EMC Power Measurement Issues

TCB Workshop October 2011

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Presentation Topics

- Proposed New Digital Transmission System (DTS) Compliance Measurement Procedures
- Update to Wireless Communication Service (WCS) Requirements
- C63.10 Issues and Status
- C63.26 Issues and Status
- Pre-Test Calibration Methodology
- Miscellaneous Issues

Digital Transmission Systems

- DTS operations authorized in 902-928, 2400-2483.5 and 5725-5850 MHz bands under auspices of §15.247 of the CFR
- Previous compliance measurement guidance provided in KDB 558074
- New guidance has been proposed in Draft KDB 718828
  - Currently posted on FCC Website for public review and comment
  - Introduced for review and inclusion in C63.10
  - Encourage all to review and file comments
- Once finalized, this new procedure will supersede the old one

Proposed DTS Procedure Summary

Fundamental Emission Bandwidth (EBW)

- §15.247(a)(2) specifies that the minimum 6 dB bandwidth shall be at least 500 kHz
- Additionally, knowledge of the BW will be required for subsequent band power measurements
- Two procedures are offered for making this measurement
  - Traditional procedure offered as primary methodology (see C63.10)
  - Use of the automatic bandwidth measurement capability of many contemporary spectrum analyzers offered as an alternative
    - Care should be exercised when using this option

Proposed DTS Procedure Summary

Fundamental Emission Output Power

- Limits applicable to the fundamental emission output power specified in §15.247(b)(3)
  - Specified in terms of conducted output power
    - Radiated procedures may be necessary with integral transmit antenna devices
  - Allows for the use of either peak or average techniques to demonstrate compliance to limit
    - Averaging permitted over the symbol alphabet only (*i.e.*, no duty cycle averaging permitted)
- Two procedures specified for performing peak power measurements
  - One for cases where RBW ≥ BW
  - One for cases where RBW < BW (integration method)
- Two procedures specified for performing average power measurements
  - Power averaging with slow sweep speed (extended integration time)
  - Trace averaging over multiple sweeps

Proposed DTS Procedure Summary

Fundamental Power Spectral Density

- A conducted power spectral density limit of 8 dBm in any 3 kHz band segment within the fundamental BW is specified in §15.247(e)
- Performing this measurement with a 3 kHz RBW over the wide bandwidths employed by contemporary DTS devices becoming burdensome
- New procedure permits measurement with 100 kHz RBW and a subsequent conversion to equivalent level in 3 kHz for comparison to limit
- Procedures specified for both peak and average PSD measurements
  - Must use procedure consistent with fundamental emission measurement

Proposed DTS Procedure Summary

Unwanted Emissions (non-restricted bands)

- §15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band the power shall be attenuated as follows:
  - By 20 dB if peak fundamental output power was used to demonstrate compliance
  - By 30 dB if average fundamental output power was used to demonstrate compliance
  - In either case, attenuation to levels below the general emission limits specified in 15.209(a) is not required
- Proposed new DTS procedure
  - Specifies a methodology for measuring the reference level in any 100 kHz of the fundamental emission
  - Specifies methodology for measuring the unwanted emission level in any 100 kHz for comparison to reference level

Proposed DTS Procedure Summary

Unwanted Emissions (restricted bands)

- Radiated Procedure
  - Traditional methodology
  - No changes to procedures defined in C63.10
- Conducted Procedure
  - Proposed as an alternative to radiated measurements
  - Measure output power, determine the maximum EIRP in specified bandwidth and then convert to equivalent field strength intensity for comparison to limit
  - Specific considerations
    - Antenna gain assumptions for determining EIRP
    - Requires a radiated test for potential case/cabinet emissions

Proposed DTS Procedure Summary

Unwanted Emissions (restricted bands)

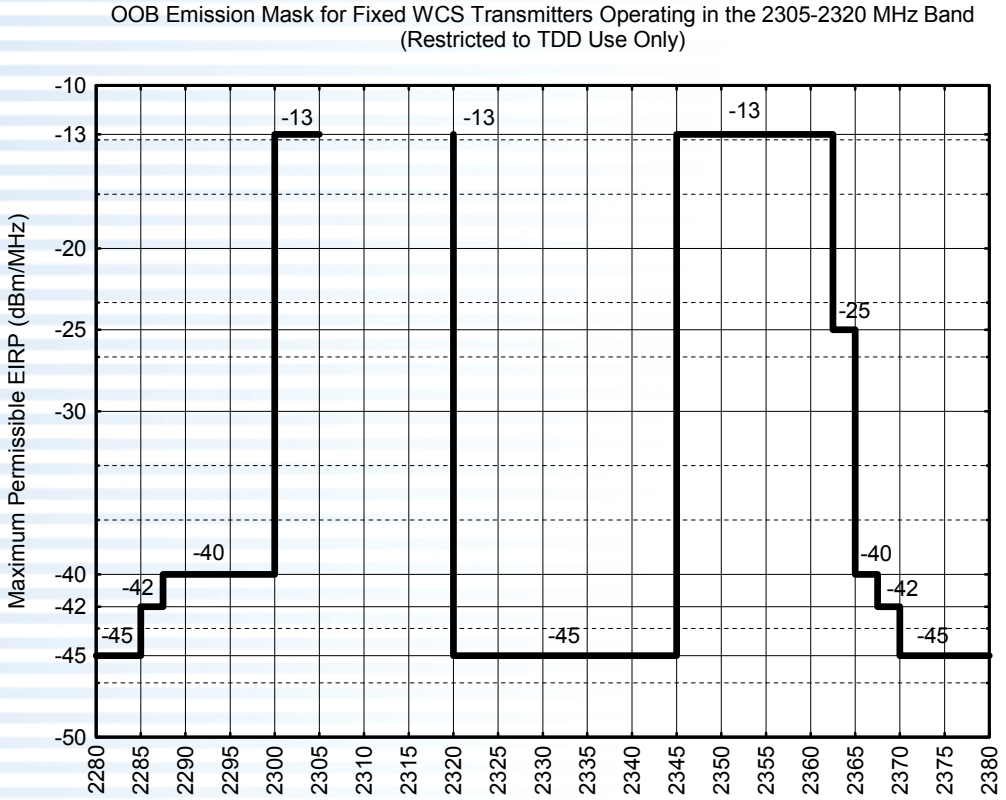
- Applicability of §15.35
  - §15.35(b) requires that when average measurements are specified, the total peak power level must be no more than 20 dB above the average emission limit
    - New guidance provides a procedure for performing this measurement
  - §15.35(c) permits a duty cycle reduction when pulsed operation is employed.
    - This allowance is only applicable to unwanted emissions that demonstrate the same pulse characteristics as the fundamental emission
    - Duty cycle is determined over a complete pulse train if the pulse train does not exceed 100 msec
    - Duty cycle determined over the 100 msec interval of maximum power if the pulse train exceeds 100 msec
    - Refer to C63.10 for further guidance

Wireless Communications Service (WCS)

- Relevant WCS rule changes (§27.50 and §27.53) briefed at April workshop
- Petitions for Reconsideration are still pending
  - Attempting to address multiple petitions affecting both WCS and SDARS in one Reconsideration Order
- Measurement guidance KDB forthcoming
- Remains on PBA list at this time
- The following charts provide modified unwanted emissions masks based on input received after last workshop
  - Implementation of step-wise rather than linear interpolation between frequency points

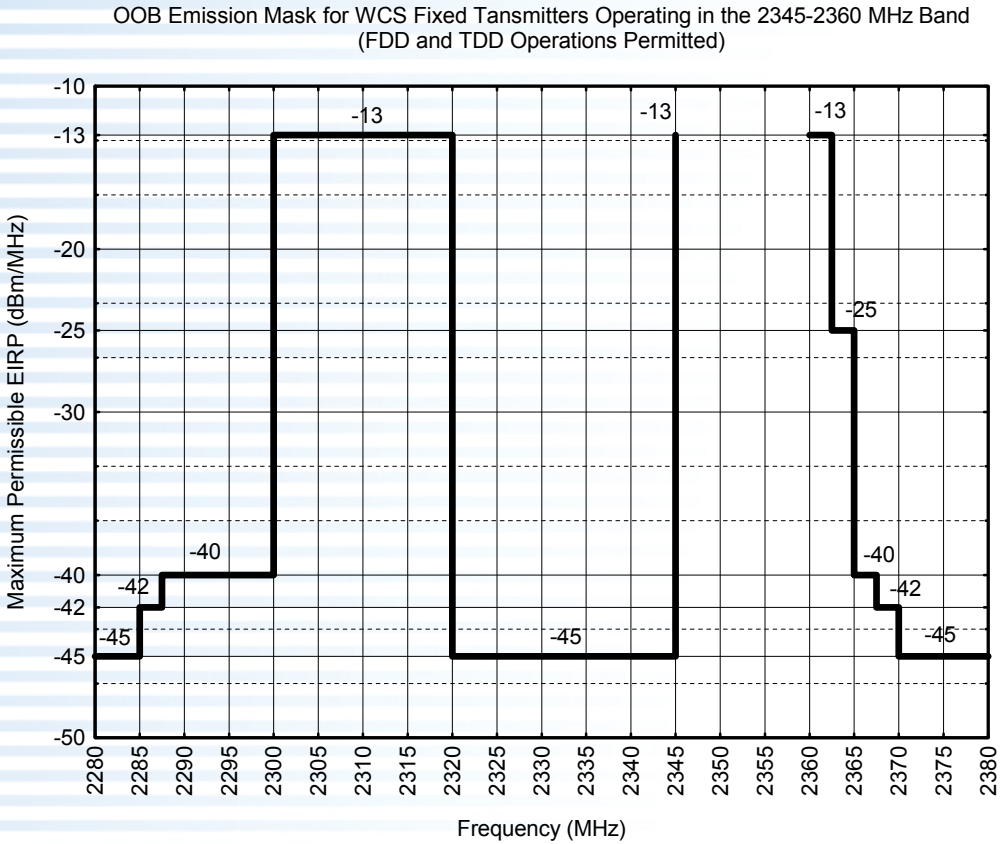
Modified WCS Unwanted Emissions Masks

- Fixed and Base Stations operating in 2305-2320 MHz



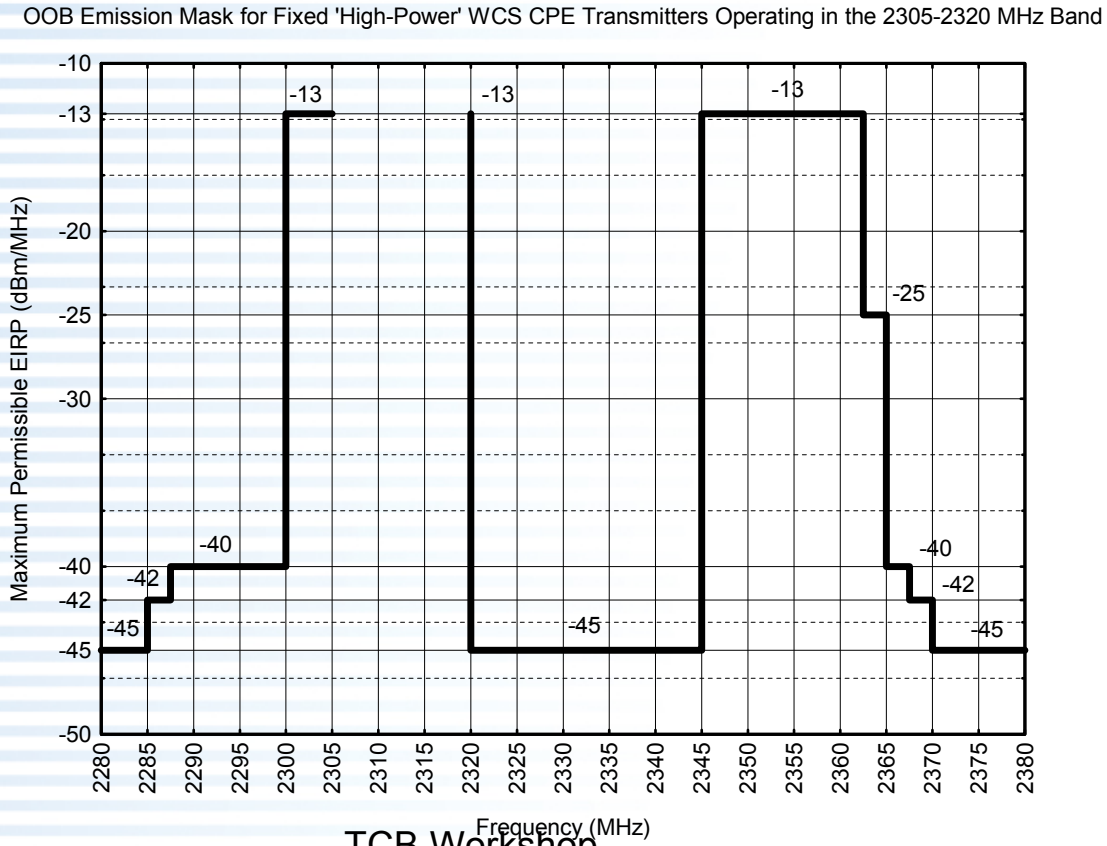
Modified WCS Unwanted Emissions Masks

- Fixed and Base Stations operating in 2345-2360 MHz



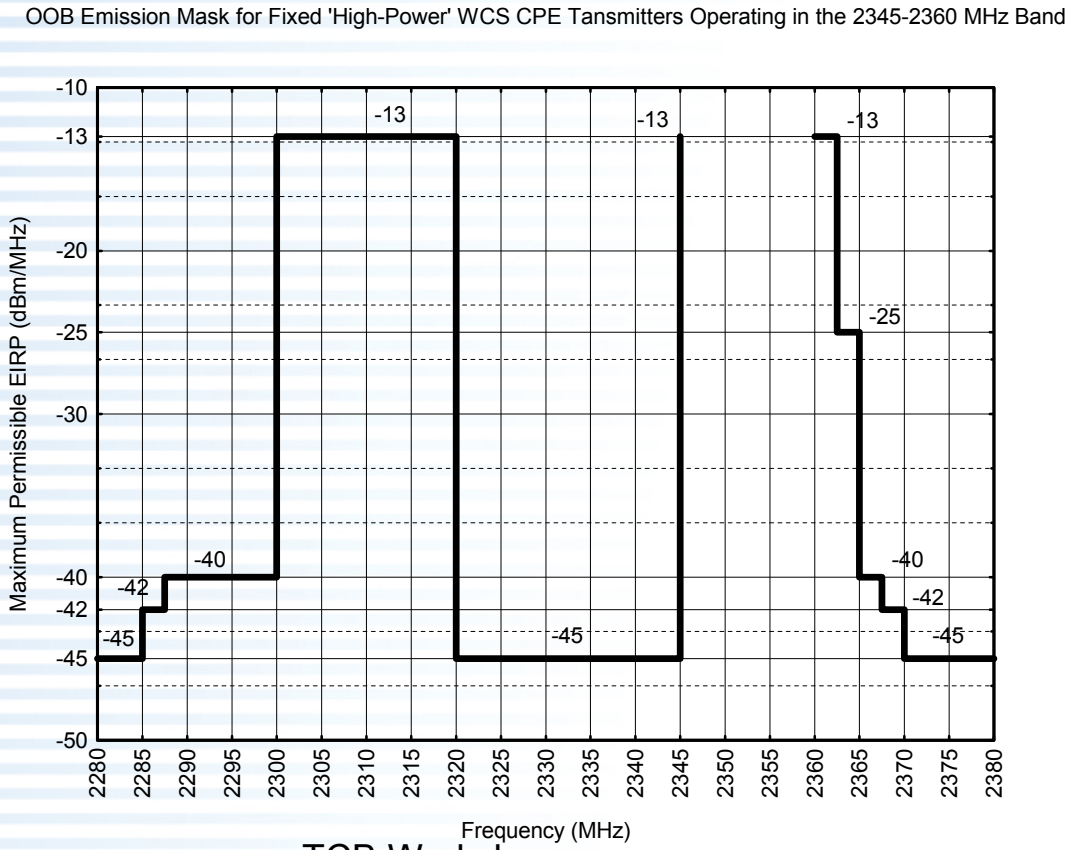
Modified WCS Unwanted Emissions Masks

- Fixed “high power” CPE Stations operating in 2305-2320 MHz



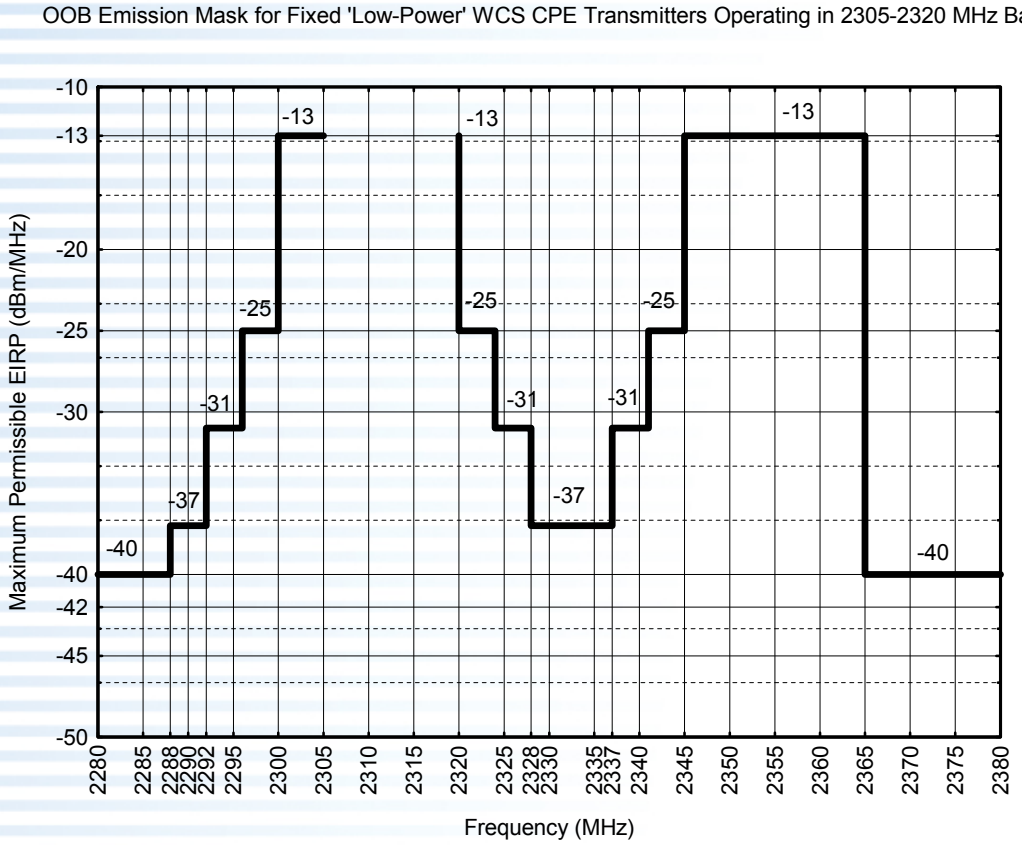
Modified WCS Unwanted Emissions Masks

- Fixed “high power” CPE Stations operating in 2345-2360 MHz



Modified WCS Unwanted Emissions Masks

- Fixed “low power” CPE Stations operating in 2305-2320 MHz



Modified WCS Unwanted Emissions Masks

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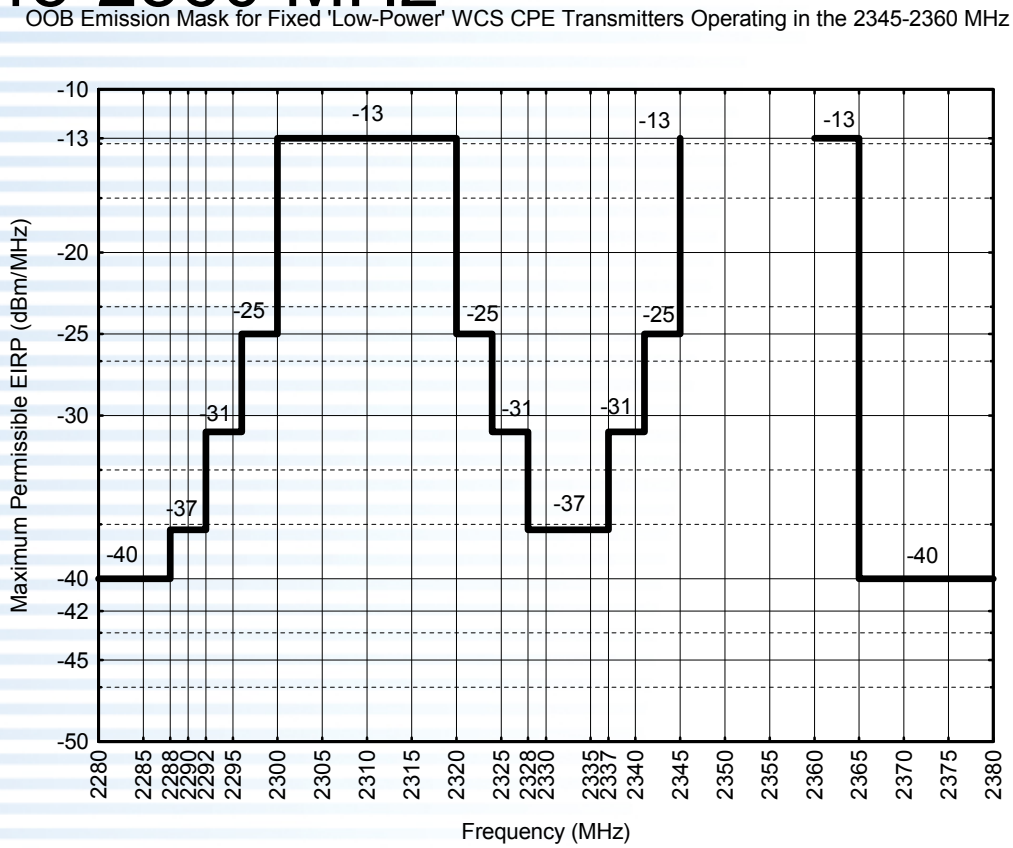
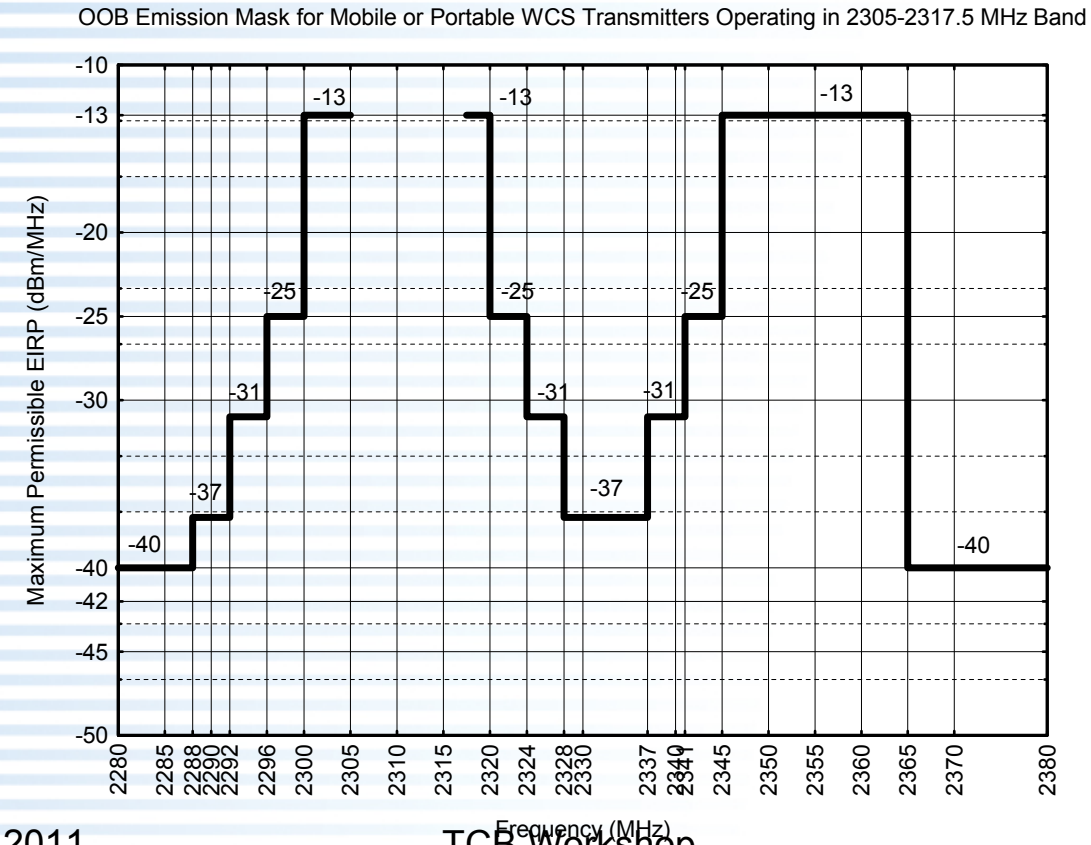


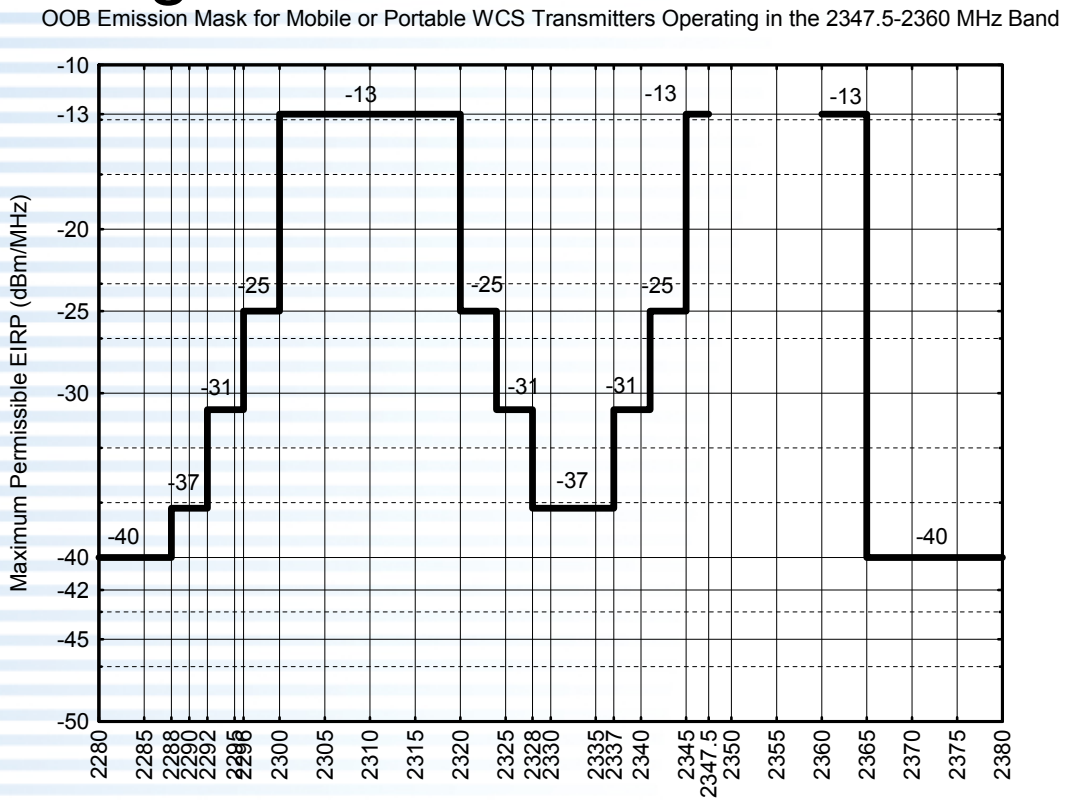
Modified WCS Unwanted Emissions Masks

- Mobile and Portable WCS Stations operating in 2305.0-2317.5 MHz



Modified WCS Unwanted Emissions Masks

- Mobile and Portable WCS Stations operating in 2347.5-2360.0 MHz



C63.10 and C63.26 Status Update

- C63.10 (20xx) Status
  - Wireless WG meeting held in Austin, TX (ETS Lindgren) on May 2-3, 2011
  - Second draft edited by committee at FCC Lab in July 2011
  - Wireless WG meeting held in Red Bank, NJ (Thompson Park) on October 3-4, 2011
  - Action items assigned for completion by November 1st with intent to simultaneously forward to IEEE Secretary to begin balloting process and C63 for final review
    - One action item is the inclusion of proposed new compliance measurement procedures for UNII and DTS
- C63.26 Status
  - Fifteen separate task groups have been defined
  - New draft to be circulated for discussion at April 2012 meeting (location TBD)

Pre-Test Calibration Methodology

- FCC released KDB 449343 in December 2010
  - Response to complaints over use of a non-standardized procedure
  - Suspended acceptance of data collected with this methodology
- C63.26 Task Group currently developing the methodology into a procedure intended for standardization
  - Survey indicates interest in using such a procedure among a number of labs
  - C63 planning to propose procedure to FCC for consideration prior to finalization of C63.26

Miscellaneous Issues

- Concern recently expressed to FCC over peak power being reported in CDMA and WCDMA test reports to demonstrate compliance to EMC requirements
  - Industry performance specifications assume average/RMS power
  - SAR testing requires reporting average power
  - Recommend that all such test reports also include average power levels for purposes of consistency

Miscellaneous Issues (continued)

- FCC Lab Perspective
  - Assumed that this concern is limited to fundamental emission measurements
  - Agree that the proper way to characterize fundamental emission power for these (and other) digital modulation techniques is in terms of average/RMS
    - Most of the relevant FCC power limits are indeed specified in terms of average power
  - Also recognize that some labs prefer to use peak detector due to relative simplicity and speed of the measurement
  - Primary FCC concern is that compliance to the stated emission limit be demonstrated
    - Peak detected levels that comply with specified average limit provides adequate demonstration of compliance
    - Reports must clearly state when the measured power is peak-detected
  - An additional requirement to also report average power levels in such cases is currently under consideration

Questions and Answers

Thanks!