60GHz Usage & Requirements

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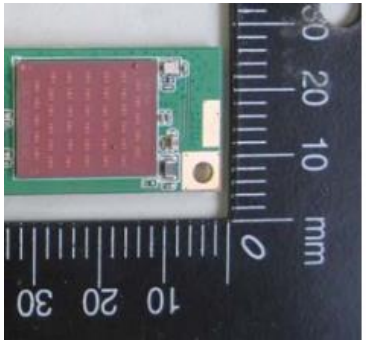
Key Discussion Items

- Two types of scenarios
- 60 GHz Usages
- Conducted power requirements
- Antenna (Beam-forming versus Omni-directional)
- RF exposure evaluation
- Recommendations

Two types of scenarios

- Point to Point Systems
  - Some of the original rules originally were written for this scenario
    - Far Field usage condition
    - Typically high antenna gains, parabolic type P2P pole mount antenna systems

- Mobile & Portable Systems
  - Smaller multi-element active antenna array systems



60GHz Usages

Instant Wireless Sync
- IP-based P2P applications
- Using I/O PAL

Wireless Display
- HD streams over HDMI or DP using A/V PAL
- CE, PE and HH usages

Cordless Computing
- Combination of Wireless display using A/V PAL, sync and I/O using I/O PAL

Internet Access
- Using native Wi-Fi, 802.11ad support

Output Power Limits

- US (FCC Part 15.255, KDB 200443 (4 documents))
  - 500mW conducted power
    - Typically calculated based on EIRP-Antenna gain
      - Not able to measure directly as antenna is mounted directly to radio silicon
  - 43dBm Peak EIRP
  - 40dBm Average EIRP

- EU (R&TTE 1999/5/EC, EN 302 567)
  - 40dBm Average EIRP
    - No conducted limit specified

Antennas – Beam-forming versus Omni-Directional

- Beam-forming typically used for mobile or portable applications
  - Primary use is in room proximity to the other transceiver
  - Lower cost and lower power consumption

- Omni-Directional antennas are either low gain or require significant power to achieve higher gain to make up for the propagation loss.
  - Larger devices can allow for higher power directly at the antenna system to achieve higher gains
  - Not really feasible in mobile or portable designs due to power consumption to allow for reasonable range

RF Exposure Evaluation

- Power Density
  - Far Field – fixed & temporary fixed
    - Calculation based on power density equation found in both ICNIRP and FCC
    - Typical distances of 20cm or more
    - Power Density calculation valid for Far Field

$$S = \frac{EIRP}{4\pi R^2}$$

S = Power Density in mW/cm^2
EIRP = Effective Isotropic Radiated Power (in mW)
R = Distance to antenna (in cm)
Limit = $1mW/cm^2$ (FCC) = $10W/m^2$ (ICNIRP)

  - Near Field – Numerical modeling required
    - Accurate and accepted by FCC, Industry Canada and EU under the R&TTE Directive
    - Power density equation breaks down and is no longer accurate within the transition field and near field regions
    - SAR (Specific Absorption Rate) testing is not feasible
      - No liquid simulant above 10 GHz
      - No SAR systems or probes above 10 GHz

Recommendations

- Conducted power limit
  - If used, should be coupled with EIRP
    - Drives limitation on antenna gain based on an EIRP prevailing limit

- Allowance for numerical modeling to assess RF exposure in the near field