Signal Boosters – Concepts, Terms, and Definitions

Office of Engineering and Technology
Laboratory Division

Overview

- Terms and definitions for §§ 20.21, 90.219: draft pub. KDB 935210 D01
- Other booster terms and definitions
- Equipment classes and frequency bands
- Backup slides:
  Booster device types background

Terms and Definitions (1)

- Draft OET Lab pub. KDB 935210 D01
  - Booster device terms and definitions for equipment authorizations
  - EAS Form-731 equipment class designators
  - Frequency bands for signal boosters under §§ 20.21, 90.219
  - Annex–Booster, amplifier, and repeater device types and configurations
  - Annex–Signal Boosters Terminology and Concepts (Order, Appendix B)
  - Annex–Booster, amplifier, and repeater various terms and definitions from other sources
  - Annex–Amplifier, booster, and repeater - basic items & reminder sheet (repeats text of preceding KDB 935210)

Terms and Definitions (2)

- The term “signal booster” for §§ 20.21, 90.219 purposes includes all manner of amplifiers, repeaters, boosters, distributed antenna systems, and in-building radiation systems that serve to amplify signals ***between a device and a wireless network***
- General definitions for *Signal Booster*:
  - Device that automatically receives, amplifies, and retransmits on a bidirectional or unidirectional basis, the signals received from base, fixed, mobile, or portable stations, with no change in frequency or authorized bandwidth [§ 20.3]
  - Device or system that automatically receives, amplifies, and retransmits signals from wireless stations into and out of building interiors, tunnels, shielded outdoor areas and other locations where these signals would otherwise be too weak for reliable communications [§ 90.219(a)]

CMRS Boosters (1)

- *Consumer Signal Booster* (Part 20) is a *Signal Booster* that is:
  - marketed and sold to general public
  - installed without third-party professional assistance
  - used “out-of-the-box” without fine tuning or other technical adjustments
  - operated only with approved antennas, cables, and/or coupling devices as specified by the booster manufacturer

CMRS Boosters (2)

Consumer Signal Boosters (Part 20) are also distinguished by:

- frequency capabilities
  - *Provider-Specific Consumer Signal Booster*
    - operates only on the frequencies and in the market areas of specified licensee(s)
    - certificated and operated only with consent of the licensee(s) whose frequencies are being amplified
  - *Wideband Consumer Signal Boosters* operate on frequencies and in the market areas of multiple licensees
- station equipment types and RF exposure device types
  - *Fixed Consumer Signal Booster* is designed to be operated in a fixed location in a building (i.e., indoors)
  - *Mobile Consumer Signal Booster* is designed to operate in a moving vehicle, and both uplink and downlink transmitting antennas are at least 20 cm from user or other persons
  - Boosters designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user (i.e., § 2.1093 portable) are not permitted

CMRS Boosters (3)

- *Industrial Signal Booster* (Part 20) is any booster that is not a *Consumer Signal Booster* (Part 20)
  - i.e., CMRS (part 20) parts 22, 24, 27, 90 (ESMR)
- *Industrial Signal Boosters*
  - may be fixed-station equipment or mobile-station equipment
  - designed for installation by licensees or qualified installers
- *Industrial signal boosters* used in CMRS bands are not distinguished as wideband or provider-specific (i.e., different from *Consumer Signal Booster*)
- It is noted that Part 90 Signal Boosters (i.e., not *Consumer Signal Boosters*), are a type of *Industrial Signal Booster*

PSRS and PLMRS Boosters (1)

All *§ 90.219 signal boosters* are classified as either:

- *Class A signal booster* (narrowband)
  - designed to retransmit signals on one or more specific channels
  - none of its passbands exceed 75 kHz
- *Class B signal booster* (wideband)
  - designed to retransmit any signals within wide frequency band
  - has a passband that exceeds 75 kHz
  - may be deployed only at fixed locations – mobile operation of Class B signal boosters is prohibited (i.e., after November 1, 2014)
  - passband of a Class B booster shall not encompass both Part 90 PSRS and PLMRS and commercial services (e.g., 90-S ESMR and 22-H)

PSRS and PLMRS Boosters (2)

- *Distributed antenna system* (*DAS*) (§ 90.219) is a system of spatially separated antennas connected via cables (i.e., coaxial or fiber optic cable) to a signal source, such as a base station or an external antenna capable of communicating with a base station wirelessly
- *DAS* configurations are considered signal boosters when the network of internal antennas achieves communication through the use of an amplifier that is connected to an external antenna that communicates with a base station wirelessly
- *DAS* are used to distribute wireless signals through large structures such as skyscrapers, hospitals, hotels, arenas and tunnels where the signal coverage may be lacking or to increase the capacity of the wireless system by achieving channel reuse on a smaller scale

Boosters Etc. in Other Rules

- New provisions in draft pub. KDB 935210 D01 mainly cover signal booster devices in the scope of Report and Order FCC 13-21 (WTB Docket 10-4)
- Booster, amplifier, and repeater devices operating under other rule parts and/or sections may continue to use existing FCC and OET rules, policies, and procedures for equipment authorization
- Other terms and definitions in rules and policies include (see details in draft pub. KDB 935210 D01):
  - Signal amplifier (Part 90)
  - External radio frequency power amplifier (ERFPA) (Part 97, § 2.815)
  - In-building radiation systems (Part 22)
  - Repeater [KDB 935210 (Apr. 2007)]
  - Mobile repeater station (Part 90 PLMRS) [§ 90.7, § 90.247]

EAS Form-731 Equipment Classes

- New and existing form-731 equipment classes for licensed-service signal booster and related equipment types
  - B2W–Part 20 Wideband Consumer Booster (CMRS 22/24/27/90-S)
  - B2P–Part 20 Provider-Specific Consumer Booster (CMRS 22/24/27/90-S)
  - B2I–Part 20 Industrial Booster (CMRS 22/24/27/90-S)
  - B9A–Part 90 Class A Industrial Booster (non-SMR)
  - B9B–Part 90 Class B Industrial Booster (non-SMR)
  - BOS–All other signal boosters (other than §§ 20.21, 90.219)
  - AMP–Amplifier (devices not under Bxx equipment classes)*
  - PCB–PCS Licensed Transmitter (booster devices not under Bxx equipment classes)*
  - TNB–Licensed Non-Broadcast Station Transmitter (booster devices not under Bxx equipment classes)*
- * Existing equipment classes PCB, TNB used for booster devices not in scope of §§ 20.21, 90.219, and FCC 13-21

§§ 20.21, 90.219 Booster Bands

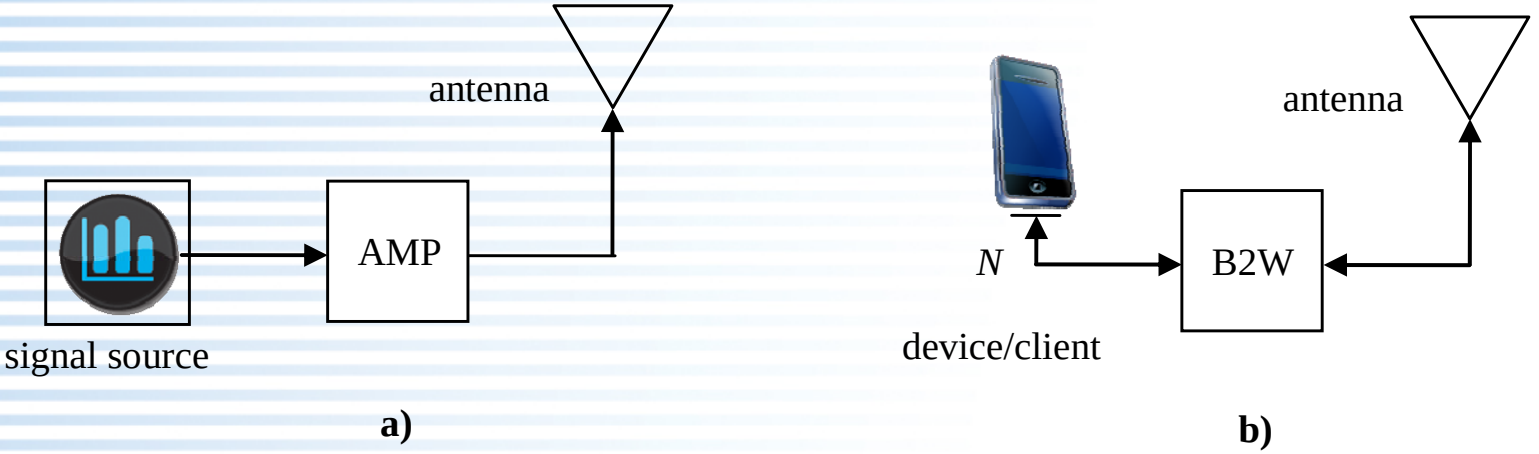
- CMRS bands
  - 22 (Cellular)
  - 24 (Broadband PCS)
  - 27-L (AWS-1)
  - 27 (Lower A-E Blocks)
  - 27 (700 MHz Upper C Block)
  - 90 (Specialized Mobile Radio) [90.614(b),(c)] (90 SMR deferred until release of Pub. Notice)
- Part 90 PLMRS, PSRS – see draft pub. KDB 935210 D01 and KDB 634817

Summary, Conclusion

- Terms and definitions for §§ 20.21, 90.219: draft pub. KDB 935210 D01
- Other booster terms and definitions
- Equipment classes and frequency bands
- Backup slides: Booster device types background

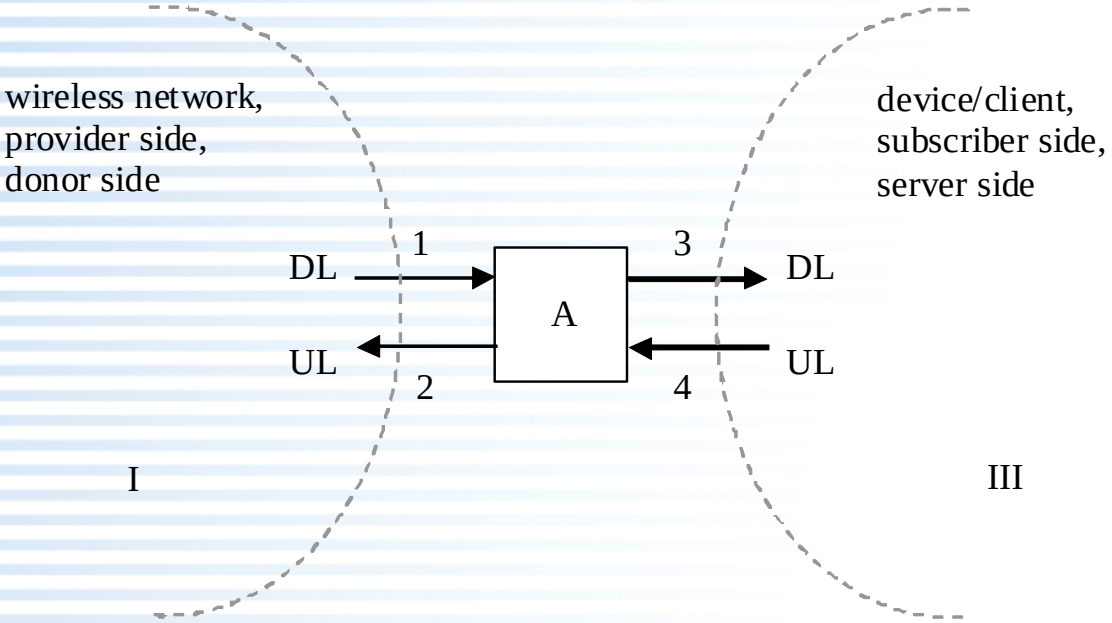
- Where booster rules are unclear and/or guidance in draft pub. KDB 935210 is not clearly applicable, an applicant or agent or test lab should submit a KDB inquiry providing device details to request evaluation procedures

Device Types Background (1)



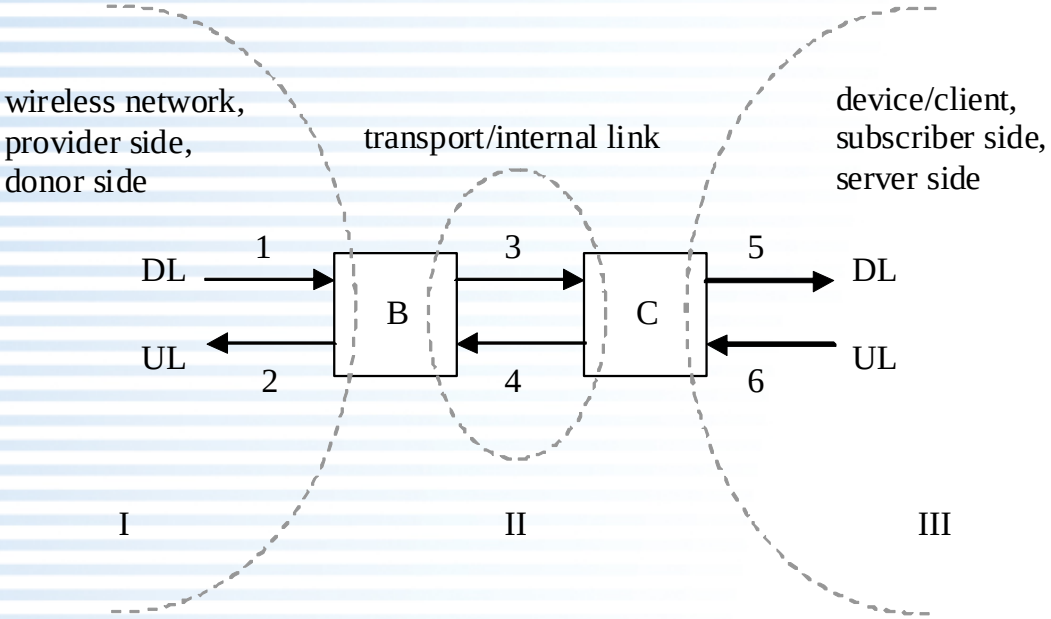
- Simplified schematics of:
  - a) single-enclosure amplifier device (not a transceiver) – Form-731 equipment class AMP
  - b) single-enclosure consumer booster – Form-731 equipment class B2W or B2P, connecting to a device at node N using either contact/proximity coupling or RF-port connection.

Device Types Background (2)



- A: Single enclosure booster device, with donor-side and server-side ports.
- UL, DL: Uplink (subscriber / mobile station to provider / base station); downlink (provider / base station to subscriber / mobile station).
- 1…4: Signal paths 1,2,3,4 typically are parts 22, 24, 27, 90 paired-band frequencies; each of donor-side and server-side may or may not connect to over-the-air antenna(s).
- I, III: Region I: provider / base-station coverage; Region II: booster internal operations; Region III: subscriber / mobile-station coverage, e.g., indoors, dead spot (§ 22.99).

Device Types Background (3)



- B, C: Donor-side and server-side system components. For this basic configuration, components B,C may or may not be electrically identical. B,C typically are tested together as a system, however generally each may be subject to separate / individual equipment authorization (e.g., separate FCC IDs).
- UL, DL: Uplink (subscriber / mobile station to provider / base station); downlink (provider / base station to subscriber / mobile station).
- Signal paths 1,2,5,6 typically are parts 22, 24, 27, 90 paired-band frequencies; each of donor-side and server-side may or may not connect to over-the-air antenna(s). Signal paths 3,4 are system internal “transport” paths, typically RF-on-fiber-optic or coax cable or over-the-air locally; for the latter two, either on-channel or frequency-shifted.
- I, II, III: Region I: provider / base-station coverage; Region II: booster internal operations; Region III: subscriber / mobile-station coverage, e.g., indoors, dead spot (§ 22.99).