ITU-R WRC-12 Agenda Item 1.4

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Agenda Item 1.4 and current issues

- **Agenda Item 1.4**: to consider, based on the results of ITU-R studies, any further regulatory measures to facilitate introduction of new aeronautical mobile (R) service (AM(R)S) systems in the bands 112-117.975 MHz, 960-1 164 MHz and 5 000-5 030 MHz in accordance with Resolutions **413 (Rev.WRC-07)**, **417 (WRC-07)** and **420 (WRC-07)**;

- Studies two existing AM(R)S allocations
  - VHF band, allocation made in 2003 but modified in 2007
  - L-Band, allocation made in 2007

- Studies one possible new allocation
  - C-Band, proposed at WRC-07 but could not reach consensus
  - To support airport surface local area network (LAN) currently under development for 5091-5150 MHz band

Agenda Item 1.4 (cont)

- VHF Band (112-117.975 MHz)

  - At WRC-03 allocation for AM(R)S was made to full 108-117.975 MHz band, but limited to support of navigation and surveillance operations (e.g., GBAS)

  *Note all ARNS allocations remained and ARNS systems given regulatory protection.

  - At WRC-07 AM(R)S allocation changed
    - 108-112 MHz limited to use by GBAS
    - 112-117.975 MHz allowed for generic AM(R)S

- Only changes likely at WRC-12 are to modify Resolution 113 to reflect the compatibility studies that have been completed.

Agenda Item 1.4 (cont)

- L-Band (960-1164 MHz)
  - Allocation added at WRC-07, limited to ICAO-standard systems
  - Regulatory protection to ARNS
  - ICAO system compatibility with other ICAO systems will be handled in ICAO, not ITU
  - Studies needed to ensure protection of non-ICAO ARNS and adjacent band RNSS

- Only changes likely at WRC-07 are to Resolution 417 to reflect the results of studies with RNSS and non-ICAO ARNS
  - EIRP limits to protect RNSS and geographic/frequency management coordination requirements to protect non-ICAO ARNS system.
  - TACAN still being studied

C-Band (5000-5030 MHz)

- At WRC-07 an AM(R)S allocation was made in band 5091-5150 MHz to support development of airport surface LAN.

- Attempted allocation for 5000-5030 MHz as well, but not agreed due to incomplete studies with incumbent RNSS
  - WRC-12 agenda item adopted to complete the studies

- Proposed system limited to surface applications at airports and based on established IEEE standard (802.16e)
  - Use of existing standard speeds development
  - Much of the classical SARPs “validation” work is already done
  - RTCA standardization work begun in Nov 2009, parallel EUROCAE effort started in January 2010.

C-Band (cont)

- Spectrum requirements studies have indicated the need for up to 200 MHz of spectrum to satisfy requirements at a large airport.

  - Assumes utilization of ITU precedence that LANs allocated in the mobile service can support both mobile applications and fixed applications

    - Some States disagree

  - Depending on assumptions, mobile applications alone exceed the spectrum available in 5091-5150 MHz

    - Especially taking into account channelization, OOB limitations and other systems (Aero Security)
    - ITU-R Report under development

  - Due to limitation to surface applications at airports,

  and fact that local base station determines useable local channels, system can be designed and standardized (SARPs) for larger band, then controlled on a State-by-State basis without impact on interoperability.

C-Band (cont)

- Compatibility assessments vary by band

  - 5000-5010 MHz band is planned for RNSS feeder uplinks
    - Similar to already demonstrated compatibility in 5091-5150 MHz band
    - ITU-R Report showing compatibility complete and approved by SG5. New RNSS criteria ($\Delta T/T$) results in even more favorable demonstration of compatibility.

  - 5010-5030 MHz band is planned for RNSS downlinks
    - Feeder link earth stations protected through geographic separation, which is eased by AM(R)S restriction to airport surface
    - Service links protected through either geographic separation or by reducing throughput to make the AM(R)S signal pulse-like – more tolerable by RNSS
      - ITU-R Report under development

C-Band (cont)

- Current issues

  - “Fixed Applications” (i.e., between aeronautical stations) in a band allocated to the mobile (e.g., AM(R)S) service
    - Precedence already established for Mobile Service (e.g., 5150-5350 MHz)
    - Safety maintained by limiting ***COMMUNICATIONS*** to those related to safety and regularity of flight
    - Cost-effective, one system for multiple applications
    - Currently aviation not unified

  - RNSS protection criteria
    - How much does “pulsing” AM(R)S signal help?
    - Can you take advantage in some geographic locations of reduced rain attenuation on the C-Band signals?
      - E.g., 3 dB C/N increase in US (2 dB rain loss) versus Marshall Islands (5 dB rain loss)

ITU-R Precedence: Performing fixed applications using a LAN operating under a mobile allocation (1 of 3)

- One Example: Band 5150-5250 MHz allocated on a primary basis to
  - MOBILE (except aeronautical mobile) 5.446A 5.446B
  - **5.446A** The use of the bands 5 150-5 350 MHz and 5 470-5 725 MHz by the stations in the mobile service shall be in accordance with Resolution **229 (WRC-03)**. (WRC-03)
  - **Resolution 229**
    - *resolves*
    - 1 that the use of these bands by the mobile service will be for the implementation of WAS *[Wireless Access Systems]*, including RLANs *[Radio Local Area Networks]*, as described in Recommendation ITU-R M.1450;

Precedence (2 of 3)

Recommendation ITU-R M.1450

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4 System architecture including fixed applications

Broadband RLANs are often point-to-multipoint architecture. Point-to-multipoint applications commonly use omnidirectional, down-looking antennas. The multipoint architecture employs several system configurations:

– point-to-multipoint centralized system (multiple devices connecting to a central device or access point via a radio interface);

– point-to-multipoint non-centralized system (multiple devices communicating in a small area on an ad hoc basis);

– **RLAN technology is sometimes used to implement fixed applications, which provide point-to-multipoint (P-MP) or point-to-point (P-P) links, e.g. between buildings in a campus environment**. P-MP systems usually adopt cellular deployment using frequency reuse schemes similar to mobile applications. Technical examples of such schemes are given in Report ITU-R F.2086 (§ 6.6). Point-to-point systems commonly use directional antennas that allow greater distance between devices with a narrow lobe angle. This allows band sharing via channel and spatial reuse with a minimum of interference with other applications.

– **RLAN technology is sometimes used for multipoint-to-multipoint (fixed and/or mobile mesh network topology, in which multiple nodes relay a message to its destination)**. Omnidirectional and/or directional antennas are used for links between the nodes of the mesh network. These links may use one or multiple RF channels. The mesh topology enhances the overall reliability of the network by enabling multiple redundant communications paths throughout the network. If one link fails for any reason (including the introduction of strong RF interference), the network automatically routes messages through alternate paths.

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Precedence (3 of 3)

- Another Example:
  - **Recommendation ITU-R M.1651 "A method for assessing the required spectrum for broadband nomadic wireless access systems including radio local area networks using the 5 GHz band "**
    - **2.2.1 Corporate office environment**
      - RLANs can be used for the replacement or extension of wired LANs. Typical cases could be temporary office installations or installations into spaces where building characteristics or protection prohibit the extensive use of cabling. More recently the sheer convenience of untethered connection to the LAN is proving very attractive to users of laptop PCs, and RLAN products are experiencing high growth rates.
      - **Terminals typically connected to infrastructure networks are designed for fixed use. Such a terminal could, for example, be a workstation, a PC or any other purpose-specific terminal. The applications are typically broadband applications. In this scenario the user device is mostly stationary and the main benefit derived from RLANs is the wireless convenience.** Thus, it will be a most likely scenario that RLANs should provide or approximate fixed network QoS to a stationary user. The user should not be able to notice the difference between using the wireless system and a wired system.
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    - **2.2.3 Wide area access environment**
      - It is envisaged by some administrations that WAS/RLANs could be used for wireless access on a wide area coverage basis. The terminals for such access should have the same air interface as indoor WAS/RLAN devices, but would likely use modified antennas and MAC protocols that allow greater range and deal with the longer propagation and multiple access delays resulting from outdoor operation. Sectoral or high-gain omnidirectional antennas, or repeaters, could be used to create micro-cells in which operational ranges of 300 to 3 000 m are possible, depending on the outdoor propagation conditions. In such deployments, the antennas are usually highly directive and are oriented toward a central AP.
      - **The applications are classified as nomadic since the terminals are capable of being moved from location to location. Some examples of nomadic applications are the provisioning of services to small transient businesses operating from industrial parks, or the linkage of several buildings in close proximity to each other to form a "campus" wireless network.**

Pulsed AM(R)S vs RNSS service links