Part 30 Updates
Lessons Learned

Laboratory Division

Office of Engineering and Technology

FCC

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Overview

- As of November 1, 2019 Number of approved applications subject to part 30 rule is as following:
  - Fixed transmitter: 22
  - Transportable transmitter: 3
  - Mobile Transmitter: 14
- 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

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 for compliance purposes instead of all of subarrays!

Total power, due to all subarrays shall be calculated!

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**