Level Probing Radar(LPR)

(FNPRM ET Docket No. 10-23)

and

Millimeter Wave Measurement Procedure Discussions

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Background

- No Part 15 rules specifically for Level Probing Radars (LPRs)
- Current rules permit operation only under 15.209 in metal or concrete tanks (TLPR) in non-restricted bands
- Other Part 15 rule sections have operational restrictions such as use on terrestrial transportation vehicles only
- In response to Petition for Rulemaking and waiver requests Commission adopted waiver in Notice and Order in 2010 for TLPR

Background

- Waiver permits operation of TLPRs in tanks with high attenuation such as metal or concrete tanks in 77 to 81 GHz band
- By waiver Commission has authorized TLPRs which comply with 15.209 for use in tanks in the 77 to 81 GHz band. Waiver not required in non-restricted bands
- Current rules limit capabilities of LPRs and TLPRs

Background

- Commission received waiver requests and other inquiries for outdoor use and use in other frequency bands

- For several years FCC and European agencies have considered LPR issues
  - Emission limits for LPRs and TLPRs
  - Frequency bands
  - Interference potential
  - Compliance measurement procedures

Background

- In 2006 the European Telecommunications Standards Institute (ETSI) adopted technical standard for TLPRs
- In 2010 The Electronic Communications Committee (ECC) in Europe published a report on interference by LPRs
- Based on ECC report and work by ETSI, a boresight emission limit was determined that correlates to a reflected emission limit the same as 15.209 under following conditions:

Background

- Conditions
  - Worst case material reflectivity
  - Downward pointing LPR antenna
  - Narrow antenna beamwidth
- Advantages
  - Applies to both LPRs and TLPRs
  - Permits higher peak levels than Part 15 with same interference protection
  - Simplifies compliance measurements
  - Harmonizes with ETSI emission limits

Proposed New Rules

- New rule Section 15.256 limited to LPRs inside or outside an enclosure
- Fundamental emission limits boresight EIRP in 1 MHz and 50 MHz. Same as ETSI
- Frequency bands 5.925-7.250, 24.05-29.00 and 75-85 GHz. Slightly different from ETSI
- Downward pointing at fixed location
- Limited antenna beamwidth & sidelobe gain
- Exempt from peak power limit in 15.35(b) and averaging in 15.35(c)

Measurement Procedure

- Fundamental emission
  - Measure maximum power in 1 MHz bandwidth with average detector and maximum power in 50 MHz bandwidth
  - For 75 to 85 GHz band downconvert to frequency range of spectrum analyzer
  - Bandwidth of downconverter must be greater than signal bandwidth
  - Measure signal in 1 MHz RBW at maximum of spectrum with power averaging detector

Measurement Procedure

- Fundamental emission (cont)
  - Measure maximum power in 50 MHz centered on maximum average power frequency in 1 MHz
  - Since 50 MHz RBW is probably not available on spectrum analyzer, use one of the following methods:
    1. Measure maximum power with RBW < 50 MHz and calculate power in 50 MHz
    2. Diode detect signal and measure maximum from 50 MHz low pass filter on oscilloscope
  - Calculate EIRP

Measurement Procedure

- Fundamental emission (cont)
  - Method 1
    a) Measure maximum signal in available RBW which is factor of 3 > or < PRF but not < 1 MHz
    b) Calculate correction factor

    20 Log (50/RBW) dB if PRF < RBW

    20 Log (50/PRF) dB if PRF > RBW

    c) Add correction factor to value from step1

Measurement Procedure

- Fundamental emission (cont)
  - Method 2
    a) Calibrate high frequency diode at RF frequency
    b) Diode detect signal
    c) Filter signal with 50 MHz low pass filter
    d) Measure maximum of signal on oscilloscope

Measurement Procedure

- Fundamental emission (cont)
  - Calculate EIRP
    - From field strength measurement or
    - Power input to antenna and antenna gain (dBi)
  - Measure bandwidth with peak detector and RBW = 1 MHz and VBW => 3 MHz

Measurement Procedure

- Unwanted emissions
  - Above 1000 MHz measure maximum average power level in 1 MHz RBW
  - Below 960 MHz measure with CISPR quasi-peak detector
  - Elevation and azimuth scans required to locate maximum emissions
  - Convert all measurements to EIRP
  - Limits are 15.209 expressed in terms of EIRP

Measurement Procedure

- Antennas
  Manufacturers specifications may be relied upon for compliance with main beam gain and bandwidth and side lobe gain requirements

Previously Certified TLPRs

- TLPRs approved under 15.209 may continue to operate if they continue to comply with 15.209 limits
- TLPRs approved under waiver may continue to operate under conditions of waiver
- Previously approved TLPRs may apply for permissive change to operate under new rules provided:
  - Operates only in proposed frequency bands
  - Complies with new proposed emission limits
  - No hardware change (software upgrade only)

Questions and Answers

Thanks!