

Inland Empire Cooperative Interference Committee - Site Standards

1. Repeaters and Base Station
 - a. The repeater and base station shall be FCC type-accepted.
 - b. The repeater and base station shall have a 100% duty cycle at the power specified for the site.
 - c. It is recommended that the repeater and base station have remote diagnostics capability.
2. Transmitter isolator
 - a. All transmitters in the 25-54 MHz range shall have an isolator(s) to provide a minimum 15 dB reverse isolation. The isolator(s) shall be installed between the transmitter and the band pass device.
 - b. All transmitters in the 66-88 MHz range shall have an isolator(s) to provide a minimum 15 dB reverse isolation. The isolator(s) shall be installed between the transmitter and the band pass device.
 - c. All transmitters in the 108 to 225 range shall have dual ferrite isolators providing a minimum of 50 dB reverse isolation. The isolator(s) shall be installed between the transmitter and the band pass device.
 - d. Transmitters in the 406-520 MHz range shall have dual ferrite isolators with a minimum of 50 dB rejection in the reverse direction. The isolators shall be installed between the transmitter and the band pass device.
 - e. Transmitters in the 746-960 MHz range shall have dual ferrite isolators with a minimum of 50 dB rejection in the reverse direction. The isolators shall be installed between the transmitter and the band pass device.
3. Duplexer/Filtering
 - a. Transmitter filtering
 - i. All transmitters in the 25-54 MHz range shall have a band pass device that will provide not less than 10 dB attenuation at 500 kHz removed from the operating frequency. This bandpass device may be part of the duplexer.
 - ii. All transmitters in the 66-88 MHz range shall have a band pass device that will provide not less than 10 dB attenuation at 1 MHz removed from the operating frequency. The isolator(s) shall be installed between the transmitter and the band pass device. This bandpass device may be part of the duplexer.
 - iii. All transmitters in the 118-225 MHz range shall have a band pass device that will provide not less than 10 dB attenuation at 400 kHz removed from the operating frequency. This bandpass device may be part of the duplexer.
 - iv. All transmitters in the 406-520 MHz range shall have a band pass device that will provide not less than 15 dB attenuation at 1 MHz removed from the operating frequency. The isolators shall be installed between the transmitter and the band pass device.
 - v. Transmitters in the 746-960 MHz range shall have a band pass device that will provide not less than 15 dB attenuation at 3 MHz removed from the operating frequency. The isolators shall be installed between the transmitter and the band pass device.
 - vi. Multi-frequency transmitters will be handled on a per case basis.
 - b. Receiver filtering
 - i. A band pass or pass-reject filter shall always be used before each receiver. A band pass device is recommended. A window filter may be substituted in multi-coupled systems. Crystal filters are also advisable at crowded facilities.
 - c. Duplexer
 - i. It is recommended that a band-pass duplexer be used that meets the minimum requirements for transmitter and receiver band pass filtering. See figure 1.
 - ii. A pass reject duplexer may be used if it meets the minimum requirements for the transmitter and receiver filtering or external band pass filters are added to meets the minimum requirements for transmitter and receiver band pass filtering. See figure 2.
 - iii. A band reject duplexer is discouraged as it will always require the addition of a band pass filter for both the transmitter and the receiver. See figure 3.
4. Antenna
 - a. The antenna shall be of heavy duty construction sufficient to handle heavy snow, ice, and winds.
 - b. Antennas longer than 16 feet shall have a top bracket to secure the antenna.
5. Coax Cabling Types and Connectors
 - a. All cables used must, at minimum, be double-shielded with 100% braid coverage.
 - b. All external coax shall be solid-shielded such as Heliax.

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- c. All internal coax shall either be of a solid outer conductor such as Heliax or double shielded such as LMR400. Heliax is recommended.
 - d. All cables used shall be covered with an insulating jacket. Cables used externally shall be covered with an ultra-violet resistant insulating jacket.
 - e. No cables with aluminum outer conductors shall be used.
 - f. Use of constant impedance connectors shall be required. Type 'N,' BNC or 7/16 DIN connector types are typical constant impedance connectors.
 - g. Adapters shall not be used for permanent connections.
6. Coax Cable Attachments
- a. All external transmission lines shall be fastened using manufactured hardware such as cushioned hangers, snap lock hangers, clip-on hangers, butterfly clamps, etc. Use of cable ties, tie-wraps and similar attachment hardware is discouraged on external transmission lines. See Figure 4 below.
 - b. Internal coax shall be connected to cable trays and other site attachment points using manufactured hardware designed for the purpose.
 - c. Use of non-insulated metallic ties shall be strictly prohibited.
 - d. Coax shall enter the site using a standard entry port with coax entry boot designed for the type of coax being used. See Figure 7.
7. Coax Weather Proofing
- a. All external connectors and ground kits shall be protected from water intrusion. Weather protection shall be accomplished using Andrews "Cold Shrink" or equivalent.
 - b. Wrapping the connector with vinyl tape, encasing with a heat shrink sleeve, or the use of natural rubber tape is not acceptable.
8. Site Grounding
- a. All coax shall be grounded within ten (10) feet of the antenna, each 100 feet along the tower if applicable, at the departure from the tower, and at the building entrance. See figure 5 below.
 - b. All coax grounding will be with a manufacturer approved ground kit. See figure 6 below.
 - c. A ground buss bar shall be supplied on the building exterior at the coax entrance if not already present. It shall be connected to the site ground using a 2 AWG solid copper wire.
 - d. An internal master ground buss bar shall be supplied inside the building if not already present. It shall be connected to the site ground using a 2 AWG solid copper wire.
 - e. All provided equipment inside the building(s) shall be individually grounded to the internal ground buss bar using 2 AWG or 6 AWG insulated copper wire as defined by the R56 standard
 - f. Each equipment rack shall be grounded to the master ground bus bar using a 2 AWG insulated copper wire.
 - g. All equipment in the rack shall be grounded to the rack ground point or bar using a minimum 10 AWG wire.
 - h. The earth ground system shall be less than 8 ohms impedance or as required.
 - i. Ground rod connections shall be made with an irreversible high-compression connector or exothermic weld.
 - j. All ground lugs shall be attached to the ground wire with a compression tool capable of 12 tons compression force.
9. Surge Suppression
- a. All coax entering an equipment shelter shall terminate in a RF surge suppressor.
 - b. The RF surge suppressor shall be rated for the frequency carried by the coax.
 - c. The RF surge suppressor shall utilize constant impedance connectors. Type 'N or 7/16 DIN connector types are typical constant impedance connectors.
 - d. AC and Telco lines shall have surge protection.
10. Generators and tanks
- a. Generators shall be industrial rated with adequate wattage for the site
 - b. Generators shall include battery with 2 amp floating battery charger.
 - c. Generators shall have a block heater, thermostatically controlled to shut down at 40 degrees Fahrenheit or warmer.
 - d. A UL mainline circuit breaker appropriate for generator amperage shall be installed.
 - e. Generator must be grounded per local code and appropriate R56 guidelines.

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- f. Tanks must be set back a minimum of 10 feet from any building per NFPA specification. If local building codes require a greater distance than this, local codes will prevail.
 - g. Tanks must be installed on concrete pad
11. Automatic Transfer Switches
- a. If a generator is installed an automatic transfer switch is necessary
 - b. The switch shall have a 600 Volt contactor
 - c. The switch shall be rated at appropriate amperage
 - d. 2 Pole construction is required
 - e. In-phase adjustable control is necessary
 - f. 7-Day programmable exerciser is required
12. Battery Systems
- a. All batteries must be of a non-gassing, non-spill able design.
 - b. Battery chargers must smart chargers for optimal charging and maintenance of the batteries. Trickle chargers are not acceptable.
 - c. The battery plant must provide for low voltage disconnect to prevent battery damage from over-discharge.
13. Towers
- a. The tower must be of sufficient strength and wind rating to support the microwave dishes, antennas and other equipment as specified.
 - b. Tower foundation must be constructed according to tower manufacturer requirements to satisfy environmental and load requirements, and based on the results of the soil survey.
 - c. A engineer or manufacturer certified tower loading and foundation drawings are required
 - d. A climbing ladder and fall protection devices are required.
 - e. A cable ladder is required for towers.
 - f. Ice bridges are required between the tower and the shelter. It must be of sufficient strength to protect the cables from falling ice.
 - g. Grounding bus bar at the bottom of the tower and a grounding bus bar every 100 feet to be installed
14. Shelters
- a. Roof load to be 150 psf or local zoning requirements whichever is greater. Roof sloped from the center to prevent water pooling.
 - b. Shelter to be rodent proof.
 - c. Shelter to have two HVAC units
 - d. ABC fire extinguisher mounted on the interior wall
 - e. Coax entry ports are required for the shelter. See Figure 7.
 - f. Cable trays are required
 - i. One cable tray down the center of the shelter, starting at the Entry Port
 - ii. Additional cable trays to be placed above each row of racks connecting to the center cable tray
 - g. All electrical distribution panels, sub-panels, and breakers shall be from a quality manufacturer.
 - h. A meter based 200 amp fused main disconnect is required.
 - i. A 200 amp distribution panel with a minimum of 40 spaces for breakers is required
 - j. Electrical cables are to be buried from transformer to shelter.
 - k. All electrical to be done to local electrical codes.
15. Licensing
- a. All equipment installed shall be properly licensed.
 - b. All tenant FCC, NTIA and amateur radio licenses shall be posted.
16. Clean-up
- c. All site property shall be left clean and free of debris, trash and food scraps.
 - d. If materials are brought in that become trash, the tenant bringing in the material shall be responsible for its removable.

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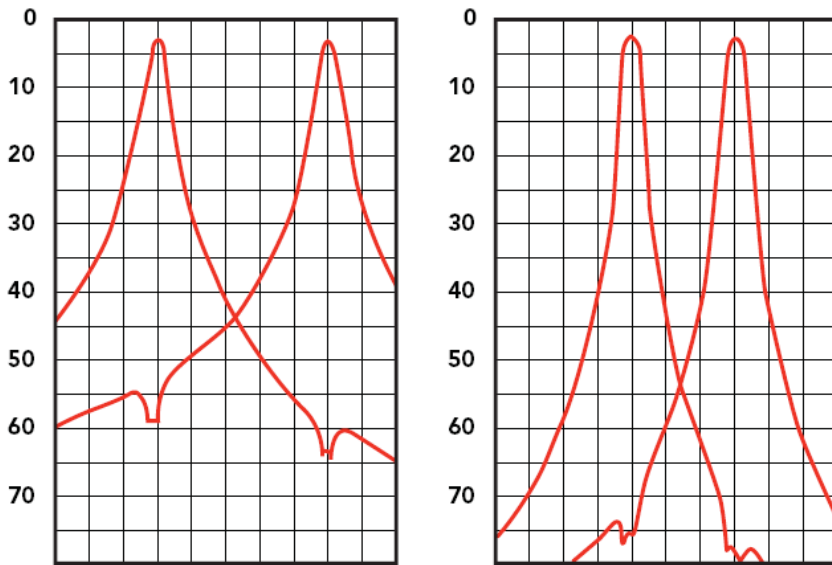


Figure 1 – Typical Band-Pass Duplexer Response

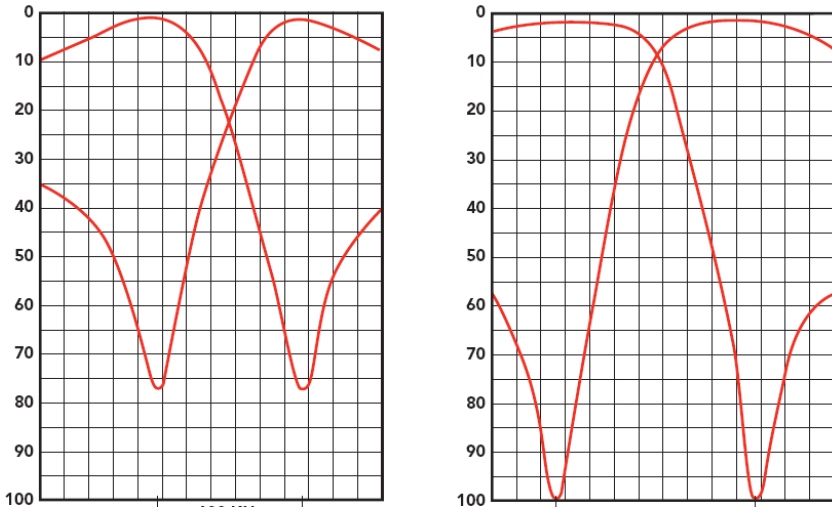


Figure 2 – Typical Pass Reject Duplexer Response

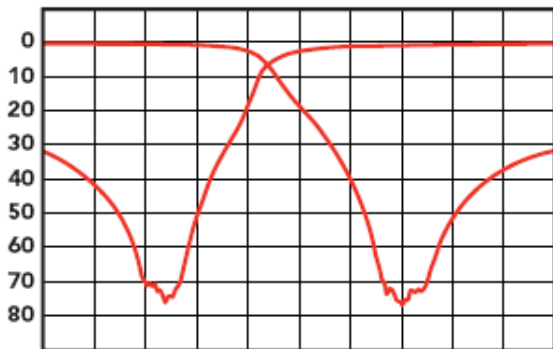


Figure 3 – Typical Reject Duplexer Response

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Hangar Selection Guide Matrix







Hanger Type	 SnapStak™ Hangers	 KwikClamp™ Hangers	 Click-On Single, Double or Miniature Hangers	 Standard Hanger	 Support/Hoisting Grip*	 Cable Tie**
Construction	Stainless steel	Stainless steel and plastic	Engineered plastic single or double	Stainless steel	Tin coated bronze	Nylon
Cable runs supported	1 to 3	1 to 3	2 to 6	1	1	1
Primary applications	Towers with prepunched cable ladders snap-in accessories	New or existing towers	Rooftops, water tower and towers with limited space	Tower installations subject to high wind, high corrosion, high ice	Monopole towers	Jumper cables and inter-rack cabling
Typical installation time (min)***	7	15	20	20	2	N/A
Key features	Attaches cables in compact bundles saving tower space	Built in tower adapter	Stackable up to three high	Stainless steel tensioning hardware	Calibrated clamp provides permanent cable support	Universal fastening
Benefits	Fastest hanger installation No additional hardware needed Attaches cables in compact three run bundles Impervious to environmental extremes Universal hanger accommodates all corrugated cables	Requires no additional hardware for tower attachments Fits round, flat angle and c channel tower members Quick installation UV stable	Attaches cables in compact six run bundles Versatile and adaptable to almost any application Easy to install click-on design UV stable	Impervious to environmental extremes Adaptable to various tower configurations	Quick installation Monopole application Accommodates single run of cable	Fits most cable sizes and tower members Quick installation Inexpensive Accommodates single run of lightweight cable
Attachment capability (Tower member type)	3/4" drilled cable ladder Various adapters see page 5	Round member Angle member Channel section Cable ladders	3/8" (M10) drilled hardware ladder Various adapters (see page 9)	3/8" (M10) drilled cable ladder Various adapters (see page 9)	All towers and monopoles	Round member Angle member Cable ladders
Additional parts needed	None	None	Threaded rod and hardware	Tower attachment hardware kit	None	None

Figure 4 – Coax Hanger Selection Guide

Grounding Kits

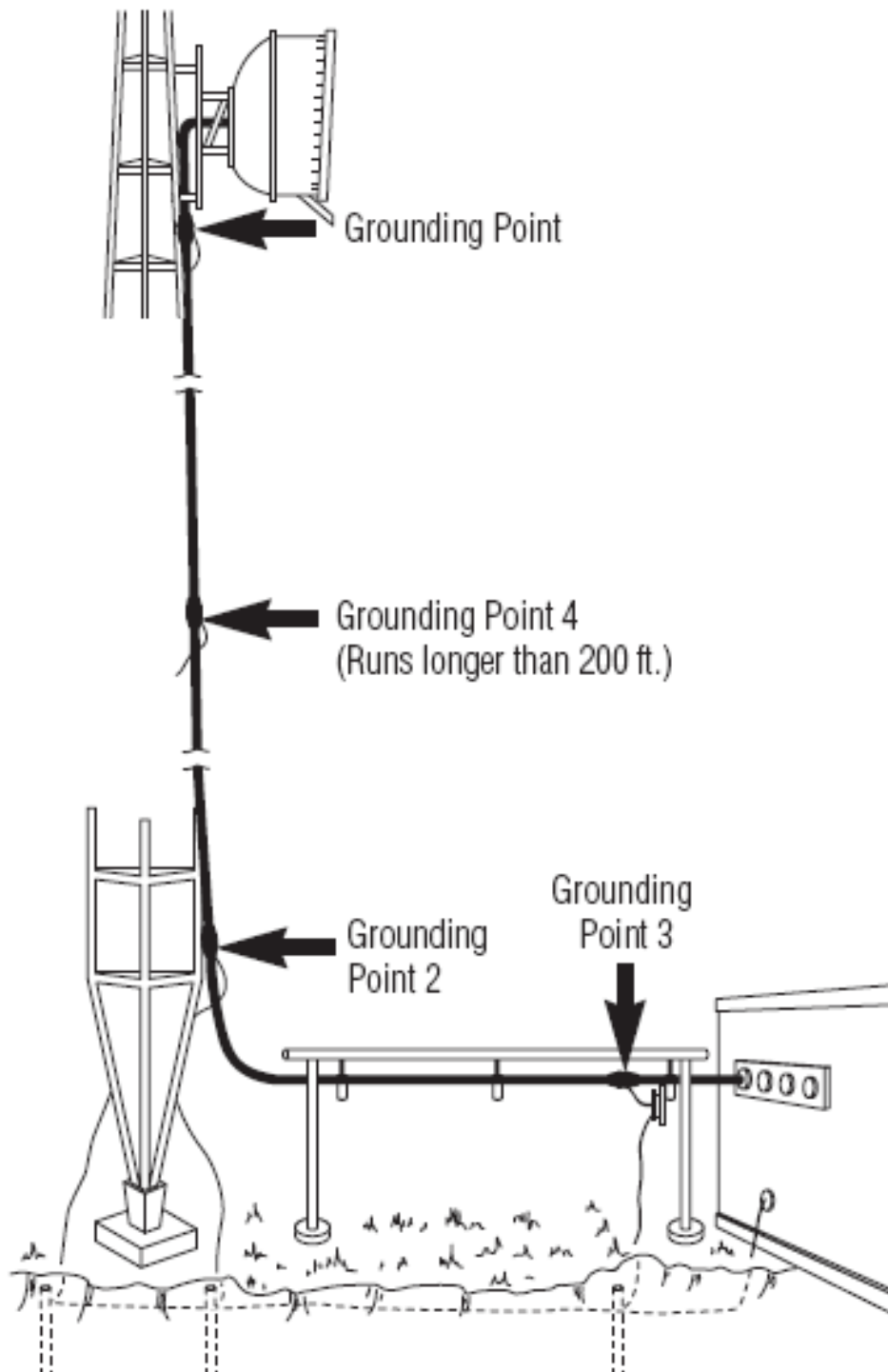


Figure 5 – Coax grounding

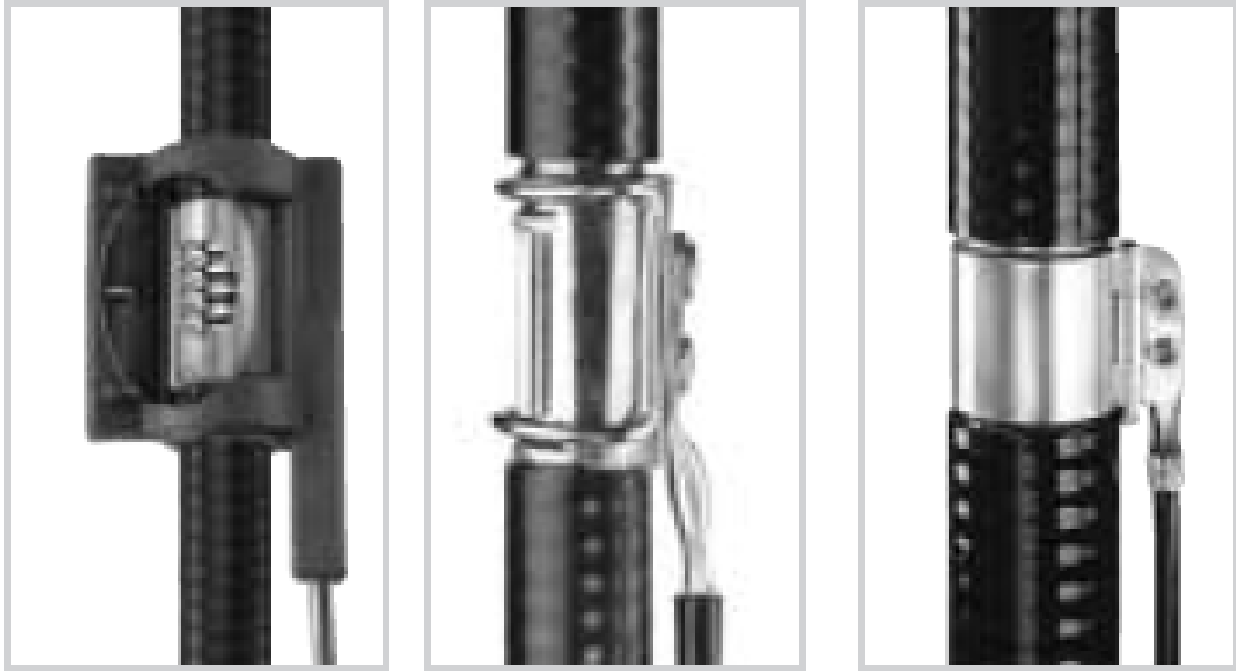


Figure 6 – Heliax Ground Kits

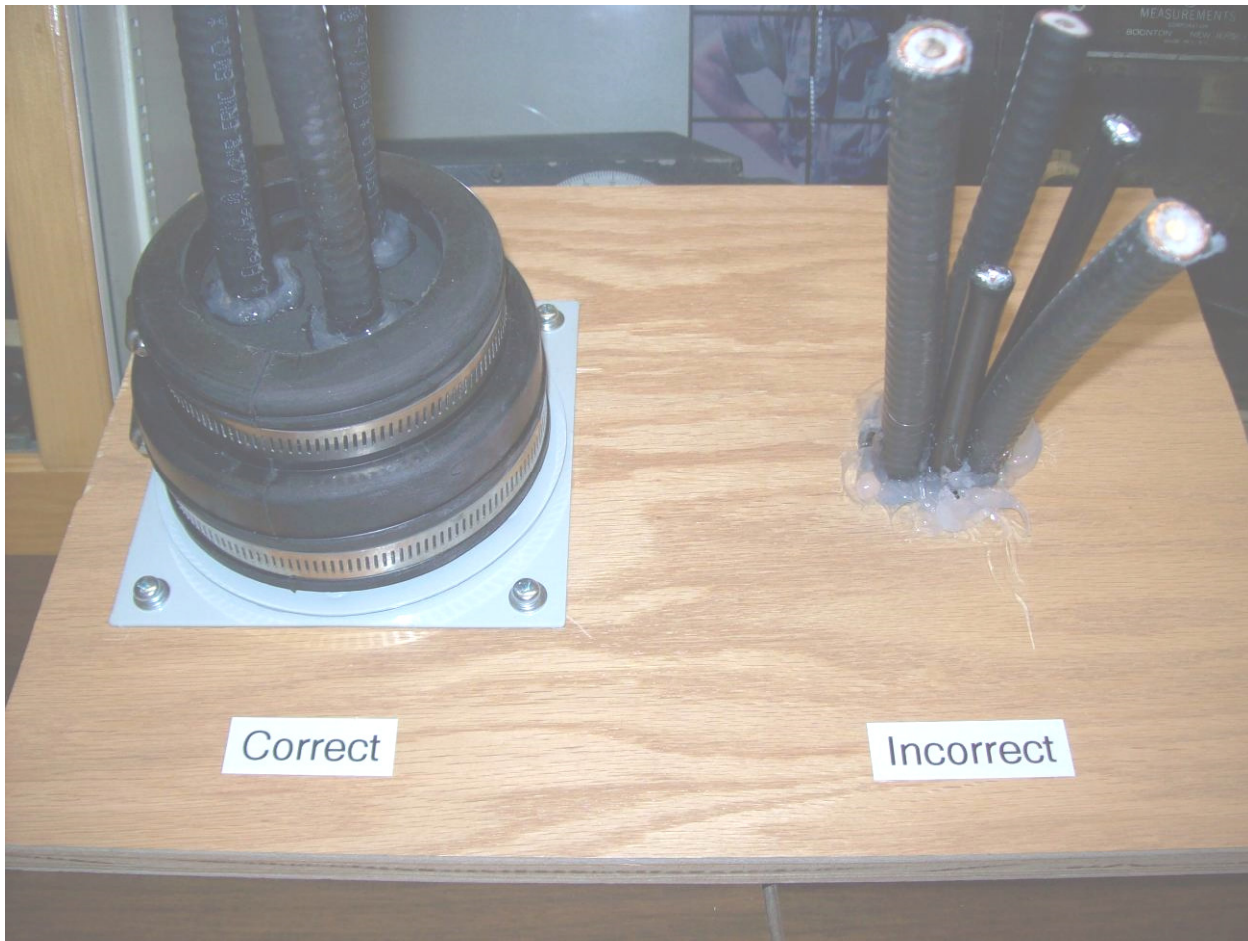


Figure 7 – Coax Entry Ports