

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Testing Publications and Standards
- B. Inspection and testing procedures for copper and fiber optic cable, RF CATV / MATV systems, and the antenna systems.
- C. Documentation and As-Built Requirements
- D. Attachments
  - (1) SYSTIMAX® Field Testing Guidelines for Enhanced Category 6 Products
  - (2) SYSTIMAX® Field Testing Guidelines for Fiber Optic Cabling Systems
  - (3) Field Instrument Data Sheet
  - (4) SYSTIMAX® Structured Cabling Systems Certification Check List

**1.2 RELATED SECTIONS**

- A. Contract Terms and Conditions
- B. Section 16710 - Telecommunications General Requirements
- C. Section 16720 - Telecommunications - Basic Materials and Methods
- D. Section 16725 - Telecommunications - Cable
- E. Section 16730 - Telecommunications - Underground Structures
- F. Section 16740 - Telecommunications - Building (RF) CATV / MATV System
- H. Section 16760 - Telecommunications - Grounding and Bonding

**1.3 APPLICABLE PUBLICATIONS AND STANDARDS**

- A. Electronics Industry Alliance/Telecommunications Industry Association (EIA/TIA)
  - (1) EIA/TIA 568A - Commercial Building Telecommunications Wiring Standard
  - (2) EIA/TIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces
  - (3) EIA/TIA TSB 67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-1  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

- (4) EIA/TIA TSB 72 - Centralized Optical Fiber Cabling Guidelines
  - (5) EIA/TIA TSB 75 – Additional Horizontal Cabling Practices for Open Offices
  - (6) EIA/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
  - (7) EIA/TIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
  - (8) EIA - 310-D - Cabinets, Racks, Panels, and Associated Equipment
  - (9) EIA/TIA-455-57A - Optical Fiber End Preparation and Examination
  - (10) EIA/TIA 455-59 - Measurement of Fiber Point Defects Using an OTDR
  - (11) EIA/TIA 455-60 - Measurement of Fiber or Cable Length Using an OTDR
  - (12) EIA/TIA 455-61 - Measurement of Fiber or Cable Attenuation Using an OTDR
  - (13) EIA/TIA 455-95 - Absolute Optical Power Test for Optical Fibers and Cables
  - (14) EIA/TIA 526-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
  - (15) ANSI/ICEA S-83-596-1994 - Fiber Optic Premises Distribution Cable Technical Requirements.
- B. Federal Communications Commission (FCC) part 15 and part 68
- C. Rural Electrification Association (REA), Bulletin 345-63, REA Standards for Acceptance Tests and Measurements of Telephone Plant
- D. California State University, Office of the Chancellor - Telecommunications Infrastructure Planning (TIP) Standards – Effective July 2003 , plus the latest TIP updates
- E. North Orange County Community College Telecommunications Standards, dated January 2007.

**PART 2 - PRODUCTS**

Not Used

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-2  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

**PART 3 - EXECUTION**

**3.1 GENERAL PROCEDURES**

- A. The Contractor will provide all tools, equipment, and fully trained staff necessary to conduct fully witnessed acceptance testing of all installed telecommunications-related products and systems.
- B. The Contractor shall prepare for review and approval by the campus a complete test plan for all install telecommunications systems that shows, at a minimum, test configurations, calibration procedures, impedance's, and measurement equipment. The scope of this work includes, but is not limited to, the following:
- (1) All system(s) shall be checked for compliance with these standards.
  - (2) A check-off list for shall be maintained for reference by Contractor personnel and/or the District's representative during tests.
  - (3) The result of the measurements outlined shall be recorded and submitted along with current as-built drawings to the District's representative as final proof of system performance.
  - (4) Any system not meeting specifications shall be replaced expeditiously by the Contractor at no cost to the University. Failure by the Contractor to act in an expeditious manner to properly remedy any abnormality resulting from installation/construction defects or workmanship, faulty material and/or the failure of the systems, components or the cable medium to perform in accordance with the University and/or Manufacturer's technical specifications, shall cause the University to place a "hold" on any other telecommunications' development or construction associated with this project. The District's representative will notify the Contractor in writing of such action and is absolved and shall be held harmless from any delays, costs over-runs, scheduling difficulties, etc. assessed by others due to the Contractor's failure to meet the final proof of system performance specifications. Final as-builts will be provided, as specified, at the end of the project.
  - (5) All systems shall meet the Quality Standards and be accepted by the District's representative before the work will be considered complete.
- C. After the Contractor has provided completed documentation of all testing and the documentation has been reviewed by the District's representative, the Contractor shall conduct "proof of performance" testing on selected components at the direction and discretion of the District's representative. Such testing will utilize the same equipment and procedures used to conduct and document the initial tests but will be applied on a random basis to verify the testing documentation. If in the judgment of the District's representative, the proof-of-performance test results vary significantly from the acceptance test results, the Contractor shall continue with testing until cleared by the District's representative.

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-3  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

- D. Contractor shall conduct random testing of up to 25% of all circuits, per type. The testing shall be witnessed by designated District's representative(s).
- E. **All test equipment** shall be calibrated by a certified laboratory or the manufacturer within the last **six** months, and such certification shall be submitted to the District's representative prior to testing.
- F. All testing shall be coordinated with the District's representative (providing a minimum of one week's notice) to ensure all acceptance and proof-of-performance testing can be witnessed by qualified personnel.

**3.2 INSPECTION AND TESTING PROCEDURES COPPER CABLE**

- A. The Contractor and District's representative will conduct routine inspections of the work in progress, and any deficiencies will be discussed at the regular progress meeting. In the event District's representative determine work is progressing in an incorrect manner and waiting for the regular meeting could cause further problems, the Contractor's on-site project manager will be notified.
- B. Copper Station and Riser Cables: The Contractor shall conduct acceptance testing, witnessed by designated campus staff, on all station and riser cable installed as part of this project as defined below:
  - (1) The correct and continuous bonding of cable shields through all riser and tie cable splices will be verified. This test shall be conducted from the BDF prior to strapping shield grounds at splice or termination points.
  - (2) Each station cable and all riser cable pairs will be tested for crosses, opens, grounds, reversed and/or transposed pairs, shorts, foreign battery, continuity, and resistance (in ohms). All riser cable pairs shall be tested for loss in dB. All problems will be resolved and the cable retested to ensure compliance.
  - (3) Using a Wavetek, Fluke, or approved equivalent Category 6 rated pair scanner (Level 2), all copper station cables will be tested to verify the installation meets the EIA/TIA Category 6 performance specifications as defined in TSB 67. All test results, including jack numbers, shall be printed on a hardcopy report. All stations shall meet or exceed this performance standard.
  - (4) All pair scanners used on the project shall be calibrated to a single common test cable at the start of each shift and after changing batteries. The hardcopy of the calibration results shall be included as a reference with each batch of station test results submitted.
  - (5) The Contractor shall provide the station test results in electronic format (floppy disk), as long as a copy of any software required to read and/or print the results are also provided at the same time.

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-4  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

- C. Copper Interbuilding and Entrance Cables: The Contractor's acceptance testing on all interbuilding and entrance cables installed as part of this project and witnessed by designated campus staff as defined below:
- (1) The correct and continuous bonding of cable shields through all riser and tie cable splices shall be verified. This test shall be conducted from the MDF and BDF prior to strapping shield grounds at splice or termination points.
  - (2) Each cable pair shall be tested for crosses, opens, grounds, reversed and/or transposed pairs, shorts, foreign battery, continuity, resistance (in ohms) and loss in dB.

**3.3 INSPECTION AND TESTING PROCEDURES FIBER CABLE**

A. Fiber Optic Riser and Station Cable

- (1) The appropriate high resolution OTDR device (Siecor, Fluke, or approved equivalent) shall be used to test the fiber riser cable. Tracing printouts (noting the appropriate optical fiber and buffer tube color designation) shall be mounted on separate pages and bound into a three-ring notebook. An incremental scale that reflects the short lengths of cable involved in these tests shall be utilized.
- (2) All fiber riser cable shall be tested from the building's BDF to each fiber IDF terminal. The results of OTDR testing to define the length of each riser cable shall be documented.
- (3) The Contractor shall conduct a power meter (loss) test of each fiber optic station and riser cable at both wavelengths A to B, B to A, and OSPL (OSPL is defined as  $L_a + L_b$ ). No individual station or riser fiber link segment (including connectors) shall measure more than 2.0 dB. Tests shall be conducted using ANSI/EIA/TIA-526-14A, Method B. The Contractor shall provide a typed list reflecting cable ID and actual measured loss.

B. Fiber Optic Interbuilding and Entrance Cable

- (1) The appropriate high resolution OTDR device (Wavetek, Siecor) or approved equivalent to test the fiber interbuilding and entrance cables shall be used. Tracing printouts (noting the appropriate optical fiber and buffer tube color designation) shall be mounted on separate pages and bound into a three-ring notebook. An incremental scale that reflects the short lengths of cable involved in these tests shall be utilized.
- (2) All fiber riser cable shall be tested from the MDF to each building's BDF terminal. The results of OTDR testing to define the length of each riser cable shall be documented.
- (3) The Contractor shall conduct a power meter (loss) test of each fiber optic station and riser cable at both wavelengths A to B, B to A, and OSPL (OSPL is defined as  $L_a + L_b$ ). No individual fiber link segment (including connectors) shall measure

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-5  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

more than 2.0 dB. The tests shall be conducted using ANSI/EIA/TIA-526-14A, Method B. A typed list reflecting cable ID and actual measured loss shall be submitted to the District's representative.

**3.4 INSPECTION AND TESTING PROCEDURES CATV / MATV (RF) SYSTEM**

- A. The Contractor will conduct acceptance tests witnessed by designated campus staff on the complete CATV / MATV RF distribution system including all cable, passive and active devices.

Details of the methods to be followed in conducting the acceptance testing will be found in the current edition of the NCTA (National Cable Television Association) Recommended Practices for CATV / MATV Measurement.

- B. Overall, the system shall provide a Carrier/Noise ratio of >43 dB and a minimum signal level of +3 dBmV and shall not exceed +10 dBmV as measured at each jack.
- C. The following tests shall be performed on the completed CATV / MATV system by the Contractor as part of the acceptance procedure:
- (1) All coaxial cable will be tested after installation for opens, shorts, and kinks with a Time Domain Reflectometer (TDR). Damaged sections will be replaced either by pulling a new line or by splicing out the defective portion. The actual length of each cable section, as installed, shall be indicated on the floor plans.
  - (2) NCTA Standard Broadcast Sweep (40 to 750 MHz) tests will be performed on the CATV / MATV RF broadband system as follows:
    - a. A signal sweep test shall be conducted from the input side of the headend amplifier to the output side of the most distant jack on each floor of the building.
    - b. After the sweep of the building RF distribution system is completed and the building system is balanced, a sweep shall be performed from the output of the building amplifier to the output side of the most distant jack on each floor of the building to verify the 750 MHz bandwidth of all cable and passive devices.
  - (3) Visual Carrier/Noise (C/N) shall be measured through the building amplifiers. The test procedure will be as outlined by the NCTA. Minimum C/N specifications are no less than 43 dB.
  - (4) Each and every CATV / MATV jack installed as part of this system will be configured to output a minimum signal per channel of +3 dBmV and shall not exceed +10 dBmV into 75 Ohms. The Contractor shall test each jack and shall change tap values, add attenuators, or otherwise balance the system so that each jack provides the defined signal levels.
  - (5) The signal at each television jack in the building shall be free of additional noise and distortion as judged by the District's representative. The Contractor shall

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-6  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

determine (using a Sencore Channelizer FS 74 or similar device) that the signal at each jack conforms to the quality standards. If excessive noise is present, the Contractor shall either resolve the problem or demonstrate the problem is not a result of the current work. At a minimum, the following tests may be required to demonstrate the origin of the problem:

- a. Modulation distortion at power frequencies
  - b. Composite third order distortion for CW and modulated carriers
  - c. Carrier to second order beat ration
  - d. Complete frequency response testing using the NCTA guidelines
- (6) The Contractor shall conduct witnessed signal leakage measurements in conformance with FCC 76.605(a)(14) and 76.609(h). Readings on all building floors shall be obtained. Any signal leakage in excess of that allowed by FCC and NCTA guidelines shall be identified and corrected. The maximum readings per floor shall be documented.
- (7) **Modulators** - The Master Antenna Television System modulators shall be tested per current Federal Communications Commission Technical Standards and the National Cable Television Association's Recommended Practices for Measurements on Cable Television Systems. These tests shall include:
- a. Depth of Modulation
  - b. Differential Gain
  - c. Differential Phase
  - d. Chrominance – Luminance Delay Inequality
- (8) **Headend** - The Master Antenna Television System headend shall be tested per current Federal Communications Commission Technical Standards and the National Cable Television Association's Recommended Practices for Measurements on Cable Television Systems. These tests shall include:
- a. Modulation Distortion at Power Frequencies
  - b. Distortions: Intermodulation products, second and third order distortions, etc.
  - c. Visual, Aural Carrier Level: 24 Hour Variation
  - d. Visual Carrier to Noise Ratio
  - e. Frequency Response
  - f. Aural Carrier Center Frequency
  - g. Signal Leakage
  - h. Color Parameters

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-7  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

**3.5 DOCUMENTATION**

A. Fiber Cable Systems

- (1) All documentation shall be neatly and legibly done and shall provide a clear understanding of the installed system.
- (2) The Contractor shall prepare "as-built" plans of all work including interbuilding, entrance, and riser cable locations with footage. All approved changes and actual in-place footage shall be marked, in red, on a "E" size drawing. The as-builts shall include all fiber optic cable placed with cable lengths, fiber assignments, and cable numbers and counts.
- (3) The Contractor shall provide signed originals of all acceptance testing documents, which are:
  - a. Fiber optic insertion loss results (using forms provided by the District's representative)
  - b. OTDR graphs and printouts and test results (in a 3-ring binder)
  - c. Current test equipment certifications

B. Copper Cable Systems

- (1) The Contractor shall use forms provided by the District's representative or Commscope SYSTIMAX<sup>®</sup>, Inc. forms, if approved by the District's representative, to document the successful testing of all inter-building, entrance, riser and tie cables.
- (2) Category 6 station cable test results noting unique station number and group test results by floor shall be provided.
- (3) The Contractor shall neatly note floor plans with "as-built" station number and any changes, additions, or deletions to outlet placement.
- (4) Inter-building, entrance, and riser plans shall be updated to include actual routes, cable numbers and counts, and lengths of cables.
- (5) The Contractor shall provide signed originals of all acceptance testing documents, which are:
  - a. Printouts and test results (in a 3-ring binder)
  - b. Current test equipment certification

C. CATV / MATV (RF) Systems

- (1) The Contractor shall provide the campus with a copy of the test equipment certification.

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-8  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**

**SECTION 16715  
TELECOMMUNICATIONS - ACCEPTANCE TESTING**

- (2) The Contractor shall provide signed originals of all acceptance testing documents, which are:
  - a. Typed list of signal strength measurements by jack location
  - b. Tracings of TDR readings for each half-inch coaxial cable test
  - c. Test measurement tracings (or scope pictures) to document the results of the sweep tests
- (3) Three sets of original manufacturer's installation and maintenance manuals for each piece of equipment installed shall be provided.
- (4) As-built shop drawing reflecting the cable lengths, tap values, and component configuration of the installed systems shall be provided.
- (5) The Contractor shall neatly annotate floor plans to reflect actual backbone cable routing and exact location of taps.
- (6) The Contractor shall provide signed originals of all acceptance testing documents, which are:
  - a. Printouts and test results (in a 3-ring binder)
  - b. Current test equipment certification

**3.6 ADMINISTRATION**

- A. All cabling placed must be entered into electronic database (Excel) approved by the District's representative. The District's representative shall provide the format and details to the Contractor, including cable number; count scheme, and terminal designations. The completed database file is to be presented to the District's representative before the completion of the project in order for the University to establish assignment records.

**END OF SECTION**

**NAME OF PROJECT**  
**LOCATION OF PROJECT**

TELECOMMUNICATIONS ACCEPTANCE TESTING  
16715-9  
XX% CONSTRUCTION DOCUMENTS – **DATE HERE**