



Basic Guidance on Antennas Used With Part 15 Intentional Radiators – Highlights of KDB Publication 353028

Office of Engineering and Technology
Laboratory Division
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Updates (May 5, 2017) are shown in BLUE



Overview

- Review §§ 15.204 and 15.203 basic rules and requirements and associated policies for antennas used with Part 15 unlicensed intentional radiators
- Review various associated policies and consolidations in updated KDB Publication 353028 D01 v01
 - referred to as 353028 in the following pages



KDB Pub. 353028 Structure

- Three clauses in 353028:
 - I) Introductory clause
 - Includes references to example rules and other KDB publications with antenna aspects that can also apply for some devices
 - §§ 15.212, 15.217, 15.219, 15.255, 15.256
 - KDB Pubs. 178919, 558074, 602159, 662911, 789033, 905462
 - **353028 not directly applicable for licensed-service devices**
 - II) Summary of §§ 15.203 and 15.204 and associated policies
 - III) Miscellaneous frequently-asked Q & A (12x)
- 353028 is a combination of:
 - Misc. previous KDB publications—now replaced by 353028
 - Selected items from previous FCC-TCB guidance



§ 15.204 Concepts (1)

- Grants for Part 15 intentional radiators must be for complete transmitter systems only
 - Thus external photos exhibits in filings should **ALWAYS show antenna(s)** [§ 2.1033(b)(7)]
 - NOT only the radio portion of a transmitter system
- Part 15 intentional radiators must be operated with antenna(s) and antenna type(s) identified and tested in an FCC ID record
 - §§ 15.204(c) [operate only with authorized antenna(s), including antenna type(s)], 15.204(c)(2) [test highest gain per antenna type, also highest output power configuration(s) across antenna type(s)], 15.204(c)(3) [explicitly identify/list allowed antenna(s) and antenna type(s)]
 - § 15.204(b) requires authorized transmission system (e.g., radio + antenna) to be marketed as complete system



§ 15.204 Concepts (2)

- 353028 D01 v01 III) D) Question: Can a part 15 transmitter be marketed without an antenna, and instead only supply a list of approved antennas?
 - D) Answer: “A part 15 transmitter cannot be marketed to end users with only a list of approved antennas. Section 15.204(b) states that an approved *transmission system* must always be marketed as a complete system, i.e., including the antenna.”
 - Irrespective of the preceding, for grantee-controlled professionally-installed part 15 transmitters:
 - Professional installer may choose the proper antenna for the installation
 - Grantee must justify professional installation—follow the professional installation justification guideline (see below this ppt)
 - Grantee must furnish proper instructions to professional installer for output power / cable / antenna configurations to meet rules
 - Instructions not given to the end user, and in no case can end users have controls to adjust power
 - Note also § 2.929(b) second party “contractual agreement” concept, and § 2.929(b)(2) continued grantee responsibility



§ 15.203 Concepts (1)

- Equipment authorization applications for Part 15 intentional radiators must have supporting information showing that only antenna(s) *furnished* by the responsible party can be used
 - Antenna characteristics directly affect field strength of RF radiated emissions
 - § 15.203 intended to prevent use of other antennas that increase transmit range by increasing radiated emissions (since 1989; similar other rules before that)
- Permanently-attached antenna, or antenna using unique coupling/coupler, are sufficient
- Antennas using standard antenna jack or (standard) electrical connector are prohibited



§ 15.203 Concepts (2)

- Approaches for § 15.203 compliance demonstration:
 - Antenna permanently attached
 - Unique (non-standard) antenna connector
 - Professional installation
- 353028 D01 v01 III) J) Question: “Is a list of non-standard antenna connectors that comply with Section 15.203 available?”
 - J) Answer: “The FCC does not publish a list of “non-standard” or unique RF connectors.”
 - Neither does FCC identify or endorse example acceptable connector types and designs
 - Applicants and TCBs must ensure that filings contain adequate descriptions and supporting information on allowed antenna(s) for a device so that Part 15 limits are not exceeded
 - Explicit installation and operation instructions, antenna(s) list, and photos
 - §§ 2.1033(b)(3), 2.1033(b)(4), 2.1033(b)(7), 15.204(c)(3)
 - Connector types not readily available to general public



§ 15.203 Concepts (3)

- Filings with “professional installation” grant comment must address the following via descriptions and supporting information
 - Describe how/why hardware is not readily available to average consumers
 - Marketing controls
 - Device not sold via retail to the general public or by mail order
 - Sold to authorized dealers or installers only
 - Describe what is unique, sophisticated, complex, or specialized about the equipment that **REQUIRES** it to be installed by a professional installer **PRIOR TO** operation
 - Installation requires special training and/or actions
 - Examples: special programming, restricted access to keypad, field strength measurements needed **when installed**



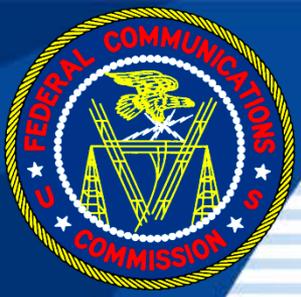
§ 15.204 Testing

- Per § 15.204(c)(2), compliance testing shall be performed using the highest gain antenna for each type of antenna to be certified with an intentional radiator
- During § 15.204(c)(2) testing [i.e., overall compliance testing for any intended antennas, NOT only the highest-gain antenna testing], the intentional radiator shall be operated at its maximum available output (conducted) power level
 - The Section 15.204(c)(2) requirement can be paraphrased that:
 - For any one antenna type, the highest gain shall be tested, AND
 - Among all intended antennas, whichever having gain that gives the highest conducted power shall also be tested
 - e.g., may be lowest gain within any one antenna type
 - For determining maximum output and worst-case emissions conditions, § 15.204(c)(2) testing must also address variations due to antenna connecting-cable attenuation and mismatch standing waves if any



353028 Misc. Q&A

- 353028 D01 v01 III) L) Question: May cable loss be considered when determining output power delivered to the antenna of a part 15 intentional radiator?
 - Answer: Yes, where antenna is permanently attached to the cable, or if antenna is professionally installed
 - Cable loss can be subtracted from the output power at the transmitter terminal to calculate the output power at the antenna input for **compliance demonstration** with the output power and any EIRP limit
 - Output power at the transmitter terminal, cable loss, the output power at the antenna all documented in test report
 - List on grant the output power at the antenna, and which cannot exceed the applicable limit
 - Cable must not be easily removed by the end user (allowing inadvertent connection of antenna using lower-loss cable thus exceeding conducted output power or EIRP limits)
 - [Among the 12 Q&As, III) L) was not previously published]



QUESTIONS ?