

DIVISION 15 REFERENCE MATERIAL

15.01 INDEX OF MATERIAL INCLUDED IN THIS DIVISION

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15.02 SPECIFICATIONS FOR TELEVISION DISTRIBUTION SYSTEMS

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2. **Definitions**

- a. These specifications are written as a recommended guide to the electrical engineer when he prepares his specifications for ETV distribution systems. Where the word "must" is used throughout, it denotes a recommendation to the engineer that he word this as a mandate in his specifications. Words such as "may" or "should" are to be considered as options or recommendations only.
- b. **Installer:** As hereinafter referenced, means the contractor responsible for installing the television distribution system as specified by the electrical engineer. The installer will normally be a subcontractor to the electrical contractor.
- c. **ITFS:** Instructional Television Fixed Services
- d. **VCR:** Videocassette recorder
- e. **Reference signal:** For the purpose of these specifications, the standard reference signal of 0 dbmV is understood to be 1 millivolt across 75 ohms.
- f. **Head-end:** The system head-end consists of the main amplification system, associated antennas, and converters used to feed the overall building distribution system.
- g. **Adjacent channel:** Two VHF television channels will be considered as adjacent channels when there is less than 6 megahertz of spectrum space between them. Example: Channel 3 and Channel 4 are adjacent; Channel 6 and Channel 7 are not adjacent.
- h. **Extraneous signals:** An extraneous signal is any RF signal or any television or random signal other than the signal the viewer wishes to view.

3. General

- a. These specifications for the design and installation of a coaxial based, TV building distribution systems have been approved by, and are the recommendations of, the South Carolina Educational Television Network (ETV). They are applicable for new buildings, renovations and additions to existing buildings. The electrical engineer should consult with the Network Technical Services Department at SCETV, 1101 George Rogers Blvd., Columbia, South Carolina (mailing address: Post Office Box 11000, South Carolina 29211) for applicable system requirements.
- b. From Section 1212.1, all new buildings and new building additions shall be provided with a complete ETV system. System shall be insulated conductors installed in raceway/cable trays for ease of future modification. Use conduits as needed.
- c. The installation must conform to accepted standards for systems of this type and must meet all applicable codes and standards (see Section 1203.2). It must be specified that the subcontractor for this work shall have been in the business of installing and servicing this type of system for a reasonable period of time and that he must show evidence of this and must also show evidence that he maintains a fully equipped service organization with an adequate stock of replacement parts or has overnight access to such parts.
- d. The system in general must be guaranteed for one year. In addition, any special equipment warranties must be furnished to the owner at completion, along with all pertinent manuals, operating instructions, etc.
- e. The distribution system must be capable of receiving VHF/UHF educational television channels, educational FM radio channels, ETV satellite channels and, where applicable; the local ITFS channels. The distribution system must be capable of distributing these signals, although UHF may be converted to VHF for economic reasons.
 - Particular emphasis is to be placed on stations operated by the South Carolina ETV Network.
 - ETV Satellite Channels – The distribution system must be capable of receiving and distributing, at a minimum, 3 separate ETV satellite channels. The Architect should co-ordinate with ETV's Network Technical Services Department the location and the type of mount to be used.
 - Instructional Television Fixed Service (ITFS) – All School Districts requesting ITFS channels must have their Architect forward the school's site coordinates (latitude & longitude) to ETV's Network Technical Services Department. ETV will run a design profile and conduct a site survey to determine the technical requirements of the system. If an antenna supporting structure is needed, ETV will provide the antenna height and antenna size needed to the Architect, allowing a complete system to be included under the general contract. The Architect will be responsible for the design, installation and certification of the required supporting structure. ETV must be provided with a Certified set of Engineering Shop Drawings for review and approval before installation of the supporting structure. It is of utmost importance that the Architect/Engineer closely co-ordinate all activities concerning ITFS reception with ETV.
 - All schools located within the coverage area of an educational TV station and/or educational radio station must be received and distributed over the school television system. If an electronic bulletin board or clock channel are distributed, Educational Radio could be transmitted on same carrier.
 - If a school requests reception of non-educational TV stations, or CATV (local cable channels), these channels must be fed on a separate cable to the Media Center's VCR

area. These channels must be fed over the system through cable converter box and a modulated channel to eliminate VCR loop through.

- f. After the building contract has been awarded, the successful sub-contractor (hereafter called the "installer") for the TV distribution system must submit to the electrical engineer, for his prior approval, a simple block diagram of the system to be installed. It must indicate by catalog number the type of amplifier, type of splitters and taps, and type of cable to be used. The engineer must submit the design to ETV for approval prior to the equipment being ordered.
- g. At or before the final inspection and completion of the work, the installer must provide the following.
 - Complete service data, including schematic diagrams and maintenance manuals of all new equipment supplied as a part of this contract,
 - a complete "as-built" system block diagram showing as accurately as possible all equipment, splitters, taps, and outlets. Diagrams are to include a complete list of signal strength readings taken on each channel used in the school. If channel 36 (295.25 MHz) is not used, a temporary channel 36 modulator must be inserted during the signal strength readings and BDS inspection. Readings are to state signal strengths at all inputs and outputs of all active devices and all television outlets in the system. (Readings shall be made with an approved field strength meter relative to 0 dBmv).
 - all readings are to be posted on the riser diagram along with notes from 15.02-4r.
 - provide 3 copies of the block diagram. One copy forwarded to ETV NTS Department (prior to scheduled BDS Inspection), 2nd copy provided to ETV representative at time of BDS Inspection, and 3rd copy to be mounted under glass and attached to the wall in a secure manner at the head-end location. Location will be designated by ETV.

4. Conduit/Raceway System

- a. ETV conduit, outlet boxes, and cabinets may be shared with integrated systems where the location is compatible with requirements for ETV service.
- b. TV outlets should be located in all classrooms and other instructional areas, principal's and assistant principal's offices, conference rooms, library, library workrooms, A/V rooms, band rooms, choir rooms, vocational classrooms, cafeterias, and at least one outlet on each side of the stage in an auditorium or large viewing area; also locate in other areas such as (hallways, lobbies, and parent waiting areas) as designated by the school district. Do not install outlets in vocational shops where TV viewing could be hazardous. Exceptions may be permissible where screens or partitions are provided to prevent such hazardous conditions.
- c. TV outlet boxes in classrooms should be a maximum of 66" above finished floor and located to the left or right of chalkboard (window side where applicable). This height may be adjusted to be consistent with TV set wall mounts. Outlet boxes in administrative and non-instructional areas will be the same height as normal convenience outlets, unless TV sets are to be wall mounted. All outlet boxes must be two-gang type, 4" x 4" x 2-1/4" deep, with single-gang plaster rings. Plaster rings must be of sufficient depth to face with finished wall and extend to the block void or wall hollow.
- d. A duplex convenience A/C outlet must be provided at the same height as each TV outlet box and within 12" horizontally.
- e. TV outlet boxes should have only one entry and one exit of a 3/4" conduit for a series type system. If cable trays are used for television distribution with a series outlet system, it is recommended that the cable tray be used from the distribution point, to the first TV outlet

only. A 3/4" conduit should be routed from outlet to outlet with constraints to contain the conduit within the interior of the classroom area which would alleviate multiple fire rated hallway wall penetrations. Each TV outlet may home run to a designated pull point (located within an electrical closet, storage room, data room, etc.) if cable attenuation and channel slope factors allow. Do not use outlet box as junction point. All active and passive devices are to be placed in designated areas only (headend, storage rooms, electrical closets, data closets, etc.) Devices will not be allowed in ceiling areas or attached to cable trays.

- f. All conduits between TV outlets must be a minimum of 3/4" in size.
- g. TV outlet conduit runs under 300' total length may have up to 10 outlets in series. Outlet conduit runs between 300' and 500' should have no more than 6 outlets in series.
- h. If TV outlet conduit runs exceed 500' in length, a TV cabinet or backboard must be installed for an extender amplifier; this can be either a metal cabinet box 24" x 24" x 6" or a plywood backboard 24" x 24" x 3/4". The TV cabinet or backboard must be connected by conduit to the main amplifier location, or to the nearest TV cabinet or backboard that is connected to the main amplifier location, as follows: for runs up to 600', 2" conduit must be provided and for runs in excess of 600', 3" conduit must be provided. Pull boxes (interior) or "hand holes" (exterior) must be provided at a maximum of every 300', or less if dictated by code requirements. All conduit bends must be sweeping.
- i. In additions to existing buildings, the nearest new line amplifier location must be connected by conduit to the existing main amplifier location as follows: for runs up to 600', 2" conduit must be provided and for runs in excess of 600', 3" conduit must be provided. Pull boxes (interior) or "hand holes" (exterior) must be provided at a maximum of every 300', or less if dictated by code requirements. All conduit bends must be sweeping.
- j. A 4' x 8' x 3/4" plywood backboard must be provided at all main amplifier or head-end locations. Backboard should be mounted in a vertical alignment with top of board at a minimum of 10' above finished floor.
- k. The main amplifier location must have:
 - 2" minimum rigid conduit extended to a dip pole for CATV entrance. Conduit must extend a minimum of 10' above ground level and must include a weatherhead or as required by the local cable provider.
 - 2" conduit extended to the ITFS antenna supporting structure.
 - 2" conduit extended to the Digital Satellite dish installation (type of installation to be selected during construction planning stage. Roof Mount, Wall Mount, Ground Mount, etc.).
 - 2" conduit stubbed 6' beyond the exterior of the building for future use. Location to be determined by ETV. Stub outs are to be adequately marked and identified for future location.
- l. The main amplifier location or head-end location must be the point at which the open-circuit satellite, ITFS and VCR signals will be mixed together and/or any other source for distribution to building.
- m. The main amplifier should be located in the central part of the building. This is to shorten the main trunk line or feeder line.
- n. There must be a weatherhead connected to the main amplifier location for open-circuit and/or roof mounted satellite antennas. It should be 2" rigid conduit 5' above roof at highest point (where applicable) within 100' of head-end. (See drawing on page 15-9.)

- o. There must be a VCR (video cassette recorder) outlet box in the wall at 42" above finish floor at the location of the VCR equipment rack. This rack is normally located in the A/V Storage or Library Office/Work Room at the District's decision. This VCR outlet box should connect to the main amplifier location with a 2" conduit and a minimum of 10 RG-6 coaxial cables. A three-gang A/C outlet box should be provided adjacent to the VCR outlet box. (See drawing on page 15-10 & 15-11.)
- p. To minimize ground potential differences, a #8 wire must be provided from the building electrical ground to all TV pull stations with AC receptacles.
- q. There must be a pull wire provided in all unused conduits. Pull wire should be nylon cord, 200-pound minimum pull strength.
- r. The final drawings must have a riser diagram with numbered junction points, such as TV-1, TV-2, TV-3, identified by actual room number. Riser must agree with as-built drawings as to what connects with what and where.

5. Power Requirements

- a. AC duplex power outlets must be provided at each TV cabinet or adjacent to each backboard. The main amplifier location must have at least two duplex A/C convenience outlets. Cords between amplifier cabinets (if used) and AC receptacles must not exceed 4 feet. AC power cords must be installed with plug retainers so that they cannot be unplugged without proper tools.
- b. A Transient Voltage Surge Suppressor Duplex Receptacle must be used at all TV Headends and VCR Cabinet locations. Receptacle must meet a minimum of 80 joules of energy absorption, 6,500 amps current handling capability in each of the three modes, 2 filtering capacitors for 7 to 1 noise reduction, 2-way protection for line and equipment, and response time less than 1 nanosecond.
- c. Where a new power outlet is installed to provide power for amplifiers in the television system, such outlets must be on a separate circuit. In an existing building where the existing electrical system makes this impractical, a suitable AC overload device should be provided as a part of the wiring.
- d. Power cords between AC power outlets and equipment cabinets must be 14/3 S cable minimum.
- f. See Item 4, Paragraph d, concerning location of AC power outlets for each TV outlet box.
- g. An earth ground must be provided and the installer should connect all head-end equipment to it (earth ground, if used, must be a minimum 3/4" x 8' rod with #6 copper wire to cabinet).
- h. All coaxial entrance cables must be grounded to a proper ground immediately upon entrance into a building equipment room to meet Article 820-33 or latest version of the National Electric Code.

6. Distribution System Operation and Performance Considerations

- a. The system as installed must provide for distribution of properly balanced and adjusted television signals.
- b. All equipment must be rated for continuous duty operations and must be installed and operated as recommended by the equipment manufacturers.
- c. The system must be able to distribute N.T.S.C. color television signals without degradation.

- d. The system must meet basic radiation limits as specified by FCC Rules, Parts 15 and 76. (i.e. all equipment must be radiation shielded.) All exterior coaxial cable connectors must be snap and seal type or equivalent, (snap and seal connectors are suggested to be used throughout the system).
- e. All devices installed in coaxial cable must be designed to match the characteristic impedance of the cable.
- f. The overall distribution system must have a VSWR of 1.2 to 1 or better.
- g. The system bandwidth, exclusive of the head-end amplifier, must be from 5 MHz to 890 MHz.
- h. System signal levels at all television receivers must be balanced. System levels will be termed "balanced" when the difference across the bandwidth of 5-300 MHz does not exceed 6 db.
- i. The highest FM radio signal level must be 20 dB below the visual carrier level of the highest TV channel carried on the system.
- j. Where required, Band Stop Filter, single band-pass filters and FM band-pass filters must be provided to reduce the level of all undesirable signals that would cause interference on TV system.
- k. The minimum output at any outlet in the system must be +6 dBmV, and the maximum signal available at any receptacle must not exceed +20 dBmV.
- l. The minimum signal input to the head-end (distribution) amplifier must meet all equipment rated requirements. The signal level of any channel measured at the output of these amplifiers must not exceed +55 dBmV.
- m. There must be a minimum RF isolation of 12 dB between television receiver and feeder line throughout the system for VHF.
- n. Extraneous signals present throughout the system must be greater than 45 dB below any desired signal. Band pass filters of no more than 6 MHz pass band may be used to meet this requirement.

7. Special Functions

- a. Provisions for local origination of television signals for distribution throughout the school must be provided.
- b. All schools, provisions for distribution of the South Carolina ETV ITFS signals throughout the school must be provided as directed. The input to the distribution system must be from an agreed-upon demarcation point from the South Carolina ETV Network.
- c. If specifically requested by the district, the installer may present a proposal providing for the simultaneous distribution and viewing of all signals specified within the school complex on a single cable.
- d. As an alternative to Paragraph c above, the installer may propose to provide for simultaneous distribution of all signals to be viewed in the school or a multi-cable system.
- e. Provisions for the installation of an ETV Digital Satellite Dish must be provided under the general contract. See enclosure for different types of approved mounts.

8. Electronic Equipment Specifications

- a. Solid-state or transistorized equipment must be required. All broadband amplifiers must pass 50-550 MHz not to exceed ± 0.75 dB of flatness.
- b. Head-end amplifiers:
 - Amplifiers must be capable of providing at least 6 dB more output gain than the actual loss of the system (see Item 12).
 - All channel amplifiers are acceptable in any system having an actual loss figure of 40 dB or less. Where, because of a calculated figure, a system with a single broadband amplifier is contracted for and the actual loss figure exceeds 40 dB, the installer must conform with the third and fourth subparagraphs under Paragraph b, at no extra cost to the district.
 - Should the system have a calculated loss figure in excess of 40 dB but less than 55 dB a broadband amplification system will be acceptable. Where the use of more than one broadband amplifier in cascade is proposed, specific performance specifications of such an arrangement must be set forth. If the installer prefers, he may set forth the merits of the use of strip amplifiers for a system with these losses and propose their use as an alternate.
 - The amplifier supplied must serve all outlets on the system without overload or distortion.
- c. Preamplifiers, Reamplifiers, and Pads
 - Necessary preamplifiers or pads must be used to balance the input signals of the system before they are fed into the head-end amplifiers.
 - Re-amplification is required in any system being provided in building additions where existing buildings are equipped with distribution systems, unless specifically waived by ETV.
 - The signal input to a re-amplifier must not be less than the equipment specification requirements, with a maximum output of +50 dBmV for any given channel.
 - The installation of taps for reamplification must not degrade services on the existing system. Do not install taps in cable between main amplifier and reamplifier.
- d. System splitters must be provided where necessary. VSWR of splitters must be less than 1.5 to 1.

9. Coaxial Cable

- a. All cable **shall** be run in raceways.
- b. All trunk line coaxial cables supplied from headend equipment and secondary pull points must be Belden # 9011 or equivalent with a maximum attenuation of .36 dB per 100 feet at 5 MHz, a maximum attenuation of 2.17 dB per 100 feet at 300 MHz. There must be (1) spare Beldin # 9011 installed between headend and all pull points.
- c. All coaxial cables supplied for drops between TV outlets must be Belden # 129114 or equivalent, with a maximum attenuation of .61dB per 100 feet at 5 MHz, a maximum attenuation of 3.37 dB per 100 feet at 300 MHz.
- d. All cable attached to electronic equipment; active or passive must be labeled to show function and location of the other end of the cable. All labels must be typed, printed or made with a suitable labeling device, and securely fastened to the cable.

- e. Appropriate fittings must be used when it is necessary to extend a length of cable. No splices will be allowed within a raceway.
- f. Where appropriate, the installer may use double-shielded cable (see Item 2, Paragraph e).
- g. Plenum cable must be used in all environmental air return areas. \

10. Television Receptacles and Cords

- a. Receptacles must provide 75 ohm access to the distribution system.
- b. Receptacles must be radiation shielded with F-type connectors.
- c. Television receiver-to-receptacle cords must be furnished for each television outlet, plus 10 spares.
- d. Cords must be RG-59 type, copper braid shield flexible cable with a minimum length of 12 feet. Where wall mounted television sets are specified, the set cord should be shortened to alleviate excess slack. Matching transformers must be provided where required for existing TV receivers.

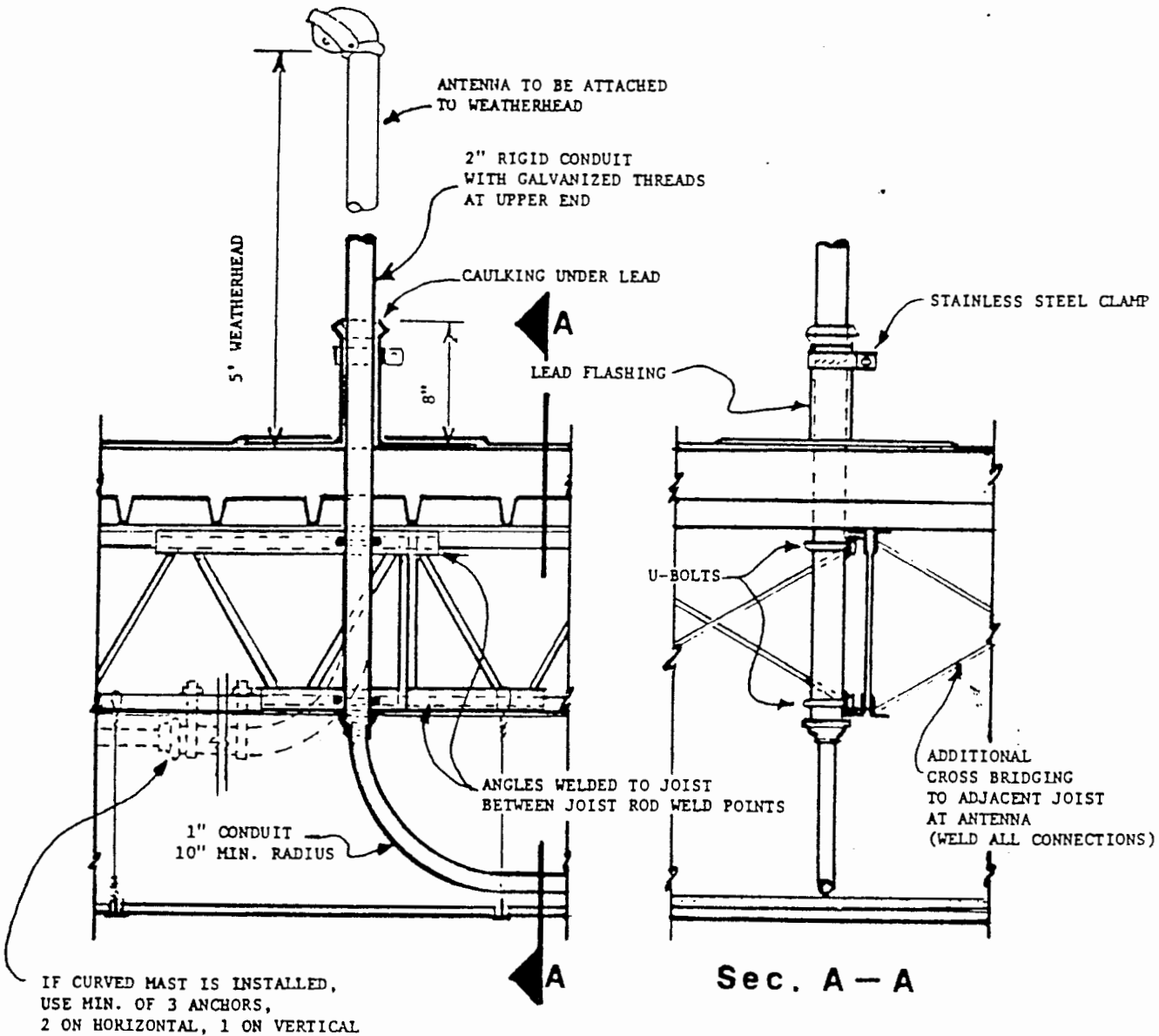
11. Antennas

- a. All antennas must be of a 75 ohm, stub-matched, CATV type.

12. Demonstration of Performance

- a. The installer must demonstrate compliance with the plans and specifications at the time of final inspection by South Carolina ETV Network Technical Services as follows.
 - Normally viewed television signals (as outlined in Item 3, Paragraph e) are to be inserted into the system head-end amplifier (Input signal requirement per equipment specifications). This signal will not be less than + 6 dBmV or more than + 20 dBmV at any outlet selected by the inspector (see Item 3, Paragraph g for required channels to be checked).
 - With the normally viewed television signals feeding the system and after selected outlets have been checked, the installer must demonstrate the reserve gain capability of the amplifier (see Item 8, first subparagraph of Paragraph b).
 - Picture quality from the ETV - ITFS, Digital Satellite, or off-air signals must be observed on a television receiver. The observed picture should exhibit no degradation of quality (noise, distortion smearing, ghosting, cross modulation, etc.).
 - Should such a demonstration of performance show that the installer has not properly balanced the system and that picture degradation is present or that reserve or output gain is not as specified, a second performance demonstration must be arranged.
 - Should a second performance demonstration fail, the installer must agree to correct the system deficiencies under the supervision of the district's service organization or consultant and must further agree to pay the district's service organization or consultant their usual fees for supervisory service, if applicable.

ETV - ROOF ANTENNA WEATHERHEAD DETAIL



ETV ANTENNA WEATHERHEAD SECTION DETAILS

NOTES:

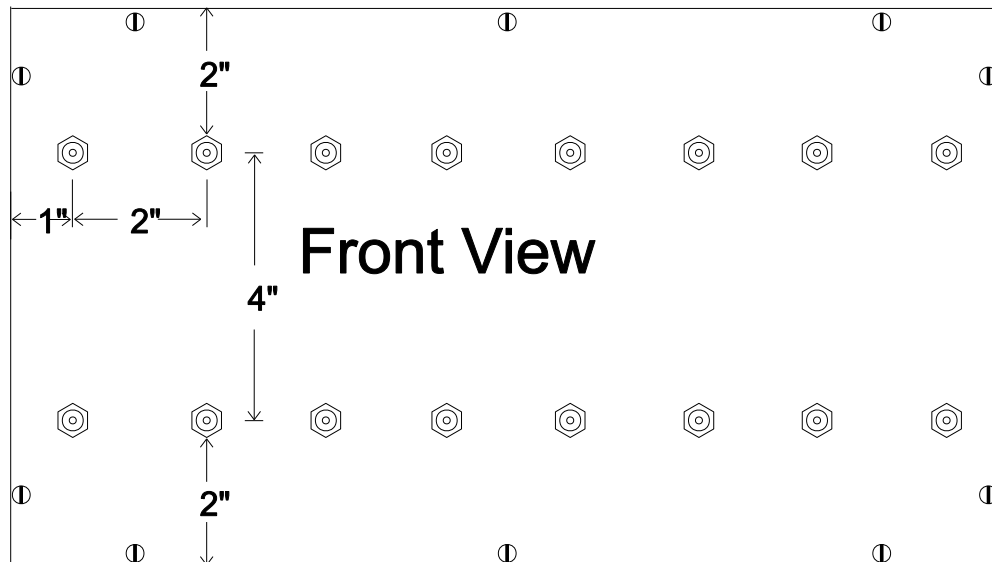
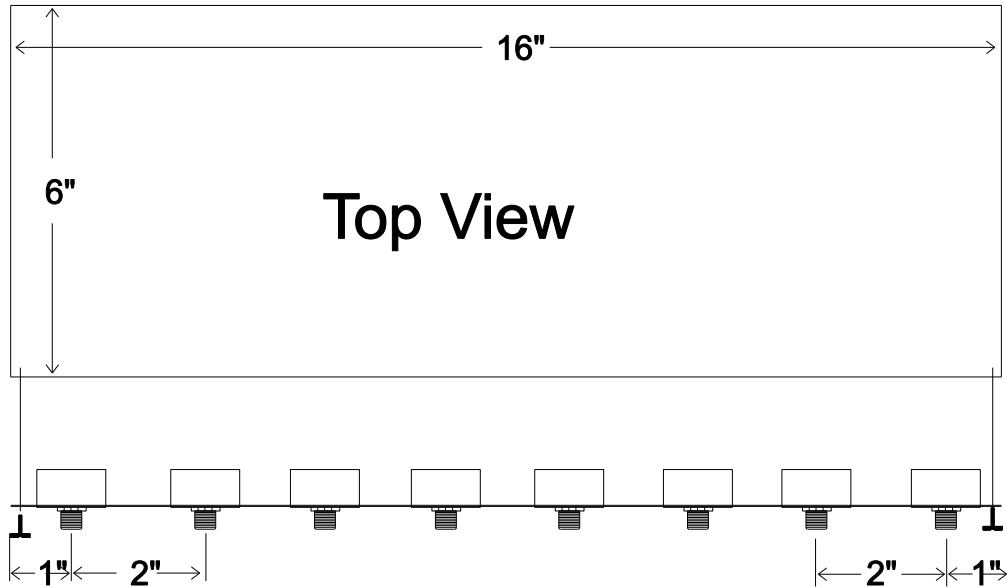
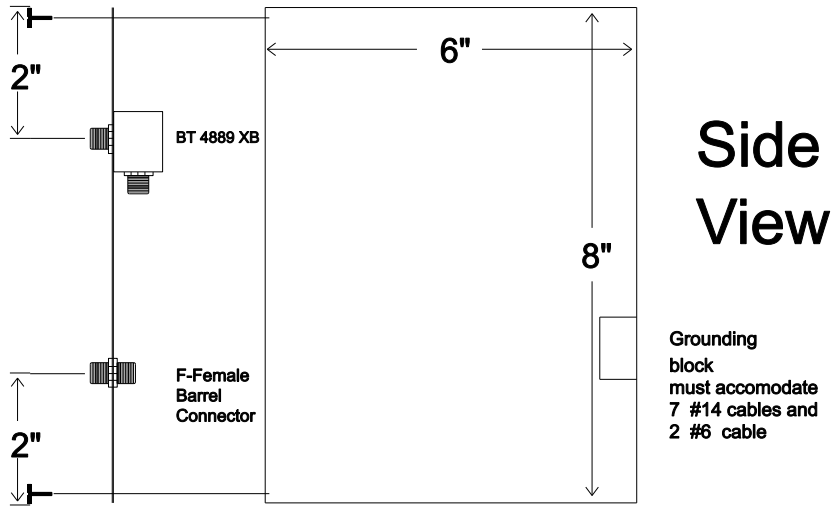
1. THE FIELD TECHNICAL SERVICES ADVISOR AT THE S. C. ETV CENTER (MAILING: P.O. Box 11000, 1101 George Rogers Blvd., COLUMBIA, S. C. 29211) SHOULD BE CONSULTED DURING THE DESIGN DEVELOPMENT PHASE OF THE DRAWINGS TO DETERMINE HEIGHT, TYPE AND LOCATION OF ANTENNA REQUIRED FOR A PARTICULAR PROJECT. NORMALLY, THE ANTENNA SHOULD BE LOCATED ON THE HIGHEST ROOF POINT.

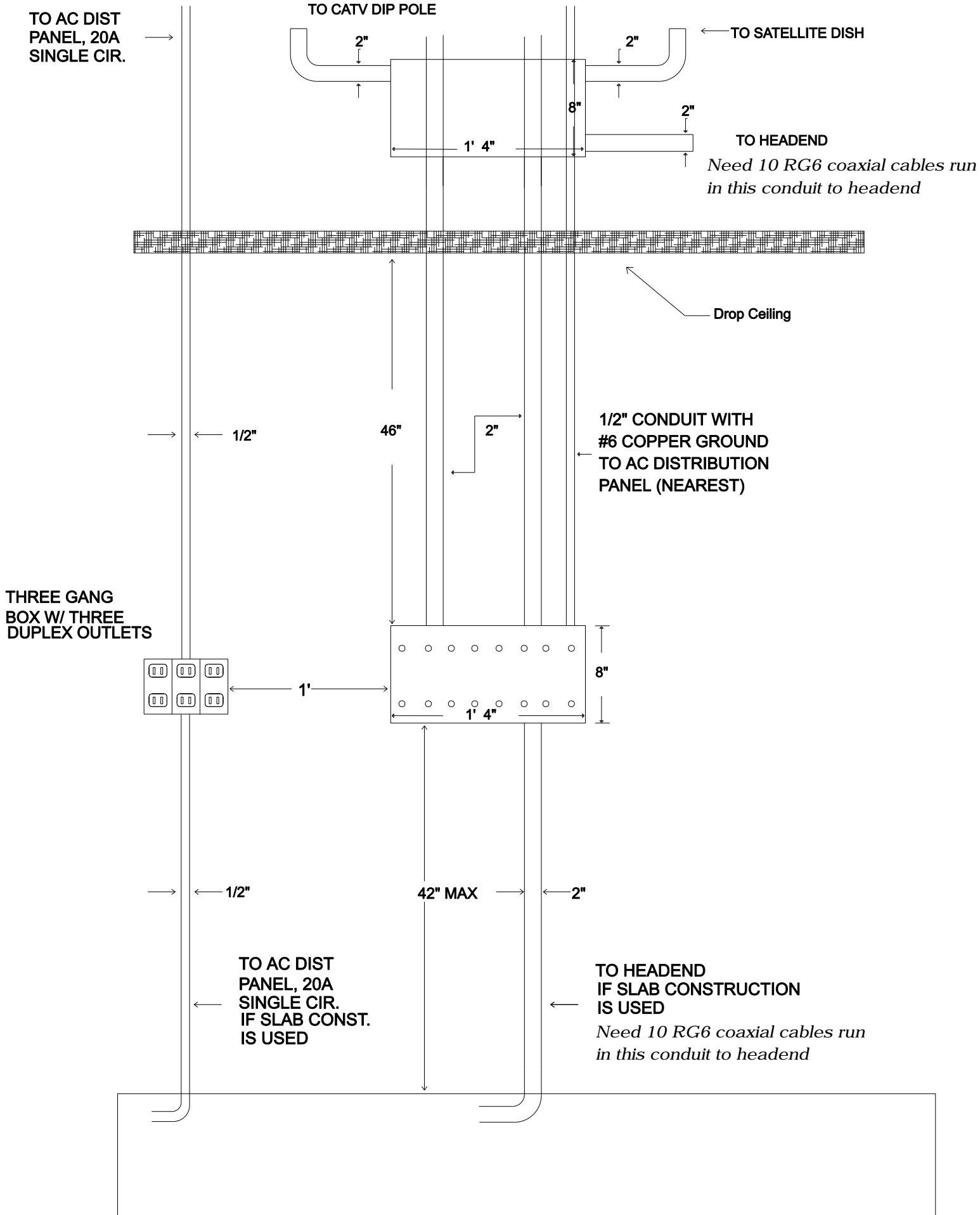
THE MAJORITY OF ANTENNAE USED IN SCHOOL PROJECTS WILL BE OF A HEIGHT THAT WILL NOT REQUIRE "GUYING." HOWEVER, WHEN GUYING IS REQUIRED, IT IS SUGGESTED THAT THE GUY POINTS ON THE ROOF BE OF 1½" RIGID CONDUIT TO PROJECT APPROXIMATELY 8" ABOVE ROOF, ATTACHED TO STRUCTURE SAME AS INDICATED FOR MAIN MAST-HEAD, AND CAPPED WITH SCREW CAP AND WELDED EYE FOR GUY ATTACHMENT.

2. THE ABOVE IS SUGGESTED WEATHERHEAD DETAILING FOR STEEL JOIST/STEEL DECK CONSTRUCTION. HOWEVER, IN ALL CASES THE STRUCTURAL ENGINEER SHOULD DESIGN TO MEET INDIVIDUAL CONDITIONS AND THE TYPE CONSTRUCTION USED IN ORDER TO INSURE STRUCTURAL INTEGRITY.

SCETV VCR Outlet Box

Detail Sheet A





TYPICAL OUTLET REQUIREMENTS FOR VCR CONSOLE