

## SECTION 27 40 00 – AUDIO VIDEO SYSTEM

### 1.01: Summary

- A. Section Includes supply, delivery, supervision, coordination, installation of equipment items specified herein and shown on drawings as well as incorporation of Owner Furnished Equipment (OFE), testing, documentation, and instruction related to complete Audio, Video, Racks, Consoles, Cables, and Control wiring
  - 1. Products Installed But Not Supplied Under This Section
    - a. Certain equipment may be identified as Owner Furnished Equipment (OFE). This OFE Equipment may presently be part of the Owner's system, or will be provided by the Owner, and will be delivered to Contractor's off-site construction facility, delivered to the Contractor's on-site secured storage area, or installed on site by others, as appropriate, for incorporation into the system.
    - b. Clean and inspect the OFE, and notify the Owner in writing of damage or defect and the extent of repair and/or adjustment required to bring the OFE to original specification. Service OFE only as directed by the Owner under the arrangements of a separate contract.
    - c. Incorporate into the system as if provided new, excepting warranty coverage.
  - 2. Related Drawings
    - a. T Series drawings correspond to this section.
  - 3. Related Sections
    - a. Electrical power, technical ground, empty conduit systems and junction boxes required by this Section are specified in Division 26.

### 1.02: References

- A. National Electric Code (N.E.C.).
- B. National Electric Safety Code (N.E.S.C.).
- C. National Fire Protection Association (N.F.P.A.).
- D. American National Standards Institute (A.N.S.I.).
- E. Electronics Industries Association (E.I.A.).
- F. Telecommunications Industries Association (T.I.A.).
- G. Audio - Design and Installation, Giddings, Howard W. Sams, 1990.
- H. Society of Motion Picture and Television Engineers (S.M.P.T.E.)
- I. American Society for Testing Materials (A.S.T.M.).
- J. Building Seismic Safety Council (B.S.S.C.)

### 1.03: Submittals

- A. Product Data
  - 1. Provide in accordance with Section 01 33 00– Submittal Procedures and before ordering, submit two (2) additional sets of catalog data sheets, neatly bound with title page, space for submittal stamps, and tabbed dividers between sections. List all proposed equipment with reference to corresponding specification paragraph numbers or equipment title. Indicate all accepted substitutions
    - a. Submit a schedule of finishes indicating proposed materials and color selections for all exposed items subject to Architect's selection.
    - b. Submit a list showing coordination of selected frequencies for all wireless transmitters.

B. Shop Drawings

1. In addition to the quantities required by Division 1, Section 01 03 30 – Submittal Procedures, submit two (2) additional sets of drawings showing 'Submittal for Construction' work to the Architect for its Consultant review. If 'Submittal for Construction' documents are rejected, correct and resubmit in the manner specified
  - a. Provide Shop Drawings and Record Drawings using the following scales:

Plans - not less than 1/8" = 1'-0"

Details - not less than 1/4" = 1"

- b. Submit point-to-point wiring diagrams and typed wire lists identifying every connection for information. Include electronic devices such as switches, transformers, and terminal blocks. Indicate locations of all components. Identify cables by types, colors, and wire numbers.
    - c. Submit system plans showing all device locations and ceiling distributed loudspeaker layouts with wattage tap settings.
    - d. Submit conduit riser diagrams showing connection of all devices, required conduit sizes along with types and quantities of cables to be used and cable identification tags.
    - e. Submit rack layouts indicating the proposed arrangement of mounted equipment including junction boxes and locations of conduit penetrations.
    - f. Submit fully dimensioned construction details of all panels, plates and other custom fabricated items or modifications (e.g. installation of audio/visual equipment in lecterns). Include complete parts lists and, as required, schematic diagrams.
    - g. Submit mounting and support details for distributed ceiling loudspeakers, and all other items mounted overhead complete with parts lists and dimensions. Include a full plan view, front elevation, and side elevation of each item with corresponding support structure and mounting hardware. Verify load ratings of all hanging components including attachment hardware. Details shall be stamped by a structural engineer registered in the state of Colorado.

C. Samples

1. Submit electronic copies of any custom programming including source codes. Include printed copies of all control screens, wiring pages, etc.
2. Provide product samples as specified in Part 2.

D. Quality Assurance/Control Submittals

1. Maintain a full set of Shop Drawings at the Project site marked up to indicate actual locations, wattage tap settings and, in general, the true state of the installation. Furnish one initial set of record drawings along with the results of all source quality control tests specified in Part 2 and field quality control tests specified in Part 3 to the Architect's Consultant for use during acceptance testing and equalization. Submit two (2) sets and one (1) set of files on cd-rom disk or portable hard drive of drawings showing "as installed" work to the Consultant for review. If 'as installed' documents are rejected, correct and resubmit in the manner specified.

E. Closeout Submittals

1. Drawings:
  - a. After acceptance of 'as installed' documents, submit the quantity of sets a required under Section 01 78 00 and two (2) additional sets of the record drawings each consisting of the following:
    - 1) One (1) set of full size prints
    - 2) One (1) set of reduced B size prints
    - 3) One (1) set of CAD drawing files on cd-rom media.

**1.04: Quality Assurance**

A. Qualifications

1. Submit the following contractor qualifications:
  - a. A completely filled out AIA Document A305 Contractor's Qualification Statement for installer showing a minimum of five years experience installing systems of similar size and scope to the Work specified in this Section.
  - b. Evidence of an in-house electronic service department:
    - 1) List names and certifications of full-time service technicians.
  - c. List in-house electronic test equipment meeting the following minimum specifications for use during the source quality control tests specified in Part 2 and field quality control tests specified in Part 3 as well as use by the Architect's Consultant at the project site during acceptance testing and equalization.
  - d. Evidence of full-time personnel with experienced on projects of similar size, scope, and construction schedule to the Work of this Section.
  - e. List the name, date of employment, qualifications and experience of the installation supervisor for this project.
  - f. List the company's drafting capabilities including the name, date of employment, qualifications and experience of the employee who will draft shop drawings and project record drawings for this installation.
  - g. List the names, dates of employment, qualifications and experience of all other personnel to be used on this project.
2. Submit a statement that the bid is based upon specified products or accepted substitutions by systems design consultant.
3. Submit a work plan indicating scheduling of employees and time frames for shop drawings, ordering of equipment, installation, testing, punch-list correction, and instruction.

B. Regulatory Requirements

1. Obtain all required permits and inspections.
2. Furnish material and workmanship for this work in conformance with all code requirements.
3. Obtain review from compliance officials responsible for enforcement of applicable codes and regulations to establish that the work complies with all requirements of reference codes indicated herein. Make corrections, changes acceptance, operation, and/or compliance with the final submittal as described herein.

C. Field Samples

1. Before delivery of equipment to the job site, submit test reports for all measurements specified under Source Quality Control Tests.
2. Before delivery to the job site, submit photographs depicting the quality of wiring and grounding within equipment racks.
3. Immediately after installation, submit photographs showing cable entries and terminations within equipment racks, enclosures and pedestals at the job site.

**1.05: Delivery, Storage, and Handling**

A. Packaging, Shipping , Handling , and Unloading

1. Coordinate with Owner's Representative for any equipment and materials to be delivered or stored on site.

B. Storage and Protection

1. Provide appropriate protection of stored and/or installed equipment from damage to the item or damage to other work, or finishes.

### **1.06: Project Conditions**

- A. Project Environmental Requirements
  1. Seismic Safety
    - a. Observe mechanical and electrical support means of all installed equipment as required for the seismic hazard zone for this installation. Refer to Federal Emergency Management Agency (FEMA) Document 303: Recommended Provisions for Seismic Regulations for New Buildings and Other Structures. Also refer to any applicable local building codes.
    - b. All equipment racks are to be anchored with suitable anchors to meet safety standards.
    - c. Appropriate safety attachments as required for overhead mounting of devices.
    - d. Shock and/or vibration isolation of equipment or fixtures as required.
  3. No Asbestos containing materials shall be used under this section. The contractor shall ensure that all materials incorporated in the project are Asbestos free unless specifically authorized in writing by the Owner.
- B. Existing Conditions
  1. Verify all project site conditions applicable to the Work of this Section. Notify the Architect in writing of any discrepancies, conflicts, or omissions prior to bid opening. Otherwise, correct these at no additional cost to the Owner.
  2. Continue to monitor the project site. If conditions develop requiring a need to vary from the Specifications or Drawings, notify the Architect's Consultant immediately in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and on approval, proceed with the necessary changes without additional cost to the Owner.
- C. Provide system warranty for a period of one (1) year against faulty materials and defects in workmanship. In addition to the above warranty, honor any manufacturer warranties that exceed this period of time.
- D. During the system warranty period, answer all service calls and requests for information within 24 hours. Repair or replace faulty materials and correct faulty workmanship within 24 hours of all service calls.
- E. Register warranty in the Owner's name for any product with a manufacturer's warranty stipulated in the Contract Documents.

### **1.07: Owner's Instructions**

- A. At the time of substantial completion, submit the system Operation Manual and the Maintenance Data Manual. Neatly bind each with tabbed dividers between sections and include a title page with space for submittal stamps.
- B. Operation Manual
  1. Table of Contents
  2. Typed description of each system including key features and operational concepts (e.g. remote control features, switching or routing functions, patch points, mixing and linking capabilities).
  3. Setup diagrams and typed instructions for use in typical situations as directed by the Architect's Consultant.
  4. Small scale plans showing locations and circuit numbers for all system outlets and receptacles.

5. Single-line block diagrams showing all major system components.
  6. Two sets of A size drawings showing the components and wiring in each individual rack. One drawing of each rack shall be mounted in a plastic jacket to the rear door of the associated rack. The other complete drawing set shall be included in the manual.
  7. Manufacturer's operation manuals for equipment intended for operation by system users (e.g. tape decks, VCRs, communication equipment).
  8. A properly licensed working copy of the latest version of any and all software required to operate or configure the systems specified herein shall be a part of the system supplied. This includes, but is not limited to, all software, firmware and hardware required for configuration, adjustment, diagnosis and repair.
  9. All software shall be fully documented, and that documentation included.
  10. Software shall be included in its "installable" state CD-ROM or other appropriate format. Back-up of the working software may be provided as an additional inclusion. Disk images are unacceptable.
  11. Any and all user definable software configurations and/or programming shall become the sole property of the owner. This includes all source code, source code copyrights, and related documentation.
  12. The compiler shall be property of the owner with all related documentation.
  13. Key schedule cross-referencing all keys to their respective functions.
- C. Maintenance Data Manual
1. Table of Contents
  2. Company name, address, telephone number and contact name for system service or maintenance.
  3. Listing of all equipment and materials with names of manufacturers and model numbers or part numbers.
  4. Catalog data sheets displaying manufacturer's names, addresses, and telephone numbers.
  5. Product manufacturers' warranties and a typed one-year system warranty explicitly covering all materials and labor.
  6. Manufacturers' service manuals for all major equipment items.
  7. Test documentation showing results of source quality control tests, field quality control tests, acceptance testing, and equalization. Document final settings for all non-user devices and controls after completion of acceptance testing and equalization including raw and equalized house curves. Document the physical position of settings as well as input and output signal levels measured in dBmv.
  8. Provide a recommended preventative maintenance schedule with reference to the applicable pages in the manufacturer's maintenance manuals. Where inadequate information is provided by the manufacturer, provide the information necessary for proper maintenance.
- D. Electronic Submittal: In addition to hard copy submittals, submit all files necessary to produce the above submittals as follows:
1. Transportation media shall be in IBM-type structure on CD-ROM or other appropriate format.
  2. A Disk Master File List ( in text format shall be placed on the CD-ROM or other appropriate format with a short description of files on that disk.

3. A Master File List in text format shall be placed on each CD-ROM or other appropriate format with a short description of files in the submittal.
  4. Drawings shall be in AutoCAD R2013 or later drawing (.DWG) format. Drawing Exchange File Format (.DXF) is not acceptable. All XREFs, fonts, and other drawing parts necessary to the drawings shall be included
  5. Word processing files shall be in Word format. Graphs and charts shall be in Excel format. Any graphic images necessary for the reproduction of the submittals shall be included in the files, and shall be included in JPEG (.JPG) file format.
  6. Manufacturers' data sheets, equipment manuals, and other documentation provided by the Manufacturers to the Contractor or documents that are similarly not otherwise available to the Contractor in electronic format shall be excluded from this requirement.
- E. Keys: Submit in triplicate all keys required for access to and operation of the systems.

### **1.08: Commissioning**

- A. Furnish one initial set of product brochures and owner's manuals to the Architect for use during acceptance testing and equalization.

## **PART 2 PRODUCTS**

### **2.01: General**

- A. Equipment, excepting Owner Furnished Equipment (OFE), and materials shall be new, latest version at time of bid and shall conform to applicable UL, CSA, or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.; equipment with significant or disfiguring cosmetic flaws will be rejected.
- B. Install all rack mounted equipment with stainless steel 10-32 pan head machine screws with flat black plastic washers protecting equipment panel.
- C. Provide security covers on non-user-operated equipment having front panel controls. Install covers at the conclusion of Acceptance Testing.
- D. Provide rack slides and mounts equal to those of the original manufacturer for the OFE requiring rack mounting. Where no same manufacturer mount is available, contractor shall supply custom mounts as manufactured by Middle Atlantic Audio Products.

### **2.02: Materials**

- A. Substitutions
  1. Only substitutions that are approved by the Architects Consultant and the Owner prior to the bid opening will be accepted.

### **2.03: Equipment**

- A. Audio Equipment
  1. Ceiling Speaker (Type A). 6.5" LF /Dome HF full range flush fitting ceiling speaker assembly. Tap Select: Rotary, 60 / 30 / 15 / 7.5 w at 70.7V. 91 dB (minimum) for one watt @ one meter, Grill assembly paint-able when using speaker protection paint mask.  
Approved Products:
    - a. JBL Control 226C/T
    - b. Tannoy CMS603ICT
  2. As Approved
  3. Surround Speaker - Low profile in-wall speaker 6" 90 degree concentric, 110 degrees coverage angle (1kHz to 6KHz), with a frequency response of 75 Hz - 51 kHz and sensitivity 91 dB (1 W = 2.83 V for 8 Ohms) Power Handling 90W average and Peak 360 Watts. Approved Products:

- a. Tannoy IW6TDC with:
  - b. Tannoy IW6 Back Can
  4. As Approved
  5. In Wall Speaker - Low profile in-wall two way speaker with 6.5" Low Frequency and 1" titanium Dome Tweeter with a bandwidth performance of 38 Hz – 20kHz and constant voltage taps of 70 V: 30 W, 15 W, 7.5 W & 3.7 W. Approved Products:
    - a. JBL Control 126 WT with:
      - 1) MTC-126RIF Rough-In Frame
    - b. As Approved
  6. Soundbar Speaker – Custom-tailored Left / Center / Right speaker to match the exact width and finish of specified display. Each channel consisting of 5" low frequency (two for center channel) and 1" high frequency driver per channel. 88dB sensitivity at 2.83V/1m 6 ohm (Left/Right) / 8 ohm (Center) input impedance. Nominal coverage 111 degrees (horizontal) by 140 degrees (vertical). Approved Products:
    - a. Leon Hz500 (width to match display) with:
      - 1) Leon HzMMB-UT wall mounting bracket or
      - 2) Leon HzUMB-UT display mount bracket
    - b. As approved
  7. Digital Signal Processor (DSP): Open architecture digital signal processor for mixing, routing, equalization, dynamics and signal alignment. Phantom powered microphone and line level inputs, in groups of four, Line level outputs, in groups of four. Windows compatible open architecture, system designer software, Ethernet control network. Approved products:
    - a. BSS London 800
    - b. Peavey Nion
    - c. QSC Q-Sys
    - d. As approved
  8. Power Amplifier (PA-3). Audio Power Amplifier, 8 Channel - 160 W/ch. @ 8ohms / 200 W/ch. @70V Inputs: Line level balanced inputs, on phoenix type connectors. Outputs: 180 watts per channel (minimum) at 8 ohms or 70 volts, on screw terminal barrier strip. Approved Products:
    - a. Crown CTS8200A
    - b. As Approved
  9. Volume Control (Wall Mount) – 50 Watt 70 volt stepping attenuator with two piece decora and stainless plate cover assembly. Approved products:
    - a. Lowell 50LVC-DSW
    - b. As approved
  10. Volume Control (Rack Mount) - 50 Watt 70 volt stepping attenuator with panel overlay for custom mounting. Approved products:
    - a. Lowell 50LVC-RM with:
      - 1) Custom Blank rack panel drilled and labeled for each applicable zone.
    - b. As approved
- B. Video Equipment
1. 55" LCD HDTV - Hospitality Grade 55" Class (55" diagonal) high definition (1,920 x 1,080) edge-lit LED backlighting LED Smart display, thin bezel, RS-232C control capability, 240 Refresh Rate, built-in digital tuner. Approved Products
    - a. Samsung HG55ND678EFXZA with:
      - 1) Chief LSA1U Wall Mount Bracket
    - b. As Approved
  2. 65" LCD HDTV - Hospitality Grade 65" Class (65" diagonal) high definition (1,920 x 1,080) edge-lit LED backlighting LED Smart display, thin bezel, RS-232C control capability, 240 Refresh Rate, built-in digital tuner. Approved Products
    - a. Samsung HG65AD890UK with:

- 1) Chief LSA1U Wall Mount Bracket
    - b. As Approved
  3. 75" LCD HDTV - Hospitality Grade 75" Class (75" diagonal) high definition (1,920 x 1,080) edge-lit LED backlighting LED Smart display, thin bezel, RS-232C control capability, 240 Refresh Rate, built-in digital tuner. Approved Products
    - a. Samsung HG75NC890AFXZA with:
      - 1) Chief LSA1U Wall Mount Bracket
    - b. As Approved
  4. 80" LCD HDTV – Commercial Grade 80" Class (80" diagonal) high definition (1,920 x 1,080) edge-lit LED backlighting LED display, 0.4" bezel, RS-232C control capability, 240 Refresh Rate, built-in digital tuner. Approved Products:
    - a. Sharp LC-80LE661U with:
      - 1) Chief LSA1U Wall Mount Bracket
    - b. As Approved
  5. Memory Care LCD Displays – Hospitality (32"/ 42" / 50" Class) LCD HDTV flat panel display with integrated QAM/ATSC Tuner and capable of hospitality content provider control interface. Approved products:
    - a. Owner Furnished display through FFE agreement with:
      - 1) Peerless SF640P Low Profile Mounting Bracket
    - b. As approved
  6. Surround Receiver - Rack mount multi-channel surround receiver with (8) HDMI: 7 (back), 1 (front) inputs with (2) HDMI: 1 (main; with ARC), 1 (zone) output for digital video and (2) assignable Component Video (Y, Pb/Cb, Pr/Cr). (10) Analog Audio RCA (5 sets of assignable stereo inputs), (3) Component Video (assignable), (2) Coax Digital Audio (assignable), and (2) Optical Audio (assignable) audio inputs. Network audio support for DLNA v1.5, AirPlay Audio Streaming, Lossless audio formats: FLAC / ALAC / WAV / FLAC HD 192/24 / ALAC 192/24 / WAV 96/24, DSD Audio Streaming, Gapless Playback (WAV, FLAC), Compressed audio formats: MP3 / WMA / AAC, and Internet Radio. Multichannel support for DTS HD Master, DTS ES, DTS 96/24, Dolby TrueHD, Dolby Digital EX, Dolby ProLogic IIz, Audyssey DSX (with MultEQ XT PRO), DTS Neo:X, and Multichannel Stereo. Powered speaker outputs (105 Watts @8ohm): Front R, Front L, Center, Surround R, Surround L, Surround Rear R, and Surround Rear L. Network and RS232 control. Approved products:
    - a. Denon AVR-X3100W Rack
    - b. As approved
  7. UTP TX / UTP RX, Type 1 – Matched transmission and receiver endpoint 4K HDMI® over HDBaseT® Extender w/IR & RS-232 to digital video over shielded CAT-6 cable. Approved products:
    - a. Crestron HD-EXT3-C-B\_SYSTEM
    - b. As approved
    - c. As approved
- C. Source Equipment
  1. Cable Set Top Box – Cable TV QAM based encrypted signal tuner as provided under Owner contract. Approved products:
    - a. Owner Furnished Receiver from CATV Service provider with:
      - 1) Rack Mounting Bracket or Shelf
    - b. As Approved
  2. Background Music Receiver (BGM RCVR) - Network based Background Music Receiver as provided under Owner contract. Approved products:
    - a. Owner Furnished Receiver from Background Music Service provider with:
      - 1) Rack Mounting Bracket or Shelf
    - b. As Approved
  3. Satellite Receiver (SAT RX, DishNet Legacy). Dish Network Satellite Receiver with HDTV HDMI output. Approved products:
    - a. Dish Network Duo ViP 722K with:



- 1) Rack Mounting Bracket or Shelf
    - b. As approved
  4. Satellite Receiver (SAT RX, DishNet Smartbox System). Dish Network Satellite Receiver with HDTV HDMI output. Approved products:
    - a. 4k Joey with:
      - 1) Rack Mounting Bracket or Shelf
    - b. As approved
  5. Satellite Receiver (SAT RX, DirectTV Legacy). Direct TV Satellite Receiver with HDTV HDMI output. Approved products:
    - a. HR24 with:
      - 1) Rack Mounting Bracket or Shelf
    - b. As approved
  6. Satellite Receiver (SAT RX, DirectTV Genie). Direct TV Satellite Receiver with HDTV HDMI output. Approved products:
    - a. HR44 with:
      - 1) Rack Mounting Bracket or Shelf
    - b. As approved
  7. Blue Ray Player – Rack mount front load video and audio player with supported formats including BD-Video, BD-R, BD-RE, DVD-Video, DVD-Audio, DVD+R, DVD+RW (Video mode, AVCHD format), DVD-R, DVD-RW (Video mode, AVCHD format) and Audio CD (CD-R, CD-RW). Using the built-in LAN port, users may optionally access additional content via BD Live. Front-loading USB slot delivers access to MP3, WAV, FLAC, MP4, WMV, JPG, PNG, and GIF files. RS-232C and IP control capability. Supports DTS-Master Audio, DTS-HD High Resolution Audio, DTS Digital Surround, Dolby TrueHD, Dolby Digital (AC-3), Dolby Digital Plus (7.1ch) surround formats though digital AES/EBU coaxial output and stereo (Left / Right) through balanced and unbalanced analog audio outputs.. Approved products:
    - a. Denon DN-500BD
    - b. As approved
  8. CD/ Media Player with Bluetooth and AM/FM Tuner - Rack mount front load CD audio player with supported formats including CD: CD-DA (CD-TEXT), CD-ROM (ISO9660), CD-R, MP3-CD and USB (FAT16 / FAT32). AM/FM Tuner w/ dedicated audio out for multi-room use. Bluetooth Version 3.0, Internal 2 TB file storage, auxiliary 3.5mm TRS input. Balanced and unbalanced analog audio outputs. IR control interface. Approved products:
    - a. Denon DN-300Z
    - b. As approved
- D. Control Systems
1. Main Rack Control Processor – 3-Series®; real-time, preemptive multi-threaded/multitasking kernel; Transaction-Safe Extended FAT file system; supports up to 10 simultaneously running programs, 512 MB SDRAM, 4 GM Flash Memory, (1) 10/100 Mbps auto-switching TCP/IP Ethernet, (1) USB, (1) RS232/422/485, , (1) RS232, (8) IR/Serial communications. Additionally, (8) Digital Logic in/out and (8) Relay Contact closures. Approved products:
    - a. Crestron CP3 with power supply
    - b. As approved
  2. Theater Rack Control Processor - 3-Series®; real-time, preemptive multi-threaded/multitasking kernel; Transaction-Safe Extended FAT file system; supports up to 10 simultaneously running programs, 256 MB DDR3 SDRAM, 4 GM Flash Memory, (1) 10/100 Mbps auto-switching TCP/IP Ethernet, (1) USB, (1) RS232/422/485 (1) IR/Serial communications. Additionally, (2) Digital Logic in/out and (2) Relay Contact closures. Approved products:
    - a. Crestron RMC3 with power supply
    - b. As approved

3. Control Card Enclosure / Cards – Enclosure to accept control card for support bidirectional RS-232, 422, or 485; IR or 1-way serial; 0-10V analog inputs; digital logic inputs or outputs; and low-voltage relay outputs. Approved products:
  - a. Enclosure
    - 1) Single Slot - Crestron CEN-CI3-1 with power supply
    - 2) Three Slot - Crestron CEN-CI3-3 with power supply
  - b. Cards
    - 1) (3) RS232/422/485 Card – Crestron C3COM-3
    - 2) (16) Digital I/O Port Card - Crestron C3IO-16
    - 3) (8) IR Serial Port Card – Crestron C3IR-8
    - 4) (8) Relay Card – Crestron C3RY-8
    - 5) (16) Relay Card – Crestron C3RY-16
  - c. As approved
4. AV Network Switch (Type 1) – Sixteen 10/100/1000Base-T auto-sensing Gigabit Ethernet w/PoE port managed switch complying with IEEE 802.3, 802.3u, 802.3ab, 802.3bc, 802.3af, 802.3at Type 1 and 2 network standards. Approved products:
  - a. Crestron CEN-SWPOE-16
  - b. As approved
5. AV Network Switch (Type 2) – Five 10/100/1000Base-T Ethernet w/PoE on four port port switch complying with IEEE 802.3, 802.3u, 802.3ab, 802.3x, and 802.3af network standards. Approved products:
  - a. Crestron CEN-SW-POE-5
  - b. As approved
6. AV Wireless Access Point - IEEE 802.11a/b/g/n Wi-Fi® protocol Dual Band, 2.4 GHz and 5 GHz (5.15-5.25 GHz or 5.8 GHz), access point with speeds up to 900 Mbps (450 Mbps @ 2.4 GHz, 450 Mbps @ 5 GHz). 600mW Transmit Power. Security standards include 64 & 128-bit WEP, WPA™, WPA2™, WPA-PSK, WPA2-PSK. PoE Powered utilizing 1.25 A @48VDC utilizing companion PoE injector. Approved products:
  - a. Crestron CEN-WAP-1500
  - b. As approved
7. 10” Touch Control Panel – 10.1 inch (257 mm) diagonal TFT Active matrix color 16:10 WXGA (1280 x 800 pixels) Edgelit LED Projected Capacitive LCD touch panel. Display brightness 400 nits (cd/m<sup>2</sup>), 16.4M/24-bit color depth, with contrast ratio of 800:1. Ethernet IEEE 802.3at Type 1 (802.3af compatible) Class 3 (12.95W) PoE Powered at 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP, IEEE 802.3af and 802.3at. Approved products:
  - a. Crestron TSW-1050 with:
    - 1) TSW-UMB-PMK / TSW-UMB Pre-Construction Wall Mount Kit (As Required)
    - 2) Custom Rack Mount Panel (As Required)
  - b. As approved
8. 7” Touch Control Panel – 7 inch (178 mm) diagonal TFT Active matrix color 15:9 WVGA (800 x 480 pixels) Edgelit LED Projected Capacitive LCD touch panel. Display brightness 300 nits (cd/m<sup>2</sup>), 262k/18-bit color depth, with contrast ratio of 300:1. Ethernet IEEE 802.3at Type 1 (802.3af compatible) Class 3 (12.95W) PoE Powered at 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP, IEEE 802.3af and 802.3at Approved products:
  - a. Crestron TSW-750 with:
    - 1) TSW-UMB-PMK / TSW-UMB Pre-Construction Wall Mount Kit (As Required)
    - 2) Custom Rack Mount Panel (As Required)
  - b. As approved

- E. RF Distribution
  - a. Refer to Section 27 41 30.
- F. Miscellaneous
  - 1. Main Equipment Cabinet - Pull Out Enclosed Equipment Rack. Approved products:
    - a. Middle Atlantic Middle WR-44-42 44 Space (77") 36" Deep Rotating Roll Out Rack System with:
      - 1) PD-2X620J 12 Outlet Dual 20 Amp Power Distribution
      - 2) LVFD-44 Vented Front Door
      - 3) BB-44-1 Grounding Buss Bar
    - b. As Approved
  - 2. Wall Mount Rack (Type 1) - Approved products:
    - a. Middle Atlantic EWR-12-22 with:
      - 1) BB-12 Grounding Buss
      - 2) PD-815SC-NS Power Strip
      - 3) LPB-\*\*\* Horizontal Cable Management
    - b. As Approved
  - 3. Wire and Cable
    - a. The following serves as a reference standard for quality and performance requirements.
    - b. Microphone / Line Level:
      - 1) Belden 1800B (non-plenum) or 1801B (plenum)
      - 2) As approved
    - c. Speaker Cable, Low Impedance:
      - 1) Belden 5000UE (non-plenum) or 6000UE (plenum)
      - 2) As Approved
    - d. Speaker Cable, Constant Voltage:
      - 1) Belden 5300FE (non-plenum) or 6300FE (plenum)
      - 2) As Approved
    - e. Control Signal (Crestron):
      - 1) Belden 1502R (non-plenum) or 1502P(plenum)
      - 2) As Approved
    - f. RF Coaxial Cable (Trunking)
      - 1) Belden 1523R (non-plenum) or 1523P(plenum)
      - 2) As Approved
    - g. RF Coaxial Cable (Drop)
      - 1) Belden 539945 (non-plenum) or 539948(plenum)
      - 2) As Approved
    - h. Video (Under 125')
      - 1) Belden 1505A (non-plenum) or 1506A(plenum)
      - 2) As Approved
    - i. Video (125' – 250')
      - 1) Belden 1604A (non-plenum) or 1695A(plenum)
      - 2) As Approved
    - j. UTP Network
      - 1) Belden 3612 006A1000 (non-plenum) or 3613 D15A1000 (plenum)
      - 2) As Approved
  - 4. Terminations. Refer to Part three of this specification for termination practice requirements.

- a. Type 1 - Low level (microphone, line level, control system) signal wiring. Acceptable products:
  - 1) Wago 280 series quick connect blocks with Wago 210 mounting rail and Wago 216 series ferrules crimped with a Wago 260 series crimp tool. No exceptions or substitutions.
- b. Type 2 - High level (speaker, DC power) signal wiring. Acceptable products:
  - 1) Wago 280 series quick connect blocks with Wago 210 mounting rail and Wago 216 series ferrules crimped with a Wago 260 series crimp tool. No exceptions or substitutions.
- c. Type 3 - Category 6 data wiring. Acceptable products:
  - 1) Industry standard 110 style punch down blocks.

## **2.04: Fabrication**

- A. Shop Assembly:
  - 1. Complete all custom fabrication work at the shop.
  - 2. Verify the depth of each rack prior to assembly to ensure that mounted equipment will fit completely inside with the rear door closed. Install all rack-mounted equipment and test the systems before delivery of equipment racks to the project site.
  - 3. Fabrication Tolerances

## **2.05: Source Quality Control**

- A. Tests
  - 1. After assembly of rack systems in the shop, measure, and record the DC resistance between the racks ground bus bar and the chassis of all rack-mounted components. Also measure and record the DC resistance between the rack ground bus bar and the signal common for all components.
  - 2. Use a sine-wave signal generator, dual trace oscilloscope and dBm meter to measure and document the level, which produces clipping at each component input used in the system.
  - 3. Using a +4 dBm sine-wave input, set controls of each component to produce a +4 dBm sine-wave output. Under these operating conditions (unity gain), note the presence of any waveform distortion, interference, or oscillations. Take corrective action to eliminate the anomalies and document the corrective measures
- B. Verification of Performance
  - 1. In the shop, photograph the interconnect wiring within racks including patch panels and grounding to show the quality of workmanship and compliance with the specified grounding procedures.
  - 2. Submit the test reports and photographs to the Architect's Consultant before delivery of racks to project site.

## **PART 3 EXECUTION**

### **3.01: Installation**

- A. Execute all work in accordance with the NEC, NESC, and with all local and state codes, ordinances, and regulations.
- B. Mount all equipment to be installed over public areas in a manner adequate to support the equipment loads with a minimum safety factor of five, using methods recommended in the referenced Handbook for Riggers and in JBL Technical Notes Volume 1, Number 19. Use

- attachment hardware with a minimum SAE Grade 5 load rating. Do not use formed eye bolts or lag screws for support of suspended equipment.
- C. Firmly and permanently, attach electrical boxes, enclosures, and permanent equipment to the building. Rigidly mounted equipment and devices shall be plumb and square.
  - D. Choose colors and finishes of all exposed and custom fabricated items and labels to blend in with the surroundings as approved by the Architect.
  - E. Install equipment in accordance with manufacturers' recommendations. Ensure that levels and impedances are properly matched between components. Verify that projector distances and lensing are appropriate for the corresponding screen sizes.
  - F. Provide shaft locks or security covers on all non-user equipment as directed by the Architect's Consultant during acceptance testing and equalization.
  - G. Wireless Systems:
    - 1. Ensure that all wireless systems operate on different frequencies from each other and from any other transmitters in the area.
    - 2. Coordinate frequency selection for compatibility with local RF environment.
  - H. Grounding and Shielding
    - 1. Mount and enclose all electrical and electronic equipment in metal enclosures or equipment racks.
    - 2. Use EMT type conduit for all wiring outside of equipment racks.
    - 3. Mount equipment racks in a manner which provides electrical isolation from the building structure and electrical raceways. Use flexible conduits and PVC fittings to provide insulated connections between equipment racks and the building electrical raceways.
    - 4. Ground the chassis of all rack mounted components in accordance with the Drawings and verify a D.C. resistance between each chassis and the rack ground bus of no more than 0.01 ohms.
    - 5. Ground the shields of interconnecting wires on one end only in accordance with the Drawings and treat the unused opposite ends as described below under Wiring Practices. Shield drain wires shall be insulated in all instances by use of appropriately sized black heat shrink tubing equal to Alpha FIT-221 series.
  - I. Wiring Practices
    - 1. Where specific instructions are not given, perform all wiring in strict adherence to standard broadcast and sound engineering practices as described in the referenced Broadcast Audio Equipment for AM, FM, Television and in Sound System Engineering.
    - 2. Group all wiring into the following classifications by power level or signal type:
      - a. Microphone Level: less than -20 dBm.
      - b. Line Level Audio and DC Control Circuits: -20 dBm to +30 dBm.
      - c. Speaker Level: greater than +30 dBm.
      - d. Video/RF Circuits
      - e. AC Power Circuits
  - J. Maintain a minimum six inch separation between wiring of different level classifications wherever possible. Otherwise, cross them perpendicular to each other. Where wiring of different level classifications share a common enclosure or junction box, provide metallic isolation barriers to completely electrically separate wiring groups.
  - K. Neatly harness wires together within racks by power level classification using horizontal and vertical wiring supports as required. Rigidly support all wires within twelve inches of connection points.
  - L. Observe consistent polarity throughout the audio systems as follows:

1. XLR Type Connectors
    - a. Positive = Pin 2
    - b. Negative = Pin 3
    - c. Common = Pin 1
  2. TRS Type Connectors
    - a. Positive = Tip
    - b. Negative = Ring
    - c. Common = Sleeve
- M. Use only balanced differential inputs throughout all sound systems unless noted otherwise. Use approved transformers to convert all unbalanced inputs to balanced inputs. Output signals may be unbalanced if inputs of subsequent devices are within the same rack. Otherwise use approved transformers to balance the outputs.
- N. Exercise care in wiring to avoid damaging the cables and equipment. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
- O. Cut off unused wire ends approximately one-half inch (1/2") past the wire jacket. Fold them back over the jacket, and secure in place with heat-shrink tubing.
- P. Make connections using rosin-core solder or approved mechanical connectors.
- Q. Terminate all field wiring in terminal boxes mounted to the walls in each equipment room prior to connection to any equipment or devices unless otherwise noted. All equipment in each equipment room shall connect to the field wiring at the appropriate terminal box. Field wiring shall not terminate directly in equipment racks unless otherwise noted. Provide 10% spare terminals at each location. Label each terminal with a unique number. Video, RGBS, and RF cables are exempted from this requirement.
- R. Do not splice cables of any signal category under any circumstances without prior approval of the Architect's Consultant.
- S. All cables shall originate and terminate at active or passive devices; cables shall not be spliced. Where several devices are in close proximity, utilize approved housing-to-housing connectors and adapters.
- T. All cables terminated in a connection plate mounted in an enclosure shall be dressed to allow removal from the enclosure and sufficient cable length for service or re-termination. Plate shall set on floor or freely swing clear.
- U. Form Television distribution system MATV / CATV trunk and feeder expansion loops, where required, using approved cable forming tools. Loops formed by hand will be rejected and be deemed cause for replacement of the entire span of cable.
- V. Prepare television system semi-rigid cable in accordance with manufacturer's recommendations, with approved coring, cleaning, preparation and assembly tools. Do not score center conductor; utilize tubing cutters to trim the outer conductor. Completely de-burr all conductors. Utilize approved center conductor cleaning tool; degrease the connector and cable prior to termination. Torque connectors to the manufacturer's recommended values.
- W. A time-domain-reflectometer (TDR) or optical-time-domain-reflectometer (OTDR), with paper tape chart recorder, shall be used to test and record each cable reflection response. There shall be no RF or AC signals on the cable. The end not connected to the TDR or OTDR shall be unconnected. The cable response shall be flat and remedial action shall be taken as necessary.
- X. Test and record cable-section time-domain-reflectometer (TDR) or optical-time-domain-reflectometer (OTDR) signature, for structural return loss before (on the reels) and after cable has been installed, but not terminated. Attach records on forms attached to this section.
- Y. All coaxial or triaxial video or RF connections to plates or panels in boxes, pedestals, racks or any similar location with limited clearance, that would prevent that the associated cable manufacturer's minimum bend radius from being strictly observed shall be provided with the appropriate right

angle or similar adapter as appropriate.

- Z. All cable installed under this specification which is to be terminated by others for "future" or Owner Furnished Equipment (OFE) in racks, shall be provided with ten (10) feet of slack when dressed to the location of future or OFE equipment. All cable installed under this specification which is to be terminated by others, shall be provided with twenty (20) feet of slack when ending in a rack enclosure. All cable provided under this specifications, to be terminated by others, shall be provided with fifty (50) feet of slack when terminating in an equipment room without a clear point of demarcation, or in a group of racks where the destination is not known.
- AA. Splices in any cable - baseband or RF- are not acceptable, except in cases of difficult "pulls", by prior written approval only; terminate all cables at active or passive devices. Do not splice wire under any circumstances.
- BB. All coaxial connectors shall be crimped with the appropriate hexagonal die crimp tool correct for the combination of cable and connector. Non-ratcheting type crimping tools are not acceptable; the presence of such tools on the job site shall be interpreted as evidence of mechanical connections incorrectly made, and provide sufficient grounds for rejection of all mechanical connections in the system.
- CC. A time-domain-reflectometer (TDR) or optical-time-domain-reflectometer (OTDR), with paper tape chart recorder, shall be used to test and record each cable reflection response. There shall be no RF or AC signals on the cable. The end not connected to the TDR or OTDR shall be unconnected. The cable response shall be flat and remedial action shall be taken as necessary.
- DD. Cable Installation in Conduit and Duct Banks
  1. Pull mandrel one size smaller than the conduit, through entire length of all underground conduits.
  2. Cable pulling lubrication shall be utilized when pulling cable.
  3. A dynamometer shall be used to measure pulling tension during long or difficult runs, The dynamometer is to be placed between the cable puller and the pull line to monitor pulling tension. The manufacturer's pulling tension maximum range shall not be exceeded.
  4. Pulling grips suitable for use with fiber cables shall be applied to the ends of the cable. Consult cable manufacturer to determine appropriate pulling grip and method of attachment. Breakaway or fuse links shall be used at the pulling grip. Insure that the correct "fuse pin" is installed in the fuse link.
  5. Cable caps (heat-shrinking type) shall be used to seal the ends of the cable to protect the cable ends prior to terminating.
  6. Use of cable blocks shall facilitate the bending of cable. For bends between 5 degrees and 45 degrees, a 45 degree cable block shall be utilized. For 45 degree to 90 degree bends, utilize a 90 degree cable block.
  7. The bend radius for all cables shall conform to manufacturers' specifications.
  8. Provide spare cables between terminal cabinets equal to 10% of the installed cables or a minimum of 2 cables of each type cable installed. Provide spare cables between terminal cabinets and equipment racks/consales equal to 15% of the installed cables or a minimum of 5 cables of each type cable installed. Label all spare cables as spares with unique identifiers. Do not use any spare cables without prior approval from the Architect's Consultant.
- EE. Labeling
  1. Label products in a logical, legible, and permanent manner corresponding to the Drawings using wording, format, style, color, and arrangement of text approved by the Architect.

2. Label all panels and wall plates using 1/8" engraved lettering. On dark panels and plates, fill engraving with white paint, and on aluminum or stainless steel panels and plates, fill engraving with black paint.
3. Provide engraved plastic labels similar to Lamicoid, squarely and permanently attached, to label patch panels, barrier strips, terminals, transformers, switches, relays and similar devices as well as the front and rear of all signal processing equipment (e.g., PA, LIM, EQ). Label all controls on distribution amplifiers, mixers, etc. as to the function of each.
4. Label push-button switches with engraved lettering filled with contrasting color paint.
5. Label all permanent wiring on both ends with approved permanent clip-on type or sleeve type markers. Wrap-around adhesive labels will not be accepted unless completely covered with clear heat shrink tubing.

### 3.02: Field Quality Control

#### A. Site Tests

1. General Testing
  - a. Maintain a competent supervisor and supporting technical personnel, acceptable to the Owner during the entire installation. Change of supervisor during the project shall not be acceptable without prior written approval from the Owner.
  - b. Before connecting any equipment to electrical power outlets, measure and record the A.C. voltages between hot, neutral, and ground and verify correct outlet polarity. Verify, test and document correct and safe function of isolated ground power systems.
  - c. Determine the best sequence of energizing systems to minimize the risk of damage.
  - d. After successfully energizing the systems, make preliminary adjustments and document the settings of all controls, parameters of corrective networks, voltages at key interconnection points, gains and losses as applicable. Replicate the unity gain tests performed at the shop and document the absence of any waveform distortion, interference signals, or oscillations.
  - e. Upon completion of the system installation, it shall be the responsibility of the Contractor to perform the necessary adjustments and balancing of all signals, amplifier gain, and other level controls to ensure proper system operation. The system shall be physically inspected by the Owner to assure that all equipment is installed in a neat and workmanlike manner as called for by the plans and specifications.
  - f. Verify the performance parameters of the individual systems following established professional procedures, in addition to those specified herein. Document all acceptance testing, calibration and correction procedures described herein, being careful to include the following information:
    - 1) Performance date of the given procedure.
    - 2) Condition of performance of procedure.
    - 3) Type of procedure, and description.
    - 4) Parameters measured and their values, including values measured prior to calibration or correction, as applicable.
    - 5) Parameters associated with calibration or corrective networks, components, or devices.
    - 6) The names of personnel conducting the procedure.
    - 7) The equipment used to conduct the procedure
2. Audio Testing



- a. Before connecting loudspeaker lines to power amplifiers, measure and record the impedance curves of all lines using a sweep test or impedance bridge at least six frequencies from 125 Hz through 8,000 Hz.
  - b. Test all low level audio cables and connections for continuity and ground faults and correct polarity.
  - c. Apply a sine-wave sweep signal to each loudspeaker system, sweeping from 50 Hz to 5,000 Hz at a sound pressure level that is 10 dB below the loudspeaker's rated electrical input power. Listen for rattles or objectionable noise and correct if apparent.
  - d. Check for proper polarity of loudspeakers by applying music program or pink noise to each system and walking through the transition areas of coverage from one loudspeaker to the next. Transition should be smooth with no apparent shifting of source back and forth from one loudspeaker to the next.
  - e. Achieve uniform distribution of sound from each loudspeaker system after all interior furnishings are in place. Drive each system with one full octave of noise centered at 4000 Hz at a level of 85 to 90 dB. Use a sound level meter that meets ANSI ST 4-1971 Type 2 standards set for slow meter damping and "A" weighting. Take all readings at seated ear height. Adjust speaker angles as necessary to achieve  $\pm 3$  dB over entire seating area. Provide plan of achieved sound distribution from each system, plotted with 4kHz pink noise levels as measured on a 10 foot square grid pattern. The process of equalizing and testing the Sound Systems may necessitate moving and adjusting certain component parts, e.g., loudspeakers. This shall be done without claim for additional payment.
  - f. Provide a list showing all build-out, termination, and pad resistor calculations. List to include measured line and source impedances used in calculations and results of tests after installation, and impedance of all inputs to equipment brought up on patch bay. Impedances in ohms are to be within  $\pm 10\%$  of design value. Levels in dB are to be within  $\pm 1$ dB of design value.
  - g. Test all low level audio cables and connections for continuity and ground faults and correct polarity.
  - h. Using a sine wave signal source, send a 1 kHz sine wave signal out of the mixing console at a level just below clipping as observed on an oscilloscope. Increase the input and then the output gain in turn on each device downstream in the signal path until the oscilloscope indicates the level in and out of each device is just below clipping. Be sure that the clipping threshold of the input attenuator, if the device under test has one, is found before adjusting its output attenuator. If the input attenuator on any device lacks sufficient padding to prevent input clipping, insert the minimum value pad required to prevent input clipping. Adjust the input attenuator on all amplifiers by first disconnecting any loudspeaker.
  - i. Upon completion of initial tests and adjustments, submit written results of tests to Architect/Consultant. In addition, submit written notification that the installation has been completed in accordance with the requirements of the Contract Documents, and is ready for equalization and inspection by representatives of the Architect/Consultant and Owner.
3. CATV Performance - Check all paths and outlets for appropriate compliance with the Performance Standards. Measure levels at all feeder termination points. Compare actual values to design calculations and investigate any difference of more than 2 db, rectify or justify these discrepancies to the satisfaction of the Owner. In all cases, the more stringent of any referenced standard shall apply.
- a. Television Distribution System amplitude standards:
    - 1) Minimum visual sync-tip level: +3 dbmV
    - 2) Maximum visual sync-tip level: +10 dbmV

- 3) Maximum amplitude difference between visual carriers 6MHz apart: 2 db
  - 4) Maximum amplitude difference between any visual carriers: 7 db
  - 5) Minimum visual/aural carrier ratio: 15 db
  - 6) Maximum visual/aural carrier ratio: 17 db
  - 7) Maximum FM station amplitude: -7 dbmV
  - 8) Minimum FM station amplitude: -20 dbmV
  - 9) Maximum variation between FM stations on adjacent channels: 3 db
  - 10) Long-term variations in amplitude: 8 db
  - b. Television Distribution System frequency standards:
    - 1) Visual frequency accuracy: +5 kHz of standard channel frequency
    - 2) Inter-carrier frequency: 4.5MHz, +/- 1kHz
    - 3) FM frequency accuracy: +2kHz of standard channel frequency.
    - 4) Television Distribution System flatness standards:
    - 5) Amplitude response within any TV channel: +0.5 db (-0.75 MHz to +3.6MHz from visual carrier)
    - 6) Amplitude response for entire spectrum (50Hz - 750 MHz): ?4 db
  - c. Television Distribution System fault standards:
    - 1) Maximum hum or low-frequency variations: 2% p-p
    - 2) Minimum visual carrier-to-noise ratio (4MHz BW): 47 db
    - 3) Maximum visual carrier-to-coherent spurious signal ratio (intermodulation): -53 db
    - 4) Maximum Cross modulation ratio: -53 db
    - 5) Maximum reflections within system: -40 db
    - 6) Television Distribution System isolation:
    - 7) Minimum drop-to-drop isolation: 25 db
  - d. Television Distribution System signal leakage:
    - 1) 15uV/M maximum (at 100')
    - 2) Television Distribution System Video Standards:
    - 3) Chroma / Luma Delay: not more than 170 ns
    - 4) Differential Phase: not more than 8 degrees
    - 5) Differential Gain: not more than 10%
    - 6) Sweep and balance reverse system path.
4. CATV Cable Testing - Each Trunk Cable line shall be inspected for proper termination:
- a. Using a standard TV receiver connected to each outlet, observe picture quality. No visible components of cross modulation (windshield wiper effect), ghosting, noise, or beat interference shall appear on the screen of the receiver tuned to any normal signal.
  - b. Carrier-to-noise test shall employ an approved field strength meter. Measurements shall be made at the termination of each Trunk Cable and system extremity. With the normal levels in the system, the field strength meter shall be tuned to the picture carrier of each channel in turn and the meter reading noted. Tune the field strength meter to an unused portion of the spectrum within the passband, read the level of remaining noise in the absence of the signal and algebraically add the meter bandwidth correction factor. Record the difference

between the two readings. Provide calculations or the manufacturer's data concerning the bandwidth correction factor.

- c. System flatness, both forward and reverse, test shall employ an approved high level sweep transmitter receiver pair. Sweep measurements shall be taken at the termination of every branch line termination in the system. Where possible, record sweep results by photographic or computer data logging means.

**B. TEST EQUIPMENT**

1. Provide the following test equipment on site during construction and available to the Owner during final adjustment and acceptance testing:
  - a. Dual-trace oscilloscope - 100 MHz bandwidth, 1 mV/cm sensitivity, TV sync separator and delayed trigger circuit. Acceptable: Tektronix 2247A
  - b. Multimeter - Measurement range, DC to 20,000 Hz, 100 mV to 300 V, 10 ma to 10A. Acceptable: Fluke 75, or as approved
  - c. OTDR configured for 62.5/125 multimode fiber at a wavelength of 1300nm: Tektronix Fibermaster OTDR; Tektronix Tekranger Mini-OTDR; GN Nettest Laser Precision CMA4000;GN Nettest Laser Precision TD-3486 Modular OTDR; or as approved.
  - d. Real Time Analyzer: Ivie IE-30 or equivalent.
  - e. NTSC Television Generator. Acceptable: Tektronix TSG-170A or as approved
  - f. High Level Synchronous Sweep System. Acceptable: Wavetek 1855B/1865B, Wavetek Stealth, Tektronix, Calan, or as approved. OR
  - g. Low Level Synchronous Sweep System equal to Advantest.
  - h. System Analyzer. Acceptable: Wavetek 1885B, Wavetek Stealth, or as approved.
  - i. NTSC Television Waveform Monitor: Acceptable: Tektronix 1730, or as approved.
  - j. NTSC Television Vectorscope: Acceptable: Tektronix 1720, or as approved.
  - k. OTDR: As approved.
  - l. Time Domain Reflectometer: Tektronix 1502B with paper tape recorder or equivalent.

**C. Inspection**

1. Provide a statement of completion certifying that the system is installed and is ready for acceptance testing and equalization to the Architect's.
2. Schedule a time for the Architect's Consultant to perform system acceptance testing and equalization with at least 14 days advance notice.
3. Furnish a technician who is familiar with the system to assist the Architect's Consultant during the acceptance testing and equalization for the duration of time it takes to complete the adjustments (regular time or overtime as required). A minimum of 24 hours, as required to complete the adjustments.
4. Each cable shall be inspected for proper termination.
5. Under the direction of the Architect's Consultant, adjust signal levels and loudspeaker aiming as required to achieve the uniform sound distribution within a tolerance of +2dB.
6. System flatness test shall employ an approved sweep transmitter receiver pair. Sweep measurements shall be taken at the termination of every cable termination in the system. Where possible, record sweep results by photographic means.
7. Record the final settings on all equipment and submit with contract closeout documents.
8. Record final settings on all equipment and submit with contract closeout documents.

9. Heat shrinking tubing shall be shrunk to cover the external connection to amplifier/passive components only after system alignment and acceptance has been completed.
10. Upon completion of initial tests and adjustments, submit written report of tests to the Owner along with all documents, diagrams, and record drawings required herein. Cable SRL, system sweep, Egress / CLI, and all FCC tests shall be performed and submitted. Report shall include date of each test, pertinent conditions such as control settings, etc., test circuit, and test equipment employed. In addition, submit written notification that the installation has been completed in accordance with the requirements of the Contract Documents, and is ready for final equalization and acceptance testing.
11. If the system does not meet criteria or if additional trips to the job site for testing or equalization are required, the Contractor shall reimburse the owner for all expenses and professional time encountered by the Architect and its Consultant.

### **3.03: Cleaning**

- A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.
- B. Clean all areas around system equipment and be sure that the inside of each equipment rack is free of wire stripping and other debris.

### **3.04: Demonstration**

- A. Designate technicians who are familiar with and qualified to operate the systems for instruction of the Owner. Provide instruction of Owner-designated personnel in the design features and proper operation of the systems. Provide a minimum of 24 hours for on-site instruction and videotape the training sessions. Make any Owner requested changes to the control system programming during this time. Coordinate instruction times through the Architect.
- B. Upon completion of the Work, the Owner may elect to verify test data as part of the acceptance procedure. Provide personnel and equipment, at the convenience of the Owner, to reasonably demonstrate system performance and to assist with such tests without additional cost to the Owner.
- C. Three months after final acceptance, the Owner reserves the right to direct changes to the control system software. Such changes shall be made without additional cost to the Owner.

**\*\*\*End Of Section 27 40 00\*\*\***

## **SECTION 27 41 30 - CATV DISTRIBUTION**

### **1.01 Summary**

Work of this Section Includes:

1. 50-1000 MHz bandwidth forward, 5-40 MHz reverse, two-way television distribution system.
2. Cables, TV set jumper cables, connectors, plates and wiring.
3. Off-air RF site survey, if head-end includes over-the-air reception.
4. Coordination with all local satellite service provider companies, premium program suppliers and systems installed by other contractors or the Owner.
5. Miscellaneous conduit and electrical work to connect work of this section to electrical raceway systems provided under Division 26.
6. Furnishing and installation of specified products with all required accessories and related cabling/wiring, supervision, coordination, programming, testing, documentation and instruction to provide a complete and properly functioning system.
7. Section corresponds to 'T' series of the Drawings.
8. Products Furnished But Not Installed Under This Section: pathways, backboards, televisions, mounts, junction boxes and NEMA enclosures indicated on the 'EAV' series drawings

### **1.02 System Description**

- A. The podium portion of the CATV shall consist of forward distribution of analog and digital QAM signals including a channel lineup as negotiated, by Owner, of with CATV service provider content with the injection of several locally orientated HDTV QAM channels on available channel allocations.
- B. The tower portion of the CATV system shall include content capabilities of the distribution plus:
  1. Return path capabilities for intelligent TV control and interfacing to video services.
  2. Injection of Pay per View channels for guest entertainment services as negotiated by Owner.
- C. Expansion capabilities in podium and tower distribution for future moves and changes as desired by Owner for public, back of house, and guest services.
- D. Expansion capabilities in on premises headend to allow addition of locally originated channels as desired

### **1.03 Related Requirements**

- A. Refer to Section 26 05 26 for provision of ground system for all CATV system power circuits.
- B. Refer to Section 26 05 33 for provision of CATV-related raceways, junction boxes and NEMA rated enclosures.
- C. Refer to Section 27 05 36 for provision of cable trays used by CATV systems.

- D. Refer to Section 27 41 00 for co-location of equipment and drops.

#### 1.04 References

- A. Federal Communications Commission (FCC) Part 47
- B. National Cable Television Association (NCTA).
- C. National Electric Code (NEC)
- D. Society of Motion Picture and Television Engineers (SMPTE)
- E. Telecommunications Industries Association (TIA)
- F. Times Fiber Communications, Technical Notes 1029-A, 1061, 1069.
- G. Sumitomo Electric Lightwave Corp., Document # SP-F01-001, Cable Placing, Issue 4

#### 1.05 Submittals

- A. Refer to 01 3300 for submittal procedures. Include one additional copy of each submittal beyond the requirements of Section 01 3300.
- B. Submit all product data and shop drawings together in one package and receive approvals prior to ordering products.
- C. Product Data:
  - 1. Submit catalog data sheets, neatly bound with tabbed dividers between sections. Include a title page and space for submittal stamps.
  - 2. Provide a list of all products in the same order that they appear in the Specifications with each product cross-referenced to Specification paragraph and equipment type or name used in the Specifications and Drawings. Identify all approved substitutions
  - 3. Submit a schedule of finishes indicating proposed materials and colors for all exposed items, subject to Architect's approval.
- D. Shop Drawings:
  - 1. Provide plans and reflected ceiling plans at a scale of not less than 1/8" = 1' and provide details at a scale of not less than 1/4" = 1'.
  - 2. Submit pathway and conduit riser diagrams for all systems specified under this Section showing required conduits and junction boxes along with types and quantities of cables to be contained in each conduit. Show details of weatherproofing, lightning protection and grounding, strain relief and cable support and fire stop protection and wall penetrations through all rated partitions.
  - 3. Submit point-to-point wiring diagrams and typed wire lists identifying all connections, connectors, taps, terminal/punch blocks and all other electronic devices. Indicate locations of all components. Identify all cables and individual wires by type, color and wire number at equipment, between equipment racks and for wiring in conduit. Include expansion loops, cable lengths and cable losses at 54 MHz and 1 GHz and all flat losses. Drawings shall comply with applicable ANSI, NCTA and IEC standards. Provide drawing set cover sheet clearly dimensioning all cable preparation details for each

- coaxial, fiber, UTP and STP cable type and connector utilized in the system. Include on cover sheet calculations for worst case maximum active device cascade for: Carrier to Noise, Composite Triple Beat, Carrier to Cross Modulation, Carrier to Hum and Carrier to second order Distortion. All calculations shall reflect full system loading within the specified pass band regardless of the actual initial channel loading.
4. Submit diagrams of antenna orientation, mounting elevation and attachment hardware schedule. For satellite antennas show orbital arc clearance and elevations rosette on site or roof plan as appropriate, and terrestrial interference surveys as required.
  5. Submit RF site survey including dipole corrected field strength, azimuth, signal grade, station identification and network affiliation for all receivable TV signals, for headend systems with off-air antennas. Report shall include description of the measurement method, test equipment, last calibration date, time & date of survey and name and contact information of the persons conducting the measurements.
  6. Submit rack layouts indicating the proposed arrangement of rack-mounted equipment including cable supports, junction boxes and conduit penetrations.
  7. Submit construction details of all panels, device plates and any other custom fabricated items and approved equipment modifications. Include complete parts lists, schematic diagrams and all dimensions required for proper assembly. Indicate finish materials and color selections, subject to Architect's approval.
  8. Submit mounting and support details for all items mounted overhead, including satellite antennas, off-air antennas, ground blocks and video displays equipment complete with parts lists and dimensions. Include a full plan view, front elevation and side elevation of each unique item with corresponding support structure and mounting hardware. Verify load ratings of all hanging components including attachment hardware. Details shall be signed and sealed by a structural engineer registered in the State of Texas.
- E. Submit samples as required in various specification paragraphs. No materials or equipment shall be installed without receipt of approved samples

### **1.06 Source Quality Control Submittals**

- A. Before delivery of equipment to the job site, submit test reports for all measurements specified under Source Quality Control Tests.
- B. Before delivery to the job site, submit photographs depicting the quality of wiring and grounding within equipment racks.
- C. Immediately after installation, submit photographs showing cable entries and terminations within equipment racks, enclosures and pedestals at the job site.
- D. Field Quality Control Submittals: Prior to the date of Substantial Completion and before scheduling Consultant's testing / adjusting / punch list site visit, submit all specified 'field quality control tests'

### **1.07 Closeout Submittals**

- A. Record Drawings: Maintain a full set of shop drawings at the project site annotated to indicate actual equipment and device locations, and, in general, the true state of the installation. Prior to Substantial Completion, furnish one initial set of record drawings along with the results of all 'source quality control tests' and 'field quality control tests' to the Architect's Consultant for use during acceptance testing and adjusting. After approval of record drawings, submit full size prints

and CAD files on portable solid state drive or CD-ROM in the submittal quantities required by Division 01 plus one additional copy for the Architect's Consultant. Include the following in Record Drawings:

1. Depths of various elements of foundation in relation to survey datum.
  2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
  3. Location of internal utilities and appurtenances concealed in construction references to visible and accessible features of structure.
  4. Field changes of dimension and detail.
  5. Changes made by Revision Order, Directive or other modifications.
  6. Details not in original Contract Drawings.
  7. Coordinates and elevations for all sleeves, utility pipe and any other miscellaneous items installed under this contract. At a minimum, the ends of each line should have the coordinate and elevation indicated.
  8. Layouts of TV distribution system devices showing actual device locations and device values.
  9. Results of all Field Quality Control Tests in this Part 3 of this Section.
- B. System Operation Manual: Furnish one initial set of equipment operation manuals to the Architect's Consultant for use during acceptance testing and adjusting. At the time of contract closeout, submit a System Operation Manual bound with tabbed dividers between sections and including a title page with space for submittal stamps.
- C. Table of Contents
1. Typed description of each system including key features and operational concepts such as remote control features and functionality, switching and routing functions, patch points, amplification, and linking capabilities.
  2. Setup diagrams and typed instructions for use in typical situations as directed by the Owner or Architect's Consultant.
  3. Small scale plans showing locations and circuit numbers for all system outlets and receptacles.
  4. Single-line block diagrams showing interconnections of all major system components.
  5. Two sets of 'A' size drawings showing the components and wiring in each individual rack. Locate one set in the manual. Attach the other copy of each rack drawing to the rear door of the associated rack in a plastic jacket.
  6. Manufacturer's operation manuals for all user-operated equipment.
  7. Properly licensed working copies of the latest version of all software required to operate or configure the systems. Software shall be included in its "installable" state on CD-ROMs or USB drives. Include full software documentation. Additionally, provide any firmware and hardware required for configuration, adjustment, diagnosis and repair.



- All user definable software configurations and programming shall become the sole property of the owner. This includes compiler, source code, source code copyrights and related documentation.
8. Key schedule cross-referencing all keys to their respective functions.
- D. System Maintenance Data Manual – Furnish one initial set of product data sheets to the Architect’s Consultant for use during acceptance testing and adjusting. At the time of contract closeout, submit a System Maintenance Data Manual bound with tabbed dividers between sections and including a title page with space for submittal stamps.
1. Table of Contents.
  2. Company name, address, telephone number and contact name for system service or maintenance.
  3. Alphabetical manufacturer listing for all products specified in this Section along with manufacturers’ addresses and telephone numbers.
  4. Listing of all installed products with model or part numbers, categorized by manufacturer (in alphabetical order).
  5. Catalog data sheets for all installed products
  6. Manufacturer's service manuals for all products specified in this Section including replacement parts lists with specific part ordering numbers.
  7. Recommended preventative maintenance schedule with reference to applicable pages in manufacturers’ service manuals. If a manufacturer does not give inadequate information, provide the information necessary for proper maintenance.
  8. Results of final tests and adjustments performed as part of system commissioning along with approved Source Quality Control and Field Quality Control submissions including the following:
    - a. Proof of performance information on each trunk amp, line extender and end of line device. See Part 3 of this Section for recommended document.
    - b. TDR/OTDR records of all cable reels and installed cable. See Part 3 of this Section for recommended document.
    - c. Main station sweep performance information on all trunk amps and line extenders. See Part 3 of this Section for recommended document.
    - d. Documentation of final settings for all non-user adjusted devices and controls after system commissioning. Include indication of physical settings as well as input and output signal levels.
  9. Manufacturers' warranties and a typed ‘one-year system warranty’ explicitly covering all materials and labor, notarized after system acceptance.
- E. Electronic Closeout Submittals:
- F. Submit solid state drive or CD-ROMs containing all electronic files used in producing the hardcopy Closeout Submittals above. Include a master file list in text format on each CD ROM with a short description of files on that disk.
- G. Provide word processing files in MS Word 2010 or later version. Provide tables, graphs and charts in MS Excel 2010 or later version. Include any graphic images necessary for the reproduction of

the submittals in JPEG (.JPG) file format. Provide drawing files (.DWG) in AutoCAD R2013 or later version. Drawing Exchange Files (.DXF) are not acceptable. Include all XREFs, fonts and other drawing parts necessary to view or plot the drawings.

- H. Keys: Submit in triplicate all keys required for access to and operation of the systems.

## 1.08 Quality Assurance

### A. Installer Qualifications

1. Submit with bid, evidence of bonding capacity as outlined in Request for Proposals.
2. Submit with bid, a completely filled out AIA Document A305 Contractor's Qualification Statement for installing company showing a minimum of five years' experience installing systems of similar size and scope to the Work specified in this Section.
3. Submit with bid, a project staffing plan with resumes indicating certifications (if applicable) and experience of key full-time personnel to be used. Show appropriate experience on projects of similar size, scope and schedule to the Work of this Section.
  - a. List the name, date of employment, qualifications and experience of the installation supervisor for this project.
  - b. List the company's drafting capabilities including the name, date of employment, qualifications and experience of the employee(s) who will draft shop drawings and project record drawings for this installation.
  - c. List the names, dates of employment, qualifications, experience and planned project roles of all other personnel to be used on this project.
4. Submit with bid, evidence of an in house electronic service department:
  - a. List names and certifications of full time service technicians and field technicians that will be involved in system optimization testing and adjusting.
  - b. List in house electronic test equipment to be used for service as well as for 'source quality control tests' and 'field quality control tests' specified in this Section.
  - c. List any portable test equipment available for use by the Architect's Consultant during system optimization testing and adjusting.
  - d. Submit with bid, a work plan indicating scheduling of employees and timeframes for shop drawings, ordering of equipment, installation, testing, correction of punch list items, instruction of Owner and Closeout Submittals.
5. Submit a statement that the bid is based upon specified products or substitutions accepted by the Architect's Consultant during the bid phase.
6. Submit with bid, an annually renewable Service and Maintenance proposal for systems specified in this Section. If accepted, the Service and Maintenance contract shall commence upon conclusion of the one-year system warranty.

## 1.09 Delivery, Storage, and Handling

- A. Delivery and Acceptance Requirements: Refer to Section 01 66 30.
- B. Storage and Handling Requirements: Refer to Section 01 66 30.
- C. Deliver all materials to the job site in manufacturer's containers, as applicable, with each container and each item within each container clearly marked as to item, quantity, size and/or model number.  
RETAIN ALL ORIGINAL MANUFACTURERS INVOICES AND PACKING LISTS FOR

## INSPECTION BY THE OWNER.

- D. Store equipment and materials safely and securely inside at designated areas of the job site in a manner that will not interfere with the work of other trades.
- E. Replace all damaged or defective work or material at no additional cost, prior to acceptance.
- F. Check, and if necessary, clean all systems, equipment, devices and components included in the Work after acceptance and completion of the work of all other trades.
- G. Replace all air filters.
- H. Provide and maintain suitable barriers, guards, fences and signs wherever necessary for the safety of others relative to and/or for the protection of this work.
- I. Protect all materials and equipment to prevent the entry or adhesion of concrete, plaster, unintended paint, or other damaging debris of materials.
- J. Store Television Distribution cable so as to provide access to both ends of each reel to allow TDR structural return loss measurements as specified in this Section. Do not store trunk cable reels flat. Inspect cable reels for shipping damage prior to testing. Uncap and terminate according to manufacturer's recommended procedure.

**1.010 Substitutions**

- A. Refer to Section 01 63 00 for substitution procedures

**1.011 Warranty**

- A. Provide 'system' warranty against faulty materials and defects in workmanship for a period of one year after system acceptance. In addition to this one-year 'system' warranty, honor any longer-term manufacturer warranties on installed products.
- B. During one-year 'system' warranty period, answer service calls and requests for information within 24 hours. Repair or replace faulty materials and correct faulty workmanship within 72 hours of call from Owner or building management office

**1.012 Fiber Optic Cable Safety**

- A. The following warnings shall be posted on the job site if fiber optic interfacing to service provider involves fiber optic transport:

WARNING: PERMANENT EYE DAMAGE CAN RESULT FROM  
LOOKING DIRECTLY INTO A LIGHT BEAM GENERATED BY  
AN LED OR LASER SOURCE OR INTO THE END OF A CABLE  
FIBER CONNECTED TO ONE OR THESE SOURCES.

CAUTION: LIGHT GENERATED BY THESE SOURCES MAY NOT  
BE VISIBLE, YET REMAIN HAZARDOUS TO THE EYE. LOOK  
FOR WARNING LABELS ON SOURCE DEVICES.

- B. Observe all warning signs on equipment and all written safety precautions in the instruction manual or equipment technical manual.
- C. Always handle cable carefully to avoid personal injury. Care should be taken with individual fibers to prevent injury to the eyes or penetration of the fibers into the skin.

## **2.01 Headend Equipment**

1. Headend System for this project will be provided under separate Owners contract with a service provider. Contractor to coordinate installation of CATV distribution with final terminations required by service provider.

## **2.02 Distribution Equipment**

- A. CATV Distribution Use Amplifier. Two-way 1 GHz RF amplifier with active return amplifier with 35 dB forward path gain and 18 dB return path gain. Input equalizer for forward balancing. Approved products:

1. Toner TIBA-37-1000 with
  - a. Forward Equalizer 870 MHz Modules (0 -22 dB in 1dB increments):
    - 1) Blonder Tongue VMI-CEQ8V
  - b. Plug-in Attenuator Modules (1 GHz 0-18 dB in 1 dB increments):
    - 1) Blonder Tongue VMI-AT

2. As Approved

- B. Television Multiport Taps – Non-Power Passing. Tap to direct a portion of the signal for use on drop cables. Pass band; 5MHz – 1 GHz, Return loss; greater than 16 db (5Hz – 1 GHz), Tap to tap isolation; greater than 25 db. Securely attach Taps to cable tray or install in junction box or securely fasten to backboards, as appropriate. Approved products:

1. Toner:
  - a. Two Port: TGT2- (\*)
  - b. Four Port: TGT4- (\*)
  - c. Eight Port: TGT8- (\*)

2. RMS:
  - a. Two Way: 1002WSB
  - b. Three Way: 1003WSB
  - c. Four Way: 1004WSB
  - d. Six Way: 1006WSB
  - e. Eight Way: 1008WSB
  - f. Sixteen Way: 9016K

3. As Approved

- C. Non-Power Passing Directional Couplers. Signal routing, splitting, combining, and coupling applications. Pass band; 5 MHz – 1 GHZ return loss; greater than 20 db, isolation between outputs; 30 db (minimum). Connection is via "F type" connectors. Approved products:

1. Toner:
  - a. Toner DCRG-(\*) Horizontal Tap
  - b. Toner DCRG-(\*) Horizontal Tap
  - c. Toner DCRG-(\*) Horizontal Tap

2. As Approved
- D. Television Outlets. User outlets that terminate drops shall mount in standard single gang boxes or "boxless" boxes in acoustically non-critical walls, with standard cover plates. No loss plates to use bulkhead "F type" female to female adapter, or hex crimp female cable end. Install on cover plate. Submit sample of assembly for approval. Coordinate exact position in field. Approved products:
1. RMS CA2245T or CA-2255T
  2. As Approved

### 2.03 Connectors and Cable

- A. Television Plenum Cable Connectors. Drop Connectors shall be compatible with Drop Cable. Connectors shall be "F-type" male for installation on coaxial drop cable. Connector to have attached crimp ferrule and be finished in a cadmium chromate plate. Submit 1' tagged and labeled samples of all cables terminated in appropriate connectors for approval. Transmittal for each sample shall include the connector part number and the manufacturer's recommended termination procedure, including tooling references. Connectors for RG 11 to have separately crimped center pin. Approved products:
1. RG-11 Type :
    - a. Gilbert GF11-AHP-\*
  2. RG-6 Type:
    - a. Gilbert GF6-AHP-\*
  3. RG-59 Type:
    - a. Gilbert GF59-AHP-\*
  4. As Approved
- B. Television Cable Connectors. Connectors shall be compatible with Cable. Connectors shall be "F type" male for installation on coaxial drop cable. Connector to have attached crimp ferrule and be finished in a cadmium chromate plate. Submit 1' tagged and labeled samples of all cables terminated in appropriate connectors for approval. Transmittal for each sample shall include the connector part number and the manufacturer's recommended termination procedure, including tooling references. Connectors for RG 11 to have separately crimped center pin. Approved products:
1. RG-11 Type :
    - a. Gilbert GF11-AH-\*
  2. RG-6 Type:
    - a. Gilbert GF6-AH-\*
  3. RG-59 Type:
    - a. Gilbert GF59-AH-\*
  4. As Approved

- C. Television Headend Connectors. All headend rack RF connectors shall be "F type" male coaxial cable connectors compatible with Headend Cable. Approved products:
1. LRC F 59NEC
  2. As Approved
- D. Television Terminators, Power Blocking. Used to terminate un-powered ports on all unused device outputs and inputs on all compatible devices. Nominal value to be 75 Ohms. Approved products:
1. Gilbert GTR FM
  2. As Approved
- E. Television Terminators, Non-Power Blocking. Used to terminate un-powered ports on all unused device outputs and inputs on all compatible devices. Nominal value to be 75 Ohms. Approved products:
1. RMS CA 1230T
  2. Gilbert GTR F
  3. As Approved
- F. Precision BNC Connectors. General requirements: dual hex crimp, fully ratcheted tool applied, gold locking pin connectors sized specifically for the cable employed on the project. True 75 Ohm design, digital signal ready. Verify compatibility with Approved Cables. Submit manufacturer's termination instructions specific to the exact project cable type for approval. Submit fully labeled and tagged, terminated cable samples for all types of coaxial connectors employed on the project. Approved products:
1. ADC BNC-\*\*\* Series
  2. As Approved
- G. Precision BNC Video Terminators, 75 Ohm. Video terminators to be 0.1 per cent laser trimmed metal film resistor sealed into BNC body. Approved products:
1. Hedco B7501LP
  2. ADC BNC-TP2
  3. As Approved
- H. Television Cable. Quad shield RG 11 style. Cable to be listed for use in application. Jacket labeled for UL class, and with footage markers. **SUBMIT TERMINATED SAMPLE FOR APPROVAL.** Approved products:
1. Comm/Scope F11SSVR
  2. As Approved
- I. Television Cable. Quad shield RG 11 style, Plenum Rated. Jacket labeled for UL class, and with footage markers. Cable to be listed for use in plenum and vertical riser applications. **SUBMIT TERMINATED SAMPLE FOR APPROVAL.** Approved products:

1. Comm/Scope 2287K
  2. Gepco 7287TK
  3. Belden 1153A
  4. As Approved
- J. Television Cable. RG-6, Quad Shield, Foam Dielectric, Riser. Jacket labeled for UL class, and with footage markers. Cable to be listed for use in application. SUBMIT TERMINATED SAMPLE FOR APPROVAL. Approved products:
1. Comm/Scope F6SSVR
  2. As Approved
- K. Television Cable. Plenum rated, Quad Shield RG 6 type coaxial cable with a solid 20 AWG copper covered steel center conductor. Jacket labeled for UL class, and with footage markers. Cable to be listed for use in application. SUBMIT TERMINATED SAMPLE FOR APPROVAL. Approved products:
1. Comm/Scope 2227K
  2. As Approved
- L. Television RF Headend Cable (As required). Use for all RF carrying cables in the headend. Cable center conductor; 22AWG silver plated copper on steel, dielectric; gas injected polyethylene, shielding; aluminum polypropylene aluminum laminated type and two layers of 95% coverage braid. Characteristic impedance; 75 Ohms +/-2 Ohms. SUBMIT TERMINATED SAMPLE FOR APPROVAL. Approved products:
1. Refer to reference standard for this cable on "AV" Series Drawings
  2. As Approved
- M. Video Baseband Cable (As Required). Precision Digital Miniature 75 Ohm coaxial cable for rack or console video interconnections under forty feet and BNC Longitudinal Time Code connections. Use Red, Green, Blue, Yellow and White insulation colors to code RGBS, or RGBHV circuits respectively. Cable to be NEC rated CMR. SUBMIT TERMINATED SAMPLES FOR APPROVAL. Approved products:
1. Comm/Scope F59HEC-2
  2. As Approved

## 2.04 Video Displays

## 2.05 Racks, Enclosures, and Hardware

- A. Equipment Rack: Equipment racks and cabinets for this project are provided under separate Owners contract with Satellite / Headend / Pay-Per-View service provider.
- B. Plates and Panels. Custom rack panels and cover plates shall be milled 3/16" thick 6061T 6 aluminum, standard EIA or NEMA sizes, brushed black hard anodized finish unless otherwise noted. Brush in direction of aluminum grain only, with grain running parallel to the long dimension of the panel or box. Surface mount panels to have beveled or chamfered edges. Install

connectors, controls, and other parts, and engrave legends, as shown on drawings. Panels typically employ sub-panels for actual device mounting. Drill and tap panel or sub-panel for connector mounting screws; do not use nuts. Employ natural stainless steel or black oxide fasteners to match appearance. Some connectors may require milling the back side of the panel to reduce panel thickness at the connector. Unless otherwise noted, engraving on plates and panels shall be 0.125" block. Use white letter fill on dark panels, and black fill on natural aluminum. Fill warning and safety labeling red. Approved products:

1. Custom Plates as Shown
- C. Cable Markers. Permanent labels corresponding to the drawings affixed to all cables. Approved products:
1. Telecrafter Products:
    - a. Drop Cables: Series 100.
    - b. Feeder and trunk cables: Series 300A using a fine point, acid based, indelible ink marker or Series 100.
  2. As Approved
- D. Heat Shrink Tubing. Approved products:
1. Panduit HSTseries
  2. As Approved

## 2.06 Fabrication

- A. Complete all custom fabrication work at the shop including pre-assembly and testing of racks and rack-mounted systems

## 2.07 Finishes

- A. Choose finish materials and finish colors of all exposed and custom fabricated items and labels to blend in with the surroundings, as approved by the Architect. Provide white plates, for painted wall locations. Provide custom, matched stained plates, for wood mounted locations.
- B. For engraved plates, panels and pushbutton switches, use 1/8" block lettering unless noted otherwise. Use white lettering on dark surfaces. Use black lettering on light surfaces such as stainless steel or brushed aluminum

## 2.08 Source Quality Control

- A. Submit pre-installation Time Domain Reflectometry reports (TDR) for all reels and installed spans of hard line trunk and feeder cable.
- B. Performance Verification:
1. In the shop, photograph the interconnect wiring within racks including patch panels and grounding to show the overall quality of workmanship and compliance with the specified grounding procedures.
  2. Submit the test reports and photographs to the Architect's Consultant before delivery



### 3.01 Installation

- A. CATV System Performance – Check all paths and outlets for appropriate compliance with the Performance Standards. Measure levels at all feeder termination points. Compare actual values to design calculations and investigate any difference of more than 2 dB, rectify or justify these discrepancies to the satisfaction of the Owner. Where not specified, FCC Rules Part 76.605 shall apply. In all cases, the more stringent of any referenced standard shall apply.
1. Television Distribution System amplitude standards:
    - a. Min. visual sync tip level: +3 dBmV
    - b. Max. visual sync tip level: +10 dBmV
    - c. Max. amplitude difference between visual carriers 6MHz apart: 2 dB
    - d. Max. amplitude difference between any visual carriers: 7 dB
    - e. Digital amplitude difference below analog visual carrier -10dB
    - f. Min. visual/aural carrier ratio: 15 dB
    - g. Max. visual/aural carrier ratio: 17 dB
    - h. Max. FM station amplitude: 7 dBmV
    - i. Min. FM station amplitude: 20 dBmV
    - j. Max. variation between FM stations on adjacent channels: 3 dB
    - k. Long term variations in amplitude: 8 dB
  2. Television Distribution System frequency standards:
    - a. Visual frequency accuracy: +5 kHz of standard channel frequency
    - b. Intercarrier frequency: 4.5 MHz, ±1 kHz
    - c. FM frequency accuracy: +2 kHz of standard channel frequency.
    - d. Television Distribution System flatness standards:
    - e. Amplitude response within any TV channel: +0.5 dB ( 0.75 MHz to +3.6 MHz from visual carrier)
    - f. Amplitude response for entire spectrum (50 Hz – 870 MHz): 4 dB
  3. Television Distribution System fault standards:
    - a. Max. hum and low frequency variations: 2% p p
    - b. Min. visual carrier to noise ratio (4 MHz BW): 47 dB
    - c. Max. visual carrier to coherent spurious signal ratio (intermod.): 53 dB
    - d. Max. cross-modulation ratio: 53 dB
    - e. Max. reflections within system: 40 dB
    - f. Television Distribution System Isolation: Min. drop to drop: 25 dB
  4. Television Distribution System signal leakage:
    - a. 15uV/M maximum (at 100')
    - b. Television Distribution System Video Standards:
    - c. Chroma / Luma Delay: not more than 170 ns
    - d. Differential Phase: not more than 8 degrees
    - e. Differential Gain: not more than 10%
    - f. Sweep and balance reverse system path
- B. CATV Cable Testing – Submit post-installation Time Domain Reflectometry reports (TDR) for installed spans of hard line trunk and feeder cable. Inspect each Trunk Cable line for proper termination as follows.
1. Using a standard analog and digital TV receiver connected to each outlet, observe picture quality. No visible components of cross modulation (windshield wiper effect),

ghosting, noise or beat interference shall appear on the screen of the receiver tuned to any normal signal.

2. Perform carrier to noise tests using an approved field strength meter. Measure at the termination of each Trunk Cable and system extremity. With the normal levels in the system, tune the field strength meter to the picture carrier of each channel in turn and record the meter reading. Tune the field strength meter to an unused portion of the spectrum within the passband. Read the level of remaining noise in the absence of the signal and algebraically add the meter bandwidth correction factor. Record the difference between the two readings. Provide calculations or the manufacturer's data concerning the bandwidth correction factor.
3. Perform system flatness tests, both forward and reverse, using an approved high level sweep transmitter receiver pair. Take sweep measurements at every branch line termination in the system. Record sweep results by computer data logging, if possible, or by means of photographs.

### **3.02 System Startup**

- A. Provide a statement of completion certifying that the system is installed, fully operational and ready for acceptance testing and adjusting by the Architect's Consultant
- B. Schedule a time for the Architect's Consultant to perform acceptance testing and adjusting with at least 14 days advance notice.
- C. Schedule all instrumentation used for Field Quality Control tests along with the same technicians who performed these tests to assist the Architect's Consultant with final acceptance testing and adjusting. Include installation personnel who are authorized, capable and properly equipped to make any required changes in the installation including correction/completion of punch list items.

### **3.03 Adjusting**

- A. Assist the Architect's Consultant in system testing/adjusting including, if necessary, any re-aiming or reconfiguration of loudspeakers or re-tapping of line transformers required to achieve uniform sound distribution throughout listener areas as directed by the Architect's Consultant.
- B. Record the results of acceptance testing/adjusting including, but not limited to:
  1. Final control settings for all non-user operated equipment including electronic/software settings and the physical position of control knobs, sliders and switches.
  2. Measured audio system frequency response curves, equalized and non-equalized, for each listener area along with corresponding 1/3 octave data tabulated on an Excel worksheet.
  3. Input and output signal levels for all audio equipment measured in dBmV.

### **3.04 Cleaning**

- A. Demonstration – Upon completion of the Work, the Owner may elect to verify test data as part of the acceptance procedure. Provide personnel and equipment, at the convenience of the Owner, to reasonably assist with such tests and demonstrate system performance without additional cost to the Owner.
- B. Training – Using technicians who are familiar with and qualified to operate the systems, provide on-site training of Owner-designated personnel for a minimum of 24 hours, instructing them in

proper system operation and highlighting key design features. Coordinate instruction times through the Architect. Provide video recordings of the training sessions. Make any Owner requested changes to the control system programming during this time.

**\*\*\*End of Section 27 41 30\*\*\***

**SECTION 27 52 23 - NURSE CALL AND ANNUNCIATOR EQUIPMENT**

**1.01: Section Includes**

- A. Wireless Nurse Call System.

**1.02: Related Sections**

- A. Section 16050 - Basic Electrical Methods and Materials.

**1.03: References**

- A. Federal Communications Commission (FCC):
  - 1. FCC CFR 47 part 15 - Telecommunications - Radio Frequency Devices.
  - 2. FCC CFR 47 part 68 - Telecommunications - Connection of Terminal Equipment to the Telephone Network.
- B. Request for Comments (RFC):
  - 1. RFC 1321 - The MD5 Message-Digest Algorithm.
  - 2. RFC 1757 - Remote Network Monitoring Management Information Base.
  - 3. RFC 1918 - Address Allocation for Private Internets.
  - 4. RFC 2104 - HMAC: Keyed-Hashing for Message Authentication.

**1.04: Submittals**

- A. Submit under provisions of section 01300.
- B. Product Data: Manufacturer's data, user and installation manuals for all equipment and software programs including computer equipment and other equipment required for complete nurse call system, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings:
  - 1. Detailed wiring diagrams and system description.
  - 2. System device locations on architectural floor plans.
  - 3. Full Schematic of system, including wiring information for all devices.
- D. Closeout Submittals:
  - 1. User manual.
  - 2. Parts list.
  - 3. System device locations on architectural floor plans.
  - 4. Wiring and connection diagram.

5. Maintenance required and maintenance schedule.
- E. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, represent actual product, color, and patterns.

### 1.05: Quality Assurance

- A. Manufacturer Qualification:
  1. Provide availability of equipment for expansions, replacements, and spare parts available to dealers or end users.
  2. Provide factory direct technical support from 8:00 a.m. to 5:00 p.m. via phone and e-mail, or via Web.
- B. Installer Qualification:
  1. One of the following:
    - a. Minimum of five years' experience installing nurse call systems, information systems, telephone systems, and devices.
    - b. Manufacture authorized installer and or dealer.
  2. After-sales support: The Contractor shall be a factory-authorized and trained dealer of the system and shall be factory-trained and certified to maintain the system after system acceptance.
- C. Mock-Up: provide a mock-up for evaluation of installation techniques and application workmanship.
  1. Finish system in areas designated by Architect.
  2. Do not proceed with remaining work until workmanship and aesthetics are approved by Architect.
  3. Remake mock-up area as required to produce acceptable work.

### 1.06: Delivery, Storage, and Handling

- A. Deliver materials in manufacturer's original, unopened, undamaged containers; and unharmed original identification labels.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Protect store materials from environmental and temperature conditions following manufacturer's instructions.
- D. Handle and operate products and systems according to manufacturer's instructions.

### 1.07: Project Conditions

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

### **1.08: Warranty**

- A. Provide manufacturer's standard limited warranty covering products for replacement and repair of defective equipment.

### **2.01: Manufactures**

- A. Acceptable Manufacturer: Notify, LLC, which is located at: 5610 Rowland Rd Suite 130 Minnetonka, MN Tel: 952-314-1644; Email: request info (grobertson@eldermark.com); Web: www.eldermark.com
- B. Substitutions: Not Permitted.
- C. Requests for substitutions will be considered in accordance with provisions of section 01600.

### **2.02: Wireless Nurse Call System**

- A. Product: Notify Nurse Call Systems
- B. System Overview:
  - 1. The nurse call system shall be suitable for informing facility care givers the Request for help from a resident and or occupant of the facility.
  - 2. The discussion system shall provide ten main functions that facilitate the progress of discussions.
    - a. Firstly, the nurse call system shall provide management of request-for-help from residents and or occupants in a completely fair scheduling manor until each individual request for help has been managed by a care giver.
    - b. Secondly, the nurse call system shall provide the option to connect a third-party wired sensors and or equipment fitted with a form c relay contact on the wired sensor and or equipment.
    - c. Thirdly, the nurse call system shall have residential management, which allows care givers to receive useful information pertaining to a resident's request-for-help, allowing the care giver to better assist an individual resident and or occupant.
    - d. Fourthly, the nurse call system shall provide reporting pertaining to the history of request-for-help from residents and or occupants and pertaining to the history of system events that map out system transactions and stability.
    - e. Fifthly, the nurse call system shall provide the option to connect a third-party wired sensors and or equipment fitted with a form c relay contact on the wired sensor and or equipment
    - f. Sixthly, the nurse call system shall provide management to send nonemergency notifications to the care givers with the same notification system used to inform the care givers about a resident and or occupant's request-for-help.
    - g. Seventhly, the nurse call system shall provide self-monitoring to inform care givers when main system components are not properly working, when batteries have to be changed, and when wireless devices have been taken off-site.
    - h. Eighthly, the nurse call system shall provide residents with mobile emergency devices, allowing care givers to be informed upon request for help from anywhere on the facility's property.
    - i. Ninthly, the nurse call system shall have the ability to tie into afire panel with a RS232 serial output connection.

- j. Tenthly, the nurse call system shall have the ability to tie into a SpectraLink cordless phone system as a means of notification about request-for-help.

C. System Functions:

1. The nurse call system in its complete configuration shall provide all of the following functions by means of purpose built professional equipment:
  - a. Operate 24 hours a day while only being able to turn the system off by physically disconnecting the power cable or power loss caused by a power outage.
  - b. Notifying care givers about a resident's request for help and or status.
  - c. Customizing notification messages presented to the care givers for devices assigned to the residents and or locations through a decentralize user interface by an authorized operator.
  - d. Manage (add, update, delete) livable and non-livable locations through a decentralize user interface by an authorized operator.
  - e. Move in residents into a livable location listed in the system through a decentralize user interface by an authorized operator.
  - f. Relocate residents without having to reassign devices to the resident through a decentralize user interface by an authorized operator.
  - g. Move out residents out of the livable location listed in the system through a decentralize user interface by an authorized operator.
  - h. Entering key information about a resident that can help with assisting the said resident through a decentralize user interface by an authorized operator.
  - i. Assign devices to residents listed in the system through a decentralize user interface by an authorized operator.
  - j. Assign devices to a location listed in the system through a decentralize user interface by an authorized operator.
  - k. Customize device functionality pertaining to what type of device is assigned to a resident or a location through a decentralize user interface by an authorized operator.

D. Compliance:

1. The discussion system shall comply with all applicable regulations and standards for equipment of this type, and with the 2006 Guidelines for Design and Construction of Health Care Facilities - Section 4.1 Nursing Facilities for Section 10.3.6 Call Systems. In addition, the system shall comply with all applicable international, national and local regulations for the design, construction and installation of electrical equipment.

E. System Configuration:

1. The nurse call system shall be an integrated modular configuration, with the following system components:
2. A control position comprising a Central Control Unit (or devices) accessible through a personal computer and network connection provided by a third party.
3. Resident position with facilities for request-for-help.
4. A notification facility with pagers.
5. A notification facility with email.
6. A notification facility with SpectraLink phones.
7. Interface facilities for external request-for-help and alarm sensors such as fall detectors, wandering, and door egress systems.

8. Remote site operation through third party equipment and internet connection.
- F. System Installation and Interconnection:
1. Installation of the system shall be based on a modular concept, controlled by the CCU.
  2. Wiring for the battery backup unit electrical line shall be terminated with a NEMA 5-15R or NEMA 5-20R receptacle. The electrical line preferably would tie into the power generator if one is to be installed.
  3. The wireless devices are connected with the CCU via the wireless receiver. The wireless communication between the wireless devices and the wireless receiver shall operate in the 900 MHz band, with spread spectrum technology. The wireless devices can only communicate with the wireless receiver after being assigned with the system.
  4. Wiring of the wireless receiver to central equipment shall be via a special 4-pin serial cable with an attached F DB9 serial connection and a 12 VDC 200mA power adapter. The wireless receiver shall be mounted on a wall, with a 3 foot radius away from other radios and metal objects, for best technical or aesthetic effect.
  5. Wiring of the paging transmitter to the central equipment shall be via a MFDB9. The serial cable cannot exceed 40 feet away from the central equipment. Power for the paging transmitter shall be supplied by a 12 VDC 4000 mA power adapter connecting into the battery backup unit. The paging transmitter shall be mounted on a wall, with a 3 foot radius away from other radios and metal objects, for best technical or aesthetic effect.
  6. Wiring for network connectivity shall be provided to manage the CCU. The wiring will shall be of Cat5e, or better copper Ethernet cable, that is a dedicated run from the CCU to a central network patch panel or network switch. The wiring shall be terminated with a RJ45 Cat5e jack, or better Ethernet RJ45 jack, on both ends.
  7. Wiring to central equipment shall be via a special twin optical fiber plus two copper cores combined in one cable. This cable is terminated with purpose designed connectors. The optical part of the connectors shall be SC compatible. It shall use series cabling with option for redundancy (loopthrough or series-connected branch topology) for interconnection of the central equipment. The equipment shall be free-standing (table-top devices) or built into 19 inches (483 mm) racks.
  8. Wiring for a wireless repeater electrical line shall be ran to a 3 inch deep 4-11/16 inch metal junction box and connected to a UL 12 VAC 20 A class 2 transformer. The electrical line preferably would tie into the power generator if one is to be installed. The junction box shall be mounted on a wall at least 80 inches from the floor and no more than 12 inches from the top of the ceiling or mounted above a false ceiling that will allow running a low voltage 18-2 wire to be ran from the junction box into the middle of the wall and finishing outside of the wall.
- G. System Operation:
1. Operation and/or control of the system shall be possible at a number of different levels:
    - a. Anonymous, using a pre-set mode that gives only viewing capabilities of current incident status and support contact information.
    - b. Caregiver, using a pre-set mode that gives limited system access with managing residents and basic historic reporting.
    - c. Administrator, using a pre-set mode that gives system access with resident and location management, site customization, and full historic reporting.
    - d. Tech Support, using a pre-set mode that gives the ability to troubleshoot and view system status for support requests.



2. Appropriate control facilities shall be provided for each of these levels through third party resources.

H. Functional Description of the Wireless Nurse Call System:

1. The wireless nurse call system in a stand-alone configuration shall provide location, resident, and device management through an easy to use interface and care giver notification through a pager.
2. Bed Station:
  - a. A request-for-help call originated at the bed by an wireless bed station shall cause the following:
    - 1) The wireless device transmits the request-for-help.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The request is routed to the designated pager and or notifier, informing when the request-for-help was initiated, the type of device used, the bed location, and or extra informative information such as the resident's name.
    - 4) The request-for-help is repeatedly notified until the bed station is reset.
  - b. The bed station can only be reset at the device that originated the request-for-help. Resetting the bed station away from the physical device shall not be accepted.
3. Bathroom Station:
  - a. A request-for-help call originated at the bathroom by an wireless bathroom station shall cause the following:
    - 1) The wireless device transmits the request-for-help.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The request is routed to the designated pager and or notifier, informing when the request-for-help was initiated, the type of device used, the bathroom location, and or extra informative information such as the resident's name.
    - 4) The request-for-help is repeatedly notified until the bathroom station is reset.
  - b. The bathroom station can only be reset at the device that originated the request-for-help. Resetting the bathroom station away from the physical device shall not be accepted.
4. Indoor Station:
  - a. A request-for-help call originated at the indoor station by an wireless indoor emergency station shall cause the following:
    - 1) The wireless device transmits the request-for-help.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The request is routed to the designated pager and or notifier, informing when the request-for-help was initiated, the type of device used, the indoor location, and or extra informative information.
    - 4) The request-for-help is repeatedly notified until the indoor station is reset.
  - b. The indoor station can only be reset at the device that originated the request-for-help. Resetting the indoor station away from the physical device shall not be accepted.
5. Outdoor Station:

- a. A request-for-help call originated at the outdoor station by a wireless outdoor emergency station shall cause the following:
    - 1) The wireless device transmits the request-for-help.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The request is routed to the designated pager and or notifier, informing when the request-for-help was initiated, the type of device used, the outdoor location, and or extra informative information.
    - 4) The request-for-help is repeatedly notified until the bed station is reset.
  - b. The outdoor station can only be reset at the device that originated the request-for-help. Resetting the outdoor station away from the physical device shall not be accepted.
6. Mobile Station:
- a. A request-for-help call originated at the mobile station by an wireless mobile emergency button shall cause the following:
    - 1) The wireless device transmits the request-for-help.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The request is routed to the designated pager and or notifier, informing when the request-for-help was initiated, the type of device used, the resident assigned to the mobile emergency button, and or extra informative information.
    - 4) The request-for-help is repeatedly notified until the mobile emergency button is reset.
  - b. The mobile station can only be reset at the device that originated the request-for-help. Resetting the mobile station away from the physical device shall not be accepted.
7. Doorbell Station:
- a. A request-for-entry call originated at the doorbell station by a wireless doorbell shall cause the following:
    - 1) The wireless doorbell transmits the request-for-entry.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The request is routed to the designated pager and or notifier, informing when the request-for-request was initiated, the type of device used, the doorbell location, and or extra informative information.
    - 4) The request-for-entry is not repeatedly notified.
8. Door Sensor:
- a. A change-of-state call originated at the door sensor by a wireless door sensor shall cause the following:
    - 1) The wireless door sensor transmits the change-of-state.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the door sensor location, and or extra informative information.
    - 4) The change-of-state is not repeatedly notified.
9. Door Sensor with Reset:
- a. A change-of-state call originated at the door sensor by an wireless door sensor with reset shall cause the following:
    - 1) The wireless door sensor with reset transmits the change-of-state.

- 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the door sensor location, and or extra informative information.
    - 4) The change-of-state is repeatedly notified until the door sensor is reset.
  - b. The door sensor with reset can only be reset at the device that originated the change-of-state. Resetting the door sensor with reset away from the physical device shall not be accepted.
10. Window Sensor:
  - a. A change-of-state call originated at the window sensor by a wireless window sensor shall cause the following:
    - 1) The wireless window sensor transmits the change-of-state.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the window sensor location, and or extra informative information.
    - 4) The change-of-state is not repeatedly notified.
11. Door Sensor with Reset:
  - a. A change-of-state call originated at the window sensor by a wireless window sensor with reset shall cause the following:
    - 1) The wireless door sensor with reset transmits the change-of-state.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the window sensor location, and or extra informative information.
    - 4) The change-of-state is repeatedly notified until the window sensor is reset.
  - b. The window sensor with reset can only be reset at the device that originated the change-of-state. Resetting the window sensor with reset away from the physical device shall not be accepted.
12. Indoor Motion Sensor:
  - a. A change-of-state call originated at the motion sensor by a wireless indoor motion sensor shall cause the following:
    - 1) The wireless motion sensor transmits the change-of-state.
    - 2) The CCU displays the request while making an audible sound upon representation.
    - 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the motion sensor location, and or extra informative information.
    - 4) The change-of-state is not repeatedly notified.
13. Outdoor Motion Sensor:
  - a. A change-of-state call originated at the motion sensor by a wireless outdoor motion sensor shall cause the following:
    - 1) The wireless motion sensor transmits the change-of-state.
    - 2) The CCU displays the request while making an audible sound upon representation.

- 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the motion sensor location, and or extra informative information.
    - 4) The change-of-state is not repeatedly notified.
  14. Smoke Sensor:
    - a. A change-of-state call originated at the smoke detector by an wireless smoke sensor shall cause the following:
      - 1) The wireless smoke sensor transmits the change-of-state.
      - 2) The CCU displays the request while making an audible sound upon representation.
      - 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the smoke sensor location, and or extra informative information.
      - 4) The change-of-state is not repeatedly notified.
  15. Smoke Transmitter:
    - a. A change-of-state call originated at the smoke detector by a wireless smoke transmitter shall cause the following:
      - 1) The wireless smoke transmitter transmits the change-of-state.
      - 2) The CCU displays the request while making an audible sound upon representation.
      - 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the smoke transmitter location, and or extra informative information.
      - 4) The change-of-state is not repeatedly notified.
  16. Glass Brake Sensor:
    - a. A change-of-state call originated at the glass brake detector by a wireless glass brake sensor shall cause the following:
      - 1) The wireless glass brake sensor transmits the change-of-state.
      - 2) The CCU displays the request while making an audible sound upon representation.
      - 3) The state change is routed to the designated pager and or notifier, informing when the change-of-state was initiated, the type of device used, the glass brake sensor location, and or extra informative information.
      - 4) The change-of-state is not repeatedly notified.
- I. Contribution Equipment:
  1. Wireless Bed Station:
    - a. The Wireless Bed Station is used as a request-for-help device near a resident's bed.
    - b. The Wireless Bed Station shall be the following PalatiumCare product or similar.
      - 1) PAL-203200 shall be a Pull Cord Station or similar.
      - 2) PAL-205520 shall be a Call Cord Momentary Station or similar.
      - 3) PAL-205610 shall be a Call Cord Latching Station or similar.
  2. Wireless Bathroom Station:
    - a. The Wireless Bathroom Station is used as a water resistant request-for-help device in a bathroom, restroom, or shower room environment.
    - b. The Wireless Bathroom Station shall be a PalatiumCare PAL-203200 or similar.

3. Wireless Indoor Emergency Station:
  - a. The Wireless Indoor Emergency Station is used as a request-for help device inside of a building.
  - b. The Wireless Indoor Emergency Station shall be a PalatiumCare PAL-203200 or similar.
4. Wireless Outdoor Emergency Station:
  - a. The Wireless Outdoor Emergency Station is used as a water resistant request-for-help device outside of a building.
  - b. The Wireless Outdoor Emergency Station shall be a PalatiumCare PAL-203200 or similar.
5. Mobile Emergency Button:
  - a. The Mobile Emergency Button is used as a request-for-help device worn by the resident.
  - b. The Mobile Emergency Button shall be the following PalatiumCare product or similar.
    - 1) PAL-204211 shall be a Pendant or similar.
    - 2) PAL-204212 shall be a Bracelet or similar.
6. Wireless Doorbell:
  - a. The Wireless Doorbell is used as a request-for-entry device outside or inside the facility.
  - b. The Wireless Doorbell will be a PalatiumCare PAL-101100 or similar.
7. Wireless Door Sensor:
  - a. The Wireless Door Sensor is used as a change-of-state device on a resident's door or a facility's door that initiates the change-of-state when the door is open.
  - b. The Wireless Door Sensor will be a PalatiumCare PAL-102030 or similar.
8. Wireless Door Sensor with Reset:
  - a. The Wireless Door Sensor with Reset is used as a change-of-state device on a resident's door or a facility's door that initiates the change-of-state when the door is open and requires a manual reset upon change-of-state.
  - b. The Wireless Door Sensor with Reset be a PalatiumCare PAL-102130 or similar.
9. Wireless Window Sensor:
  - a. The Wireless Window Sensor is used as a change-of-state device on a resident's window or a facility's window that initiates the change-of-state when the window is open.
  - b. The Wireless Window Sensor will be a PalatiumCare PAL-102030 or similar.
10. Wireless Window Sensor with Reset:
  - a. The Wireless Window Sensor with Reset is used as a change-of-state device on a resident's window or a facility's window that initiates the change-of-state when the window is open and requires a manual reset upon change-of-state.
  - b. The Wireless Window Sensor with Reset will be a PalatiumCare PAL-102130 or similar.
11. Wireless Indoor Motion Sensor:
  - a. The Wireless Indoor Motion Sensor is used as a notification-of-entry device in a resident's room or a facility's room.
  - b. The Wireless Indoor Motion Sensor shall be the following PalatiumCare product or similar.
    - 1) PAL-109210 shall be a High Traffic Motion Detector or similar.
    - 2) PAL-109310 shall be a Pet Immunity Motion Detector or similar.
12. Wireless Outdoor Motion Sensor:

- a. The Wireless Outdoor Motion Sensor is used as a notification-of-entry device outside of facility.
  - b. The Wireless Outdoor Motion Sensor shall be the following PalatiumCare product or similar.
    - 1) PAL-109420 shall be a Wide Range Motion Detector or similar.
    - 2) PAL-109520 shall be a Long Range Motion Detector or similar.
13. Wireless Smoke Sensor:
- a. The Wireless Smoke Sensor is used as a change-of-state device in a resident's room or a facility's room that initiates the change-of-state when smoke is detected within range of the detector.
  - b. The Wireless Smoke Sensor be a PalatiumCare PAL-10800 or similar.
14. Wireless Smoke Transmitter:
- a. The Wireless Smoke Transmitter is used as a change-of-state device in a resident's room or a facility's room that initiates the change-of-state when smoke is detected within range of the third party detector with a built in form C relay.
  - b. The Wireless Smoke Transmitter be a PalatiumCare PAL-100020 or similar.
15. Wireless Glass Brake Sensor:
- a. The Wireless Glass Brake Sensor is used as a change-of-state device in a resident's room or a facility's room that initiates the change-of-state when glass is broken within range of the detector.
  - b. The Wireless Glass Brake Sensor be a PalatiumCare PAL-12000 or similar.
16. Pager:
- a. The Pager is for caregivers to receive notification of wireless sensors and emergency stations.
  - b. The Pager shall be a PalatiumCare PAL-113200 or similar.
17. Wireless Repeater:
- a. The Wireless Repeater is used to connect wireless signals to the Wireless Receiver that are not with-in range of the Wireless Receiver.
  - b. The Wireless Repeater shall be a PalatiumCare PAL-112310 or similar.
18. Battery Backup Unit:
- a. The Battery Backup Unit is to provide temporary power to the Central Control Equipment in case of a power outage and limited power surge protection.
  - b. The Battery Backup Unit shall be a PalatiumCare PAL-115600 or similar.
- J. Central Control Equipment:
1. Central Control Unit:
    - a. The Central Control Unit forms together with the Wireless Receiver, the heart of the Wireless Nurse Call System.
    - b. The Central Control Unit for the Wireless Nurse Call System shall be a PalatiumCare PAL-211400 or similar:
  2. Wireless Receiver:
    - a. The Wireless Receiver shall link the central control unit with wireless signals from the wireless repeaters, wireless sensors, and emergency stations.
    - b. The Wireless Receiver shall be a PalatiumCare PAL-112200 or similar.
  3. Paging Transmitter:
    - a. The Paging Transmitter is used to send notifications, automated by the central control unit or manually initiated by an operator, to the Pagers.
    - b. The Paging Transmitter shall be a PalatiumCare PAL-113100 or similar.
- K. Application Software:

1. The application shall be modular and shall run under any operating system and web browser that supports Microsoft Silverlight 4.
  2. The software modules shall be protected for copying by a license key.
- L. Technical Data:
1. The wireless nurse call system shall have the following technical specification.
  2. Wireless Repeater:
    - a. Operating Frequency: 902-928 MHz (USA), 915-928 MHz (Australia), 921-928 MHz (New Zealand).
    - b. Battery Life: 8 hours.
  3. Wireless Devices:
    - a. Operating Frequency: 902-928 MHz (USA), 915-928 MHz (Australia), 921-928 MHz (New Zealand).
  4. Paging Transmitter:
    - a. Operating Frequency: 467.8000 MHz or 469.7000 MHz (USA).
  5. System Environmental Conditions:
    - a. Operating Temperature Range: 0 degree C to +60 degree C (32 degree F to 140 degree F).
    - b. Relative Humidity: 90%, non-condensing.

### 3.01: Examination

- A. If preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.
- B. Ensure power source is protected against accidental shutoff.

### 3.02: Installation

- A. Installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work.

### 3.03: Field Quality Control

- A. Installation contractor shall submit a written test report that the system has been 100% tested and approved. Final test shall be witnessed by the owner, engineer, electrical contractor, and performed by the installation contractor. Final test report shall be received and acknowledged by the owner prior to request for final payment.
- B. Provide instruction to the owner's satisfaction with regard to proper use and operation of the system.

### 3.04: Demonstration

- A. Demonstrate at final inspection that devices functions properly.

\*\*\*End of Section 27 52 23\*\*\*