

Part 22

22.99 " *In-building radiation systems*. Supplementary systems comprising low power transmitters, receivers, indoor antennas and/or leaky coaxial cable radiators, designed to improve service reliability inside buildings or structures located within the service areas of stations in the Public Mobile Services."

Part 24

No special definitions given – use Part 22 concepts.

FIBER-OPTIC AND OTHER SIMILAR RF DISTRIBUTION SYSTEMS

Fiber-optic distribution systems are a type of in-building radiation system that receives RF signals from an antenna, distributes the signal over fiber-optic cable, and then retransmits at another location for example within a building or tunnel. Most fiber-optic systems are signal boosters; however, some may be repeaters. These systems generally have two enclosures typically called host (or local or donor unit) and remote. Some systems may also have an optional expander box for fan-out to multiple remotes. The system transmits downlink signals from the remote unit to handsets, portables, or clients, and transmits uplink signals via from the host unit. **Usually but not always the uplink goes through an intermediate amplifier to a "donor" antenna.** Therefore both uplink and downlink must be tested, unless filing effectively documents how connection of uplink to donor antenna with or without an intermediate amplifier will be prevented, **such as for always only a cabled connection to a base station(see note 1 below).** Fiber-optic systems are not amplifiers (AMP equipment class) – **they are equipment class TNB or PCB.** The same approval procedures also apply for multiple-enclosure systems connected by coax cable.

Synonyms and related terms: in-building radiation system, coverage enhancer, distributed antenna system, fiber-optic distribution system, converter, donor antenna

NOTE 1:

The ION-B is identified in the User's Manual (page 4, para. 1) as a "distributed antenna system". Because of its function and the fact that it does not perform channel translation, it would be classified as a **signal booster** according to the definition in 22.99.

Within the User Manual it is stated that the master unit is connected to the base station via coaxial cable.

Typical in-building or distributed antenna systems can consist of five different components (enclosures), not counting antennas:

1) host unit

- a) transmits uplink to base station via antenna thru coax, **passive interface unit**, or **active interface unit** (amplifier)
- b) sends base-station downlink via **fiber-optic** or coax to **remote**
- c) receives handset uplink via **fiber-optic** or coax from **remote**
- d) optional connection to **expansion unit** via fiber-optic
- e) separate FCC ID from **remote**, unless electrically identical
- f) **non-transmitting host unit(see note 2 below)**
- i) connects directly to a base station via coax cable but does not connect to antenna or amplifier
- ii) Part 15 digital device subject to Verification, no FCC ID

2) remote unit

- a) receives base-station downlink via fiber-optic or coax from **host**, transmits via antenna to handsets
- b) returns handset uplink via fiber-optic or coax to **host**
- c) separate FCC ID from **remote**, unless electrically identical(see note 2 below)

3) expansion unit

- a) fiber-optic or coax from **host**
- b) fiber-optic or coax fan-out to **remote(s)**
- c) Part 15 digital device subject to Verification, no FCC ID

4) passive interface unit

- a) contains attenuators, splitters, combiners
- b) coax cable connection between **host** and base-station
- c) passive device, no FCC ID

5) active interface unit

- a) amplifies uplink signal from **host unit** for transmit by donor antenna
- b) attenuates downlink from donor antenna
- c) coax cable connection between **host** and **active interface unit**
- d) usually has separate FCC ID; in some cases could be combined/included with **host** as one enclosure

NOTE 2:

The ION-M19P system consists of the master unit and remote unit(s). The master and remote are in separate enclosures and are connected via fiber optic cable. Since the master or host unit always connects directly to a BTS via coaxial cable and not to an antenna or amplifier, it is a *non-transmitting host* according to the FCC guidance above and thus is subject to Part 15 digital device Verification and does not require an FCC ID.

REMINDER SHEET ITEMS

Form 731 entries –

- a) For ERFPA as defined above
 - i) In one enclosure
 - (1) Equipment Class – AMP
 - (2) List AMP in frequency tolerance field of Form 731
 - (3) List emission designators without necessary bandwidth (e.g., F3E, F1D)
 - ii) In two enclosures
 - (1) Does not exist (if it does, use same entries as for one enclosure)
- b) **For Booster as defined above**
 - i) In one enclosure
 - (1) Equipment Class – TNB or PCB
 - (2) List AMP in frequency tolerance field of Form 731
 - (3) List emission designators without necessary bandwidth (e.g., F3E, F1D)
 - (4) List in comments field the word “booster”
 - ii) **In two enclosures (host/remote)**
 - (1) Two separate FCC IDs/applications **(Not applicable...see Note 2)**
 - (2) Equipment Class – TNB or PCB
 - (3) List AMP in frequency tolerance field of Form 731
 - (4) List emission designators without necessary bandwidth (e.g., F3E, F1D)
 - (5) List in comments field the words “Part of booster system used with FCC ID: xxxyyy.” (Where xxxyyy is FCC ID of other TNB or PCB in system). **(I believe i(4) above would be the appropriate statement for this device. See Note 2.)**
- c) For Repeater as defined above
 - i) In one enclosure
 - (1) Equipment Class – TNB or PCB
 - (2) List AMP in frequency tolerance field of Form 731 if device contains no frequency translation; otherwise, measure frequency tolerance and list.
 - (3) List in comments field the word “repeater”
 - ii) In two enclosures (host/remote)
 - (1) Two separate FCC IDs/applications
 - (2) Equipment Class – TNB or PCB
 - (3) List AMP in frequency tolerance field of Form 731 if device contains no frequency translation; otherwise, measure frequency tolerance and list.
 - (4) List in comments field the words “Part of repeater system used with FCC

ID: xxxyyy.” (Where xxxyyy is FCC ID of other TNB or PCB in system).

Applicable rule part(s) –

- . Specific rule part(s) the device will be used with. Verify applicable emission masks etc and if booster rules apply.
- . Check to see if frequency and device is licensable in applicable rule part.

Booster rules – Include exhibit or correspondence showing applicant was informed that boosters must meet all criteria stated in Sections 90.219 and 22.383 for related booster/in-building operations.

Single or multiple FCC IDs – One FCC ID per transmitter enclosure or rack, not per system.

Form 731 line items – All transmitters in the device (uplink/downlink) should be listed and tested.

System operation – When transmitter requires other devices in a system, select Form 731 “Part of system...” checkbox. **List FCC IDs of other components (not applicable...see Note 2).**

Test with system components if needed (tested with host unit). Usually applies for fiber-

optic systems. Control of power level is one implication.

Radiated spurs (enclosure) – Use of CW signal (low, mid. and high freq.) is acceptable rather than all modulations

Conducted spurs – Test all modulation types [TDMA, CDMA, and FM (covers GSM and F1D)] at low, mid. and high frequency

Intermodulation – Test all modulation types [TDMA, CDMA, and FM (covers GSM and F1D)]

- . CW signal rather than typical signal is acceptable (for FM).
- . At maximum drive level, for each modulation: one test with three tones, or two tests (high-, low-band edge) with two tones
- . Limit usually is -13dBm conducted.
- . Not needed for Single Channel systems.

Combination of modulation types not needed.

Occupied bandwidth – Use RBW 300 Hz or 1% RBW. The spectral shape of the output should look similar to input for all modulations.

Output power –

. Power on Form 731 should be clearly understood as either composite of multi-channels or per carrier. If power is composite include in comments field: "Power output listed is composite for multi-channel operation." (**see note 3. power listed on form 731 is composite**)

. Check that the input drive level is at maximum input rating and maximum gain settings for all tests. Check both uplink and downlink input levels. See manual or brochures/technical description for maximum rating. May need to check FCC identifier of transmitter used for tests.

. Confirm device cannot operate in saturation. Are there means to control maximum power and to assure linear operation (use in system configuration may be necessary)? How is saturation or over-modulation prevented for pulsed signal inputs?

. Meets power limits of 90.219 for Part 90 booster operations.

Out of Band Rejection – Test for rejection of out of band signals. Filter freq. response plots are acceptable.

NOTE 3:

The power listed on Form 731 is composite power. Each time the number of carriers is doubled through the system, the power per carrier is reduced by 3 dB.

RF input power level is +12 dBm for maximum rf output before compression.

The system automatically reduces amplifier gain level when the rf input drive is increased to in order to prevent saturation.

Other notes:

The User Manual mentions various other remote devices that can be purchased and used with the fiber host unit. These remote units hold separate certifications. The WLAN remote capability is not sold in the USA since it is not allowed to operate such a device under FCC Part 15 rules.