Ultra Wide Band (UWB) and Short-Range Devices (SRD) technologies

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New trends in radiocommunications

- Typical frequency management faces new challenges in relation with :
  - New radiocommunication technologies (Ultra Wide Band, software radio, cognitive radio,….)
  - The need for increased bandwidth and mobility for civil telecommunications applications
  - The willingness from number of radio administrations to facilitate the spectrum access (so-called “flexibility”), including rapid access to the spectrum
- All these trends are currently presenting a high potential of risk for many “public” frequency users, among of which the meteorological community

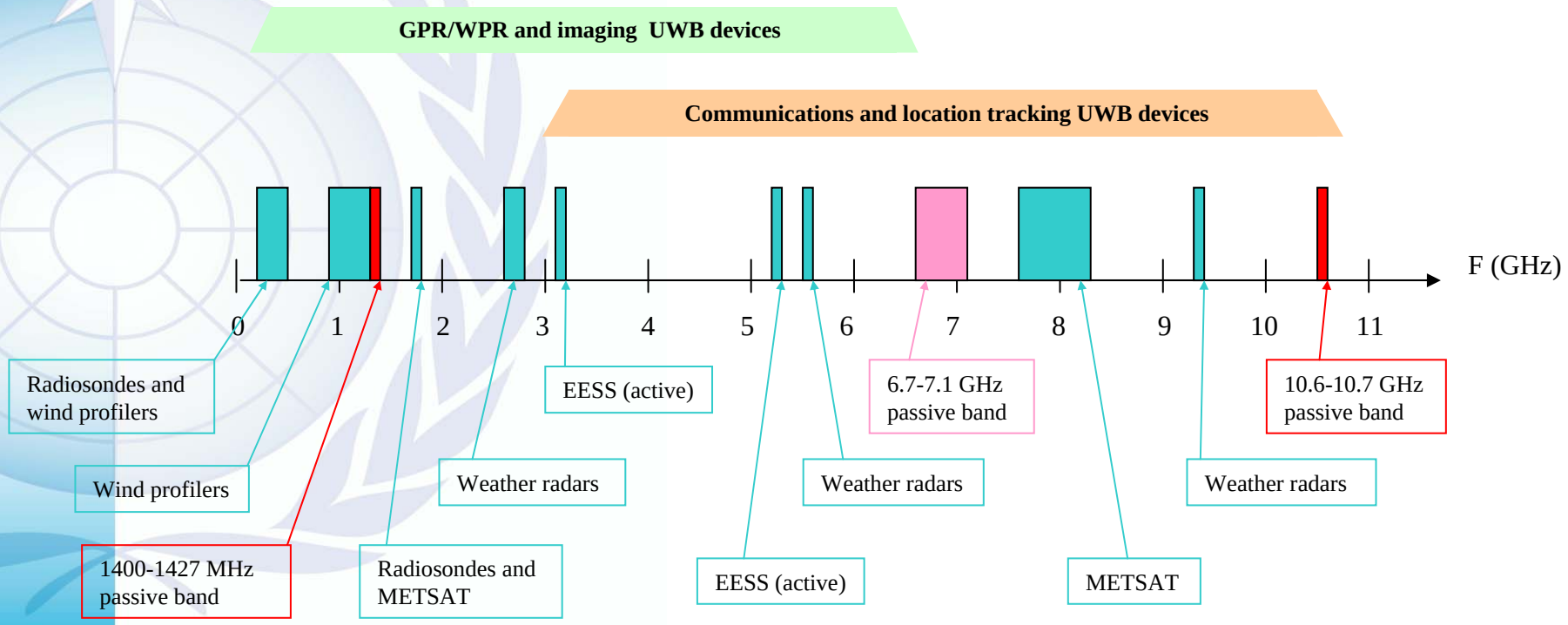
What are Ultra Wide Band (UWB)

- Ultra Wide Band devices cover a large range of applications :
  - Short-Range Communications (maximum 10m for computers, TV sets, phones,….)
  - Location tracking, to precisely locate objects in a short distance (max 30m)
  - Wall and Ground Penetrating radars,
  - Short-range radars (e.g. automotive) (see presentation on 24 GHz)
- Make use of a large variety of different radio technologies (radar pulses, CDMA, OFDM,..) :
  - Initially developed for military applications
  - Now available for civil use at low cost

What are Ultra Wide Band (UWB)

- All present the same characteristics:
  - Large Bandwidth from 500 kHz up to 5 GHz,
  - Low power or e.i.r.p. density levels
  - Potential fo high density deployment
- Hence extend over large frequency ranges (mainly between 1 and 10.6 GHz) potentially impacting a variety of radiocommunication services

Spectrum Overview



The interference scenarios

- All interference scenarios are possible depending on:
  - UWB characteristics and operational modes
  - “Victim” applications characeristics
- Single entry case, i.e. interference produced by one single UWB devices
- Aggregate case, i.e. interference produced by a number of UWB devices simultaneously transmitting
- Interferers at short distances (few km) from terrestrial stations

Impact on meteorological applications

- Low potential impact :
  - Radiosondes
  - Wind profilers
  - METSAT (both satellites and receiving Earth stations)
  - EESS active sensors
- High potential impact :
  - EESS passive sensors
  - Weather radars

Regulatory implications

- For terrestrial applications (radars, METSAT receiving stations,…), the interferers are at short distances, hence limited to domestic rules (free circulation is however an issue)
- For satellites uplink (as well as for Radio Astronomy), the interference case extend over international rules
- UWB devices do not present potential impact for receiving satellites (active)
- This is the case for satellite passive sensing that hence represents an international issue :
  - interference from UWB in one country may interfere the satellite passive sensors of another country
  - Global measurements that benefit to all WMO members may be polluted
- Some UWB devices (SRR, GPR/WPR,…) intend to transmit in bands covered by Radio Regulations Footnote 5.340 that states that “all emissions are prohibited”

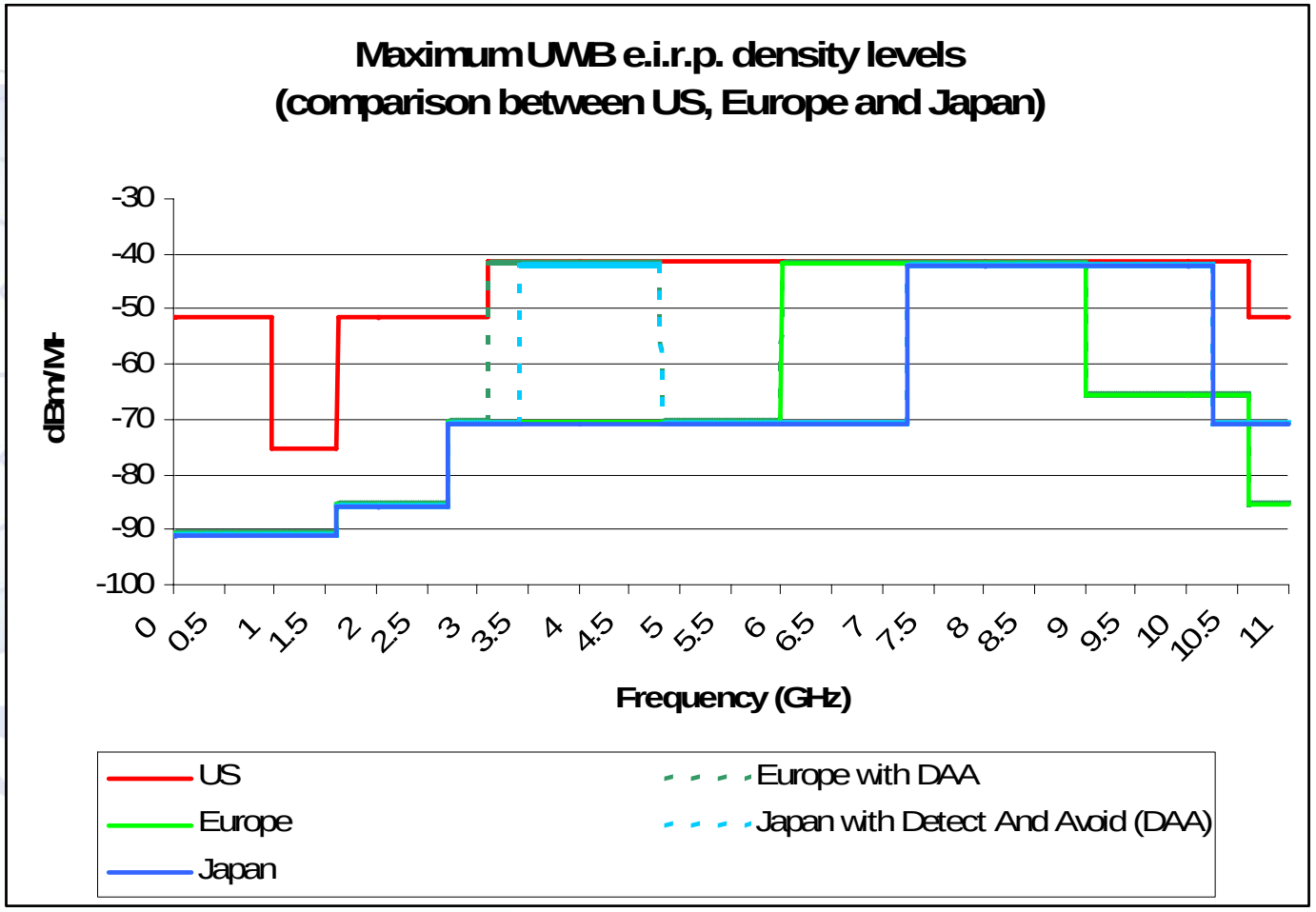
Developments in ITU-R

- ITU-R created a Task Group (TG 1/8) dedicated UWB issues, that concluded its work in October 2005, adopting :
  - **Report** SM.2057 (more than 800 pages !) presenting and summarising compatibility studies
  - Recommendation SM 1755 on **"Characteristics"**, providing general characteristics of UWB applications
  - Recommendation SM 1757 on **"Impact"**, summarising, for all bands and services, the results of technical studies and recommended maximum power levels as in the Report
  - Recommendation SM 1756 on **"Framework"**, providing general guidance to administrations to cope with regulatory and licensing provisions to authorise the use of UWB on their territories (also providing, as examples, the current or expected regulations in the US, in Europe and in Japan)
  - Recommendation SM 1754 on **"Measurements"**, providing information on the way to adequately measure power spectral density of UWB devices

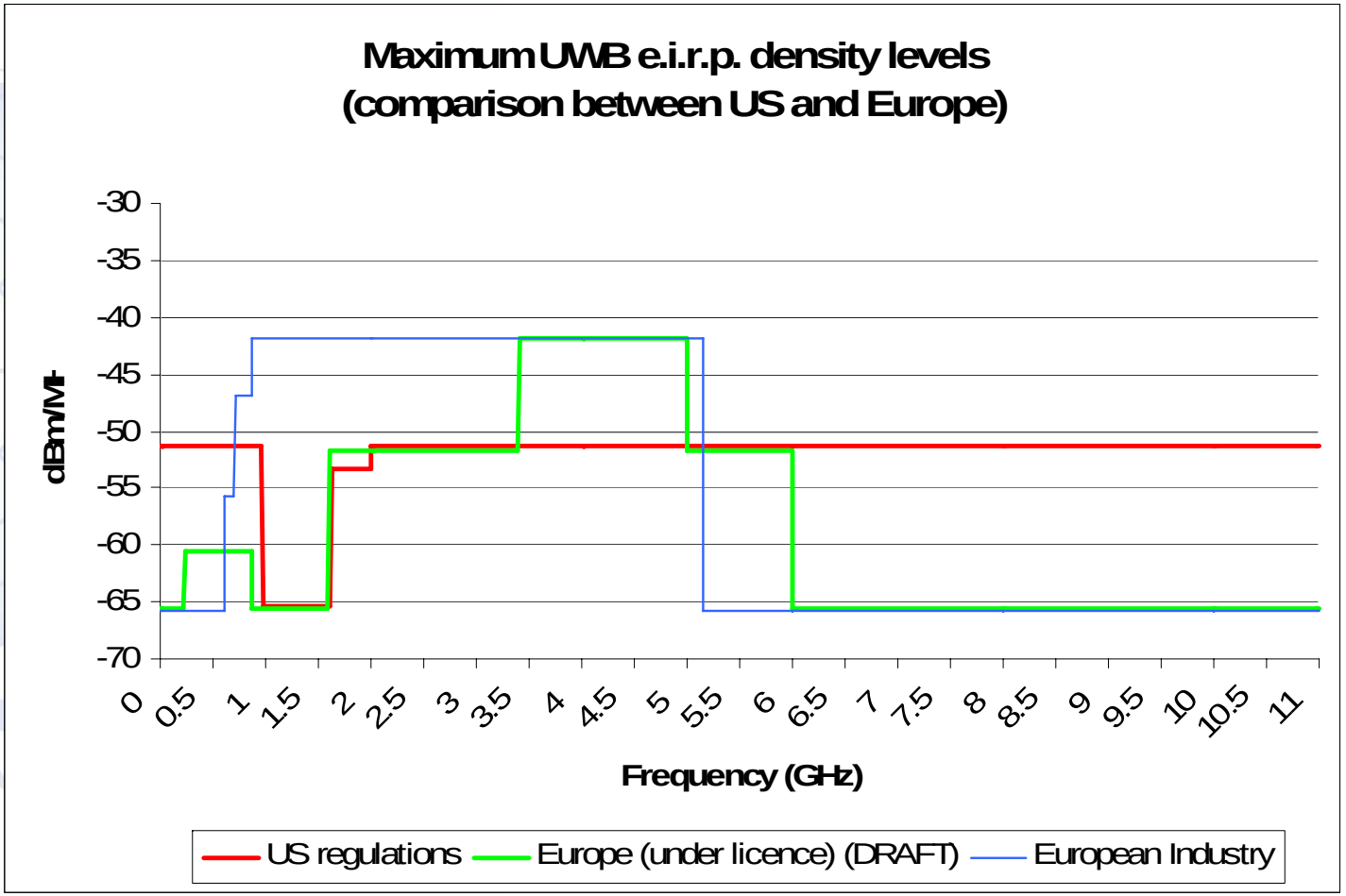
TG 1/8 conclusions

- Thanks to the involvement of WMO and several meteorological services, TG 1/8 conclusions are positive to meteorological interest :
  - High potential impact to weather radars and passive bands are recognised and the recommended power levels as in Rec. SM.1757 consistent with their protection requirements
  - Special attention is given to the protection requirements of the passive services in Recommendation SM 1756, stressing RR footnote 5.340

Communication and location tracking



GPR/WPR


Maximum UWB e.i.r.p. density levels
(comparison between US and Europe)
dBm/MHz
-30
-35
-40
-45
-50
-55
-60
-65
-70
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
Frequency (GHz)
US regulations
Europe (under licence) (DRAFT)
European Industry

Future actions on UWB

- Apart from US, Europe and Japan, a number of other Administrations are still in the process of adopting their National Rules for UWB

- All meteorological services need to be involved on this issue and undertake all possible actions to convince their national radiocommunication authorities to follow the TG 1/8 conclusions

Short-Range Devices (SRD)

SRD are used for large number of different applications, including :

- Domotic,
- Tracking, Tracing and Data Acquisition
- Wideband Data Transmission systems (RLAN, WIFI, …)
- Railway applications
- Road Transport and Traffic Telematics (RTTT)
- Equipment for Detecting Movement and Alert
- Alarms
- Model Control
- Inductive applications
- Radio microphones
- Assistive Listening Devices
- RFID
- Medical implants
- Wireless Audio Applications

Short-Range Devices (SRD)

- characteritics :
  - small bandwidths
  - Low power or e.i.r.p. density levels
  - From very low duty cycle to 100% operations
  - Potential for high density deployment (indoor or outdoor)
  - Number of different frequency bands from few 10 kHz to several GHz

Short-Range Devices (SRD)

- SRD are not regulated by Radio regulations but on a National (or regional basis)
- The Radio Regulations is however designating some bands for “ISM” (Industrial, scientific medical) that are usually used also for SRD

  - 6 765-6 795 kHz
  - 13 553-13 567 kHz
  - 26 957-27 283 kHz
  - 40.66-40.70 MHz
  - 433.05-434.79 MHz
  - 902-928 MHz
  - 2 400-2 500 MHz
  - 5 725-5 875 MHz
  - 24-24.25 GHz
  - 61-61.5 GHz
  - 122-123 GHz
  - 244-246 GHz

Short-Range Devices (SRD)

- For the meteorological community, the following main bands are concerned:
  - 401-406 MHz for Medical implants
  - 5 GHz band for RLANs
  - 24 GHz (unwanted emissions)
- Never-ending demand for new applications and frequency band (e.g.auditive implants at 400 MHz or medical implants in S-Band radar)
- Require a continuous survey of frequency management issues

UWB and SRD Threats

- The aggregate interference from multiple equipments is usually the dominant scenario (assessment of number of equipment is not a trivial issue)
- This is of particular concerns for EESS passive sensors
- for this case, the aggregate effect of emissions from SRDs deployed within one country can also have negative impact on space-based radiocommunication systems operated by other administrations
- National decisions : difficult for WMO to survey all countries policies (important role of national NMHS)
- Free circulation : risk of multiple non compliant equipments
- unlicensed and mass-market leading to “point of no-return” : if not adequately regulated or if initial sharing assumptions are not correct,
  - uncontrolled deployment of a very large number of “interfering” SRD or UWB, impossible to manage by NRA, i.e. a *de facto* pre-emption of the band
  - Loss of a band for the whole meteorological community (even if limited to one single country) with obvious operational and financial consequences
- Don’t hesitate to get in contact with WMO SG-RFC on these issues

Thank you for your attention