



# Overview and Synopsis of ANSI C63.26

TCB Workshop  
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# Introduction

- ANSI C63.26-2015 “*American National Standard for Compliance Testing of Transmitters Used in the Licensed Radio Services*” was published on January 15<sup>th</sup>, 2015.
- FCC has issued a Public Notice (DA 16-348) requesting comments regarding the prospect of incorporating the standard into the Commission’s rules by reference.
- The deadlines for comments have been established as:
  - 15 days after publication in the Federal Register (FR) for initial comments
  - 25 days after publication in the FR for reply comments
- Interested parties do not have to wait for FR publication to file comments.
  - Encourage all TCB’s to review and comment ASAP



# Overview of ANSI C63.26

- ANSI C63.36 was developed to provide standardized procedures for collecting the data necessary to demonstrate compliance to the RF-related requirements codified in the applicable FCC and IC rules for licensed radio services.
- Early in the development process it became evident that the scope would have to be constrained in the initial effort.
- It was decided to focus the work in the first edition of the standard on contemporary digital devices, particularly those utilizing complex modulation/access schemes that produce noise-like emissions.



# Overview Continued

- In this context, noise-like emissions are considered to be emissions that are similar to white Gaussian noise in that they share the following attributes:
  - Peak power is a random value parameter
  - Average power is a function of receive (*i.e.*, measurement) bandwidth (similar to  $kTB$ )
    - Allows for BW scalability and the use of power integration techniques for analyzing broadband signals
  - Emissions typically exhibit high Peak-to-Average Power Ratio (PAPR or PAR) levels
- Despite the focus on noise-like emissions, much of the guidance offered in the standard is also applicable to legacy CW-like emissions typically associated with analog technologies.



# Synopsis of ANSI C63.26

- The subsequent slides will attempt to summarize the content of the C63.26 standard on a Clause-by-Clause basis.
- Attempts will be made to highlight the most important issues from a compliance measurement perspective.
- In this setting, only a high-level summary is feasible and therefore, interested parties are encouraged to refer to the actual standard for additional detail.



## Clauses 1 through 3

- Clause 1 defines the scope and purpose of the standard and provides a brief discussion with respect to measurement uncertainty considerations.
- Clause 2 provides a list of the normative references utilized by the standard.
- Clause 3 provides a list of distinctive terms used in the standard along with contextual definitions.



## Clause 4: Measurement Instrumentation

- Provides a list of the measurement instrumentation and associated minimum capabilities necessary for performing the compliance tests specified by the standard.
- Also provides precautions that must be considered when using instrumentation such as spectrum analyzers to measure the power contained in broadband, noise-like signals (e.g., realization of ample headroom to accommodate high PARs).



# Clause 5: Basic Measurement Considerations

- 5.1 Frequency Range and Number of Frequencies to be Tested:
  - specifies the minimum spectrum and number of frequencies/channels to be investigated in compliance tests
- 5.2 Output Power Measurement Procedures:
  - Provides detailed procedures for measuring the output (fundamental emission) and unwanted emission power levels to demonstrate compliance to those limits that are specified in terms of peak power, peak power spectral density (PSD), average power, or average PSD



# Clause 5: Basic Measurement Considerations (continued)

## ● 5.2 Output Power Measurement Procedures (continued):

- Guidance provided for performing compliance measurements on devices with various transmission configurations and/or operational limitations:
  - Continuous and non-continuous transmissions
  - Constant and non-constant duty cycles
- Describes necessary adjustments to measured power data to account for:
  - Downstream measurement peripherals (e.g., cables, pre-amplifiers, external attenuators)
  - Multi-output-port devices
  - Simple channel aggregation (e.g., contiguous channels)



# Clause 5: Basic Measurement Considerations (continued)

## ● 5.2 Output Power Measurement

### Procedures (continued):

- Guidance provided for determining the ERP or EIRP from measured power data (fundamental and unwanted emissions)
- Procedures described for determining the Peak-to-Average Power Ratio (PAR or PAPR)
  - Use of the Complimentary Cumulative Distribution Function (CCDF) statistical methodology
  - Alternative methodologies
- Provides guidance for mathematically converting radiated field strength measurement data to EIRP
  - Underlying presumption is that radiated measurements are performed in the far field regions of both transmit and receive (measurement) antennas



# Clause 5: Basic Measurement Considerations (continued)

- 5.3 Modulation Characteristics:
  - Lists modulation-specific test and/or reporting requirements
- 5.4 Occupied Bandwidth Measurements:
  - Provides two acceptable procedures for measuring the occupied bandwidth (OBW) of licensed transmitters
    - Relative measurement procedure (*i.e.*, -X dB EBW)
      - considered best method for CW-like emissions
    - Power bandwidth measurement procedure (*i.e.*, 99% OBW)
      - considered best method for noise-like emissions



# Clause 5: Basic Measurement Considerations (continued)

## ● 5.5 Radiated Emissions Testing:

- Radiated emissions testing becomes necessary when:
  - Conducted measurement procedures are used to demonstrate compliance to output power and unwanted emissions limits, or
  - EUT utilizes an integral antenna with no access port for performing conducted measurements
- Precedent has required radiated measurements to utilize the techniques provided in TIA-603, which has come to be known as the “signal substitution” method
- C63.26 provides a new option for performing direct radiated (*e.g.*, field strength) measurements in lieu of signal substitution methods if specified conditions can be satisfied (*i.e.*, performed on a validated test site)



# Clause 5: Basic Measurement Considerations (continued)

- 5.5 Radiated Emissions Testing (continued):
  - Since many modern devices operating in the licensed radio services (e.g., smart phones) often include multiple licensed and unlicensed applications, this new option offers a consistent methodology for performing compliance measurements relative to all incorporated technologies
  - It is important to note that this option can only be exercised if the radiated measurements are to be performed on a validated test site as defined by ANSI C63.4



# Clause 5: Basic Measurement Considerations (continued)

- 5.5 Radiated Emissions Testing (continued):
  - Guidance common to both measurement approaches (signal substitution and field strength) is provided, to include:
    - instrumentation
    - measurement antennae
    - test sites
    - EUT arrangements (tabletop and floor-standing)
    - operational configurations
    - pre-scan testing



# Clause 5: Basic Measurement Considerations (continued)

- 5.5 Radiated Emissions Testing (continued):
  - Specific guidance provided with respect to the signal substitution method for performing radiated measurements
    - Pertinent procedures from TIA-603 incorporated to provide a means for future maintenance
  - Specific guidance provided with respect to performing the optional direct radiated (field strength) measurement methodology
  - Guidance offered with respect to recording and reporting of the test results



# Clause 5: Basic Measurement Considerations (continued)

- 5.6 Frequency Stability:
  - Provides guidance in the form of instrumentation requirements and detailed procedures for measuring the frequency stability of an EUT over variations in temperature and supply voltage
- 5.7 Unwanted Emissions Conducted Measurement Procedures:
  - Provides basic guidance for measuring unwanted (band-edge, out-of-band, and spurious) emission levels in an antenna-port conducted test set-up.



## Clause 6: Additional Test Methods for Transmitters Operating in Specific Licensed Radio Services

- This clause provides guidance related to unique considerations associated with operations in specific licensed radio services.
- Includes specialty guidance applicable to:
  - Cellular radio
  - Medical implants
  - Smart antenna systems
  - Multi-antenna-port technologies (e.g., MIMO)
  - Emissions into GPS frequency bands



## Clause 7: RF Repeaters, Amplifiers, and Signal Booster Test Guidance

- This clause provides guidance and procedures specific to obtaining the measurement data necessary to demonstrate compliance to requirements applicable to the subject devices.
- 7.1 lists specialized instrumentation and equipment necessary for performing the specified measurements.
- 7.2 provides compliance measurement guidance applicable to non-consumer repeaters, amplifiers, and industrial signal boosters.



## Clause 7: RF Repeaters, Amplifiers, and Signal Booster Test Guidance (continued)

- 7.3 provides detailed compliance measurement guidance applicable to wideband consumer signal boosters that operate in the Commercial Mobile Radio Service (CMRS) frequency bands and reflect rule requirements associated with the Network Protection Standard that became effective in May, 2013.
- 7.4 provides detailed compliance measurement guidance applicable to provider-specific consumer signal boosters operating in CMRS frequency bands and reflect the rule requirements associated with the Network Protection Standard.



# Clause 8: Test Reports

- This clause describes the minimum data to be included in a compliance test report.



# ANSI C63.26 Annex's

- There are 11 Annex's (A through K) to the standard that provide ancillary information relative to the guidance and procedures offered in the main body, to include:
  - Example test report
  - Pre-test site characterization methodology
  - Basic RF mathematical relationships
  - Signal booster-specific terminology and information
  - Example emission mask information.
  - Glossary
  - Bibliography



# Future Work

- ANSI C63.26 Working Group (WG) to start work on next edition of the standard.
  - Project Initiation Notification System Form (PINS-C) has been prepared and submitted
- Example C63.26 WG Topics for next edition:
  - Measurement of complex channel aggregation techniques
    - non-contiguous channels
    - Symmetrical and asymmetrical channels
    - multi-technology channels (CDMA, LTE FDD and TDD)
  - Revisions and improvements to radiated test procedures, to include consideration of millimeter (mm) wave technologies (i.e., 5G)



# Future Work (continued)

- Example C63.26 WG Topics for next edition (continued):
  - Inclusion of new or recent licensed technologies and/or services (e.g., Medical Body Area Networks (MABN), Citizens Broadband Radio, etc.)
  - MIMO evolutions (e.g., applicability to handsets, massive MIMO, etc.)
- Encourage TCB's to offer recommendations and/or participate in future C6.26 WG efforts.
- Future FCC Work
  - KDB publication 971168 currently being updated to reflect evolutions realized in the C63.26 standard development process.



# Questions?