Part 30 Updates

Laboratory Division

Office of Engineering and Technology

FCC

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Overview

- As of April 3, 2020 Number of approved applications subject to part 30 rule is as following:
  - Fixed transmitter: 27
  - Transportable transmitter: 4
  - Mobile Transmitter: 21
- To perform OOB and Spurious emission compliance testing, C63 mmW JTG recommends three methods:
  1. Radiated, EIRP, also known as "Early Exit"
  2. Radiated, TRP
  3. Radiated, EIRP, to conducted power conversion
     - Only applicable to band edge
- Overall, fixed transmitters took advantage of all recommended methods by C63 mmW JTG
  - Specifically, almost all applications utilized 3rd method to meet OOB limit at the band edge
  - A limited number of applications performed TRP measurements
- KDB Publication 842590, originally published in 2019, was revised and published on April 3, 2020
- Use of alternative test sites, compact antenna range and reverberation chamber, is currently being studied by ANSI C63 mmW Joint Task Group

Radiated EIRP Measurement

- Radiated EIRP Measurement Used For:
  a. (In-band) Power Density Measurement
  b. Unwanted Emission Measurement
     - Early Exit
  c. Unwanted Emission Measurement (TRP)
     - When a few measurements are added and averaged in linear terms to determine TRP
     - The results are summed across two polarizations.
- In all three cases, it is assumed a linearly polarized measurement (receive) antenna is used!
- Measurements are recorded over two orthogonal (cross) polarizations
  - In cases a and b, there is no need to sum the measurements across the two polarizations!

EIRP to Conducted Power Conversion Method

- As applicable to part 30 devices, use of this method is only allowed at the band edge and is subject to a few conditions.
- §30.203 defines the band edge as
  - the area immediately outside and adjacent to the licensee's block, having a bandwidth equal to 10 % of the channel bandwidth
    - Band edge changes as the channel bandwidth increases or decreases!
    - It does not define the boundary separating OOB from spurious domain!

Use of TRP Measurement Method

- If radiated (EIRP) measurement results do not meet the unwanted emission limits, as stated in §30.203, then TRP measurement is performed.
- TRP measurements may be performed anywhere in the unwanted emission domain
  - OOB or Spurious
- A few applications utilized this method
  - Mainly two- cut method as described in KDB Publication 842590 D01

Compliance Measurements, Multiple Antenna Systems

- Implementing Advanced Antenna System (AAS) Technology
  - Appears to be a common practice
  - Phased array antenna systems with subarrays
    - With # of radiating elements varying from 4 to 256 (per subarray)
  - Steering capability
- Of the applications reviewed in EA system
  - Subarrays of each device performed almost identically (per polarization)
- If the antenna system is comprised of multiple identical subarrays then only one subarray may be tested, at a time, for compliance purposes instead of all of subarrays!

Total power, due to all subarrays shall be calculated!

Backup Slides

Compliance Measurements, Multiple Antenna Systems

- A few fixed transmitters and mobile devices were tested in the FCC Laboratory
  - Some systems provided electronic steering capability
    - Transmission at boresight of the antenna system created maximum radiated power level
    - Steered beams maintained their directivity within certain scanning area in elevation or azimuth
    - However, directivity reduced beyond those points
- For antenna systems with steering capability
  - One beam position corresponding with maximum radiated power may be tested for compliance purposes!

Compliance Measurements, Multiple Modulation Schemes

- Devices tested in the FCC Laboratory
  - Implemented three distinct modulations
    - QPSK, 16 QAM and 64 QAM
- Measured in-band power level showed no remarkable difference as modulation changed
  - Differences in power level were smaller than uncertainty of radiated measurement
- This trend was also observed in the applications found in EA system
- For compliance purposes, one modulation (lowest order) may be selected for testing!
  - Lowest order modulation, typically the worst case

Sample Devices Measurement Results*

Device A in-band power, BW: 50 MHz, Horizontal Polarization

Modulation	Power Density (dBm/50 MHz)	Max Variation in Power (dB)	Measurement Uncertainty
QPSK	22.5	1	2 dB
16 QAM	22.0		
64 QAM	21.5		

Device A in-band power, BW: 100 MHz, Horizontal Polarization

Modulation	Power Density (dBm/100 MHz)	Max Variation in Power (dB)	Measurement Uncertainty
QPSK	22.2	2	2 dB
16 QAM	21.0		
64 QAM	20.2		

*** Subcarrier Spacing of all Measurements: 120 kHz**

Sample Devices Measurement Results*

Device B in-band power, BW: 50 MHz, Horizontal Polarization

Modulation	Power Density (dBm/50 MHz)	Max Variation in Power (dB)	Measurement Uncertainty
QPSK	43.5	0.9	3 dB
16 QAM	42.6		
64 QAM	43.5		

Device B in-band power, BW: 100 MHz, Horizontal Polarization

Modulation	Power Density (dBm/100 MHz)	Max Variation in Power (dB)	Measurement Uncertainty
QPSK	46.8	0.9	3 dB
16 QAM	46.8		
64 QAM	45.9		

*** Subcarrier Spacing of all Measurements: 120 kHz**

Sample Devices Measurement Results*

Device C in-band power, BW: 100 MHz, Horizontal Polarization

Modulation	Power Density (dBm/100 MHz)	Max Variation in Power (dB)	Measurement Uncertainty
QPSK	57.5	0.5	3 dB
16 QAM	57.5		
64 QAM	57.0		

Device C in-band power, BW: 200 MHz, Horizontal Polarization

Modulation	Power Density (dBm/200 MHz)	Max Variation in Power (dB)	Measurement Uncertainty
QPSK	58.5	0.2	3 dB
16 QAM	58.7		
64 QAM	58.6		

Device C in-band power, BW: 400 MHz, Horizontal Polarization

Modulation	Power Density (dBm/400 MHz)	Max Variation in Power (dB)	Measurement Uncertainty
QPSK	57.5	0.8	3 dB
16 QAM	58.3		
64 QAM	58.1		

*** Subcarrier Spacing of all Measurements: 120 kHz**