NASA Radio Spectrum Issues: Remote Sensing Spectrum Issues at WRC-03 and Beyond

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Introduction

- 2003 World Radiocommunication Conference will to be held in Geneva, Switzerland from 09-June-03 to 04-July-03
- Three Agenda Items Directly Concerning Remote Sensing
  - *AI 1.5* Allocations in the 5150-5725 MHz range
  - *AI 1.12* Dealing with 35.5-36 GHz Active Sensing and 36-37 GHz passive sensing allocations
  - *AI 1.38* Dealing with a possible allocation of 6 MHz for active sensing in the 420-470 MHz range

Allocations in the 5150-5725 MHz Range

- AI 1.5 deals with two active remote sensing issues:
  - Existing allocation in the 5250-5350 MHz band
  - Possible additional allocation in the 5460-5570 MHz band
- Existing allocation used by spaceborne Synthetic Aperture Radars (SAR) such as Radarsat (Canada), SIR-C and SRTM (NASA), and Envisat (ESA)
- Allocation also used by spaceborne altimeters such as TOPEX/POSEIDON and JASON (joint CNES/NASA missions)

The 5 GHz Problem

- Wireless access systems in the mobile service, including RLANs, seeking allocations in the 5150-5350 MHz and 5470-5725 MHz bands
- Such wireless applications have been found to cause interference to active sensors in some cases (e.g., ubiquitous outdoor use, >250 mW)
- Wireless advocates (Microsoft, Cisco, Intel, Apple, Motorola, et al) pushing hard for allocations for wireless access systems
- APT, CITEL and CEPT with differences in proposals, but all support both WAS and EESS

Active Sensing in the 35.5-36 GHz Band

- Prior to WRC-97, precipitation radars had a primary allocation without such constraints in the 35.5-35.6 GHz band by footnote 5.551
- WRC-97 allocated the 35.5-36 GHz band to EESS and SRS (active) with the constraints of footnote 5.551A
- Resolution 730, seeks to remove the footnote 5.551A from the 35.5-35.6 GHz band as a minimum, and from the entire 500 MHz if possible.

Status of 35.5-36 GHz Issue

- CPM text based on compatibility studies offers three possible methods to deal with the issue:
  - Remove footnote 5.551A from 35.5-35.6 GHz band, restoring status prior to WRC-97
  - Replace footnote in 35.5-36 GHz band with new footnote stipulating PFD limit on active sensors
  - Remove existing footnote from entire 35.5-36 GHz band
- CITEL, APT propose simply removing footnote
- CEPT proposes a PFD limit on the active sensors

Passive Sensing in 36-37 GHz Band

- 36-37 GHz band allocated to EESS (passive) and used by a large number of spaceborne passive sensors
- 36-37 GHz band also allocated to fixed and mobile services, although not yet used by these services
- Preliminary studies have shown that in order to protect passive sensors to the levels given in Rec. SA.1029, some constraints would be required on the terrestrial services

Status of 36-37 GHz Issue

- CPM text offers two possible methods to deal with the issue:
  - Do not change any allocation, but continue studying the sharing situation under normal ITU-R studies
  - Study the sharing situation with great urgency and place provisional limitations on the power and/or deployment of terrestrial stations until the issue can be reviewed by a future WRC
- CITEL proposes NOC
- APT proposes NOC with Resolution urging protection of passive sensors and further study
- CEPT proposes NOC with a Resolution urging further study and limiting deployment of the FS and MS

Possible Allocation to EESS (active) in the 420-470 MHz Range

- Allocation needed for SAR in this frequency range to study tropical biomass in rainforests and to study Antarctic ice thickness
- WRC-03 probably the last chance to achieve such an allocation as it has been on three different WRC agendas without succeeding
- Studies have shown that SAR operating in 420-470 MHz would interfere with virtually any existing allocated service to some extent
- 450-470 MHz band ruled out as it is used by various countries for public safety applications.

Possible Allocation to EESS (active) in the 420-470 MHz Range (continued)

- 420-450 MHz range used by radiolocation, fixed, mobile and amateur services
- Studies indicate that SAR could not operate within line-of-sight of space object tracking radars (only about 10 sites in world)
- Studies indicate that some sensitive amateur service applications could experience unacceptable interference for short periods of time

Status of the 420-470 MHz Active Sensing Issue

- CPM text basically offers two possible methods to deal with the issue:
  - Make an allocation to the EESS (active) in the 432-438 MHz band with appropriate technical and operational limitations to protect incumbent services
  - Make no allocation
- Based on studies to date, the only viable option is the 432-438 MHz band, which still would have to be limited in areas of operation and in power levels per the ITU-R Recommendation SA.1260
- APT and CEPT propose secondary allocation
- CITEL proposes no allocation
- Canada and Brazil propose secondary allocation

Other Agenda Items Indirectly Concerning Remote Sensing

- Possible Allocation to High Altitude Platform Stations (HAPS) for ground-to-HAPS use in 31.0-31.3 GHz
  - Adjacent band transmissions could interfere with passive sensing in 31.3-31.8 GHz band
  - CITEL, CEPT and APT proposals all specify transmissions limits for HAPS to protect passive sensors in adjacent band

Other Agenda Items Indirectly Concerning Remote Sensing (continued)

- Possible allocations to MSS feederlinks near 1400 MHz
  - Concern that uplinks could interfere with nearby passive remote sensing allocation in 1400-1427 MHz
  - NASA to fly mission(s) that utlizes 1400-1427 MHz for remote sensing of ocean salinity and soil moisture content
  - Final Analysis only proponent of allocation
  - US Proposal for allocation in 1390-1392 MHz with protection for nearby EESS (passive) allocation
  - APT and CEPT propose no allocation

Future Conference Remote Sensing Issues

- Consider sharing around 4300 MHz between radio altimeters and passive sensors (WRC-07)
  - ITU-R has approved Recommendation on sharing in the band
  - APT supports agenda item
- Consider allocations in the frequency bands above 275 GHz (WRC-07)
  - Passive sensors noted in footnote 5.565, but there are currently no recognized allocations above 275 GHz in Table of Allocations
  - APT and CEPT support an agenda item looking at allocations above 275 GHz that would include passive sensors
  - US does not believe allocations are necessary at this time but could support registration of uses above 275 GHz

Current Remote Sensing Issues

- Domestic issue on FCC Rules for wireless access systems known as U-NII (Unlicensed – National Information Infrastructure) devices in the 5250-5350 MHz band
- Domestic issue on FCC Rules for Ultra-Wide Band (UWB) devices, especially vehicular radars near 24 GHz

Remote Sensing Concerns for 5250 - 5350 MHz

- Domestically, the FCC has Part 15 device rules in the 5150-5350 MHz and 5725-5825 MHz bands for U-NII devices
  - Rules allow devices in 5250-5350 MHz band to emit up to 250 mW of power with up to a 6 dBi antenna indoors or outdoors
  - Studies have shown that outdoor usage of these devices would cause interference to certain EESS (active) sensors

Domestic U-NII Dilemma

- In the original FCC proceedings, NASA had commented that lower power devices that were limited to 1% or less outdoor use would be compatible
- FCC did nothing to restrict outdoor usage and did not adopt the lower power level
- FCC is issuing further NPRM to add the 5470-5625 MHz band to U-NII with even higher power levels and outdoor use
- CITEL proposal to WRC-03 supports current US U-NII Part 15 rules as well as dynamic frequency selection and transmitter power control

UWB Vehicular Radars

- 2002 FCC Report & Order on UWB devices allows vehicular radar to operate at –41 dBm EIRP centered at 24.125 GHz
- UWB vehicular radars would overlap 23.6-24 GHz exclusively passive remote sensing band
- In sufficient numbers that are easily attainable, such vehicular radars would cause harmful interference to passive sensors using this band

UWB Dilemma

- NASA and NOAA opposed the vehicular radars and got some concessions in the rules to protect passive sensors:
  - Emissions ≥ 38° above the horizon attenuated another 10 dB
  - Emissions ≥ 30° above the horizon must be further attenuated through a phased approach
- Subsequent studies indicate that reflections from these radars may still cause unacceptable interference to passive sensors when deployment increases in future
- Move within Europe to get vehicular radar manufacturers to move to 76-77 GHz after early use of 24 GHz
- US not allowed to submit studies to ITU-R that show possible interference problems