



C63.26 STM1-RF Power Output Update

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Background

- C63.26 attempting to document standard procedures for performing compliance measurements on transmitters intended for operation in the U.S. licensed radio services and which require FCC certification.
- Standard Test Methods task group 1 (STM 1) is assigned the task of documenting, and where necessary, developing, standard procedures for measuring the RF output power in the fundamental emission of licensed transmitters
 - Specific considerations: average power measurements, signal substitution methods, peak power measurements, peak-to-average ratio measurements.



Objective

- The objective of STM-1 is to document standard test procedures for measuring the fundamental emission output power of licensed transmitters that will produce accurate and consistent (repeatable) results across a range of currently available instrumentation options.



Approach

- Research and document the FCC rules for licensed operation related to fundamental emission output power limits.
 - Note how the limits are expressed (e.g., ERP, EIRP, PSD, PAR)
 - Note any associated bandwidth limitations or channel plans
 - Note any measurement guidance provided by the rules
- Research lab policies, industry standards, and applicable literature for established measurement procedures and practices.
- Identify predominate signal/waveform types (modulation formats, emission bandwidths and access schemes) among contemporary and near-term future technologies.



Approach (continued)

- Initially focus on those rule parts that accommodate devices transmitting digitally-modulated broadband emissions
 - Most questions related to measurement of broadband signals
 - Procedures and policies not well established
 - > 1 MHz assumed as demarcation between narrowband and broadband emissions
 - Relevant rule parts are §22H, §24E, §27, §90 (Y&Z)



Constraints

- FCC rules require that measurement of RF output power be performed over a period of continuous transmission (over a burst duration or time slot allocation).
 - STM 1 not addressing how to set up DUT for this condition
 - Proper DUT set-up assumed to be responsibility of test lab in coordination with manufacturer/applicant
- FCC rules require that measurements be performed in “worst-case” (highest realized power) operational mode.
 - STM 1 not addressing how to identify worst-case mode
 - Intent is to develop technology-independent procedures
 - Means for identifying worst-case mode to be left up to test labs



Progress on Specific Tasks

- Average Power Measurements
 - Instrumentation
 - Average Power Meter (assumed as reference instrument)
 - Spectrum/Signal Analyzer
 - Measurement Methodology (BB emissions)
 - Integrated band/channel power
 - Comparing several possible techniques (Power meter, SA Marker BPWR function)
 - Issues
 - Minimum instrumentation specifications
 - Proper analyzer settings (RBW, integration time, etc.)
 - Signal bandwidth definition (EBW vs. OBW)



Progress on Specific Tasks

- Signal Substitution Methods
 - FCC rules permit conducted measurements for determining the output power in the fundamental emission of licensed devices (§2.1046).
 - Practical considerations (e.g., devices with integral antenna) often require that radiated measurements be performed.
 - No rules requirement for use of a calibrated test site.
 - To compensate, FCC lab policy has been to require use of signal substitution methodology.
 - FCC refers to TIA 603 standard.



Progress on Specific Tasks

- Signal substitution (continued)
 - Questions/Issues
 - Many test facilities use calibrated test sites (required for Part 15 measurements) to perform radiated measurements on licensed devices.
 - Some have complained that requiring signal substitution introduces unnecessary redundancy.
 - Substitute signal is often CW
 - Questions arise as to whether a CW signal is fairly representative of a digitally-modulated broadband signal.
 - Measurements and white papers under review within STM 1 to examine this issue.
 - TIA standard procedures vague with respect to applicability to broadband emissions.



Progress on Specific Tasks

- Peak Power Measurements
 - Some FCC rule parts specify output power limits in terms of “peak” power.
 - Not clear that the intent is to measure the instantaneous peak power of a digitally-modulated signal.
 - Arranging meetings with other FCC bureaus to resolve this question.
 - For digitally-modulated broadband emissions, measurement of instantaneous peak power can be challenging
 - Statistical time-domain parameter
 - Requires instrumentation with resolution/measurement bandwidths \geq signal emission bandwidth
 - This topic has not yet been considered in detail



Progress on Specific Tasks

- Peak-to-Average Ratio (PAR) Measurements
 - Recent rules modifications require the measurement of PAR when average output power is measured.
 - E.g., Part 24(E) and 27.50(d)
 - A method for performing this measurement is the use of Complimentary Cumulative Distribution Function (CCDF) curves.
 - Statistical power measurement
 - Capability included in many modern test instruments.
 - Suggested technique in recent FCC Public Notice (DA 10-592).
 - This topic has not yet been considered in detail.



Future Work

- Continue to refine average integrated band power measurement procedures for broadband waveforms.
- Develop/document procedures for measuring the average fundamental output power of narrowband digitally-modulated waveforms.
- Develop/document procedures for measuring the peak fundamental output power for both narrowband and broadband digitally-modulated waveforms.
- Define those rule parts where each procedure is applicable.
- Describe procedures for performing compliance measurements on both a conducted and radiated basis
 - Signal maximization
 - Signal substitution



Recent KDB-Published Measurement Procedures

- Medical Device Radiocommunication (MedRadio) Service
 - New radio service established by 2009 rulemaking (FCC-09-23)
 - Regulations codified in new Subpart I of Part 95 rules
 - Incorporates existing Medical Implant Communications (MICS) “core” frequency band of 402-405 MHz and establishes two newly designated “wing” bands (401-402 MHz and 405-406 MHz)
 - Original MICS rules permitted use of an average power procedure for measuring the output power of the fundamental emission.
 - Referenced a procedure that was defined in ANSI C63.17-1998 permitting the use of video averaging techniques.
 - ANSI C63.17-1998 replaced by ANSI C63.17-2006
 - Newer standard no longer contains the average power procedure.
 - FCC recently published a power measurement procedure (KDB publication 771134) to replace the average power procedure previously contained in C63.17-1998
 - FCC also recently published guidelines on the use of a human torso simulator when performing compliance measurements of MedRadio Service devices (KDB publication 617965)



Recent KDB-Published Measurement Procedures

- 3650-3700 MHz Wireless Broadband Services
 - 2005 rulemaking (FCC-05-56) established rules to provide for licensed terrestrial wireless broadband service utilizing contention-based protocol
 - Regulations codified in Subpart Z of the Part 90 rules
 - Establishes limits on total power over 25 MHz bandwidth and on maximum power spectral density in 1 MHz.
 - FCC recently published procedures for measuring both the total power and the power spectral density (KDB publication 965270)
 - Procedures tested by FCC lab and Motorola and found to produce output power results consistent with power levels measured with an average power meter.
 - Rules also accommodate use of MIMO antenna technologies
 - Guidance with respect to compliance measurements for MIMO antennae currently under development



Questions and Answers

Thanks!