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DIVISION 16 - ELECTRICAL

SECTION 16802

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07/03

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SECTION 16802

BROADBAND COMMUNICATION DISTRIBUTION SYSTEM (BCDS)
07/03

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers the requirements for broadband communication distribution systems (BCDS). Accordingly, this section should be tailored carefully to suit project conditions and to meet project requirements.

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

The publications listed below form a part of this section to the extent referenced:

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

- EIA ANSI/TIA/EIA-606 (1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- EIA ANSI/TIA/EIA-607 (1994) Commercial Building Grounding and Bonding Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE Std 802.7 (1989) Recommended Practices for Broadband Local Area Networks

JOHN F. KENNEDY SPACE CENTER (KSC)

- KSC STD E 0021 (2002) Standard for KSC Communication Premises Distribution Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2002) National Electrical Code

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

47 CFR 76.605

Multichannel Video and Cable Service;
Technical Standards

1.2 SYSTEM DESCRIPTION

Community antenna television (CATV) system, commonly referred to as cable television, is a network of cables, headend, electronic and passive components that process and amplify television (TV) signals for distribution from the headend equipment to the individual television outlets.

BCDS, based on CATV design principles, provides a frequency-division multiplexed RF communications network for video, audio, and IEEE Std 802.7 broadband Local Area Networks. The existing inbound path occupies the frequency spectrum from 5-112 MHz. The existing outbound path occupies the frequency spectrum from 150-450 MHz. BCDS shall be installed in accordance with 47 CFR 76.605.

1.2.1 Mid-Split Architecture

The mid-split design is no longer used in the CATV arena and is not supported by CATV amplifier manufacturers. Because the amplifiers are no longer available, new facility design will require the inbound path to occupy the frequency spectrum from 5-65 MHz and the outbound path to occupy the frequency spectrum from 80 to 862 MHz (65/80 split).

Future system growth will require the inbound path to be used for set-top box data return.

The headend to facility path wiring will not be provided under this contract. The transmission path typically uses two single-mode fibers, or CATV cable.

1.2.2 Scope

The scope of work encompasses inside-plant horizontal/vertical riser, trunk/distribution cable, taps, splitters, directional couplers, connectors, customer faceplate, drop cable, inbound path fiber-optic transmitter, outbound path fiber-optic receiver, active electronics required for internal building distribution and interfacing to outside BCDS cable plant, and backbone cables and connecting hardware to transport BCDS signals between equipment items in a building. Transmission equipment will provide BCDS channels using 1550 nm fiber optic transmitter/receivers for the outbound path and 1310 nm transmitter/receivers for the inbound path.

Work under this contract shall include the following:

- a. The BCDS electronics systems and equipment, cable, terminations, etc., comprising a complete broadband distribution system. Contractor shall provide system design and any supplementary systems equipment/components required to meet the performance requirements of the system, as part of the bid.

- b. All work within the communications equipment room and telecommunications room, horizontal and backbone distribution, including but not limited to:
 - 1. Installation of appropriately rated trunk and distribution cable and coaxial drop wiring as indicated or otherwise required.
 - 2. Installation of equipment cabinets, backboards, amplifiers, taps and associated bonding and grounding.
 - 3. Installation of cable support trays, risers and wall penetration.
 - 4. Termination of all cables.
 - 5. Contractor shall provide all cables for interconnections of all components, as required for a complete and operating system.
 - 6. Testing of the completed BCDS installation.
 - 7. Installation spares

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C and in the range of 0 to 95 percent relative humidity, non condensing.

1.4 QUALIFICATIONS

1.4.1 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract shall be commercially available off-the-shelf and shall be from manufacturer's that have a minimum of three (3) years experience in producing the types of systems and equipment specified. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation.

1.4.2 Contractor Qualifications

Installation of the system addressed in this section shall be by a Contractor with a minimum of three (3) year's experience in installing CATV video systems of similar nature and magnitude.

1.5 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01300 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Preliminary Drawings

SD-03 Product Data

Manufacturer's catalog data shall be provided for the following items:

Return Path Transmitter

Forward Path Receiver

Amplifier

Taps

Connectors

Cable

Splitters

Power Supply

Couplers

Equalizers

Equipment Cabinet

SD-05 Design Data

Design Analysis and Calculations

Bill of Material

SD-07 Certificates

Qualifications

SD-09 Manufacturer's Field Reports

Test Plan

Field Test Report

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

As-Built Drawings

Cable Schedule

1.5.1 PRELIMINARY DRAWINGS

Prior to the start of work, the contractor shall submit preliminary drawings of the following:

Scaled 1/4 inch per foot 1:50 main equipment room floor plans showing the planned location of all installed BCDS components.

Scaled 1/8 inch per foot 1:100 floor plans showing the planned location of all BCDS outlets. The estimated length with an approved variance shall be provided. This length is from the tap to the user outlet.

Drawings shall be CAD generated on size "F" sheets. Submit reproducible hard copies. The Contractor shall obtain electronic files of the building floor plan from the Contracting Officer.

1.5.2 PRODUCT DATA

Specification sheets and/or manufacturers catalog data for all equipment shall be provided.

1.5.3 DESIGN DATA

Design analysis and calculations shall be submitted consisting of the power supply capacity, distribution calculations, and outlet port calculations with schematic diagrams showing trunk and distribution segments, cable type, transmission path length, CFP numbers, etc. to verify the requirements are met.

Provide a print out of all design calculations. Data shall include calculated signal levels at each user (outbound) port at 150 and 450 megahertz, and calculated signal levels at each distribution (inbound) port at 5 and 112 megahertz. Minimum gain at each distribution port shall be 6.0 dB.

Calculations shall be performed on a computer using approved system design software. Submit data on the type of program used to perform the calculations.

A bill of material listing all parts and components for the installed system by manufacturer's name, quantity, part number, and nomenclature, and recommended spares level required for normal maintenance and unscheduled repairs shall be submitted.

1.5.4 QUALIFICATIONS

The qualifications of the manufacturer, contractor, and the installer to perform the work specified herein shall be submitted. This shall include proof of the minimum qualifications specified herein.

1.5.5 TEST PLAN

A test plan defining the tests required to ensure that the system meets technical, operational, and performance specifications, shall be submitted 30 days prior to the proposed test date. The test plan must be approved before the start of any testing.

The contractor shall provide all required test equipment. Equipment calibration shall be traceable to national standards.

The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

1.5.6 FIELD TEST REPORT

Test reports shall be submitted in booklet form with witness signatures verifying execution of tests. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within fourteen (14) days after completion of testing.

1.5.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the BCDS system. The operations and maintenance documentation shall be provided in electronic form, MS Word or Adobe Acrobat format on CD media.

1.5.8 AS-BUILT DRAWINGS

At the completion of the project, the contractor shall submit final record "As-Built" drawings of the following:

Scaled 1/4 inch per foot 1:50 main equipment room floor plans showing all installed BCDS components.

Scaled 1/8 inch per foot 1:100 building floor plans showing routing of trunk cables, distribution cables, locations of taps, and all BCDS outlets. All outlets and taps shall be numbered as indicated on the cable schedule.

Drawings shall be CAD generated on size "F" sheets. Submit reproducible hard copies and electronic copies in ".DXF" or ".DWG" format.

1.5.9 CABLE SCHEDULE

At the completion of the project, submit cable schedules indicating label at each end, and installed length. Format shall comply with KSC STD E 0021. Schedule shall be in 8-1/2 inches by 11 inches 216mm by 279mm format. Submit hard copy, and copy of electronic file in "Excel" (.xls) format.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 SYSTEM COORDINATION

The Contractor shall coordinate with the Contracting Officer and respective support contractor for exact system installation requirements, and requirements for interface with the center-wide BCDS network.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the respective EIA ANSI/TIA/EIA-606, EIA ANSI/TIA/EIA-607, IEEE Std 802.7, NFPA 70, 47 CFR 76.605, and the requirements specified below.

The BCDS installation shall incorporate system equipment compatible with the planned distribution of high definition television (HDTV) compressed digital signals.

2.2 CABLE

2.2.1 Trunk and Distribution Cable

Trunk and distribution cable shall be broadband 0.5 inch CATV cable, semi-flexible coax, or where the bend radius is less than 4 inches, Type RG-11. Cable jacket shall be factory marked at regular intervals, indicating verifying organization and performance level. Cable shall be rated plenum (CMP) per NFPA 70 when installed in ducts, plenums and other air-handling spaces. For cable subject to moisture from flooding or to atmospheric contamination, cable protected by a black polyethylene jacket with a flooding or other water migration deterrent compound between the jacket and the aluminum shield shall be used. Underground, flooded cable shall have sequential footage marking on the outer jacket.

The 0.5 inch CATV semi-flexible coaxial cable shall be Times Fiber T10500J/T10500JB or approve equal with the following characteristics:

- a. Copper-clad aluminum center conductor.
- b. Foamed polyethylene dielectric produced by gas injection in combination with enhanced dimensional uniformity.
- c. Seamless high purity electrical grade aluminum tube outer conductor (ASTM B-221).
- d. 75 ohms impedance.
- e. Nominal capacitance of 15.6 pF/ft (51.2 pF/m)
- f. 87 percent nominal velocity of propagation.
- g. Abrasion resistant, low coefficient of friction medium density black polyethylene jacket(Federal Specification LP-390 and ASTM D-1248 jacketing material).
- h. Maximum attenuation characteristics:

Frequency(MHz)@68°F(20°C)	dB/100 ft	dB/100 meters
5	0.16	0.52
55	0.55	1.80
211	1.08	3.55
250	1.19	3.92
270	1.24	4.07
300	1.31	4.30
330	1.38	4.54

Frequency(MHz)@68°F(20°C)	dB/100 ft	dB/100 meters
350	1.43	4.69
400	1.53	5.02
450	1.63	5.35
500	1.73	5.68
550	1.82	5.97
600	1.91	6.27
750	2.16	7.09
870	2.35	7.69
1000	2.53	8.30

The RG-11 coaxial cable shall be CommScope F11SSV or equivalent with the following characteristics:

- a. No. 14 AWG copper-clad steel center conductor.
- b. Gas expanded polyethylene dielectric with nominal 7.11 mm 0.28 inches outer diameter.
- c. Aluminum-polypropylene-aluminum laminated tape shield with overlap bonded to the dielectric.
- d. 34 AWG aluminum braid wire shield with 60 percent coverage.
- e. Non-bonded tape shield.
- f. 34 AWG aluminum braid wire shield with 40 percent coverage.
- g. 75 ohms impedance.
- h. 82 to 85 percent nominal velocity of propagation.
- i. PVC jacket with nominal diameter of 0.405 inches
- j. Maximum attenuation characteristics:

Frequency(MHz)@68°F(20°C)	dB/100 ft	dB/100 meters
5	0.38	1.25
55	0.96	3.15
83	1.18	3.87
187	1.75	5.74
211	1.90	6.23
250	2.05	6.72
300	2.25	7.38
350	2.42	7.94
400	2.60	8.53
450	2.75	9.02
500	2.90	9.51
550	3.04	9.97
600	3.18	10.43
750	3.65	11.97
865	3.98	13.05

2.2.2 Outlet Drop Cable

Outlet drop cable shall be broadband CATV cable, Type RG-6. Cable jacket shall be factory marked at regular intervals, indicating verifying

organization and performance level.

RG-6 coaxial cable shall be Belden 82120 or equivalent with the following characteristics:

- a. No. 18 AWG copper-clad steel center conductor.
- b. Aluminum foil-polyester tape inner shield with 100 percent coverage and aluminum foil/braid outer shield with 95 percent coverage.
- c. Characteristic impedance of 75 ohms.
- d. Foam FEP dielectric.
- e. Nominal capacitance, conductor to shield, of 16.5 pf per 100 ft.
- f. Maximum operating voltage of 300 V RMS.
- g. Maximum attenuation characteristics:

Frequency(MHz)@68°F(20°C)	dB/100 ft	dB/100 meters
10	0.90	3.0
50	1.90	6.20
100	2.60	8.50
200	3.70	12.1
400	5.00	16.6
700	6.60	21.7
900	7.40	24.3
1000	8.10	26.6

2.3 CONNECTING HARDWARE

2.3.1 Drop Cable Connectors

Connectors shall be Type 'F' terminators. User outlets shall be as configured on the drawings and provided with a self-terminating Type 'F' barrel, and be provided with locking terminator. Connectors shall be incorporated into the customer faceplate (CFP) with telecommunication system services at locations indicated on the drawings.

2.3.1.1 Trunk and Distribution Cable Connectors

Connectors shall be the "KS" Type 5/8-24 threaded pin type. The connectors shall be designed for the cable dimension, tolerance and assembly to ensure proper connection and termination.

2.3.2 Taps

Taps shall be 8-port with RFI shielding and tap values selected to meet distribution design goals. The last tap in the distribution string shall have its thru port terminated in 75 ohms. This shall be accomplished using a Type 'KS' male to Type 'F' female adaptor, and a Type 'F' terminator.

2.3.3 Patch Cables

Patch cables shall be RG-6 cable assemblies consisting of flexible coaxial cable with Type 'F' connectors at each end. Provide 3 metera patch cable

for each user outlet. BCDS patch cables may be field fabricated.

2.3.4 Splitters

Splitters shall be contained in a die cast aluminum housing with mountable tabs and grounding blocks. They shall be provided with RFI shielding and rated for performance to 1000 MHz. The two-way splitter nominal insertion loss at 450 MHz shall be 3.9 dB, with a maximum insertion loss at 450 MHz of 4.3 dB. Isolation from 10 to 860 MHz shall be 20 dB minimum, with a return loss at 30 to 750 MHz of 18 dB maximum. The splitters shall also be available in a three-way configuration.

2.3.5 Directional Couplers

Directional couplers shall be contained in a die cast aluminum alloy housing with mountable tabs, rated for performance up to 1000 MHz, and be available in a range of tap values of 16, 12, 9, and 7 dB. Maximum input return loss shall be 18 dB over 30 to 750 MHz and 16 dB over 750 to 1000 MHz. Isolation from 10 to 860 MHz shall be 20 dB minimum for all tap values exclusive of 16 dB, which shall have a minimum isolation of 22 dB.

2.3.6 In-Line Equalizers

In-line equalizers shall provide compensation of RF signal level and tilt for inbound and outbound transmission paths. In-line equalizers shall be consistent with the split of the RF spectrum.

2.4 EQUIPMENT

Active equipment, including amplifiers and power supplies, shall be sized and provided as necessary to meet the requirements of the system design. All system equipment shall be compatible with the planned distribution of standard definition (SDTV) and high definition television (HDTV) compressed digital signals.

2.4.1 Power Supply

Power supply shall be rated for 120 VAC, 60 HZ input, with plus or minus 2 percent (worst case line/load regulation), and 60-90 VAC output at the required ampere capacity. The required ampere capacity shall be determined during the design phase, based on the number of required amplifiers.

Efficiency shall be a minimum of 80 percent at full load with isolation at RFI filter of 40 dB, 5 to 860 MHz. The unit shall be provided with an internal test point and meters for voltage and current, front panel circuit breaker and pilot light. A method of power backup, using an uninterruptible power supply or resident battery system, shall be provided.

2.4.2 Amplifier

Amplifier shall be capable of being wall mounted on a wall with suitable mounting hardware. The forward path passband shall be 80 to 862 MHz minimum. The return path passband shall be 5 to 65 MHz minimum. Amplifier shall be provided complete with a status monitor transponder. The amplifier housing shall accept the return path transmitter and the forward path receiver. Amplifier performance criteria shall meet or exceed the design requirements. The system shall employ no more than three cascaded trunk amplifiers.

2.4.3 Return Path Transmitter

Transmitter wavelength shall be 1310 nm. The transmitter may be mounted in the amplifier housing. Fiber optic connectors shall be FC/APC style.

2.4.4 Forward Path Receiver

Receiver shall be capable of receiving 1550 nm wavelength. The receiver may be mounted in the amplifier housing. Fiber optic connectors shall be FC/APC style.

2.5 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with fire retardant paint.

2.6 CABLE SUPPORTS

Cable supports shall be flexible cable wrap type, large bundle supports manufactured for the purpose of supporting low-voltage cable. Units shall be adjustable to a 4 inches or 6 inches 102mm - 152mm diameter loop, be mounted to the building structure in an approved manner. Unit shall be suitable for use in a plenum space.

2.7 LABELS

Labels shall be as specified in Section 16704 HORIZONTAL CABLE.

2.8 EQUIPMENT CABINET

Cabinet shall be as manufactured by "Optima" to match existing equipment at the center.

BCDS equipment cabinet shall meet the following criteria:

- a. Floor mounted, beige colored 16 gauge steel construction.
- b. Heavy-duty aluminum frame.
- c. Die-cast aluminum corner sockets.
- d. Extruded aluminum bezels.
- e. Interior welded joints.
- f. Standard mounting rails.
- g. Nominal 77 inches H by 19 inches W by 30 inches D.
- h. Lockable smoked plexiglass hinged door on front and steel hinged, louvered door in rear. Doors shall be field reversible.
- i. Vented roof.
- j. Removable side panels.
- k. Leveling feet.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be provided. Components shall be labeled in accordance with EIA ANSI/TIA/EIA-606. Penetration in fire-rated construction shall be firestopped in accordance with Section 16700 BASIC PREMISE DISTRIBUTION SYSTEM (PDS) REQUIREMENTS. Conduits, outlets and raceways shall be installed in accordance with applicable sections of this specification. Wiring shall be installed as specified in these specifications. Wiring, and terminal blocks and outlets shall be marked in accordance with EIA ANSI/TIA/EIA-606. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with AC power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance, and if installed in plenums or other spaces used for environmental air, shall comply with NFPA 70 requirements for this type of installation.

3.1.1 Cable

BCDS cable shall be routed preferably to the exterior of the telephone and data cabling, from the communications room, out to the work station, using appropriate mounting hardware. Coordinate requirements with Section 16704 PREMISE WIRING SYSTEM. Where only BCDS is required at a CFP, the rough-in and finish CFP shall be the same as specified in Section 16704 PREMISE WIRING SYSTEM

The rated cable pulling tension shall not be exceeded. Cable shall not be stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Adequate slack shall be provided at each end for future termination. Above the ceiling at each outlet, coil 36 inches 914mm of slack cable that will allow future removal of the existing termination, and re-termination using a new device.

Coaxial cable not in a wireway shall be suspended a minimum of 6 inches 150 mm and a maximum of 12 inches 300mm above ceilings by cable supports. Cable supports shall be a minimum of 3 feet 915 mm and a maximum of 8 feet 2440 mm apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 2 inches 50mm per NFPA 70 Article 820-52 shall be maintained when such placement cannot be avoided. All cables shall be terminated; no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not be excessively tightened.

In raised floor areas, cable shall be installed after the flooring system has been installed. Cable 72 inches 1.8 mm long shall be neatly coiled below each feed point in raised floor areas.

No cable shall sag more than 8 inches 203 mm and shall not touch any lighting fixture or drop ceiling in any way.

No cable shall be spliced or otherwise re-terminated to fulfill the requirements of the job, other than at the wall outlet and communications

closet.

All cable must be run above as many obstructions as possible such as ducts, other cabling, conduit, piping, etc.

No cable shall be tie wrapped closely parallel or directly on electrical conduit.

All cables shall be labeled at each end as indicated in the cable schedule.

All BCDS cable with the exception of trunk and distribution cable, shall be routed from the nearest 8-port multi-tap to the user outlet, and routed through ceilings in neatly tie wrapped bundles, and secured to structural members, unless otherwise stated on the design in conduit. Where cables must pass through drilled openings, conduit sleeve shall be installed proportionally to the feed-thru distance at all locations. Appropriate fire caulk shall be installed per NFPA 70.

One pull string shall be provided in each bundle, and up from each station outlet, and secured up in the ceiling space.

A walk through with the Contracting Officer shall be conducted prior to installation to examine installation conditions. Replacement of any tiles or other materials damaged during installation shall be the responsibility of the installing contractor.

Trunk and distribution cable shall be installed in a manner that there is no visible damage to the cable outer conductor, due to improper bonding or handling during installation.

3.1.2 Taps

Taps shall be installed at 30 inches 60mm on center or at intervals as dictated by the design, on distribution lines. Drop lines shall be extended directly from the tap to the outlet, with no splices or taps. Securely fasten the tap to the building structure, and ground in accordance with manufacturer's recommendations. Label all taps as numbered in the Cable Schedule.

3.1.3 Outlets

Install connectors in CFP's at all locations shown on the drawings that are to contain a BCDS service. Coordinate with requirements for other systems required in the CFP. Label all BCDS outlets in CFP's as numbered in the Cable Schedule.

3.1.4 Equipment

All active equipment shall be located in the facility communications room(s).

Where required, amplifiers shall be wall mounted on the BCDS equipment backboard in the communications equipment room/closet. Power supplies shall be [floor], [wall], or [rack] mounted, as required by the conditions.

Provide all line voltage circuits, appropriate AC receptacles and grounding as required by the manufacturer's recommendations and NFPA 70. Label all equipment with designated name and number.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual work stations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Coaxial Cable

All cables shall be terminated at each end. Trunk and distribution cables shall be terminated with appropriate connectors or end-of-line terminators as required. Loop-type cable systems shall be terminated with appropriate drop connectors and terminators as required. Trunk cable shield conductor shall be grounded to communications ground at only one point and shall not make electrical contact with ground anywhere else.

3.3 GROUNDING

Signal distribution system ground bus shall be installed in the telecommunications entrance facility and in each telecommunications closet, in accordance with EIA ANSI/TIA/EIA-607. Equipment frames/housings shall be connected to the ground bus.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

- a. An amount of "F" connectors equal to 5 percent of the total number installed.
- b. An amount of 8-port taps equal to 5 percent of the total number installed, with a minimum of one.
- c. An amount of patch cables equal to 5 percent of the total number installed.
- d. One (1) set of any and all special tools required for cable preparation/termination such as coring tools, jacket removal, cable-cutters, center conductor foam removal and cable strippers. This shall be applicable for all types of installed cable to establish cross connects and to change and/or maintain equipment.

3.5 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

100 percent of the installation shall be tested, including ALL terminations.

Each outlet shall be tested post-termination using an appropriate instrument to verify both the integrity of all conductors and correctness of the termination sequence.

Test equipment shall include the following:

- a. Calan model 3010R or equal Sweep Generator.
- b. Calan model 3010R with Option 52 or equal Sweep Generator.
- c. Wavetek Model C1 or Equal Oscilloscope Camera.
- d. Miscellaneous test cables, connectors, and adapters.

3.5.1 Trunk Cable Test

Trunk Cable Test:

Connect a sweep generator to either end of the cable through appropriate adapters and test cable (the test cable must be as short as possible). Connect the sweep recovery unit to the other end of the trunk cable through the appropriate adapters and test cable (minimum length). Set the sweep generator to sweep from 5 megahertz to 862 MHz with an output level of plus 50 dBmV. The sweep display should have a smooth slope free of ripples (no more than 1 dB peak to valley change within a 6 megahertz bandwidth) or other distortions with the highest level at 5 megahertz and the lowest level at 400 megahertz. The lowest level must exceed plus 30 dBmV for proper system operation. The actual level is dependent on the length of the trunk cable.

If the cable run contains directional couplers and/or splitters, these devices should be included in the sweep tests. All unused cable lengths connected to the directional couplers and/or splitters must be terminated with a 75-ohm terminator when each segment is swept.

Set the sweep recovery unit markers to display the maximum and minimum levels on the sweep. Photograph the sweep presentation using the oscilloscope camera. Label the photograph with scale, date, and cable nomenclature.

3.5.2 Branch Cable Test - Forward

Branch Cable Test - Forward: Connect a sweep generator to the amplifier end of the branch cable through the appropriate adapters and test cable (the test cable must be as short as possible). Connect the sweep recovery unit to the tap end of the cable at the output of the last tap (remove the 75-ohm end of the branch terminator and install the test cable) using a minimum length test cable. Set the sweep generator to sweep from 80 megahertz to 862 megahertz with an output level of plus 50 dBmV. The sweep display should have a smooth slope free of ripples (no more than 1 dB peak to valley change within a 6 megahertz bandwidth) or other distortions with the highest level at 80 megahertz and the lowest level at 862 megahertz. The lowest level must exceed plus 22 dBmV for proper system operation. The actual level is dependent on the branch length and the number of taps.

Set the sweep recovery unit markers to display the maximum and minimum levels of the sweep. Photograph the sweep presentation using the oscilloscope camera. Label the photograph with scale, date, and cable nomenclature.

3.5.3 Branch Cable Test - Reverse

Branch Cable Test - Reverse. Connect a sweep generator to the tap end of

the cable through appropriate adapters and test cable (the test cable must be as short as possible). Connect the sweep recovery unit to the amplifier end of the branch cable through the same test cable used for the forward sweep. Set the sweep generator to sweep from 5 megahertz to 65 megahertz with an output level of plus 50 dBmV. The sweep display should have a smooth slope free of ripples (no more than 1 dB peak-to-valley change within a 6 megahertz bandwidth) or other distortions with the highest level at 5 megahertz and the lowest level at 65 megahertz. The lowest level must exceed plus 29.5 dBmV for proper system operation. The actual level is dependent on the branch length and the number of taps.

Set the sweep recovery unit markers to display the maximum and minimum levels of the sweep. Photograph the sweep presentation using the oscilloscope camera. Label the photograph with scale, date, and cable nomenclature.

NOTE: Equalizer modules, both high frequency and low frequency, must be installed in the equalizer housings prior to testing. Note that equalizers are only in the branch distribution cable system.

3.5.4 Coaxial Cable

Cable shall be tested for continuity, shorts and opens. Characteristic impedance shall be verified over the range of intended operation. Cable length shall be verified. Cable shall be sweep tested for attenuation over the range of intended operation.

The installed system shall have an outbound path loss of 39 plus or minus 3 dB, as measured from the distribution port of the amplifier, to any user outlet port, based on a distribution level of 45 dBmV.

The inbound path loss shall be 32.5 plus or minus 3 dB, as measured from any user outlet port, back to the distribution port of the amplifier. The 32.5 dB level is based on a 50 dBmV transmitter level from a cable modem or converter box. This level will provide a 17.5 dBmV input level at the distribution port.

Verify continuity of all installed user cables after termination of Type "F" connectors.

Repair/replace any defective components at no cost to the Government.

-- End of Section --