

PASSIVE MICROWAVE PROTECTION

- **RESULTS OF WRC-07**
- **DISASTER MANGEMENT**
- **FUTURE WORK FOR WRC-11, RFI INTERFERENCE ON SATELLITE PASSIVE OBSERVATIONS**

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Agenda items 1.2 and 1.20 of WRC-07

- Agenda Item **1.2: SHARING ISSUE** Establish sharing conditions between passive and active services within the bands 10.6-10.68 and 36-37 GHz. Those two bands are shared with other services (terrestrial FS and MS).
- Agenda Item **1.20: UNWANTED EMISSIONS ISSUE** Protection of passive sensors from unwanted emissions within purely passive bands (5.340: all emissions are prohibited). The passive sensors are unable to discriminate between these natural radiations and man-made radiations. Article 5.340 of the RR enables the passive services to deploy and operate their systems.

List of the passive bands under consideration

- **1400-1427 MHz: salinity (ocean), soil moisture (ground)**
- **10.6-10.7 MHz: rain, snow, ice, sea state, ocean wind**
- **23.6-24 GHz: total content of water vapour**
- **31.3-31.5 GHz: the lowest cumulated effects due to oxygen and water vapour in the vicinity of the 50 GHz band. Optimum window channel to see the Earth's surface: reference for the other channels.**
- **36-37 GHz: cloud liquid water, vegetation structure, surface roughness**
- **50.2-50.4 GHz: temperature profile**

Agenda item 1.2 of WRC-07

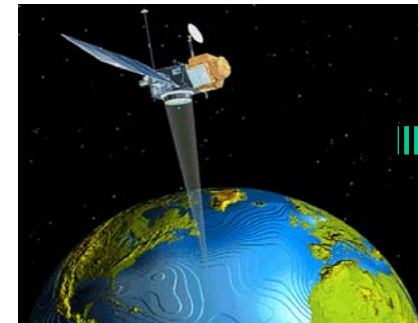
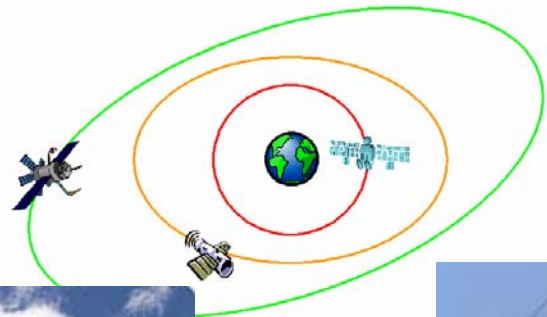
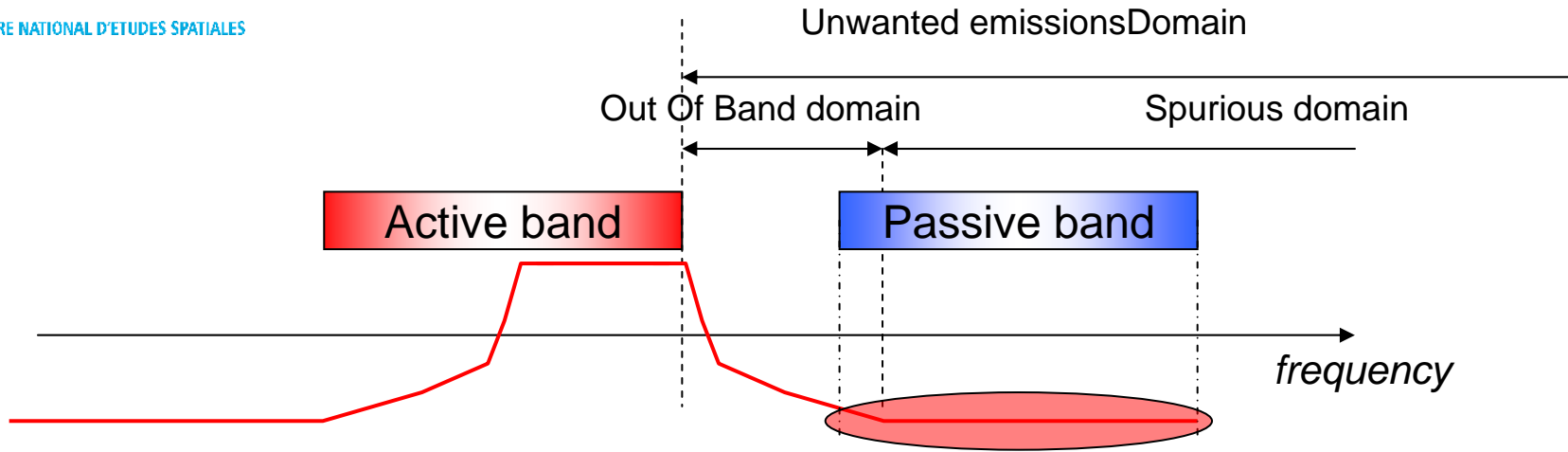
- Considers sharing conditions between FS/MS and passive sensors in the bands 10.6-10.68 GHz and 36-37 GHz
- Band 10.6-10.68 GHz shared between
 - FS & MS: active services
 - EESS (passive), SRS (passive), Radio Astronomy
 - *Note: the band 10.68 to 10.7 GHz is purely passive (5.340)*
- Band 36-37 GHz shared between
 - FS & MS: active services
 - EESS (passive), SRS (passive)
- **One proposed method in the Conference preparatory text: development of sharing criteria based on single entry emission limits to be included in a footnote of Article 5 of the Radio Regulations.**

Agenda item 1.20 of WRC-07

Agenda Item 1.20: Considers the results of studies, and proposals for regulatory measures regarding the protection of passive sensors from unwanted/out-of-band emissions of active services falling within some specified passive bands (i.e., 1400-1427 MHz, 23.6-24 GHz, 31.3-31.5 GHz, 50.2-50.4 GHz and 52.6-54.25 GHz)

One proposed method in the Conference preparatory text: development of a single entry emission limit for each corresponding active service within the EESS (passive) band to be included in a footnote of Article 5 of the Radio Regulations.

Agenda item 1.20 of WRC-07: definitions



FESS(passive)
AI 1.20



Agenda item 1.20 of WRC-07: unwanted emission problem, list of band pairs

Allocated band to EESS (passive)	Allocated band to the active service	Active service
1 400-1 427 MHz	1 350-1 400 MHz	Fixed and mobile service , radiolocation
1 400-1 427 MHz	1 427-1 429 MHz	Fixed and mobile service (except aeronautical mobile)) and space operation service (Earth to Space)
1 400-1 427 MHz	1 429-1 452 MHz	Fixed and mobile service
23,6-24 GHz	22,55-23,55 GHz	Inter-satellites (ISS) service
31,3-31,5 GHz	30-31 GHz	FSS (Earth to Space)
50,2-50,4 GHz	50,4-51,4 GHz ¹	FSS (Earth to Space)
50,2-50,4 GHz	47,2-50,2 GHz (Régions 2 et 3) 49,44-50,2 GHz (Région 1)	FS

- Protection of EESS in the band 31.3-31.5 GHz vis-à-vis FS for the 31-31.3 GHz band (WRC03: - 38dBW/100MHz)) in regions 2 and 3
- Protection of EESS in the band 52.6-54.25 GHz vis-à-vis FS for the 51.4-52.6 GHz band (WRC03: - 33dBW/100MHz)) in regions 2 et 3

Agenda items 1.2 and 1.20 of WRC-07: decision of the Conference

- **Recommended levels** for the following services and frequency bands
 - For the protection of the exclusive passive bands (footnote 5.340) 1400-1427 MHz (applicable to all active services around 1.4 GHz) and 31.3-31.5 GHz (for FSS in the 30-31 GHz band)
 - The FS and MS services operating within the band 10.6-10.68 GHz
- **Mandatory limits** for the following services and frequency bands
 - For FS and MS services operating within the band 36-37 GHz
 - For the protection of the following exclusive passive frequency bands (5.340): 23.6-24 GHz (ISS below 22.55 GHz), 31.3-31.5 GHz (FS at 31-31.3 GHz), 50.2-50.4 GHz (for FSS below 50.2 and above 50.4 GHz) and 52.6-54.25 GHz (for FS below 52.6 GHz)

Disaster management (1/2)

In response to heightened global awareness of the need for improved international disaster management, ITU-D Study Group 2 Question 22/2 was formed.

ITU-D SG 2 Question 22/2 *“Utilization of ICT for disaster management, resources, and active and passive space-based sensing systems as they apply to disaster and emergency relief situations”*

Identification and examination of active and passive sensing system applications for their potential effect in enhancing disaster mitigation.

Preliminary draft report on the ITWG website.

Disaster management (2/2)

- The aim is to show how useful are the passive frequencies (in addition to EESS active and optical wavelengths) when considering the issue of disaster management (**useful argument in international meetings, such as ITU-R WRC**). List of scenarios of disaster management (fully explained in the report).
 - Coastal Hazards/Tsunamis
 - Drought
 - Earthquake
 - Extreme Weather
 - Floods
 - Landslides/Subsidence
 - Pollution
 - Sea and Lake Ice
 - Volcanoes
 - Wildfires

Future work on passive sensors (1/3)

- **Agenda item 1.6 of WRC-2011**
 - **Spectrum use by passive sensors between 275 and 3000 GHz**
 - **Free space optical links**
- Preliminary document on passive remote sensing between 275 and 3000 GHz on the ITWG website. A first analysis shows that **there is some information available between 275 and 1 THz, but very little between 1 and 3 THz.**
- Further work to be undertaken for optical links.
- **ITWG participants are encouraged to provide information** for the agenda item (no frequency allocation envisaged, identification of frequency bands, reference windows, spectral lines, required bandwidths, ...)

Future work on passive sensors (2/3)

- **Agenda 1.8 of WRC-2011:** regulatory issues relative to the fixed service between 71 and 238 GHz (protection of the **passive band 86-92 GHz**)
- The **exclusive band 86-92 GHz** is widely used by many passive sensors. The usefulness of this band has been shown (for example in case of a tropical cyclone as shown in the ITU-D workshop - December 2007 in Geneva - on the role of remote sensing in disaster management) for many applications.
- In addition to electromagnetic compatibility studies conducted between active services for passive bands, it seems necessary to answer the following question: if the proposed limits (based on international agreed recomm. for the protection of microwave passive sensors), are exceeded, what are the **actual consequences in terms of reliability of the weather forecasting?**
- Importance of **getting a quantitative explanation of various levels of degradation**. It is still possible to keep arguing that it is not so obvious to derive this kind of information since complex algorithms are needed to model the atmosphere which is known to be very unstable by nature. It is true that it is hard to distinguish between weak radio frequency interference and naturally geophysical variability.
- **Space and meteorological agencies have to bring evidence that interference exceeding the interference quoted in RS.1029-2 will disrupt the existing or planned algorithms.**

Future work on passive sensors (3/3)

- ⇒ **Identify passive frequency bands** with a view of a precise future work plan. Focus on some frequency bands, especially for example the 86-92 GHz band which is under consideration within ITU-R, or around 50 GHz which is essential.
- ⇒ One aspect of degradation is the **lack of data**: already examined by UK MET Office. What is the impact of this lack of data on the overall output products if satellite data are systematically excluded in all geographic areas? Report published where **the main idea is to convert the impact of satellite data to a date which you have to go back to match the degraded level of performance.**
- ⇒ Better knowledge of the sensitivity of the passive frequency bands to RFI degradation ⇒ **Like disaster management, it can be a convincing argument for administrations for a better protection of passive frequency bands.**

CONCLUSION 1: LEVELS AND LIMITS IN THE RR, WRC-07

- The mandatory limits for most of the bands above 20 GHz in the Radio Regulation provide a long term protection of the passive bands.
- The recommended levels for the bands below 20 GHz represent a clear signal to Administrations for a better protection, in particular for the passive band 1400-1427 MHz band which is unique for soil moisture and sea salinity. This year, a joint ESA-CNES mission called **SMOS** will be launched.

CONCLUSION 2: FUTURE AGENDAS FOR WRC-2011

The relevant agenda items in connection with Remote Sensing are as follows for WRC-2011

1.6: frequencies between 275 and 3000 GHz: **passive**

⇒ Information asked to ITWG participants

1.8: regulatory issues relative to the fixed service between 71 and 238 GHz (protection of the **passive band 86-92 GHz** in particular)

⇒ Study of impact of RFI on the provided meteorological outputs.

CONCLUSION 3: ITU-R Resolutions

- ITU-R Resolution adopted at the last RA-07: ITU studies of disaster prediction, detection, mitigation and relief "considering the importance of radiocommunication systems in assisting disaster management through techniques for early warning, prevention, mitigation and relief"
- ITU-R Resolution adopted at the last WRC-07: Radiocommunications use for Earth observation applications "to carry out studies on possible means to improve the recognition of the essential role and global importance of Earth observation radiocommunications applications and the knowledge and understanding of administrations regarding the utilization and benefits of these applications"