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Abstract: [Frequency Band Considerations for the Use of Body Area Network]

Purpose: [To provide an introduction to the frequency band considerations for the Use of body area network]

Frequency Band Considerations for the Use of Body Area Network

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Outline

- WMTS
- Licensed Band
- Unlicensed Band
- ISM Band
- MICS Band
- Discussions

Wireless Medical Telemetry Service (WMTS)

- Definition for WMTS by the FCC, which is consistent with recommendations made in April 1999 by the American Hospital Association (AHA) task group on wireless medical telemetry;

  "the measurement and recording of physiological parameters and other patient-related information via bi- or unidirectional electromagnetic signal"
- Voice and video communications are expressly prohibited in the WMTS bands
- Communication distance < 3 m ?

WMTS Bands

- Licensed Band

  WMTS1 608-614 MHz
  WMTS2 1395-1400 MHz
  WMTS3 1429-1432 MHz

- Unlicensed Band

  9-315 KHz
  13.553-13.556 MHz (13 MHz ISM Band)
  174-216 MHz (TV channels 7-13)
  218-222 MHz
  293-320 MHz
  410-450 MHz
  512-608 MHz (TV channels 14-36)
  614-668 MHz (TV channels 38-46)
  902-928 MHz (915 MHz ISM band)
  2.4-2.4835 MHz (2.45 GHz ISM band)
  5.725-5.875 GHz (5.8 GHz ISM band)

Licensed **Band**

•This is the only designated frequency spectrum for medical telemetry systems
• They are protected from interference due to other wireless devices
• There are comparatively fewer interference sources
• Both the FCC and FDA encourage use of WMTS
• New FCC-approved equipment permitted (the FCC will not approve new equipment for use in the TV & PLMRS [Private Land Mobile Radio services] bands)
• Frequencies are coordinated to ensure interference-free operation

Authorized Users of WMTS

- Eligible WMTS users are limited to authorized healthcare providers, which includes licensed physicians, healthcare facilities, and certain trained and supervised technicians
- The healthcare facilities eligible for the WMTS are defined as those that offer services for use beyond 24 hours, including hospitals and other medical providers. Ambulances and other moving vehicles are not included whitin this definitions

WMTS Service Rules

- The service rules for the equipment and use of the WMTS include limitations on transmitter output power, out-of-band emissions, and protection of other services.

- Users of the WMTS will be co-primary with other users such as radio astronomy and military radar.
  - The 608-614 MHz is shared with the radio astronomy service. WMTS devices are required to obtain written permission to be used for transmitting within 80 km of some radio astronomy facilities and within 32 km of other radio astronomy facilities.
  - The 1395-1400 MHz is shared with military radar. Theses system can have a protected radius of up to 90 km. The government uses of these frequencies are being phased out over the next few years.

Limitations of WMTS

Despite its advantages, WMTS has a number of limitations:

- **Restricted Bandwidth**
  The WMTS uses a restricted bandwidth with only 6 MHz of contiguous bandwidth and14 MHz total (6+5+3 MHz)

- **Neither video nor voice transmission is permitted**
  Video is excluded because it could occupy a significant portion of the spectrum allocated to the WMTS. Voice transmission is excluded because of concerns that allowing voice transmissions could encourage the equipment to be used as a form of wireless intercom

- Because the WMTS is broken up into three bands, a single facility will find it difficult to use the entire spectrum
- Because WMTS operation is authorized only within a health care facility, operation in ambulances or other moving vehicles or in patients' homes is specifically excluded

Unlicensed **Band**

•No interference protection. Hospitals must accept interference or shut down if causing interference

• Hundreds of thousands of existing devices such as mobile radios or walkie-talkies used by policemen, firemen, taxicabs, and delivery trucks

• Tens of thousands more devices expected in the future

• High power operations already permitted in portions of the above spectrum with more high power operations permitted in the future

• Interference from mobile operations is unpredictable

•Millions of existing operations including wireless LANs and microwave ovens

• Increased interference potential with popularity of wireless networking technologies

ISM Bands

The FCC ruling does not require that all medical devices use WMTS bands. An alternative spectrum for medical telemetry use is the ISM band. The amount of spectrum is limited, and each band eventually fills up, forcing new users to higher bands.

- **ISM-900**
  Freq. range:902-928 MHz
  Bandwidth:26 MHz

- **ISM-2.4**
  Freq. range:2400-2483.5 MHz
  Bandwidth:83.5 MHz

- **ISM-5.8**
  Freq. range:5.725GHz-5.850 GHz
  Bandwidth:125 MHz

Advantages of the ISM Band

Medical telemetry systems that utilize the ISM band have a number of advantages over WMTS:

- The ISM band occupies 83 MHz of bandwidth (2.4 GHz ISM band), including guard bands to protect against adjacent-channel interference. This is 14 times more than the 6 MHz currently occupied by the WMTS
- WMTS has no guard bands to protect against interference from TV channels 36 and 38
- Unlike the WMTS, the ISM band allows audio and/or video transmissions
- The ISM band is available and compatible worldwide for wireless applications
- The propagation characteristics of the ISM frequency band make it ideal for in-building use where structures attenuate the signal between floors

Limitations of the ISM Band

- Other radiators in the ISM band such as other mobile devices, some wireless telephone networks, and microwave ovens can cause interference.

Medical Implant Communications Service

- The FCC proposed designating an additional two MHz of spectrum for the MICS devices, at 401-402 MHz and 405-406 MHz, adjacent to the existing Medical Implant Communications Service band at 402-405 MHz
- New service for Advance Medical Radio Communication **(MedRadio)** devices shall be in the 401-406 MHz band
- The FCC also proposed increased flexibility for the newly designated 401-402 MHz and 405-406 MHz band to allow the use of low power, low duty cycle MedRadio devices without requiring the frequency agility capability required by the current MICS rules
- The frequency agility would continue to be required of device in the core 402-405 MHz band to accommodate devices that might be used for more critical purposes

Frequency agile, means the device change their transmission and reception characteristics as conditions warrant, to better ensure transmission.

MICS Band and Body worn Devices

- To accommodate a wider variety of devices than the current MICS services, which is limited to use of implant devices, the FCC proposed allowing the use of body-worn transmitting devices in the MedRadio service

Discussions

Frequency band?

1- Medical

2- Medical and non medical band

1- On-body

2- In-body

3- On-body and In-body