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

Office of Engineering and Technology
Laboratory Division
May 3, 2017

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.
Approaches for § 15.203 compliance demonstration:
- Antenna permanently attached
- Unique (non-standard) antenna connector
- Professional installation

**Question:** “Is a list of non-standard antenna connectors that comply with Section 15.203 available?”

**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 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 ?