

on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is listed as being resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA “Vertical Flame Test — Cables in Cable Trays,” as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

800.180 Grounding Devices. Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

800.182 Communications Raceways and Cable Routing Assemblies. Communications raceways and cable routing assemblies shall be listed in accordance with 800.182(A) through (C).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-4-2011, *Signaling, Optical Fiber and Communications Raceways and Cable Routing Assemblies*.

(A) **Plenum Communications Raceways and Plenum Cable Routing Assemblies.** Plenum communications raceways and plenum cable routing assemblies shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

(B) **Riser Communications Raceways and Riser Cable Routing Assemblies.** Riser communications raceways and riser cable routing assemblies shall be listed as having adequate fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

(C) **General-Purpose Communications Raceways and General-Purpose Cable Routing Assemblies.** General-purpose communications raceways and general-purpose cable routing assemblies shall be listed as being resistant to the spread of fire.

ARTICLE 810 Radio and Television Equipment

Informational Note: The general term *grounding conductor* as previously used in this article is replaced by either

the term *bonding conductor* or the term *grounding electrode conductor* (GEC), where applicable, to more accurately reflect the application and function of the conductor.

I. General

810.1 Scope. This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

810.2 Definitions. For definitions applicable to this article, see Part I of Article 100.

810.3 Other Articles. Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

810.4 Community Television Antenna. The antenna shall comply with this article. The distribution system shall comply with Article 820.

810.5 Radio Noise Suppressors. Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

810.6 Antenna Lead-In Protectors. Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL Subject 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

810.7 Grounding Devices. Where bonding or grounding is required, devices used to connect a shield, a sheath, non-current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.



A bonding device intended to provide a termination point for the **bonding** conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means, as described in 830.93, shall be considered accessible.

(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means. If the building or structure served has no intersystem bonding termination or **grounding means**, as described in 830.100(B)(2), the grounding electrode conductor shall be connected to either of the following:

- (1) To any one of the individual **grounding** electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4).
- (2) If the building or structure served has no intersystem bonding termination or has no grounding means, as described in 830.100(B)(2) or (B)(3)(1), to any one of the individual **grounding** electrodes described in 250.52(A)(7) and (A)(8), or to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (½ in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning conductors as covered in 800.53 and at least 1.8 m (6 ft) from electrodes of other systems. Steam or hot water pipes or lightning-rod conductors shall not be employed as grounding electrodes for protectors, NIUs with integral protection, grounded metallic members, NIUs with metallic enclosures, and other equipment.

(C) Electrode Connection. Connections to grounding electrodes shall comply with 250.70.

(D) Bonding of Electrodes. A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the network-powered broadband communications system grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

Exception: At mobile homes as covered in 830.106.

Informational Note No. 1: See 250.60 for use of air terminals (lightning rods).

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

830.106 Grounding and Bonding at Mobile Homes.

(A) Grounding. Grounding shall comply with 830.106(A)(1) or (A)(2).

- (1) Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the

mobile home it serves, the network-powered broadband communications cable **shield, network-powered broadband communications cable metallic members not used for communications or powering, network interface unit, and primary protector grounding terminal** shall be connected to a grounding electrode conductor or grounding electrode in accordance with 830.100(B)(3).

- (2) Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located **within 9.0 m (30 ft)** of the exterior wall of the mobile home it serves, the network-powered broadband communications cable **shield, network-powered broadband communications cable metallic members not used for communications or powering, network interface unit, and primary protector grounding terminal** shall be connected to a grounding electrode in accordance with 830.100(B)(3).

(B) Bonding. The network-powered broadband communications cable grounding terminal, network interface unit grounding terminal, if present, and primary protector grounding terminal shall be bonded together with a copper bonding conductor not smaller than 12 AWG. The network-powered broadband communications cable grounding terminal, network interface unit grounding terminal, primary protector grounding terminal, or the grounding electrode shall be bonded to the metal frame or available grounding terminal of the mobile home with a copper bonding conductor not smaller than 12 AWG under any of the following conditions:

- (1) Where there is no mobile home service equipment or disconnecting means as in 830.106(A)
- (2) Where the mobile home is supplied by cord and plug

V. Installation Methods Within Buildings

830.110 Raceways and Cable Routing Assemblies for Network-Powered Broadband Communications Cables.

(A) Types of Raceways. Low-power network-powered broadband communications cables shall be permitted to be installed in any raceway that complies with either 830.110(A)(1) or (A)(2) and in cable routing assemblies installed in compliance with 830.110(C). Medium-power network-powered broadband communications cables shall be permitted to be installed in any raceway that complies with 830.110(A)(1).

(1) Raceways Recognized in Chapter 3. Low- and medium-power network-powered broadband communications cables shall be permitted to be installed in any raceway included in Chapter 3. The raceways shall be installed in accordance with the requirements of Chapter 3.

(2) Communications Raceways. Low-power network-powered broadband communications cables shall be permitted



II. Receiving Equipment — Antenna Systems

810.11 Material. Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).

810.12 Supports. Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

810.13 Avoidance of Contacts with Conductors of Other Systems. Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

810.14 Splices. Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

810.15 Grounding. Masts and metal structures supporting antennas shall be grounded in accordance with 810.21.

810.16 Size of Wire-Strung Antenna — Receiving Station.

(A) Size of Antenna Conductors. Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

(B) Self-Supporting Antennas. Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors

Material	Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is		
	Less Than 11 m (35 ft)	11 m to 45 m (35 ft to 150 ft)	Over 45 m (150 ft)
Aluminum alloy, hard-drawn copper	19	14	12
Copper-clad steel, bronze, or other high-strength material	20	17	14

810.17 Size of Lead-in — Receiving Station. Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

810.18 Clearances — Receiving Stations.

(A) Outside of Buildings. Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.

Informational Note No. 1: See 250.60 for use of air terminals. For further information, see NFPA 780-2014, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non-current-carrying metal parts of elec-



trical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2011, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

(B) Antennas and Lead-ins — Indoors. Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

Exception No. 1: Where such other conductors are in metal raceways or cable armor.

Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.

(C) In Boxes or Other Enclosures. Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations. Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

810.20 Antenna Discharge Units — Receiving Stations.

(A) Where Required. Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.

(B) Location. Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

(C) Grounding. The antenna discharge unit shall be grounded in accordance with 810.21.

810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations. Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through (K).

(A) Material. The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

(B) Insulation. Insulation on bonding conductors or grounding electrode conductors shall not be required.

(C) Supports. The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.

(D) Physical Protection. Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

(E) Run in Straight Line. The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

(F) Electrode. The bonding conductor or grounding electrode conductor shall be connected as required in (F)(1) through (F)(3).

(1) In Buildings or Structures with an Intersystem Bonding Termination. If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: See Article 100 for the definition of Intersystem Bonding Termination.

(2) In Buildings or Structures with Grounding Means. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

(1) The building or structure grounding electrode system as covered in 250.50



- (2) The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
- (3) The power service accessible means external to the building, as covered in 250.94
- (4) The nonflexible metallic power service raceway
- (5) The service equipment enclosure, or
- (6) The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on non-removable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is non-removable.

(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means. If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a **grounding** electrode as described in 250.52.

(G) Inside or Outside Building. The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

(H) Size. The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

(I) Common Ground. A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

(J) Bonding of Electrodes. A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

(K) Electrode Connection. Connections to grounding electrodes shall comply with 250.70.

III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

810.51 Other Sections. In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

810.52 Size of Antenna. Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

Table 810.52 Size of Outdoor Antenna Conductors

Material	Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is	
	Less Than 45 m (150 ft)	Over 45 m (150 ft)
Hard-drawn copper	14	10
Copper-clad steel, bronze, or other high-strength material	14	12

810.53 Size of Lead-in Conductors. Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

810.54 Clearance on Building. Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.

810.55 Entrance to Building. Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

- (1) Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
- (2) Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
- (3) Through a drilled window pane

810.56 Protection Against Accidental Contact. Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

810.57 Antenna Discharge Units — Transmitting Stations. Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.



Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.

Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.

810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations. Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through (C).

(A) Other Sections. All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through (K).

(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor. The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor. The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

IV. Interior Installation — Transmitting Stations

810.70 Clearance from Other Conductors. All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

Exception No. 1: As provided in Article 640.

Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.

810.71 General. Transmitters shall comply with 810.71(A) through (C).

(A) Enclosing. The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

(B) Grounding of Controls. All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor

if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

(C) Interlocks on Doors. All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

ARTICLE 820 Community Antenna Television and Radio Distribution Systems

Informational Note: The general term *grounding conductor* as previously used in this article is replaced by either the term *bonding conductor* or the term *grounding electrode conductor (GEC)*, where applicable, to more accurately reflect the application and function of the conductor.

See Informational Note Figure 800(a) and Informational Note Figure 800(b) for an illustrative application of a bonding conductor or grounding electrode conductor.

I. General

820.1 Scope. This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

Informational Note: See 90.2(B)(4) for installations of CATV and radio distribution systems that are not covered.

820.2 Definitions. See Part I of Article 100. For the purposes of this article, the following additional definitions apply.

Abandoned Coaxial Cable. Installed coaxial cable that is not terminated at equipment other than a coaxial connector and not identified for future use with a tag.

Informational Note: See Part I of Article 100 for a definition of *Equipment*.

Coaxial Cable. A cylindrical assembly composed of a conductor centered inside a metallic tube or shield, separated by a dielectric material, and usually covered by an insulating jacket.

Exposed (to Accidental Contact). A circuit in such a position that, in case of failure of supports and or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of *Exposed*.

Point of Entrance. The point within a building at which the coaxial cable emerges from an external wall, from a



(B) Direct-Buried Cables and Raceways. Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power or Class 1 circuit.

Exception No. 1: Where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.

Exception No. 2: Where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.

820.48 Unlisted Cables Entering Buildings. Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block.

820.49 Metallic Entrance Conduit Grounding. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) containing entrance coaxial cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode in accordance with 820.100(B).

III. Protection

820.93 Grounding of the Outer Conductive Shield of Coaxial Cables. Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

(A) Entering Buildings. In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

Informational Note: See 820.2 for a definition of *Point of Entrance*.

(B) Terminating Outside of the Building. In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

(C) Location. Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

(D) Hazardous (Classified) Locations. Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitable material.

Exception: As permitted in 501.150, 502.150, and 503.150.

IV. Grounding Methods

820.100 Cable Bonding and Grounding. The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) through (D).

Exception: For communications systems using coaxial cable confined within the premises and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.

(A) Bonding Conductor or Grounding Electrode Conductor.

(1) Insulation. The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

(2) Material. The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

(3) Size. The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. It shall have a current-carrying capacity not less than the outer sheath of the coaxial cable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

(4) Length. The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-



family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate grounding electrode as specified in 250.52(A)(5), (A)(6), or (A)(7) shall be used, the grounding electrode conductor shall be connected to the separate grounding electrode in accordance with 250.70, and the separate grounding electrode shall be connected to the power grounding electrode system in accordance with 820.100(D).

(5) Run in Straight Line. The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

(6) Physical Protection. Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

(B) Electrode. The bonding conductor or grounding electrode conductor shall be connected in accordance with 820.100(B)(1), (B)(2), or (B)(3).

(1) In Buildings or Structures with an Intersystem Bonding Termination. If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: See Part I of Article 100 for the definition of *Intersystem Bonding Termination*.

(2) In Buildings or Structures with Grounding Means. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

- (1) The building or structure grounding electrode system as covered in 250.50
- (2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52

- (3) The power service accessible means external to enclosures as covered in 250.94
- (4) The nonflexible metallic power service raceway
- (5) The service equipment enclosure
- (6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service, or
- (7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to an electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on non-removable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means, as described in 820.93, shall be considered accessible.

(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means. If the building or structure served has no intersystem bonding termination or grounding means, as described in 820.100(B)(2), the grounding electrode conductor shall be connected to either of the following:

- (1) To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4).
- (2) If the building or structure served has no intersystem bonding termination or grounding means, as described in 820.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8). **Steam or hot water pipes or air terminal conductors (lightning-rod conductors) shall not be employed as grounding electrodes for bonding conductors or grounding electrode conductors.**

(C) Electrode Connection. Connections to grounding electrodes shall comply with 250.70.

(D) Bonding of Electrodes. A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the community antenna television system's grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

Exception: At mobile homes as covered in 820.106.

Informational Note No. 1: See 250.60 for use of air terminals (lightning rods).

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.



(E) **Shield Protection Devices.** Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

820.103 Equipment Grounding. Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

820.106 Grounding and Bonding at Mobile Homes.

(A) **Grounding.** Grounding shall comply with 820.106(A)(1) and (A)(2).

- (1) Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, the coaxial cable shield ground, or surge arrester **grounding terminal**, shall be connected to a grounding electrode conductor or grounding electrode in accordance with 820.100(B)(3).
- (2) Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, the coaxial cable shield ground, or surge arrester **grounding terminal**, shall be connected to a grounding electrode in accordance with 820.100(B)(3).

(B) **Bonding.** The coaxial cable shield grounding terminal, surge arrester grounding terminal, or grounding electrode shall be connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under any of the following conditions:

- (1) Where there is no mobile home service equipment or disconnecting means as in 820.106(A)
- (2) Where the mobile home is supplied by cord and plug

V. Installation Methods Within Buildings

820.110 Raceways and Cable Routing Assemblies for Coaxial Cables.

(A) **Types of Raceways.** Coaxial cables shall be permitted to be installed in any raceway that complies with either (A)(1) or (A)(2) and in cable routing assemblies installed in compliance with 820.110(C).

(1) **Raceways Recognized in Chapter 3.** Coaxial cables shall be permitted to be installed in any raceway included in Chapter 3. The raceways shall be installed in accordance with the requirements of Chapter 3.

(2) **Communications Raceways.** Coaxial cables shall be permitted to be installed in listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways, selected in accordance with the provisions of 800.110, 800.113, and

820.113 and installed in accordance with 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(B) **Raceway Fill for Coaxial Cables.** The raceway fill requirements of Chapters 3 and 9 shall not apply to coaxial cables.

(C) **Cable Routing Assemblies.** Coaxial cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with the provisions of 800.113 and installed in accordance with 820.110(C)(1) and (2).

(1) **Horizontal Support.** Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft), and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

(2) **Vertical Support.** Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

820.113 Installation of Coaxial Cables. Installation of coaxial cables shall comply with 820.113(A) through (K). Installation of raceways shall comply with 820.110.

(A) **Listing.** Coaxial cables installed in buildings shall be listed.

Exception: Coaxial cables that comply with 820.48 shall not be required to be listed.

(B) **Fabricated Ducts Used for Environmental Air.** The following cables shall be permitted in ducts as described in 300.22(B) if they are directly associated with the air distribution system:

- (1) Up to 1.22 m (4 ft) of Type CATVP cable
- (2) Types CATVP, CATVR, CATV, and CATVX cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2012, Standard for the Installation of Air-Conditioning and Ventilating Systems.

(C) **Other Spaces Used For Environmental Air (Plenums).** The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

- (1) Type CATVP cable
- (2) Type CATVP cable installed in plenum communications raceways
- (3) Type CATVP cable supported by open metallic cable trays or cable tray systems



ing shall be grounded in accordance with 830.100, or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

Informational Note: See 830.2 for the definition of *Point of Entrance*.

(B) Terminating Outside of the Building. In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 830.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 830.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

IV. Grounding Methods

830.100 Cable, Network Interface Unit, and Primary Protector Bonding and Grounding. Network interface units containing protectors, NIUs with metallic enclosures, primary protectors, and the metallic members of the network-powered broadband communications cable that are intended to be bonded or grounded shall be connected as specified in 830.100(A) through (D).

(A) Bonding Conductor or Grounding Electrode Conductor.

(1) Insulation. The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

(2) Material. The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

(3) Size. The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG and shall have a current-carrying capacity not less than that of the grounded metallic member(s) and protected conductor(s) of the network-powered broadband communications cable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

(4) Length. The bonding conductor **or** grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor **or** grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate communications ground rod meeting the minimum dimensional criteria of 830.100(B)(3)(2) shall be driven, and the grounding electrode conductor shall be connected to the communications ground rod in accordance with 830.100(C). The communications ground rod shall be bonded to the power grounding electrode system in accordance with 830.100(D).

(5) Run in Straight Line. The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

(6) Physical Protection. Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

(B) Electrode. The bonding conductor or grounding electrode conductor shall be connected in accordance with 830.100(B)(1), (B)(2), or (B)(3).

(1) In Buildings or Structures with an Intersystem Bonding Termination. If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: See **Part I** of Article 100 for the definition of *Intersystem Bonding Termination*.

(2) In Buildings or Structures with Grounding Means. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

- (1) The building or structure grounding electrode system as covered in 250.50
- (2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
- (3) The power service accessible means external to enclosures as covered in **250.94**
- (4) The nonflexible metallic power service raceway
- (5) The service equipment enclosure
- (6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service, or
- (7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to an electrode as covered in 250.32

