory limitations such as power control or DFS to protect EESS in the 5250-5350 and 5470-5570 MHz band and Radars (including meteorological radars) in the 5470-5725 MHz band.

Even though such IMT-2000 identification in the 5 GHz range would be made under the related regulatory limitations that apply to RLAN, WMO feels that there is a risk that once the band is identified for IMT-2000, there could be future initiatives to reopen the issue in order to relax or even withdraw the current limitations, in the same line that what is currently occurring under agenda item 1.9 (WRC-07) for the Broadcasting Satellite Service in the 2500-2690 MHz band.

It has also to be noted that a number of WMO members have already experienced interference from RLAN to meteorological radars in this 5 GHz range that put at risk the operation of these radars and hence the safety of life missions that are part of the meteorological services duties.

Keeping in mind studies in the 2700-2900 MHz prior to WRC-2000 that already concluded on the non compatibility between IMT-2000 and radars, WMO is strongly opposed to any IMT-2000 and IM66-Advanced identification in the 2700-2900 MHz and 5250-5650 MHz bands.

Agenda item 1.12 :

“to consider possible changes in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference: “Advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks” in accordance to Resolution 86 (WRC-03)”

Resolves 1 of Resolution **86 (WRC-03)** calls for consideration of any proposals which deal with deficiencies in the advance publication, coordination and notification procedures of the Radio Regulations for space services which have either been identified by the Board and included in the Rules of Procedure or which have been identified by administrations or by the Bureau, as appropriate.

There is a significant difference between space telecommunication systems and EESS/SRS satellite systems employing active/passive sensors. The data set to be submitted in accordance with the current RR Appendix 4 does not take into account the specificity of active/passive sensors. It would preferable to introduce an additional column or columns into “Table of characteristics to be submitted for space and radio astronomy services” (Annex 2 to Appendix 4 RR) similar to the existing column for Radio astronomy.

WMO supports consideration by the Special Committee for regulatory/procedural matters of modifications to Appendix 4 to permit recording and publication of appropriate data pertaining to EESS and SRS active and passive sensors.

Agenda item 1.17

“to consider the results of ITU-R studies on compatibility between the fixed-satellite service and other services around 1.4 GHz, in accordance with Resolution 745 (WRC-03)”

Under agenda item 1.16 (WRC-03) and acknowledging the non-completion of technical compatibility studies, last WRC-03 made a conditional secondary allocation to FSS for MSS feeder links near 1.4 GHz. Agenda item 1.17 (WRC-07) is the follow-up on this issue and requests the ITU-R finalize these technical studies with a view to determine whether these MSS feeder links are compatible with existing services, and in particular passive service in the 1400-1427 MHz band.

For EESS, this band is a vital resource for measuring salinity and other aspects of the Earth and its atmosphere and, to that respect, is one of the passive bands quoted in footnote **5.340** that prohibits all emissions, emphasizing its particular importance for the scientific community. A number of sensors are planned to use this frequency band in the near future (SMOS and AQUARIUS) for such measurements.

From the current technical studies it seems likely that the NGSO MSS feederlinks will be able to use the allocated bands only with significant constraints to protect existing services, among of which EESS (passive) in the 1400-1427 MHz band. Furthermore, no service providers are continuing to pursue opportunities or participating in relevant studies to use this allocation, which obviously indicates a lack of need for this allocation.

WMO is of the view that such a secondary FSS allocation should not be confirmed at WRC-07.

Agenda item 1.20

“to consider the results of studies, and proposals for regulatory measures, if appropriate, regarding the protection of the Earth exploration-satellite service (passive) from unwanted emissions of active services in accordance with Resolution 738 (WRC-03)”

The issue of the protection of the Earth exploration-satellite service (passive) from unwanted emissions of active services has been on the agenda for the last three WRCs during which a large number of administrations supported regulatory measures for the protection of passive services, and in particular the inclusion of limits on the unwanted emissions of active services in the Radio Regulations.

WRC-03 did not reach agreement to take such action and a compromise solution was to continue the studies according to Resolution 738 and re-visit the issue at WRC-07.

It can be noted that such an inclusion of limits on unwanted emissions into a passive band in the RR was taken by WRC-03 to protect to protect the EESS (passive) in the band 31.3-31.5 GHz with regards to HAPS, as given in RR footnote **5.543A**.

The frequency bands under consideration are given in Resolution 738 (WRC-03), namely the 1400-1427 MHz, 23.6-24 GHz, 31.3-31.5 GHz and 50.2-50.4 GHz passive bands, are all key bands for the scientific and meteorological communities and quoted in footnote **5.340** that prohibits all emissions.

WMO supports appropriate regulatory measures in the Radio Regulations to ensure the protection of the Earth exploration satellite service (passive) from unwanted emissions. Such measures should minimize the burden on the relevant active services but the protection of the related passive bands should be a prerequisite.

Agenda item 7.2

The Preliminary agenda for the 2010 World Radiocommunication Conference already includes the following item :

- 2.2** *to consider frequency allocations between 275 GHz and 3 000 GHz taking into account the result of ITU-R studies in accordance with Resolution 950 (WRC-03);*

New technological advancements enable the implementation of passive measurements in the range 275 GHz to 3000 GHz of chemical and physical parameters of high interest for climatological and meteorological purposes. The scientific and meteorological communities are currently performing detailed studies to determine the adequate frequency bands above 275 GHz to be used by EESS and the related sensors characteristics as well as performance and protection criteria. With growing interest in ground-based remote sensing platforms, requirements for those systems should be considered as well.

There are already some sensors performing measurements in this frequency range or that are being developed to be launched in a near future. An early assessment of allocations above 275 GHz under such an agenda item would, on one hand, help the scientific and meteorological communities to prepare next generation instruments, and on the other hand, encourage potential active services to focus on frequency bands that could avoid compatibility difficulties.

However, it seems that the lack of use by the various active services indicates that a general consideration of frequency allocations between 275 GHz and 3 000 GHz taking into account the result of ITU-R studies in accordance with Resolution 950 (WRC-03) might be premature.

The bands above 275 GHz are of direct interest for meteorological community. Hence, WMO supports either the retention of agenda item 2.2 (WRC-10) or, as an alternative, consideration of a modified agenda item that would propose to review and revise RR footnote 5.565 to update the uses of the spectrum from 275 to 3 000 GHz by the Earth exploration-satellite (passive), radio astronomy, and space research (passive) services.

Other Agenda items Agenda item 1.5

“to consider spectrum requirements and possible additional spectrum allocations for aeronautical telecommand and high bit-rate aeronautical telemetry, in accordance with Resolution 230 (WRC-03)”

This agenda item includes consideration of bands in the range from 3 to 30 GHz in which a number of frequency bands are used for meteorological purposes. Projections indicate a large amount of spectrum (several hundred MHz) is required for telecommand and telemetry, including Unmanned Aeronautical Vehicles (UAV).

In particular, the band 22.5-23.6 GHz is currently under study in ITU-R as a potential long-term candidate band. This band is adjacent to the 23.6-24 GHz passive band for which compatibility difficulties regarding out-of-band emissions with aeronautical services would certainly be similar to those currently studied under agenda item 1.20. If the band 22.5-23.6 GHz were to be actually proposed, it would probably generate confusion with all the work already in progress under agenda item 1.20 concerning compatibility between Inter Satellite Service in the band 22.55-23.55 GHz and EESS (passive) in the band 23.6-24 GHz.

In addition, it worth noting that few UAVs have already been operated in the past by some meteorological services and that such vehicles may present interests in the future for climatological and meteorological purposes, either for research or operational use. Related detailed characteristics and needs are not determined but it is assumed that they would fit in the current general requirements made for other purposes.

WMO urges that compatibility with related applications be ensured when new allocations for aeronautical telecommand and telemetry may affect meteorological bands. In particular, if the band 22.55-23.55 GHz is further considered, protection of the passive band at 23.6-24 GHz is required.

Agenda item 1.6

“to consider additional allocations for the aeronautical mobile (R) service in parts of the bands between 108 MHz and 6 GHz, in accordance with Resolution 414 (WRC-03) and, to study current satellite frequency allocations, that will support the modernization of civil aviation telecommunication systems, taking into account Resolution 415 (WRC-03)”

This agenda item covers the range from 108 MHz to 6 GHz in which a number of frequency bands are used for meteorological purposes.

WMO urges that compatibility with related applications be ensured when new allocations for aeronautical mobile service may affect meteorological bands.

Agenda item 1.8

“to consider the results of ITU-R studies on technical sharing and regulatory provisions for the application of high altitude platform stations operating in the bands 27.5-28.35 GHz and 31-31.3 GHz in response to Resolution 145 (WRC-03), and for high altitude platform stations

operating in the bands 47.2-47.5 GHz and 47.9-48.2 GHz in response to Resolution 122 (Rev. WRC-03)”

WRC-03 incorporated power density limits in RR footnote **5.543A** to protect to protect the EESS (passive) in the bands 31.3-31.5 GHz with regards to HAPS operating in the Fixed Service (FS). These limits adequately protect passive satellite services operating in 31.3-31.8 GHz and are assumed to provide sufficient power for operation of ground-to-HAPS links.

WMO urges that Resolution 145 (WRC-03) shall not lead to relaxation of these power density limits.

Agenda item 1.18

“to review pfd limits in the band 17.7-19.7 GHz for satellite systems using highly inclined orbits, in accordance with Resolution 141 (WRC-03)”

The protection of the 18.6-18.8 GHz EESS (passive) band from FSS and FS are given in RR provisions **5.522A**, **21.5A**, **21.16.1** and **5.522B**.

In addition, the extension from 200 to 300 MHz bandwidth of current METSAT allocation is currently under study in the 18.0-18.4 GHz under agenda item 1.2 (WRC-07).

WMO is of the view that the determination of power flux density (pfd) limits to be applied to Highly Elliptical Orbit (HEO) satellites in the 17.7-19.7 GHz band shall not lead to any review of the abovementioned RR provisions and shall also not impede the possible METSAT allocation in the 18 GHz range.

Agenda item 1.19

“to consider the results of the ITU-R studies regarding spectrum requirement for global broadband satellite systems in order to identify possible global harmonized FSS frequency bands for the use of Internet applications, and consider the appropriate regulatory/technical provisions, taking also into account No. 5.516B of the Radio Regulations”

This agenda item is rather wide open since no specific frequency bands are mentioned.

WMO urges that compatibility with related applications be ensured when possible identification of global harmonised FSS frequency bands for the use of Internet applications may affect meteorological bands.
