



LBUSD TELEVISION DISTRIBUTION SYSTEM STANDARDS

Revision 04-09-04

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Broadband radio frequency active and passive components
- B. Coaxial cable and connectors
- C. Support and termination hardware

1.02 APPLICABLE PUBLICATIONS:

- A. Federal Communications Commission (FCC) Part 15 and Part 76
- B. National Electrical Code (NEC) Article 820
- C. National Cable Television Association (N.C.T.A.)
 - 1. Recommended Practices for Measurements on Cable Television Systems

1.03 SUBMITTALS

- A. Submit the following:
- B. Provide product data for:
 - 1. Broadband amplifiers
 - 2. Splitters, taps, In-line Equalizers, terminators and directional couplers
 - 3. 75 Ohm coaxial cable and connectors
 - 4. RG6U cable assemblies
- C. Manufacturer's installation instructions
 - 1. The Contractor shall provide three copies of the required manufacturer's installation instruction prior to beginning any installation work.
 - 2. Installation instructions are required for the following equipment and components:
 - a. Broadband amplifiers
 - b. Splitters, taps, terminators and directional couplers
- D. Broadband Communications Engineer Qualifications
 - 1. The Contractor shall submit documented proof that all work undertaken on the Television Distribution System is under the direct supervision of a qualified broadband communications engineer.

2. A "qualified broadband communications engineer" is defined as someone that can demonstrate successfully completing the design and installation of multi-channel radio frequency cable television systems for a period of at least five years, or can demonstrate the completion of a manufacturer's certified training course in system design and a minimum of two years of experience. Experience shall include system design, acceptance testing and documentation.
 3. The submittal must document a minimum of five completed projects utilizing the type of products and materials outlined in the Contract Documents.
- E. Broadband Communications Technician Qualifications
1. The Contractor shall submit certification reflecting the qualifications of the technicians who will be responsible for the installation, activation and testing of the Television Distribution Systems equipment.
 2. If no such certification exists, the Contractor must obtain the services of certified Broadband Communications Technicians to undertake the Television Distribution System work.
- F. Television Distribution System design schematics
1. Prior to equipment installation, the Broadband Communications Engineer shall submit to LBUSD, design schematics reflecting signal levels and expected performance figures of the Master Antenna Television distribution system based upon the particular equipment to be used.
 2. Prior to the installation of the distribution system equipment, the Broadband Communications Engineer shall review the suggested schematics in the Contract Documents and shall submit to LBUSD a red lined copy reflecting any changes based upon field conditions, product limitations and/or LBUSD's request.
 3. After installation of the distribution system equipment, the Broadband Communications Engineer shall submit to LBUSD a schematic of the distribution system reflecting the actual locations of the equipment installed and the method of interconnection. The schematic shall also include the measured signal levels at the amplifiers, taps and outlets.

PART 2 – MATERIALS

2.01 COMPONENTS

- A. UL or third party certified. Provide a complete system of broadband distribution cabling and pathway components and support structures, pathways, and spaces complete with conduits, pull wires, raceways, pull boxes, outlets, cables, ground boxes, as per the drawings. Fixed cables and pathway systems for Television signal distribution systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70.

2.02 DISTRIBUTION SYSTEM AMPLIFIERS

- A. Materials
1. Amplifiers must meet or exceed the following specifications:
 - a. Be upgradeable to Bi-Directional.
 - b. Frequency range: 50 to 750 MHz.
 - c. Minimum full gain: 30 dB
 - d. Attenuation range: 6 dB or greater
 - e. Tilt range: 4 dB or greater

- f. Return loss: 14 dB or greater
 - g. Channel loading: 110 channels
 - h. Output level: 45dBmV at 750 MHz.
2. Amplifiers must be locally powered and designed to prohibit unauthorized access to electronic components.
 3. Amplifiers may not be cascaded more than 3 deep from Headend.
- B. Manufacturers: Blonder Tongue, or LBUSD approved equal

2.03 DIRECTIONAL COUPLERS

- A. Materials
1. Directional couplers must meet or exceed the following specifications:
 - a. Frequency range: 50 to 1000 MHz.
 - b. Housing and faceplate to be constructed of die cast aluminum
 - c. Minimum isolation: 18 dB
 - d. Shall be Bi-directional
- B. Manufacturers: General Instrument, SSP-K series, and Scientific Atlanta, SADC series or LBUSD approved equal

2.04 SPLITTERS

- A. Materials
1. Splitters must meet or exceed the following specifications:
 - a. Frequency range: 50 to 1000 MHz.
 - b. Housing and faceplate to be constructed of die cast aluminum
 - c. Minimum isolation: 18 dB
 - d. Shall be Bi-directional
- B. Manufacturers: General Instrument, SSP-K series, and Scientific Atlanta, SAS series or LBUSD approved equal.

2.05 DROP TAPS AND IN-LINE EQUALIZERS

- A. Materials
1. Drop taps and In-Line Equalizers must meet or exceed the following specifications:
 - a. Frequency range: 50 to 1000 MHz.
 - b. Housing and faceplate to be constructed of die cast aluminum
 - c. Each tap factory labeled with the tap value
 - d. Shall be Bi-directional
 - e. Any unused ports shall be terminated with a 75-Ohm terminator.
 - f. 2, 4, and 8 port taps may be used.
 - g. Taps shall be designed to deliver outputs per 3.04 below. If taps require different outputs (including the use of in-line equalizers, or

different value taps at the same location), or other than RG-6 to make this specification, then taps shall be labeled to show which taps are to be use for which rooms, and with which cable. Additionally this shall be designated on the design maps and the as-builts.

- h. Taps shall not be so far away from any outlet, current or proposed, as to require more than 300 feet of cable (either RG-6 or RG-11)
- B. Manufacturers: General Instrument, SSP-K series, and Scientific Atlanta, SAT series or LBUSD approved equal.

2.06 COAXIAL CABLE

A. Materials

- 1. RG-6 and RG-11 cable shall;
 - a. Have a frequency range: 50 to 1000 MHz.
 - b. RG-6 and RG-11 shall be of Quad Shield construction.
 - c. Be plenum rated where required by law or regulation, otherwise PVC is acceptable.
 - d. Have an 18 AWG solid copper center conductor.
 - e. Have a .180" nominal diameter foam polyethylene dielectric.
 - f. Have a .003" foil inner shield and 34 AWG, 60% coverage, aluminum inner braid.
 - g. Have a .002" foil outer shield and 34 AWG, 40% coverage, aluminum outer braid.
 - h. Have 75-Ohm impedance.
 - i. Either RG-6 and RG-11 may be used for drop cables
 - j. Only RG-11 or greater cable may be used for backbone and distribution to taps
- 2. .500 cable shall;
 - a. Have a frequency range: 50 to 1000 MHz.
 - b. Have 75-Ohm impedance.
 - c. Only RG-11 or greater cable may be used for backbone and distribution to taps.

- B. Manufacturers: Belden, Trilogy Communications, Inc., Com-Scope, or LBUSD approved equal.

2.07 CONNECTORS

A. F-Connectors

- 1. Where required, the "F" style connectors for the RG-6, and RG-11 and .500 cables shall be one-piece crimp-on or compression type.
- 3. .500 Cable may be terminated in either "F" connectors, with jumpers to the actives and passives, or with 5/8" housing entry connectors.

4. Only a connector recommended by the cable manufacturer shall be installed.

B. Manufacturers: Gilbert Engineering, Inc., and Augat LRC or LBUSD approved equal.

2.08 "F" / "F" RG6U CABLE ASSEMBLY

A. Materials

1. Contractor shall provide one (1) RG6U cable assembly for each TV outlet. Quantities shall be for 100% TV outlet population.
2. RG6U cable assembly shall be made up of 75 Ohm coax, with double aluminum shield and 67% braided shield.
3. "F" connectors shall be nickel or gold plated.
4. RG6U cable assemblies shall be available in 4 foot and 6 foot lengths. 70% of quantity shall be 4' long and 30% of quantity shall be 6 feet long.

B. Manufacturer: Gruber Industries or LBUSD approved equal.

2.09 PATHWAYS (BACKBONE AND HORIZONTAL)

A. Pathways shall conform to LBUSD and TIA/EIA-569 standards. Pathway shall be conduit, and raceway installations. Provide grounding and bonding as required by EIA/TIA-607.

B. Backbone pathways are facilities for the installation of television signal distribution trunk cables between entrance facilities, "Head End" room, MDF and outlet locations. These backbone pathways consist of 2" and/or 3" conduits, either underground or overhead, which are provided as per construction documents.

C. Ground Boxes and Pullboxes

1. Ground boxes shall be made of concrete and the minimum size shall be 35 _" x 17 _" x 12". Ground box covers shall be rated for traffic (type T.05) and shall be marked communications. Metal covers shall be used in all location subject to vehicle traffic. Gravel shall be installed below all ground boxes for drainage. Unless otherwise noted, exterior pull boxes shall be 18" x 18" 4".
2. Interior pull boxes shall consist of 16 gauge steel minimum, unless otherwise noted on plans. Indoor enclosures shall conform to NEMA Type 2, unless otherwise noted. Size pull boxes to not less than minimum Code requirements. Increase size above Code requirements where necessary to provide space for pulling, racking or splicing enclosed conductors, or where specified or indicated dimensions exceed Code requirements.
3. Exterior metal pull boxes exposed to weather (and not installed in or below grade) shall be equipped with rain-tight or weatherproof removable covers. Enclosures installed on vertical exterior walls shall conform to NEMA Type 3R. Enclosures installed on exterior horizontal surfaces such as rooftops or breezeways shall conform to NEMA Type 4 unless otherwise noted and shall be equipped with hinged covers and external mounting feet. Rain tight or weatherproof boxes shall use threaded watertight hubs for top or side entry and may use knockout for bottom entry only. For exterior pull boxes, use a minimum of 16 gauge galvanized G-90 grade sheet steel.
4. Pull Boxes shall be labeled "Signal" with screw on 1/8" engraved, black plate, white letters.

D. Conduit

1. Underground conduit shall consist of Schedule 40 PVC - 2 inch and 3 inch inside diameter or type C telephone conduit - 2 inch and 3 inch inside diameter (if concrete encased).
2. Conduit shall have a factory formed bell on one end for interconnecting segments.
3. Conduit located under heavy use highways or railroad rights-of-ways shall be encased in steel casing consistent with the AASHTO or AREA specifications. The thickness of the steel casing shall be engineered for each specific application. This may vary based on campus codes.
4. Spacers: High impact spacers shall be used in all multi-duct systems, for both solely owned or joint telecommunications/power construction. They shall conform with NEMA TC-2, TC-6, TC-8, and ASTM F 512 dimensions.
5. All fittings shall be designed specifically for use with the type of conduit placed.
6. All conduits shall be equipped with seal plugs in all ground boxes and expansion rubber seal plugs within all buildings.

2.10 RACEWAY

- A. Unless otherwise indicate, raceway shall be three channel, Wiremold 5500 with all necessary hardware and equipment to install a Television Distribution cable system as described above.
- B. Raceway color shall be ivory.

2.11 FIRESTOPPING MATERIAL

- A. Contractor shall provide all necessary fire stopping of openings through which cable is installed under this specification, in accordance with NFPA 70 and all local codes. This includes installation in conduits, raceways, or bare penetrations. Provide and install UL 1479 approved (Fire Barrier Caulk) firestop material.

2.12 MISCELLANEOUS HARDWARE

- A. The Contractor shall provide and install all hardware necessary to provide a fully operational distribution system. Miscellaneous hardware shall include but is not limited to faceplates, faceplate labels, cable labeling, nuts, bolts, washers, screws, cable ties, straps, spacers, hooks, sleeves, strain reliefs, clamps, arms, braces, brackets, fire sleeves and firestopping.

PART 3 – EXECUTION

3.01 SCOPE OF WORK

- A. The Contractor shall be responsible for the professional installation of all Television Distribution System passive and active equipment and the interconnection to the headend facility.
- B. The source for programming will come from both Nextel microwave system and the local cable operator. The cable operator for Long Beach and Signal Hill is Charter Communications. The cable operator for Lakewood is Media-One.
- C. The contractor shall provide amplification in the headend so that standard Amplifier outputs come out of the "Head End" into the distribution system. This amplifier shall not be considered when figuring the 3-amplifier cascade.
- D. The microwave receive antenna shall be mounted on the highest roof at each school site. The microwave antenna shall be mounted in-line-of-sight of Mt. Wilson to the north or Modjeska Peak to the east. The antenna location shall be within 100 meters of the "Head End". Exact antenna and "Head End" location shall be coordinated by the Contractor with LBUSD Office of Multimedia Services and LBUSD Maintenance Department.
- E. Nextel will provide and install;
 - 1. The antenna
 - 2. Antenna mounting hardware
 - 3. Cable from the antenna to the "Head End",
 - 4. "Head End" cabinet
 - 5. And "Head End" electronics.
- F. The Contractor will provide and install one (1) two-inch conduit complete with weather head from the microwave receive antenna to the "Head End" location.
- G. The local cable television signal will originate from the telephone pole or underground vault specified by the CATV operator. The Contractor shall provide and install two (2) three-inch conduits from the CATV operator designated telephone pole or underground vault. The Contractor shall coordinate with the CATV operator, LBUSD Office of Multimedia Services and LBUSD Maintenance Department for conduit routes and destination.
- H. The Contractor shall coordinate with campus and LBUSD for designating rooms that may serve as "Television Studios" for local broadcast origination.
- I. If the "Head End" and MDF are in separate locations, the Contractor shall provide and install one (1) two-inch conduit from designated "Head End" location to the MDF. If distance from "Head End" to MDF is greater than 500 feet, the conduit size will be a minimum three-inch. The Contractor shall provide and install .500 coax from the "Head End" to the MDF.
- J. The Contractor shall provide and install one (1) two-inch conduit from any designated "Television Studio" to the "Head End". The Contractor shall provide and install one (1) RG-6 for distances less than 100 feet or one (1) RG-11 for distances less than 200 and .500 for distances greater than 200 feet.
- K. All installation shall be performed in a workman like manner. All cost to repair or replace system components damaged by workman error shall be responsibility of the Contractor.

3.02 COMPLETE SYSTEM

- A. The Contractor is responsible for coordinating the installation and activation of the distribution system to ensure that a complete and fully operational Television Distribution System is available for immediate use once the installation is complete.
- B. Contractor shall provide one (1) RG6U cable assembly for each TV outlet. Quantities shall be for 100% TV outlet population. RG6U cables assemblies shall be 4 feet or 6 feet in length at each location. If TV set is more than 5 feet from TV outlet faceplate, Contractor shall field verify actual distance between TV set and TV coax outlet faceplate. Contractor shall coordinate lengths required with LBUSD Office of Multimedia Services.

3.03 GENERAL INSTALLATION GUIDELINES

- A. All distribution system installation and activation work must be performed according to published industry guidelines, rules and regulations. If a dispute occurs, local, state and national codes have precedence; then LBUSD policies and procedures; then standards such as the National Cable Television Association; then finally, the manufacturer's recommendations.

3.04 DETAILED DISTRIBUTION SYSTEM DESIGN

- A. The Contractor shall provide all of the required submittals before beginning any work on the distribution system identified in this section.
- B. The distribution system design submittal shall approximate the level of detail outlined in the Contract Documents with the addition of projected loss figures based upon actual products to be used and the actual length of each coaxial cable run.
- C. Prior to the start of distribution construction, signal shall be present at the MDF to enable testing and alignment as construction progresses.
- D. Distribution to all buildings and classrooms shall begin at the "Head End".
- E. Television Distribution System conduits for main trunk cables shall follow routing of other signal and communications conduits. Television System conduits shall be dedicated solely for Television Distribution Systems cabling only.
- F. All amplifiers shall connect to 120 VAC without the use of an extension cord. The Contractor shall coordinate with LBUSD Office of Multimedia Services and LBUSD Maintenance Department for electrical outlet locations.
- G. Contractor will coordinate outlet locations as designated on construction documents. Contractor will verify outlet locations with campus faculty, LBUSD Office of Multimedia Services and LBUSD Maintenance Department.
- H. All outlets shall be installed within three (3) feet of television.
- I. All unused outlets shall be terminated.
- J. Amplifiers may not be cascaded more than 3 deep from Headend.
- K. Drop taps shall be designed with ports to accommodate all current and proposed (as shown by LBUSD) outlets.
- L. Taps shall be designed to deliver outputs specified. If taps require different outputs (including the use of in-line equalizers, or different value taps at the same location), or other than RG-6 to make this specification, then taps shall be labeled to show which taps are to be use for which rooms, and with which cable. Additionally this shall be designated on the design maps and the as-builts.

- M. Taps shall not be so far away from any outlet, current or proposed as to require more than 300 feet of cable (either RG-6 or RG-11).
- N. The Contractor shall ensure that the distribution system meets or exceeds the following performance criteria at any and all distribution system outlet connections for the drops.
 - 1. Minimum signal level: + 3 dBmV
 - 2. Maximum signal level: + 12 dBmV
 - 3. Maximum difference between adjacent video carriers: 1 dB
 - 4. Maximum difference between any video carriers: 9 dB
 - 5. Minimum audio/video carrier ratio: -13 dB
 - 6. Maximum audio/video carrier ratio: -17 dB
 - 7. Carrier to noise ratio: 43 dB (minimum)
 - 8. Hum: 1%
 - 9. Tap isolation: 30 dB
 - 10. Reflections: -40 dB

3.05 TESTING AND DOCUMENTATION

- A. The Contractor shall perform and document all tests and measurements recommended and/or required by the manufacturer of the individual products installed in the distribution system.
- C. The Contractor shall perform and document all tests and measurements recommended by the Federal Communications Commission, the Society of Cable Telecommunications Engineers and the National Cable Television Association.
- D. The Contractor shall perform measurements at all outlet locations and cable connections, at both channel 3 and channel 85 to confirm signal levels. Measurement shall be recorded on as-builts.
- E. The contractor shall perform measurement on all amplifiers, recording input levels, output level, attenuators and equalizers used.
- F. The contractor shall perform measurement on all taps, recording all levels.
- G. The Contractor shall provide LBUSD with the results of the proof of performance tests normally associated with Television Distribution System as a part of the final acceptance procedures. LBUSD shall provide a qualified representative to witness all final testing and acceptance procedures, and shall be give 48 hours notice of all testing so that such representative may be present. The supervised Proof of performance test shall include Sweep testing of all amplifiers, and end taps, along with outlets located at the furthest locations from the MDF. Sweep testing shall be for the entire range of the active system (50-750 MHz). For each Outlet that fails (and is ultimately corrected), 10 additional outlets shall be tested. (Note, if the sweep testing is not performed (per the options) then the same testing shall be done with a meter and either the CATV provided signal, or by a signal generator provided by the contractor set to channels 3 and 85.) A record of the Sweep testing shall be made by the contractor and submitted with the As-Builts).
- H. The Contractor shall provide three (3) hard copy sets and two (2) electronic copies of As-Build documentation specific to the campus Television Distribution System. One laminated set shall left in the campus MDF. One (1) bond set and one (1) electronic copy shall be provided to LBUSD Office of Multimedia Services. One (1)

bond set and one (1) electronic copy shall be provided to LBUSD Maintenance Department.

- I. The As-Build documentation shall provide:
 1. Measured signal levels and losses
 2. Amplifier locations
 3. Microwave receiver antenna location
 4. Local CATV connection
 5. "Head End" location
 6. "Television Studio" location
 7. Taps and Splitters and their values
 8. Conduit routes and quantities
 9. Trunk cable routes and quantities
 10. Drop cable routes and quantities
 11. Outlet locations and label identification scheme and Measured signal levels

3.06 PATHWAY INSTALLATION

- A. Comply with EIA/TIA-569. Conceal interior conduit under floor slabs and within finished walls, ceilings, and floors where possible.
- B. Keep conduit minimum 6 inches away from parallel runs of electrical power equipment, flues, steam, and hot water pipes.
- C. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project.
- D. Run conduits in crawl spaces and under floor slabs as if exposed.
- E. Install no more than two 90-degree bends for a single horizontal cable run.
- F. Run raceway as determined by site survey.
- G. Provide Pullboxes with "Seal-tight" flex conduit for building separation transitions.
- H. Provide all coring, patching and painting as needed for Intra-Building and Inter-Building pathways.

3.07 COMMUNICATIONS DUCT BANK

- A. Trenches
 1. All underground trenches shall be 24" wide by 30" deep. Trenches shall be back-filled at 95% compaction. Contractor shall restore surface to same or better condition. Contractor shall contact Dig Alert a minimum of 48 hours prior to excavation to verify the location of existing underground utilities. Modifications to pathway design may be dictated by field conditions subject

to approval by LBUSD.

2. Compaction notification testing must be provided to the LBUSD 48 hours prior to testing so that a LBUSD inspector may be present.

3.08 CONDUIT

- A. All communications conduits shall be placed in a uniform manner between ground boxes and pull boxes. Conduit in position #1 at one ground box or pull box shall maintain its position within the duct run and terminate in the #1 position at the next box. The position of all conduits between ground boxes and pull boxes shall be maintained.
- B. Long radius bends (over 30 feet) shall be used whenever possible to make changes in direction. If it is found to be necessary to place a 90-degree bend in the conduit run, a factory-made sweep of no less than 60-inch radius shall be used. No conduit run shall exceed a total of 180 degrees of bend between any two points (such as manholes or buildings) considering both vertical and horizontal sweeps. Cold-formed trench bends shall have a radius of not less than 60 inches and shall pass mandrel integrity. Bend radius criterion is 2" or less 6 times the diameter of the conduit and any conduit larger than 2" is 10 times the diameter of the conduit.
 1. The length and destination of all conduits shall be identified in each ground box, pull box and building. Embossed metal or heavy plastic tags strapped to each conduit shall be used.
 2. After installation of communications conduits, the contractor shall prove all conduits by pulling a mandrel with a diameter _ inch smaller than the conduit and 6 inches long through each conduit end-to-end. An inspector designated by LBUSD shall be notified 24 hours before this procedure. Each conduit shall be cleaned with a bristle brush to remove any debris.
 3. Utility marking tape (see 3.4.a) shall be buried 12 inches below the surface directly above the conduit. Where communications and power conduits occupy the same trench, all conduit structures shall be built with the telecommunications conduits placed above the power conduits and separated by a minimum of 12" of compact earth or 3" of concrete encasement, unless otherwise called out on the construction drawings and approved by LBUSD. If this type of construction is required, it shall receive the prior approval of the contractor and LBUSD.
 4. A horizontal and vertical separation of 1 inch shall between the ducts be maintained by installing high impact spacers with horizontal and vertical locking intervals of ten feet.

3.09 OVERHEAD CONDUIT

- A. Backbone pathways are facilities for the installation of television distribution cables between "Head End", MDF and Television Studios. These backbone pathways consist of 2" conduits, either underground or overhead, which are provided as per construction documents. Where overhead conduit is required between or within buildings, Contractor shall utilize EMT conduit with an inside diameter of 2", unless otherwise specified. All fittings shall be compression type as specified by LBUSD standards. All fittings shall be watertight. Fitting types shall be pre-approved by the designated LBUSD representative. Unless pre-approved by the designated LBUSD representative, all conduits shall be installed by a qualified electrical contractor who has at least five years experience in similar installations within the Southern California area.

- B. Contractor shall install conduit at roof locations utilizing the current LBUSD approved methodology and process.
- C. All roof penetrations must be coordinated and approved by LBUSD, prior to installation.

3.10 COMMUNICATIONS ENTRANCE CONDUIT

- A. To prevent shear, all inter-building conduit (either underground or aerial) shall transition from PVC or metal to Sealtite flex conduit when attaching to a permanent structure. The contractor and LBUSD shall determine the placement of all entrance conduits. All applicable standards shall be adhered to, i.e., LBUSD, NEC, BICSI, or G.O. 128.

3.11 DUCT-BANK LOCATING CABLE (electronically detectable warning tape)

- A. Warning tape shall be a minimum of 3" wide, orange in color, and shall have a nondegradable imprint as follows:
 - 1. "Caution fiber optic cable buried below"
 - 2. The tape shall be electronically detectable.

3.12 PULL ROPE

- A. Pull rope shall be new _" polypropylene over polyester rope with a minimum 1700 lb. Tensile strength. Pull rope shall be new material that is free of knots, kinks, and abrasions and shall be placed as a single continuous length in every new duct section. Pull rope shall be secured at each end.

END