

SECTION 274133 - MASTER ANTENNA TELEVISION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. MATV equipment using an off-air antenna system as the signal source.
2. Off-air antennas.
3. MATV head-end components.
4. MATV distribution wiring and components.
5. Cable TV distribution wiring and components.

1.2 DEFINITIONS

1. User Interface: End point of Contractor's responsibility for Work of this Section. User interfaces are the 75-ohm terminals on device plates.

B. PERFORMANCE REQUIREMENTS

1. Minimum acceptable performance of distribution system at all user-interface points shall be as follows:
 - a. RF Video-Carrier Level: Between 3 and 12 dBmV.
 - b. Relative Video-Carrier Level: Within 3 dB to adjacent channel.
 - c. Carrier Level Stability, Short Term: Level shall not change more than 0.5 dB during a 60-minute period.
 - d. Carrier Level Stability, Long Term: Level shall not change more than 2 dB during a 24-hour period.
 - e. Channel Frequency Response: Across any 6-MHz channel in the 54- to 220-MHz frequency range, referenced to video; signal amplitude shall be plus or minus 1 dB, maximum.
 - f. Carrier-to-Noise Ratio: 45 dB or more.
 - g. RF Visual Signal-to-Noise Ratio: 43 dB or more.
 - h. Antenna Combiner Insertion Loss: 40 dB maximum.
 - i. Signal Power Splitter and Isolation Tap Return Loss: 17 dB maximum.
 - j. Cable Connectors Attenuation: Less than 0.1 dB.
 - k. Retain three subparagraphs below if capability for FM reception is required.
 - l. RF FM Carrier Level: 13 to 17 dB below video-carrier level.
 - m. FM Frequency Response: More than in the 88- to 108-MHz frequency range; signal amplitude is plus or minus 0.75 dB, maximum.
 - n. FM Carrier-to-Noise Ratio: More than 24 dB.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 SYSTEMS REQUIREMENTS

- A. Components: Plug-in units.
- B. Equipment: integrated circuit devices.
- C. Power Supply Characteristics: Devices shall be within specified parameters for ac supply voltages within the range of 105 to 130 V.
- D. Provide ac-powered equipment with integral surge suppressors complying with UL 1449.
- E. RF and Video Impedance Matching: Signal-handling components, including connecting cable, shall have end-to-end impedance-matched signal paths. Match and balance devices used at connections where it is impossible to avoid impedance mismatch or mismatch of balanced circuits to unbalanced circuits.

2.2 MATV EQUIPMENT

- A. Description: Signal-source components, signal-processing and amplifying equipment, distribution components, and interconnecting wiring. System shall receive, amplify, process, and distribute signals to outlets for receiving sets. Equipment shall translate UHF channels to VHF channels before distribution to outlets.
- B. Identification of Signal Sources Distributed:
 - 1. Channel 2,4,5,7,9,11,13 UHF 21,31,41,47 and FM and radio signals..
- C. MATV System Qualitative and Quantitative Performance Requirements: Reception quality of color-television program transmissions at each system outlet from each service and source shall be equal to or superior than that obtained with performance checks specified in "Field Quality Control" Article, using standard, commercial, cable-ready, multiple A/V input color-television receivers.

2.3 OFF-AIR ANTENNAS

- A. Antennas shall be tested, marked, and packaged, according to CEA-774-A, CEA-2028, and CEA-2032. Antennas shall be labeled according to CEA antenna mapping program.
- B. Off-Air, Mast-Mounted Antennas: Weatherproof single-channel or broadband type, constructed of high-strength anodized aluminum and rated to survive in a 100-mph (160-km/h) wind, minimum.
 - 1. Elements: Internally dampened against mechanical vibration that may occur in service.
 - 2. Ends of Crossarms and Elements: Sealed.
 - 3. Mounting and Connecting Hardware: Corrosion proof.
 - 4. Frequency Range: Matched to source frequencies.
 - 5. FM Antenna: Separate from the broadband antenna and the directional antenna, with 2-dB minimum gain.
- C. Antenna-Supporting Structures: Prefabricated, hot-dip galvanized-steel units.
 - 1. Strength of Structure and Attachments: Adequate to withstand 100-mph (160-km/h) winds while supporting installed antennas.
 - 2. Comply with 47 CFR 17 and TIA 222-G.
 - 3. Comply with FAA AC 70/7460-1K.

2.4 MATV HEADEND COMPONENTS

- A. Headend Equipment: Processors Broadband amplifier+ FM module for receiving off-air television and FM signals and outputting the signals to cable distribution system. Equip coaxial down-leads of the off-air antennas with preamplifiers to send signals at strength required by headend. Headend component performance specified in this article is minimum acceptable; better performance may be required to comply with minimum acceptable system performance standard in "Performance Requirements" Article.
 - 1. House units in standard 19-inch (483-mm) electronic equipment cabinet complying with EIA 310.
- B. Down-Lead Preamplifiers: Antenna mast-mounted preamplifier, designed to boost antenna signal and contained in weatherproof housing; single-channel or broadband type. Install power supplies indoors at headend equipment, connected through power inserters to provide power to preamplifiers through the coaxial down-lead cable.
 - 1. Frequency Response: Plus or minus 0.75 dB.
 - 2. Minimum Input: Minus 20 dBmV.
 - 3. Return Loss: 14 dB.
 - 4. I/O Impedance: 75 ohms.
- C. Processors: One for each channel to be translated.
 - 1. Bandwidth: 6 MHz.
 - 2. Return Loss: 16 dB, within the 6-MHz bandwidth.
 - 3. Noise: Not more than 10 dB at maximum gain.

4. Input Level Range, VHF: Minus 20 to plus 30 dBmV.
5. Input Level Range, UHF: Minus 20 to plus 25 dBmV.
6. Output Level Range: 50 to 60 dBmV.
7. Carrier-to-Noise Ratio: Minus 57 dB at plus 10-dBmV input.
8. Automatic Gain Control: Plus or minus 1-dB output variation for rated input level range variation.
9. Frequency Stability: Plus or minus 10 kHz over the operational temperature range.
10. Spurious Output: 60 dB below the video carrier with video-carrier output level at plus 60 dBmV and audio-carrier level at plus 45 dBmV.
11. Adjacent Channel Rejection: Not less than 60 dB.
12. I/O Impedance: 75 ohms.

D. Broadband Amplifier:

1. Frequency Range: 54 to 108, 174 to 220 MHz.
2. Frequency Response: Plus or minus 1.0 dB across passband.
3. Maximum Noise: 10 dB.
4. Minimum Return Loss: 16 dB.
5. I/O Impedance: 75 ohms.

E. FM Module: One RF processor module for each station listed.

1. Frequency Range: Between 88 and 108 MHz.
2. Output Level: 52 dBmV.
3. Output Level Control: Plus or minus 10 dB.
4. Stability: 0.005 percent, crystal controlled.
5. Sensitivity: 3 mV for 30-dB quieting.
6. Input Level: 60 mV, stereo.
7. Image Rejection: 90 dB.
8. Passband: 200 kHz.
9. Selectivity: Plus or minus 150 kHz or less, at 30 dB down. Plus or minus 250 kHz or less, at 50 dB down.

F. Combining Network (Mixer): Combines the off-air television FM signals into a single-broadband output. An output test point, a 75-ohm television jack, a mixer output step attenuator dual-pilot insertion network, and a removable mixer-to-trunk jumper are included.

1. Passband: As required by system performance.
2. Distortion: Not more than plus or minus 0.1 dB over any 6-MHz segment.
3. Distortion: Not more than plus or minus 0.5 dB over the 54- to 216-MHz frequency range.
4. Nominal Insertion Loss:
 - a. 15 dB maximum, channel input to single-system output.
 - b. 13 dB maximum, channel input to mixer output.
 - c. 20 dB maximum at test point, e.g., loss from trunk output.
5. Isolation between any Two Inputs: 30 dB.
6. I/O Impedance: 70 ohms.

2.5 DISTRIBUTION COMPONENTS

- A. Signal Power Splitters and Isolation Taps: Metal-enclosed directional couplers with brass connector parts. Where installed in signal circuits used to supply cable-powered amplifiers, power throughput capacity shall exceed load by at least 25 percent.
 - 1. Return Loss: 17 dB.
 - 2. RFI Shielding: 100 dB.
 - 3. Isolation: 25 dB.
 - 4. I/O Impedance: 75 ohms.
- B. Distribution System Amplifiers: Powered by coaxial cable system and equipped with surge protection device and external test points to allow convenient signal monitoring.
- C. Cable System Power Supplies: Plug-in, modular construction, with surge, short-circuit and overload protection.
- D. Signal Traps: Packaged filters tuned to interference frequencies encountered in Project.
- E. Attenuators: Passive, of fixed value, and used to balance signal levels.
- F. Terminating Resistors: Enclosed units rated 0.5 W and matched for coaxial impedance.
- G. User-Interface Device: Flush, female-type outlets, designed to mimic power duplex outlet; for mounting in standard outlet box; with metallic parts of anodized brass, beryllium copper, or phosphor bronze. Cable connector mounting shall be semirecessed so its protrusion is flush with the plane of device plate.
 - 1. Cable Connector: Female, Type F.
 - 2. Wall Plates: Match materials and finish of power outlets in same space.
 - 3. Attenuation: Less than 0.1 dB.
 - 4. Voltage Standing-Wave Ratio: Less than 1.15 to 1.

2.6 ENCLOSURES

- A. Enclosures for Interior, Controlled Environments: NEMA 250, Type 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install signal line surge suppressors on coaxial cables entering headend equipment space and at antenna-mounted amplifiers.

3.2 ANTENNA AND HEADEND INSTALLATION

- A. Mount headend equipment in electronic-equipment cabinets recommended by manufacturer. Group related items in methodical sequence.

- B. Arrange equipment to facilitate access for maintenance and to preserve headroom and passage space. Parts that require periodic service or maintenance shall be readily accessible. Headend components that require tuning adjustments shall be accessible from the front of equipment cabinets.
- C. Align antenna elements to achieve maximum signal level and quality.
- D. Antenna-Supporting Structure: Increase antenna height as required to obtain signal strength needed for specified system performance.
 - 1. Attachment to Building: Use **0.375-inch- (10-mm-)** minimum expansion anchors for masonry, and place anchors clear of grout or mortar joints.
- E. Antenna Cable Entrance: Use weatherproof entrance fittings, and seal at penetrations of the building envelope.
- F. Apartment distribution wiring shall include a separate cable wire home run for each apartment. Cable wire shall run from outlet in each apartment to amplifiers in cellar/basement. Each wire run shall clearly tagged in cellar, indicating apartment of origin. Cable runs must be continuous with no splices. All wiring to be concealed within partitions

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
- C. Tests and Inspections:
 - 1. Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.
 - 2. Replace malfunctioning or damaged items.
 - 3. Retest until satisfactory performance and conditions are achieved.
 - 4. Prepare television equipment for acceptance and operational testing.
 - 5. Use an agile receiver and signal strength meter or spectrum analyzer for testing.
 - 6. Off-Air, Mast-Mounted Antenna Sources: Connect receiver to the down-lead of a 10-element, single-channel antenna, tuned and oriented to optimize reception for the channel and placed at system antenna's location. Alternatively, connect receiver to a single-channel video amplifier connected to the down-lead of the above single-channel antenna.
 - 7. Test Schedule: Schedule tests after pretesting has successfully been completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.
 - 8. Operational Tests: Perform tests of operational system to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

9. Distribution System Acceptance Tests:
 - a. Field-Strength Instrument: Rated for minus 40-dBmV measuring sensitivity and a frequency range of 54 to 812 MHz, minimum. Provide documentation of recent calibration against recognized standards.
 - b. Signal Level and Picture Quality: Use a field-strength meter or spectrum analyzer, and a standard television receiver to measure signal levels and check picture quality at all user-interface outlets.
10. Signal-to-Noise-Ratio Test: Use a field-strength meter to make a sequence of measurements at the output of the last distribution amplifier or of another agreed-on location in system. With system operating at normal levels, tune meter to the picture carrier frequency of each of the designated channels in turn and record the level. With signal removed and input to corresponding headend amplifier terminated at 75 ohms, measure the level of noise at same tuning settings. With meter correction factor added to last readings, differences from first set must not be less than 45 dB.
11. Qualitative and Quantitative Performance Tests: Demonstrate reception quality of color-television program transmissions at each user interface from each designated channel and source. Quality shall be equal to or superior than that obtained with performance checks specified below, using a standard, commercial, cable-ready, color-television receiver. Level and quality of signal at each outlet and from each service and source shall comply with the following Specifications when tested according to 47 CFR 76:
 - a. RF video-carrier level.
 - b. Relative video-carrier level.
 - c. Carrier level stability, during 60-minute and 24-hour periods.
 - d. Broadband frequency response.
 - e. Channel frequency response.
 - f. Carrier-to-noise ratio.
 - g. RF visual signal-to-noise ratio.
 - h. Antenna combiner insertion loss.
 - i. Signal power splitter loss.
 - j. Cable connector attenuation.
 - k. RF FM carrier level.
 - l. FM frequency response.
 - m. FM carrier-to-noise ratio.

D. Headend and distribution system will be considered defective if they do not pass tests and inspections.

E. Cap all unused connectors and seal weathertight.

3.4 DEMONSTRATION

A. Owner's maintenance personnel to adjust, operate, and maintain MATV equipment.

END OF SECTION 274133