13780 INSTRUCTIONAL TELEVISION SYSTEM

****

CSI 2004 MasterFormat number: 27 41 35

****

PART 1 : GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installations of a complete Instructional Television System (ITV) at all new facilities.
2. Expansion and/or Replacement of existing ITV System at new additions, remodeling and renovations projects.

****

SPECIFIER: Sketches for the Instructional Television System, as referenced in this document, are found in the Appendix "A" section of the M-DCPS Design Criteria. SPECIFIER shall incorporate into the project Drawings any information contained in these sketches that are applicable to the scope of the project.

****

3. Refer to M-DCPS Design Criteria – Appendix section, for wiring requirements on the Television Distribution System, also known as the "Instructional Television (ITV) System).

B. Related Sections:

1. 03300 - Cast-In-Place Concrete.
2. 16112 - Raceways and Conduits.
3. 16120 - Wires and Cables.
4. 16131 - Outlet, Pull, and Junction Boxes.
5. 16450 - Grounding
6. 16670 - Lightning Protection System

1.2 SYSTEM DESCRIPTION

A. Provide a television distribution system consisting of specified local OTA (Over the AIR) Digital Channels, Comcast Channels and in-house generated video signals, distributed in accordance with the requirements outlined in this document, to all designated locations identified in the Contract Documents.

1.3 SUBMITTALS

A. Submit shop drawings to A/E demonstrating compliance with all requirements of this document and design specifications.

B. Submit calculations and mounting details, signed and sealed by a Florida registered structural engineer, demonstrating that the entire assembly of the new mast with antennas

and all other appurtenances mounted to same, meet the applicable wind loads requirements as determined by FBC and American Society of Civil Engineers (ASCE) 7.

C. Quality Assurance/Control Submittals: Florida registered engineer shall submit signed and sealed drawings indicating the following:

1. Structural/Wind load calculations.
2. Antenna and appurtenances mounting details.
3. Grounding and lighting protection in compliance with NEC 820-20 – 820-55. System shall include ground block installed outside building, and two (2) 10-foot long copper ground rods spaced 6 feet apart connected by AWF4 copper conductor. Lighting protection shall be separate from electrical ground system.

D. At project completion provide the following:

1. Five (5) copies of Operation and Maintenance manuals complete with list of replacement parts.
2. As-built drawings of ITV system. Drawing shall show locations of all components and conduit identification.

1.4 QUALITY ASSURANCE

A. All Instructional Television (ITV) System equipment and wiring shall be installed by a qualified installer having a minimum of 5 years' experience in the design, installation and integration of professional television production and distribution equipment.

B. ITV System installer shall provide a list of three (3) projects they have completed within the past twenty-four (24) months, comprising of work similar or greater in size and complexity as the scope of this contract. Provide name of each entity for which the work was performed, location of the work, contact person and telephone number, e-mail address, and a brief description of the work. Failure to submit this information at the time of bidding may result in bidder not being recommended for award.

C. Notification: Notify the A/E before the start and at completion of the work.

D. Equipment shall be listed by UL or other OSHA approved Nationally Recognized Testing Laboratory (NRTL) and bear the appropriate label according to referenced standards.

1.5 WARRANTY:

A. Provide a non-prorated warranty to correct all defects in materials and workmanship for a period of 2-years from the date of Substantial Completion.

PART 2 : PRODUCTS

2.1 GENERAL EQUIPMENT AND WIRING

A. Antennas:

1. UHF Broadband Antenna, BTY Series, Model BTY-UHF-BB by Blonder Tongue. No substitution allowed.

a. High Gain, Low Sidelobes, HDTV Compatible.
b. Bandwidth: 470-860 MHz.
c. Gain: 10.2 dBi.
d. 3 db Beamwidth (Horizontal Degrees): 62
e. Front to back Ratio (dB): 18
f. Number of Elements: 11
g. Boom Length: 24 inches.
h. UHF antenna shall be mounted 12 inches from the top end of the antenna mast.

2. VHF: Highband Antenna, Model WL7-13/S by Toner Cable Equipment. No substitution allowed.

a. Bandwidth: 174-216 MHz.
b. Channels: 7 to 13.
c. Gain: 11.5 dBi.
d. Impedance: 75 Ohms. e. VSWR: <1.25:1
e. FR:BK Ratio: >25 dB.
f. Polarization H or V
g. H. Beam Width: 50 deg.
h. V Beam Width 70 deg.
i. Side Lobe Suppression: >30 dB.
j. Connectors: “F” Connector.
k. Boom Length: 96 inches.
l. Std. Mount: 1/2” U-Bolts to fit 3-1/2” O.D. Pipe.
m. VHF antenna shall be mounted 36 inches above the top edge of the parapet wall, and 24 inches below the UHF antenna.

****

SPECIFIER: A/E shall develop a project specific Line-of-Sight Signal Strength Report in compliance with Division 13 of M-DCPS Design Criteria and select one of the following antenna support structures based on the specific findings of the Report. Coordinate final selection of antenna structure with M-DCPS Facilities Design and Standards.

****

B. Antenna Support Structure:

[Mast Pole - Parapet-mounted - Round 3" dia. galvanized steel pipe. Minimum 10'-0" long. Mast shall extend 6'-0" above top of parapet wall. Installation shall comply with Plans and all applicable requirements noted in this document.]

or

[Self-Supported Steel Monopole: Tapered, round galvanized steel pole. Design No. RA500-B11 Rev: R4, by Union metal Co. or other A/E approved equal. Installation shall comply with Plans and all applicable requirements noted in this document.]

C. Metal Enclosure (Provided at base of structure, only when a metal monopole antenna structure is specified): Nema 3R 36" H x 24" W X 8" D # 36248RE w/backplate # 3624P by Graybar or other A/E approved equal.

D. TV Amplifiers: Broadband Amplifiers: Blonder Tongue MUVB-35 UHF/VHF AMP. No substitution allowed.

E. Splitter/Combiner: DGS-8 1x8 Combiner, or other A/E approved equal.

F. RF Over Fiber Transmitter: Thor F-RF-1310-TX-32mW.

G. Fiber Optic Cable Splitter: Thor F-PLC-1X16.

H. Optical Mini Node: F-MININODE-2RP-HP.

I. Fiber Cable Signal Distribution:

1. RF Over Fiber-Rack Riser Cable: Thor Fiber Part Number: F-Fiber-XX (XX=distance in meters).
2. RF Over Fiber-Backbone Between Buildings: Belden FDSD004R9 - Indoor/Outdoor Riser OS2 Distribution (4 Fibers).

J. Antenna Trunk Lines: Type RG6/U, Model No. 9116SB by Belden Division or other A/E approved equal.

K. Coaxial Cable TV Signal Distribution:

1. Main and Sub-Trunk Lines for above ground and indoor use only: Type RG11/U, Model No. 1523A by Belden Division or other A/E approved equal.
2. Main and Sub-Trunk Lines for underground and outdoor use:

    a. RG11 Duobond Plus 1525A by Belden Division or other A/E approved equal.
    b. 75-Ohm coaxial cable Model No. PIII-700 JCASS by CommScope or other A/E approved equal.

3. TV RF Outlets: Wall taps with 1 output. Model No. WP-81-I by Toner Cable Equipment Co, or other A/E approved equal.

L. IPTV Cable TV Signal Distribution:

1. IPTV Trunk Line: Belden FDSD004R9 -Indoor/Outdoor Riser Cable OS2 Distribution (4 fibers).
2. IDF Network Switch for each floor level at each building: Netgear GS728TPP v2 (24 ports) or GS752TPP v2 (48 ports) depending on classroom quantity per floor.
3. IDF Network Switch SFP Fiber adapter to interconnect Network Switches: FS.COM model SFP1G-LX-31 SFP.
4. Fiber connection line between SPF's: Belden FDS004R9 – Indoor Riser Cable OS2 Distribution (4 Fibers)
5. Head End Network Switch: Netgear GS728TPP v2 (24 ports.)
6. Head End Network Switch SFP Fiber adapter to interconnect Network Switches: FS.COM model SFP1G-LX-31 SFP.
7. Cisco RV340 Firewall for Network Switch.
8. DGS 8 8x1 Combiner.
9. Amino Communications H150 IPTV Set Top Box. **(ID # 31)**

****

SPECIFIER: A/E shall coordinate with M-DCPS Facilities Design and Standards to determine if the following Section titled "ITV Production and Distribution Equipment" is applicable to the scope of the project. If M-DCPS determines that this section is applicable because new ITV Production and Distribution Equipment is required for the project, A/E shall edit this Section based on the following parameters:

A. Select ITV "BASIC" System for use at Elementary Schools, K-8 Centers and Middle Schools.

B. Select ITV "ADVANCE" System for use at Senior High Schools and other Facilities as designated by M-DCPS Facilities Design and Standards

NOTE: The ITV System sketches referenced in this Section are found in Appendix "A" of M-DCPS Design Criteria. A/E shall incorporate into the project documents, all information contained in these sketches that are applicable to the scope of the project.

****

2.2 ITV PRODUCTION AND DISTRIBUTION EQUIPMENT

A. ITV "BASIC" System – For use at Elementary Schools, K-8 Centers and Middle Schools

1. <u>At CCTV Room</u> – Furnish and install the following:

a. One (1) SAMSUNG UN24H4000AFXZA: 24" Class LED HDTV and SDI/HDMI converter, or accepted equivalent approved by M-DCPS Facilities Design and Standards. **(ID #1)**
b. Three (3) ELECTROVOICE RE50/B: Dynamic microphone (Black) with desktop stand or accepted equivalent approved by M-DCPS Facilities Design and Standards. **(ID #2)**
c. Two (2) MIDDLE ATLANTIC MRK-4026 Vertical Rack, gangable configuration, UL Listed, 76.125" H x 22" W x 26.4" D, with lockable back door and one side panel SPN-40-267, fully steel welded construction, finished in a durable black powder coat, or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #3)**
d. Electric Strip: Vertical electric strip with 16 outlets 115VAC, 20 Amp, with power surge, by Middle Atlantic Co or other A/E approved equal.
e. Two (2) BLACKMAGIC HyperDeck Studio Mini: Dual SD Card recorder with rack mount. Product substitution not allowed. **(ID #4)**
f. One (1) MACKIE 1202 VLZ4: 4 Mic, 12 Channel Mixer. Product substitution not allowed. **(ID #5)**
g. One (1) CABLECAST INFO CHANNEL, to include:
    1) One (1) CBL-VIOLITE-CG-SVR: Cablecast VIO server hardware in a 1RU chassis configured for CG playout on up to two (2) channels with SDI outputs. Product substitution not allowed. **(ID #6)**
    2) One (1) CBL-CGPLAYER-LIC: Cablecast CG bulletin board software for installation in Cablecast VIO video servers. Product substitution not allowed. **(ID #6)**
    3) One (1) CRYSTAL IMAGE TECHNOLOGIES RM-F117: 1 RU 17" 1920X1080 wide screen rack-mount monitor/keyboard, mouse and KVM-B-6 (VGA/USB) cable or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #7)**

h. Two (2) BLACKMAGIC HDL-SMTVDUO2: SmartView dual pack color monitor, rack-mount dual 8" LCD monitors, with 2 x BNC (3G-SDI) Input or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #8)**
i. One (1) CONTEMPORARY RESEARCH ATSC-SDI 4: HDTV tuner/demodulator, includes HD2-RC remote and power supply. Product substitution not allowed. **(ID #9)**
j. One (1) AJA KUMO 1616: Compact HD-SDI router with power supply or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #10)**
k. One (1) AJA KUMO CP: 1 RU Hardware control panel for Kumo router or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #11)**
l. Two (2) AJA 3G-AMA: 3G-SDI Analog Audio embedder/dis-embedder. Product substitution not allowed. **(ID #12)**
m. One (1) BLO13900090: Blonder Tongue AQT8-QAM/IP 6281A ATSC/QAM Transcoder. Product substitution not allowed. **(ID #13)**
n. One (1) TCE12500120: Zycast HDME402 4 Program HD Encoder/QAM Modulator MPEG2/4. Product substitution not allowed. **(ID #14)**
o. Three (3) BLO18900260: Blonder Tongue HDE-CSV-QAM/IP (6382B) MPEG-2 HD Encoder. Product substitution not allowed. **(ID #15)**
p. Two (1) BLO17600150: Blonder Tongue HDE-3 MCH (6389) Rack mount 1RU. Product substitution not allowed. **(ID #16)**
q. One (1) M-LYNX-503: Marshall Electronics M-LYNX-503 Rack-Mountable Triple 5" LCD Monitor Unit with 3G-SDI (HD-SDI, SD-SDI), HDMI, Composite or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #17)**
r. One (1) SONY PXW-Z190: Sony 4K 3CMOS 1/3" XDCAM Professional Handheld Camcorder or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #18)**
s. One (1) GENERAY LED-6200T: 144 LED Variable Color On-Camera light or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #19)**
t. One (1) LIBEC LX10 STUDIO: LX Head, dual panhandle RT50B tripod with DL-3B Dolly 35lbs. capacity or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #20)**
u. Two (10) SANDISK SDSDXXY-256G-ANCIN: Sandisk 256G Class 10 Extreme Pro Memory Card or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #21)**

At Cafetorium: Furnish and Install the following items at sound equipment rack:

v. One (1) BLACKMAGIC TERANEX MINI AUDIO TO SDI: Blackmagic Teranex Mini Audio to SDI Converter with rackmount. Product substitution not allowed. **(ID #22)**
w. Two (2) BLACKMAGIC OPTICAL 12G CONVERTER: Blackmagic HD-SDI Converter to Optical Fiber Converter or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #23)**
x. One (1) TEC NEC WPL-1103: Stainless steel wall 12G SDI Feed thru plate. Product substitution not allowed. **(ID #24)**
y. Two (2) FS.COM: SFP1G-LX-31SFP or accepted equivalent as approved by M-DCPS Facilities Design and Standards. **(ID #25)**

2. ITV Basic System – General Installation Instructions and other requirements:

At CCTV Room:

a. Provide and install one (1) HD-SDI Camera setup fully equipped with lens, viewfinder and on-camera light. Camera shall be powered from AC adaptor attached to the tripod leg.
b. Camera system shall be mounted on a 2-stage tripod with dolly and handler bars.
c. Provide one (1) 25-foot long RG-59 jumper cable with appropriate BNC end connectors, for use with camera set-up.
d. Provide one (1) 75-foot long RG-59 jumper cable with appropriate BNC end connectors, for use with camera set-up in the Cafetorium area.
e. Provide one (1) 25-foot long electrical extension cord 3/16 120 Volts, for camera.
f. Provide one (1) 75-foot long electrical extension cord 3/16 120 Volts, for camera set- up in the Cafetorium area.
g. At the 12"X12"X6" Junction box (j-box) located next to the end of the Chroma-key wall, provide an I/O cover-panel assembly, with provision to plug-in three (3) microphones, one (1) BNC for HD-Cam, one (1) BNC HD-video program OUT, and one BNC HD-video to HD-video production switcher.

   - For reference see ITV BASIC SYSTEM - CCTV Room - Sketch No:002 - Plan View".

h. Provide and install three (3) microphones with table stand and extra flexible audio cables terminated with XLR connectors and connected to audio microphone I/O panel.

   - For reference see ITV BASIC SYSTEM - CCTV Room - Sketch No:002 - Plan View".

i. Provide and install two (2) equipment racks in a gangable configuration. One end of equipment racks shall be placed against the wall next to main 36" X36" X8 D" "HUB" j-box. Maintain a minimum of 36" clearance from the rear wall to the rear face of the racks, to provide service access to the equipment

   - For reference see ITV BASIC SYSTEM - CCTV Room - Sketch No:001 - Equipment Rack - Elevation View", ITV BASIC SYSTEM - CCTV Room - Sketch No:002 - Plan View" and "ITV BASIC SYSTEM - CCTV Room - Sketch No:003A through C - Wiring Distribution".

j. The ITV system shall be capable of sending and receiving digital HD-SDI MPEG- 2/DOLBY AC3 (two (2) channels) audio signal embedded to-and-from the distribution router system.
k. Provide and install all necessary wiring for recording and playback to all HD-SDI recorder/player units and the "RF" system.
l. Each vertical rack shall have a power strip with surge protector mounted inside each rack to power all the equipment with the flick-of-a-switch.
m. The complete system is to be designed in SD/HD-SDI, MPEG-2 and QAM 64/256 J.83 Annex B format, 16:9 aspect ratio; 480i, 1080i capable.
n. Provide and install in Rack #2, two (2) Dual SD Card recorder/player with IN and OUT BNC connectors in a rack-mount configuration.
o. Provide and install in Rack #2, twelve (12) channel audio console mixer, with equalization per channel, in a desktop configuration.
p. Provide and install Main RF Amplifier and combiner at bottom of Rack #1.
q. The system shall be capable to record and playback CATV (Clean QAM) signals into HD-SDI recording devices through the distribution router and main ATSC/QAM demodulator.

r. In Rack #1, provide and install one (1) server, in a rack-mount configuration, as an in- house Info-Channel.
s. In Rack #1, provide and install one (1) RU 17" wide screen monitor/keyboard and mouse, in a rack-mount configuration, to be used for the Info-Channel.
t. In Rack #2, provide and install two (2) dual-pack HD-SDI color monitors, in a rack- mount configuration.
u. In Rack #1, provide and install one (1) 3-pack 5" SDI/Analog color monitor, in a rack- mount configuration, with video loop on each monitor.
v. In Rack #1, provide and install one (1) 24" HD LED TV/monitor with (ATSC/NTSC/QAM) tuner, in a rack-mount configuration, to serve as a main distribution monitor.
w. In Rack #1, provide and install one (1) TV/cable (ATSC/NTSC/QAM) Demodulator with SDI out-put, in a rack-mount configuration.
x. In Rack #1, provide and install one (1) sixteen-by-sixteen (16 X 16) HD-SDI (audio embedded) router, with one (1) Control Panel with BNC 75 OHMS connectors, with assigned sources and destinations labeled, as follows:

INPUT		OUTPUT	
1	TV Studio	1	HD-Encoder (1)
2	HyperDeck (1)	2	HD-Encoder (2)
3	HyperDeck (2)	3	HD-Encoder (3)
4	Demodulator	4	HD-Encoder (4)
5	Cafetorium	5	HyperDeck (1)
6-16	Spares	6	HyperDeck (2)
		7-15	Spares
		16	TV Monitor

y. In Rack #2, provide and install three (3) CATV/NTSC Demodulators. **(ID #9)**
z. In Rack #1, install three (3) Digital Transfer Adapter (DTA) cable boxes provided by others. **(ID#27)**
aa. In Rack #2, provide and install:

1) One (1) Six-slot frame. **(ID#16)**
2) Three (3) HD-SDI to QAM 256 Encoders. **(ID #15)**
3) One (1) 4 Program HD Encoder/QAM Modulator. **(ID #14)**

bb. Balance and combine complete head-end system to main RF amplifier.
cc. Follow MDCPS CCTV/ITV Channel Lineup chart below for channel assignment to radio frequency final combiner.

OVER THE AIR (OTA)	IN-HOUSE
Channel 2 - WPBT	Channel 8 - Encoder #1 – Ch. 8
Channel 4 - WFOR	Channel 12 - Encoder #2 – Ch. 12
Channel 6 - WTVJ	Channel 14 - Encoder #3 – Ch. 14
Channel 7 - WSVN	
Channel 10 - WPLG	Channel 18-1 - Comcast Decoder
Channel 17 - WLRN-17	Channel 18-2 - Comcast Decoder
Channel 23 - WLTV	Channel 20-1 - Comcast Decoder

Channel 51 - WSCV	Channel 20-2 - Info Channel

dd. IPTV/ITV channels to be used include:

IPTV	OTA CHANNELS	IN-HOUSE
1	Channel 2 - WPBT	
2	Channel 4 - WFOR	
3	Channel 6 - WTVJ	
4	Channel 7 - WSVN	
5	Channel 10 - WPLG	
6	Channel 17 - WLRN	
7	Channel 23 - WLTV	
8	Channel 51 - WSCV	
9		TV Studio
10		HyperDeck (1)
11		HyperDeck (2)
12		
13		Comcast-1
14		Comcast-2
15		Comcast-3
16		Info Channel
17		Cafetorium
18		Language Art “Little Theater”

At Cafetorium:

ee. At the existing Audio Rack serving the Cafetorium, provide and install one rack-mounted (1) Audio to SDI Embedder. In addition, perform the following:

1) Connect the Embedder audio input to the audio program-out of the existing audio rack.
2) Connect embedder HD output to HD input on optical converter.
3) Connect fiber SFP to output of optical converter.
4) Adjacent to the audio rack provide a 1" conduit with RG-59 cable that is terminated at an 8" W X 8" H X 6" D j-box located at the “apron” of the Cafetorium stage. Provide and install (1) one female “feed-through” BNC adaptor on the cover-plate of the 8" W X 8" H X 6" D j-box and label the connector on the “outer” face of the cover-plate “HD-SDI Camera to Signal Embedder”. Furnish and install both ends of the RG-59 cable with BNC connectors, and connect one end to the female “feed-through” adaptor, and the other end to the HD Encoder at the audio rack.
5) Adjacent to the audio rack provide a 2" conduit with fiber riser cable that is terminated at the 36" X 36" X 8" D “HUB” j-box located in the CCTV room. Provide and install SFP connector at the other end of this fiber riser cable and connect to optical to HD-SDI converter then the HD – SDI to Input 5 on the router located at Rack #1 in the CCTV room.

- For reference see “ITV BASIC SYSTEM - CCTV Room - Sketch No: 003A through C - Wiring Distribution”, and ITV BASIC SYSTEM - School Facility - Sketch No: 004 - Distribution Raceway”.

3. General Requirements

a. In addition to all equipment mentioned previously, provide the following:
   1) All necessary cables and connectors and accessories to make the installation fully operational.
   2) Fiber encoders & decoders when necessary due to distance.
   3) Vented blank panels to cover all un-used spaces in racks and console.
   4) Use tamperproof screws to secure all equipment to the racks.
   5) Ethernet switcher/router for initial setup and equipment’s operation requiring RJ-45 access in CCTV Room.
   6) Complete ITV System shall operate in HD (1080i) format, provide combined “RF” signals to main amplifier input with the maximum of 10 dBmV of (clean) not-encrypted 64/256 QAM ITU J.83 Annex B signal format, with proper signal balance of ± 1.5 dBmV through the spectrum, MER:> 44 dB equalized and a maximum output of 43 dBmV. Consult and coordinate with M-DCPS Project Manager for the final inspection date for this work.

B. ITV “ADVANCE” System – For use at Senior High Schools and other Facilities as designated by M-DCPS Facilities Design and Standards (Information being developed).

2.3 SYSTEM DISTRIBUTION PARAMETERS

A. Signal Level (0 dBmV to +15 dBmV):

1. Minimum available at the output of any receptacle using specific normally viewed open circuit television channels, and all closed-circuit channels: +3 dBmv.
2. Maximum available at the output of any receptacle, using specific normally viewed open circuit television channels and all closed-circuit channels: +10 dBmv.

   a. Level Difference Between Adjacent Channels: 1.5 dB
   b. Level Difference Between All Channels: 3 dB

3. Operate all distribution amplifiers at maximum rated output of 30 dBmV to 43 dBmV.

B. Bandwidth of the System: 84 MHz, include Clean 64/256 QAM ITU j.83 Annex B and CATV channels from 49 MHZ to 860 MHZ, flat within ± 0.5 dB across any 6 MHZ portion of the system.

2.4 SYSTEM EQUIPMENT

A. RF Head End Distribution.

1. Comply with M-DCPS TV/Radio Frequency System Distribution Raceways and wiring requirements through entire facility. Installation shall go from the external UHF-VHF antennas to RF head end combiner system, then to all coaxial TV drops. See M- DCPS Design Criteria – Appendix for RF Distribution Design Schematic for additional details and requirements.

B. IPTV Head End Distribution.

1. Comply with M-DCPS TV/IPTV/Radio Frequency System Distribution Raceways and wiring requirements through entire facility. Installation shall go from the external UHF-VHF antennas to the head end IPTV encoder system, through the ITS infrastructure, then to the individual decoders at all Ethernet TV drops. See M-DCPS Design Criteria – Appendix for additional details and requirements.

C. "RF" Amplifiers:

1. Broadband amplifiers. Comply with the following:

a. Bandwidth: 55 to 1GHZ.
b. Frequency Response: +/- 0.5 dB
c. Max Gain: 50 dB
d. Max Input Level: 4dBmv to 10dBmv
e. Output Level: 30 dBmv to 45 dBmv.
f. MER: 36 to 44 dB
g. RCL: 12dB to 15 dB
h. EVM: 1.1 to 1.2 dB
i. Gain Range: 6 dB
j. Slope Range: 6 dB
k. Return Loss:

1) Input: 16 dB
2) Output: 16 dB

l. Test Points: -30 +/- 1 dB
m. Noise Figure: 7.5 dB
n. Current DC: 0.55 amps.
o. Powering: 23 watts.

D. Splitter and Directional Couplers. Comply with the following:

		2-Way	4-Way	8-Way
1.	Bandwidth	5-1000Mhz	5-1000Mhz	5-1000Mhz
2.	Thru loss	4.2dB max	7.2dB max	11.9dB max
3.	Isolation	25dB min	27dB mi	20dB min
4.	Return Lost	18dB min	18dB mi	16dB min
5.	Radiation Shielding	-80 dB	-80 dB	-80dB

E. Tapoffs: Multi-tap directional couplers.

1. Two Output Taps:

Isolation (dB)	Thru loss +/-0.2dB
8	3.7
11	2.2
14	1.3
17	1.2
20	1.1

23	0.9
26	0.9
29	0.9

2. Four Output Taps. Comply with the following:

Isolation (dB)	Thru loss +/-0.2dB
11	4.0
14	2.2
17	1.3
20	1.2
23	1.1
26	0.9
29	0.9

3. Common Spec 1000 MHZ:

   a. Isolation dB:

      1) Tap-to-Tap: -21.
      2) Out-to-Tap: -21.

   b. Return Loss dB:

      1) In: -15.
      2) Out: -15.
      3) Tap: -15.

4. Radiation Shield Bandwidth: 5-1000 MHZ -100 dB

F. TV RF Outlets:

1. Wall taps with 1 output: Model No. WP-81-I.

Impedance	Connector	Bandwidth	RF 1SO	Thru
75	F	5 -1000MHz	12dB	0.9dB
			16dB	0.7dB
			20dB	0.6dB
			24dB	0.6dB
			28dB	0.6dB
			30dB	0.6dB

G. Headend Equipment Enclosure Racks: (for use with “ITV ADVANCE System only)

1. Heavy gage steel construction, ventilated, vertical rack with lockable back door as indicated on the Plans.

a. Provide 3 vertical racks at Senior High Schools. Racks shall be arranged in a gangable configuration at indicated on the M-DCPS Design Criteria – Appendix section.
b. Each rack shall have one 115 VAC 16 outlet strip, capable of 20-Ampere with power surge protection.

H. Coaxial Cable TV Signal Distribution:

1. Type: RG6/U (Model No. 9116SB).

a. Frequency: 1000MHz
b. Attenuation (dB/100 max): 5.10.
c. Use: Dropline (maximum length 100 ft.)
d. Conductor Material and Diameter: 18 AWG solid bare copper covered steel, 0.040".
e. Dielectric gas injected foam polyethylene.
f. Shield Type: Duobond, 60 percent aluminum braids. Duofoil, 40 percent aluminum braids.
g. Jacket Material and Diameter: PVC (black color) 0.295".
h. Nominal Velocity of Propagation: 82 percent.
i. Impedance: 75 ohms.
j. 100 percent shielded coverage.
k. 100 percent sweep tested 5 MHZ to 600 MHZ.
l. UL/NEC and CSA Rating: CATV and FT-1.
m. Flame Test: UL 1581 Vertical tray.

2. Type: RG6/U (Model No. 1694A).
a.
b. Frequency: 5000MHz
c. Attenuation (dB/100 max): 1.7 dB @ 5.000MHz
d. Use: Dropline (maximum length 100 ft.)
e. Conductor Material and Diameter: 18 AWG solid bare copper covered steel, 0.040".
f. Gas-injected High-Density polyethylene.
g. Shield Type: Layer 1 - Duofoil, Aluminum Foil- Polyester Tape-aluminum Foil 100%. Layer 2 - Braid TC – Tinned Cooper 95%
h. Jacket Material and Diameter: PVC (green color) 0.274".
i. Nominal Velocity of Propagation: 82 percent.
j. Impedance: 75 ohms.
k. 100 percent shielded coverage.
l. 100 percent sweep tested 5 MHZ to 600 MHZ.
m. UL/NEC and CSA Rating: CATV and FT-1.
n. Flame Test: UL 1581 Vertical tray.

3. Type: RG11/U (Model No. 1523A).

a. Frequency: 1000 MHZ.
b. Attenuation (dB/100 max): 3.18.
c. Use: Main and Sub Trunk lines.
d. Conductor Material and Diameter: 14 AWG solid bare copper covered steel 0.064".
e. Dielectric Material and Diameter: Gas injected foam polyethylene 0.285".
f. Shield Type: Bonded duofoil, 77 percent aluminum braid, bonded foil-shorting fold.
g. Jacket Material and Diameter: PVC (black) 0.405".

h. Nominal velocity of propagation: 82 percent.
i. Impedance 75 ohms.
j. 100 percent shielded coverage.
k. 100 percent sweeptested 5 MHZ to 600 MHZ.
l. UL/NEC and CSA Rating: CATV and FT-1.
m. Flame Test: UL 1581 vertical tray.

4. Type: RG11 Duobond Plus (Model No. 1525A).

a. Frequency: 1000MHZ.
b. Attenuation (dB/100 max): 3.18.
c. Use: Main and Trunk underground lines.
d. 77 percent braid product code 9764.
e. Flooded direct burial cable.
f. Impedance 75 $\pm$ 3 ohms.
g. Nominal velocity of propagation 82 percent.
h. Nominal delay 1.2 ns/ft.
i. Attenuation at 1000 MHZ 3.18 dB/100 ft.

I. Antenna Support Structure in accordance with Plans and M-DCPS Design Standards.

J. Lightning Protection System: Copper or bronze components, UL listed and of the size weight and construction for use according to UL requirements and manufacturer's recommendations or according to the Drawings. Electrode resistance shall not exceed 2 Ohms. Installer shall use a megger tester to verify.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance:

1. Signal Parameters:

a. Modulation Modes: (Clean) Not-Encrypted 64/256 QAM ITU j.83 Annex B
b. Symbol Rates: 1-7 Msps variable, with presets for Annex B
c. Frequency Coverage: 57-1000 MHz, 6 MHz Channels
d. Channel Plan: Standard CATV, 8VSB, HRC, IRC, QAM 64, QAM 256
e. Maximum Power through Bandwidth: +43dBmV
f. Broadband: Modulation MER, QAM 64 (36-40), QAM 256 (40-44dB)
g. MER: > 44 dB equalized
h. I/Q Imbalance: < 1 degree
i. Spurious Emissions: < -60 dBc
j. QAM 64, QAM 256, (36 to 44 dB)

NOTE. From the final combiner, all programs are multiplexed into a multi-program transport stream through the main distribution amplifier specified in this document.

2. RF Isolation between RF Signal Outlet and Distribution Cable: Minimum 12 dB.

PART 3 : EXECUTION

3.1 INSTALLATION

A. ITV system shall be installed according to applicable codes, M-DCPS Design Standards, accepted shop drawings and wiring diagrams.

B. Install ground system as indicated on the drawings and according to Code. Provide ground points next to the location of the TV distribution rack(s) and at all junction boxes.

C. Commercial Cable Television Conduit:

1. Coordinate with local CATV Company for location of CATV service entrance.

D. Install antenna support structure and antenna to meet applicable Codes and as noted on the Drawings.

E. Lightning Protection System:

1. Install according to NEC, NFPA 78, UL 96A, Lightning Protection Institute (LPI) standards, other applicable codes and standards, and according to the Drawings.
2. Lighting Protection System shall be completely separate from the electrical ground- fault system.
3. Connections made in lightning protection system shall be electrically continuous to ground rods. All bonding conductors shall be a minimum of AWG #4.

3.2 FIELD QUALITY CONTROL

A. Site Tests:

1. Check and test the system for shorts, grounds, continuity, and proper functioning and operation.
2. Perform final connections of equipment, testing of system, and other necessary adjustments, employed by or under the direct supervision of the equipment manufacturer.
3. Test and report network latency values at each STB end point
4. Upon completion of installation, test entire system in presence of A/E and the Board.
5. Using a QAM 64/256 Modulation Signal Generator, an RF meter/receiver and a spectrum analyzer acceptable to A/E, demonstrate that the required signal strength and signal quality is provided at head end.
6. Equipment that must be used all the time:

a. QAM / RF signal generator.
b. RF Meter.
c. Optical Time-Domain Reflectometer (OTDR) – For fiber installation only.
d. Optical Phased Time Domain Reflectometer (OPTDR) – For fiber installation only.
e. Light Source Generator (-10dBM to 2dBM) – For fiber installation only.

3.3 TRAINING

A. ITV System installer shall provide designated M-DCPS personnel, two separate 4-hour training sessions, on the proper operation of all ITV System equipment and software provided under the scope of the project.

B. The first training session shall be conducted once the project is Substantially Completed and all ITV System equipment is fully operational. The second training session shall be conducted 5 to 6 months after the project has been Substantially Completed, with the intent to train additional M-DCPS personnel and offer a refresher course to personnel that were trained at the initial session.

C. ITV System installer shall provide appropriate “hand-outs” to all participants during each training session.

D. ITV System installer shall video record initial training session and provide the School Administration Staff and the M-DCPS Project Manager copies of the recording for future reference.

END OF SECTION