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Overview

This document identifies and describes the specification supporting the Wireless Radio Installation project. The goal of this project is to improve network resiliency for multiple buildings located off UNLV’s Maryland Campus. The wireless radios will provide improved throughput and redundancy for the Graduate Art Studios (GRS), Police Headquarters (PHQ) and the Center for Academic Enrichment and Outreach (CAEO). Most of the radio equipment is no longer supported by the manufacturer. The document describes the general project requirements and the wireless radio installation requirements.

General Project Requirements

1. Contractor shall visit site prior to bid and verify that conditions are as indicated. Contractor shall include in bid costs required to make work meet existing conditions
2. UNLV reserves the first choice to keep existing equipment and materials. The Contractor shall coordinate with UNLV and deliver designated equipment and materials removed under the contract to owner's designated storage area. Remaining material removed shall become the property of the Contractor.
3. Low voltage service shall be maintained to existing areas during construction. Contractor shall provide cables and termination etc, as required to maintain continuity of service.
4. Work shall be provided in accordance with the latest adopted editions of the applicable international building code (IBC), international energy conservation code (IECC), national electric code (NEC), and other applicable federal, state, and local regulations.
5. Conduit will be installed in strict compliance with the TIA 569 standard. Cable will be installed in strict compliance with the TIA 568 standard.
6. All cabling, pathway, ground busses and termination hardware, cable managers, racks and cabinets shall be provided with identification (labeling) in accordance with UNLV Campus Wiring Specification. http://oit.unlv.edu/forms/unlv-wiring-specifications
7. Contractor shall provide listed firestoping for all telecom/low voltage conduits and cables as required.
8. Conduit/Pathway routing indicated on drawings is for general reference only. Contractor shall field coordinate and verify exact routing as required.
9. Contractor shall maintain separation from electrical feeders, electronic ballasts, transformers, etc to minimize electromagnetic compatibility issues.
10. Contractor shall perform work in a workmanlike manner to the satisfaction of UNLV
11. Work, materials, and equipment shall conform to the latest edition of local, state and national codes and ordinances.
12. All low voltage system components shall be listed or labeled by UL or another nationally recognized testing laboratory (NRTL).
13. All cabling shall be complete, operable, tested (end-to-end) in accordance with the applicable UNLV and TIA standards for the specific media involved.
14. Contractor must use “call before you dig”.


15. Contractor must contact UNLV planning and construction to verify “call before you dig”.

16. Reference UNLV campus wiring specification, 
   http://oit.unlv.edu/forms/unlv-wiring-specifications for general requirements for cabling installation.

17. UNLV will not loan equipment, tools or ladders to the Contractor. Contractors shall be responsible for bringing all tools and equipment required to complete the job.

**Contractor Requirements**

1. The UNLV Campus Wiring Specification details requirements for Coordination of Work, Regulatory Requirements, Contractor and Installer Requirements, Submittal Requirements and Approved Manufacturers.
   a. The winning contractor shall be responsible for knowing and meeting these requirements.
   b. Any questions regarding these requirements should be directed to the Technical point of contact.

**Coordination of work**

1. Early in the construction timeline, before any construction work starts, a representative of the low voltage communications installer, who shall serve as supervisor to the installation crew throughout construction, shall attend a pre-construction meeting where installation details, including but not limited to cable routes, labeling, wire management, timeline, and schedule will be discussed. The representative shall attend regular meetings with UNLV staff to review work progress and discuss issues that may arise.

2. The Contractor shall assign at least one lead technician on site at all times to lead and manage the work activities. The designated lead technician shall attend the Plan of the Day meeting at the beginning of each work day to discuss the planned activities for the day.

3. All work activities must be coordinated with the designated UNLV Network Development and Engineering’s Point of Contact provided in Section “Technical Point of Contact”

**Regulatory requirements**

1. All work and material shall conform to the appropriate portions of the following specifications, codes, and regulations:
   a. ANSI/TIA-569-D Telecommunications Pathways and Spaces
   b. ANSI/TIA 568-D.0 Generic Telecommunications Cabling for Customer Premises
   c. ANSI/TIA-568-D.1 Commercial Building Telecommunications Cabling Standard
   d. ANSI/TIA-568-D.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard
   e. ANSI/TIA-568-D.3 Optical Fiber Cabling Components Standard
f. ANSI/TIA-606-B Administration Standard for Telecommunications Infrastructure

h. ANSI/TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling

i. National Electrical Manufacturers Association (NEMA)

j. National Electrical Code, latest revision (NEC)

k. National Fire Protection Agency (NFPA) – 70

l. Local, State and Federal Codes including Nevada Revised Statute (NRS) 278.583

m. UL 497 Protectors

n. UL 1459 Standard for Safety for Telephone Equipment

o. UL 1863 Standard for Safety for Communications Circuit Accessories

p. UL 2024 Standard for Safety for Optical Fiber Cable Raceway

q. UL 723 Standard for Safety for Surface Burning Characteristics of Building Materials

r. UL 1581 Standard for Safety for Reference Standard for Wires, Cables and Flexible Cords

s. National Electrical Safety Code (NESC)

t. ANSI/TIA 310-D - Cabinets, Racks, Panels, and Associated Equipment

u. Occupation Safety and Health Administration (OSHA)

v. Federal Communications Commission (FCC)

w. Nevada State Public Works Board Adopted Standards

**Contractor and Installer Qualifications**

1. Contractor must possess a valid State of Nevada Contractor’s License and have successfully performed at least three projects with similar size and work scope, within two years of the date of this bid. Proof of performance shall be in the form of reference sheets which shall include a brief description of the project, the start and end dates, and contact information.

2. All contractor personnel who will be performing work on this project shall have been trained on the work they will be performing. They shall have been trained on the Contractor’s company policies with respect to personnel safety, telecommunications industry cabling quality and neatness standards, and use of Construction Standard Institute (CSI)-standard specifications and drawings.

3. Contractor, at all times during performance and until work is completed and accepted, shall have on the premises a competent supervisor, satisfactory to UNLV and with authority to act for the Contractor regarding work schedules and any changes to the scope of work. The supervisor must be a BICSI certified Installer and BICSI member in good standing.
4. Contractor must provide at least one lead technician on site at all times during project who is a BICSI certified installer and a BICSI member in good standing. A copy of the certificate and BICSI member number must be provided with bidding documents.
5. Contactor must be certified installers of the products they select for installation. Contractor shall provide evidence of manufacturer certification and this evidence must be provided with bidding documents.

Submittal

1. The Contractor shall furnish the following in a single consolidated submittal with an Approval copy to UNLV:
   a. Contractor’s license number and proof of qualifications.
   b. A copy of the BICSI certificate and the BICSI member number of the lead technician as described in the above Contractor Qualifications section.
   c. A copy of the BICSI certificate and the BICSI member number of the supervisor as described in the above Contractor Qualifications section.
   d. Reference sheets which provide three references from similar projects that the Contractor has completed. Each reference shall include a brief description of the project, the start and end dates, and contact information.
   e. A copy of a valid manufacturer certified installer certification.
   f. The manufacturer and model of the materials to be used.

Products and Materials

1. All material required for a complete installation shall be furnished by the Contractor unless otherwise specified in this document.
2. All materials provided by the Contractor must be new, free from defects and must meet the UNLV’s specifications. Potential bidders shall submit the manufacturer and model of materials that will be used for the work.
3. All fixtures and hardware must be installed as shown in drawings and in direct coordination with UNLV Network Development and Engineering’s written direction. No custom items shall be used except as reviewed and approved by UNLV Network Development and Engineering. The contractor shall be held financially responsible for any work or re-work required due to improper approval and /or acceptance of that work performed which differs from the construction documents.
4. All products shall be new, and brought to the jobsite in original manufacturer’s packaging. Electrical components (including innerduct) shall bear the Underwriter’s Laboratories label.
5. The Contractor shall inspect all products and materials prior to installation. Damaged cable or any other components failing to meet specifications shall not be used in installation.
Conduits

6. After Award of Contract, no change to materials and products except when the unavailability is beyond the Contractor’s control, i.e., due to strike, bankruptcy, discontinuance of manufacture, etc. Requests for substitutions shall be made in writing and shall be accompanied by complete description of the substituted material or equipment.

Cable Handling

1. During cable installation, set reels and use sufficient pulleys and manpower so that cables are not pulled around blunt corners or against material that might cause chafing. For the purpose of this paragraph, any edge with a radius of less than 5 inches is considered “blunt”.
2. Any non-rotational surface that has sufficient friction to cause shaving or particles to be pulled off the cable jackets is unacceptable.
3. Observation of improper cabling handling techniques on the job may cause the Customer to require the Contractor to discard observed cables, including any other already installed by the personnel found using improper techniques.
4. In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to manufacturer’s recommendations for the limitations on the installed cables.
5. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
6. Provide pull cords in all sections of conduit. Tapes shall be marked in feet and secured at each end of the conduit.

Conduit

1. Conduit shall be Electrical Metallic Tubing produced in accordance with ANSI C80.3 standard and run in the most direct route practical.
2. Conduit runs containing more than two 90-degree bends, or a reverse (180 degree) bend require a pull box.
3. All pull boxes shall be placed in a straight section of conduit. Contractor shall align the corresponding conduits at each end.
4. All offsets shall be considered equivalent to a 90-degree bend.
5. Sections of conduit longer than 100 ft. require a pull box.
6. Conduit bend radii will be a standard ten times the outside diameter of conduit unless otherwise approved by UNLV Network Development and Engineering.
7. Conduits entering the IDF through the wall shall be reamed or bushed, and terminated not more than 4 inches from the wall surface.
8. Conduits entering the IDF from below shall be terminated 4 inches above finished floor
9. Conduit runs for distribution cables (both horizontal and vertical), except station outlets, shall be not less than 4” in diameter. They will be equipped with a plastic or nylon number 12 or larger pull line that is rated at 800-lb. test minimum.

10. Conduit installed for data and/or voice cabling may not be shared with any other cable.

11. After installation, all conduits shall be clean, dry, unobstructed, capped for protection and labeled with their destination (by room number) for identification.

12. Allowable fill capacity is 40% or as defined by the National Electric Code, whichever is lower.

13. Conduit runs for horizontal distribution cables, utilizing the trapeze hanger method to support the conduits, shall utilize threaded rods of not less than 3/8” in diameter.

14. Conduit shall not block access to existing services.

15. Pull boxes will be installed in position and relationship to adjoining work, securely anchored to supporting structure, sealed and finished, and in a manner which produces a level box with square, plumb, and straight edges.

16. All LB conduit bodies used to turn conduit pathways 90 degrees will be Smart LBs manufactured by Madison Electric Products.

Testing

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions.

2. Any defect in the cabling system after installation shall be repaired or replaced in order to ensure 100% usable copper cables and fiber strands.

3. Test results shall be submitted and reviewed prior to system acceptance.

4. All test results and as-builds shall be provided to the UNLV Project Manager and the Technical Point of Contact in PDF format prior to acceptance.

5. All test results must be labeled with the specific cable that was tested by its unique identifier as described in the Labeling section.

Copper Data Cable

1. All Data cables shall be tested in accordance with ANSI/TIA-568-D.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, UNLV Campus Wiring Specification, and industry best practices. The Contractor shall be responsible for bringing any discrepancies to the attention of the Technical Point of Contact prior to installation.

2. Testing
   a. Each cable shall be tested for wire map, length and performance. The data cables shall be bi-directional tested using an ANSI/TIA 1152 level III or better cable analyzer. The cable analyzer shall be within the calibration period recommended by the manufacturer.
i. Wire Map
   1. Each pair of each installed cable shall be tested for continuity, opens, shorts, pair-reversals, split pairs, transposed pairs, and any other mis-wiring. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturer’s recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

ii. Length
   1. Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA-568-D.2 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. The longest pair length shall be recorded as the length for the cable.

iii. Performance Verification
   1. Category 6 or 6A data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
      a. Propagation Delay
      b. Delay Skew
      c. Insertion Loss
      d. NEXT (Near-End Crosstalk)
      e. PS NEXT (Power Sum Near-End Crosstalk)
      f. ACR-N (Attenuation to Crosstalk Ratio Near-End) – recorded for information only
      g. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End) – recorded for information only
      h. ACR-F (Attenuation to Crosstalk Ratio Far-End)
      i. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
      j. Return Loss
      k. TCL (Transverse Conversion Loss) – recorded for information only
      l. ELTCTL (Equal Level Transverse Conversion Transfer Loss) – recorded for information only

3. Equipment
a. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA 568-D.2 Standard, and the result shown as pass/fail.

**Fiber Optic Cable**
1. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA 568-D.3 Standard, and the result shown as pass/fail. The test results shall include all tests performed and the actual test result achieved.
2. Test evaluation for panel to panel (backbone) optical fiber cabling shall be based on the values set forth in TIA-568-D.3, Optical Fiber Cabling Components. Each strand of fiber in the respective cable shall be evaluated against this standard. Any fibers that exceed the acceptable values set by this standard shall be repaired or replaced at the installers’ cost.

**Single-mode**
1. Single mode optical fiber attenuation shall be measured at 1310 nm and 1550 nm using a laser light source and power meter. Tests shall be performed at both wavelengths in one direction on each strand of fiber. The set-up and test shall be performed in accordance with ANSI/TIA-568-D.3. Two-meter patch cords shall be used as test references and for the actual test. This test method utilizes a one-jumper reference, two-jumper test to estimate the actual link loss of the install cable plus two patch cords. Single-mode fiber optic cable must meet or exceed the following limits:
   a. Attenuation: 0.4dB/km at 1310nm, 0.3dB/km at 1550nm.
   b. Connectors: Max loss for a mated pair of connectors shall be less than 0.5dB

**OTDR**
1. Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses.
2. The OTDR measurements for length shall be performed in accordance with TIA 568-D.3.
3. The measurements to determine splice loss shall be performed in accordance with manufacturer’s recommendations and best industry practices.

**Warranty and Acceptance**
1. UNLV staff will inspect the contractor’s work weekly and ensure that it meets the requirements identified in the Regulatory Requirements section. The contractor will, at their cost, correct issues identified by UNLV prior to acceptance.
2. All cabling installations must be covered by an end-to-end manufacturer warranty of no less than 20 years. The warranty is required to cover cabling, components, and performance. Parts and labor for replacements must also be included in the warranty. The warranty period shall begin at the date of the Owner’s system acceptance.
3. As a condition for project acceptance
a. Contractor shall submit to UNLV inspection and test reports for review and approval. Any test results that are found to not meet requirements detailed in this document will require the Contractor to repair or replace the offending cable or strand.

b. All installed cables will be documented on an as-built diagram. The diagram will indicate the location and actual label of all installed cabling. As-builts will be provided to Planning and Construction in PDF format upon completion. Network Engineering and Development will verify all that the data contained the as-builts matches the actual labels prior to activating ports.

i. Contractor shall update the master UNLV fiber infrastructure CAD drawing with any changes made during the course of the project.

4. During the course of the Project the Contractor shall maintain an adequate inspection system and shall perform such inspections to insure that the materials supplied and the work performed conform to requirements detailed in the “Products and Materials” section.

Technical Point of Contact

1. NDE’s technical points of contact are Jon Myers at 702-895-0731 and Lorita Chesler at 702-895-0724.

Wireless Radio Installation Requirements:

A. UNLV provides network access to 25,000 students and 5,000 staff members. Special care must be taken to avoid unplanned network outages. As such, the Contractor must coordinate all work with the Customer.

B. Dayton Residence Hall is a student dormitory and as such, additional requirements regarding work schedule and behavior must be met by the contractor.

a. All work will be scheduled with UNLV’s Planning and Construction and UNLV’s Student Affairs Maintenance departments

b. Contractor will check out and return keys at the Rebel Repair Help Desk in the Student Affairs Maintenance building

c. Work can not start before 9:00 AM

Cabling and Component installation

A. General Cabling and Component Requirements
   a. The installer shall use authorized products that they are certified to install from a
      manufacturer on the approved list in Appendix A6 of UNLV’s Wiring Specification.
      i. Components not listed in Appendix A6 must be manufactured by a
         company on the list of UNLV approved manufacturers or otherwise
         approved by UNLV.
   b. All cabling will be installed in a secure, neat and professional manner.
      i. Zip ties will not be used.
      ii. Cables will be bundled using hook and loop tape
      iii. Cables will be routed up masts using cable management and will not be
           secured directly to the mast.
      iv. Ground cable will be run separately from the data cabling.
   c. Category 6 (Cat 6) cabling
      i. Contractor shall provide and install (2) Cables for each location.
         1. The cables will be run from the IDF to the Contractor provided
            NEMA enclosure mounted to the radio mast or sled.
      ii. Cables will be OSP rated category 6 cables manufactured by one of the
          UNLV approved manufacturers.
   d. Fiber Cabling
      i. Contractor shall provide and install (1) 6-strand single-mode OSP rated
         cable for locations which require fiber for data transport.
      ii. All fiber shall be installed in contractor provided ¾” innerduct, orange.
      iii. Cables will be manufactured by one of the UNLV approved
           manufacturers.

B. IDF Room installation requirements
   a. For each location:
      i. Contractor shall provide and install (1) Leviton QuickPort patch panel,
         (Model number 49255-H48) or equivalent that has been viewed, tested
         and approved by Network Development and Engineering staff.
      ii. Contractor shall terminate Cat 6 cabling into Cat 6 keystone jacks and
          snap them into the contractor provided patch panel.
          1. All keystone jacks from the manufacturers on the approved list fit
             into this patch panel
      iii. Contractor shall provide and install (1) Panduit 2U WMPF1E Horizontal
            Cable manager
      iv. Contractor shall provide and install (1) 1RU vented 19” rack shelf in the
          existing IDF rack per location.
      v. Contractor provide and install (1) Siklu 60W PoE injector per radio
         1. Contractor shall secure PoE injectors to the contractor provided
            shelf
2. Contractor will run power cord to existing UPS or PDU
   b. For each location that requires fiber for data transport:
      i. Contractor shall provide (1) 6-strand LC fiber adapter panel and install it in each IDF room’s existing fiber enclosure
      ii. Contractor shall terminate each fiber strand to meet requirements in UNLV’s Campus Wiring Specification.
         1. Contractor shall terminate all fiber using LC connectors
         2. Terminations will be made using fusion splice pigtailers or “no epoxy, no polish” fiber connectors.

C. Roof installation requirements
   a. For each location:
      i. Contractor shall provide and install (1) 12”x12”x6” NEMA 4 rated enclosure.
         1. Enclosure will be mounted to the radio mast or sled or to unistrut mounted near the radio.
         2. Cable terminations and surge protection will be located in the enclosure.
         3. A similarly sized enclosure that will house all terminations will be acceptable upon approval by UNLV.
         4. Contractor shall terminate the Cat 6 cables in Cat 6 jacks, and mount them in a faceplate.
            a. The faceplate will meet requirements identified in the UNLV Campus Wiring Standard.
            b. The faceplate shall be mounted to a surface mount faceplate or electrical box with appropriate reducer ring mounted inside of the NEMA enclosure.
      ii. Contractor shall provide and install (1) outdoor rated Cat 6 patch cord for each radio.
         1. The patch cord will patch the radio into the to the Cat 6 jack located in the NEMA 4 enclosure mounted to the mast.
      iii. Contractor shall provide and install (1) ground cable to the wireless radio per the manufacturer’s Installation User Manual
      iv. Contractor shall provide and install Surge protection as recommended by Siklu EH-2200F Installation User Manual
      v. Contractor shall ground all conduit and junction boxes per NEC code.
   b. For each location that requires fiber for data transport:
      i. Contractor shall provide (1) 1-panel fiber enclosure per radio location and install it in the contractor provided NEMA 4 enclosure.
      ii. Contractor shall provide (1) 6-strand LC fiber adapter panel per radio location and install it the NEMA 4 enclosure.
      iii. Contractor shall terminate each fiber strand to meet requirements in UNLV’s Campus Wiring Specification.
         1. Contractor shall terminate all fiber using LC connectors
2. Terminations will be made using fusion splice pigtales or “no epoxy, no polish” fiber connectors.

D. Labeling requirements
   a. Contractor will be responsible for labeling all installed cables and components.
      i. The labeling scheme will use the format described in Appendix A2 of UNLV’s Wiring Specification.
   b. Contractor will label the patch panel port, cable termination points, and faceplates
      i. Contractor will also be responsible for labeling new patch panels with the next sequential patch panel number unique to the IDF.
      ii. Cables and patch panel port will be labeled slightly differently than indicated in the UNLV wiring standard as the roof has no room number.
         1. The contractor shall label each cable and port roof#-idf#-patchpanel#-port#
         2. Example: roof1-4148-5-1
   c. Contractor shall label PoE injector with destination and purpose.

Location Specific Requirements

A. Graduate Art Studios (GRS)
   a. GRS will use Cat 6 cabling for data transport and power.
   b. Contractor shall inspect the existing mast and reutilize or replace with installed solution certified to withstand up to 100 mile per hour wind force at the location identified in Exhibit A.
   c. Contractor shall reuse existing 2” conduit from IDF 117 to the roof mast location.
   d. Contractor shall provide and install (1) Customer specified wireless radio per the manufacturer's Installation User Manual to Contractor-provided or existing mast.
   e. Contractor shall provide and install (1) Siklu power injector in the GRS IDF 117 and power the injector from the existing UPS in IDF 117.
   f. Contractor shall provide and install (2) Cat 6 OSP cables from GRS 117 to the Contractor provided NEMA enclosure mounted to the radio mast.
   g. Contractor shall provide and install (1) Cat 6 OSP patch cable from the NEMA enclosure mounted to the radio mast to the radio uplink port.

B. Police Headquarters (PHQ)
   a. PHQ will use Cat 6 cabling for data transport and power.
   b. Contractor shall inspect the existing mast and reutilize or replace with installed solution certified to withstand up to 100 mile per hour wind force at the location identified in Exhibit A.
   c. Contractor shall reuse 1½” conduit from IDF 120 to roof mast location.
   d. Contractor shall provide and install (2) Customer specified wireless radios per the manufacturer's Installation User Manual to Contractor provided mast.
e. Contractor shall provide and install (2) Siklu power injectors in the PHQ IDF 120 and power the injector from the existing UPS.

f. Contractor shall provide and install (2) Cat 6 OSP cables from PHQ 120 to the Contractor provided NEMA enclosure mounted to the radio mast.

g. Contractor shall provide and install (2) Cat 6 OSP patch cables from the NEMA enclosure mounted to the radio mast to the radio uplink ports.

C. Center for Academic Enrichment and Outreach (CAEO)
   a. CAEO will use Cat 6 cabling for power and data transport.
   b. Contractor shall inspect the existing mast and reutilize or replace with installed solution certified to withstand up to 100 mile per hour wind force at the location identified in Exhibit B.
   c. Contractor shall re-use existing 4” conduit roof penetration as identified by UNLV.
   d. Contractor shall provide and install 2” conduit from IDF to existing roof penetration.
   e. Contractor shall provide and install (2) Customer specified wireless radios per the manufacturer's Installation User Manual to the existing/Contractor-provided mast.
   f. Contractor shall provide and install (2) Siklu power injectors in the CAEO IDF 650 and power the injector from the existing UPS.
   g. Contractor shall provide and install (2) Cat 6 OSP cables from CAEO IDF 650 to the Contractor provided NEMA enclosure mounted to the radio mast.
   h. Contractor shall provide and install (1) Cat 6 OSP patch cable from the NEMA enclosure mounted to the radio mast to the each radio uplink port.
   i. Upon completion, the Contractor shall remove the existing radio and deliver it to UNLV.
      i. Contractor shall remove existing cabling from original installation.
      ii. **Contractor shall seal roof penetration from original installation.**

D. Dayton Residence Hall (DAY)
   a. DAY will use Cat 6 cabling for power and fiber cabling for data transport.
   b. Contractor shall inspect the existing mast and reutilize or replace with installed solution certified to withstand up to 100 mile per hour wind force at the location identified in Exhibit B.
      i. Specific location on parapet will be identified by UNLV.
   c. Contractor shall provide and install (1) 2” conduit from DAY N 501 IDF to the radio location on the exterior wall.
      i. This will require a core drill through the wall, but not a roof penetration.
      ii. The conduit path is not identified and must be verified by the contractor.
   d. Contractor shall provide and install one (1) Customer specified wireless radio per manufacturer's Installation User Manual to Contractor installed mast.
   e. Contractor shall provide and install one (1) Siklu power injector in the DAY 501 and power the injector from the existing UPS.
   f. Contractor shall provide and install (1) 6-strand OSP Single-mode fiber cable from DAY 501 to the Contractor provided NEMA enclosure mounted to the radio mast.
g. Contractor shall provide and install (2) Cat 6 OSP cables from DAY 501 to the Contractor provided NEMA enclosure mounted to the radio mast.

h. Contractor shall provide and install (1) Cat 6 OSP patch cable from the NEMA enclosure mounted to the radio mast to the radio uplink port.

i. Contractor shall provide and install (1) outdoor rated Single-mode LC-LC fiber patch cord.
   i. The patch cord will patch the radio into the fiber enclosure located in the NEMA 4 enclosure mounted to the mast.

j. Contractor shall provide and deliver to UNLV:
   i. (2) 1m indoor rated SC-LC OS2 Single-mode fiber optic patch cords
   ii. (4) 1m indoor rated SC-SC OS2 Single-mode fiber optic patch cords
   iii. (2) 2m indoor rated SC-SC OS2 Single-mode fiber optic patch cords
   iv. (2) 1m indoor rated LC-LC OS2 Single-mode fiber optic patch cords
   v. The patch cords will patch the fiber enclosure located in the IDF to the UNLV network.

k. Contractor shall provide (1) Cisco Silku EH-SFP-SM fiber optic transceiver and install it in the radio fiber port

l. Contractor shall provide (1) Cisco GLC-LH-SMD fiber optic transceiver and deliver it to UNLV.

m. Upon completion, the Contractor shall remove the existing radio and deliver it to UNLV.
   i. Contractor shall remove existing cabling from original installation.
   ii. Contractor shall remove enclosure, mast, and mounting hardware from original installation.
   iii. Contractor shall repair wall penetration from original installation to meet existing fire assembly.
   iv. Contractor shall patch and paint all holes from original installation to match exterior

E. Tam Alumni Center (TAC)
   a. TAC will use Cat 6 cabling for power and fiber cabling for data transport.
   b. Contractor shall remove and dispose of the existing radio and cabling as identified by UNLV.
   c. Contractor shall remove and dispose of existing ¾” conduit and fittings on roof as identified by UNLV.
   d. Contractor shall inspect the existing mast and reutilize or replace with installed solution certified to withstand up to 100 mile per hour wind force.
   e. Contractor shall reuse existing 2” conduit from IDF 127 to roof.
   f. Contractor shall provide and install a weatherhead or other approved waterproof fittings to the top of the existing 2” conduit.
   g. Contractor shall provide and install 2” conduit from the weatherhead or other approved waterproof fittings to contractor provided NEMA 4 enclosure.
   h. Contractor shall provide and install (1) Customer specified wireless radio per the manufacturer’s Installation User Manual to Contractor-provided or existing mast.
i. Contractor shall provide and install (1) Siklu power injector in the TAC 127 and power the injector from the existing UPS in IDF 127.

j. Contractor shall provide and install (2) Cat 6 OSP cables from TAC 127 to the Contractor provided NEMA enclosure mounted to the radio mast.

k. Contractor shall provide and install (1) Cat 6 OSP patch cable from the NEMA enclosure mounted to the radio mast to the radio uplink port.

l. Contractor shall provide and install (1) outdoor rated Single-mode LC-LC fiber patch cord.
   i. The patch cord will patch the radio into the fiber enclosure located in the NEMA 4 enclosure mounted to the mast.

m. Contractor shall provide and deliver to UNLV”
   i. (2) 1m indoor rated LC-LC OS2 Single-mode fiber optic patch cords.
   ii. (2) 2m indoor rated LC-LC OS2 Single-mode fiber optic patch cords.
   iii. The patch cord will patch the fiber enclosure located in the IDF to the UNLV network.

n. Contractor shall provide (1) Silku EH-SFP-SM fiber optic transceiver and install it in the radio fiber port

o. Contractor shall provide (1) Cisco GLC-LH-SMD fiber optic transceiver and deliver it to UNLV.

F. Student Union (SU)
   a. SU will use Cat 6 cabling for power and data transport.
   b. Contractor shall inspect the existing mast and reutilize or replace with installed solution certified to withstand up to 100 mile per hour wind force at the location identified in Exhibit A.
   c. Contractor shall reuse existing 4” conduit from IDF 229 to IDF 318.
   d. Contractor shall reuse existing 2 ¼” conduit from IDF 318 to roof junction box.
   e. Contractor shall provide and install 2” conduit from junction box to radio mast.
   f. Contractor shall provide and install (2) Customer specified wireless radio per the manufacturer’s Installation User Manual to Contractor-provided or existing mast.
   g. Contractor shall provide and install (2) Siklu power injector in the SU 229 and power the injector from the existing UPS in IDF 229.
   h. Contractor shall provide and install (2) Cat 6 OSP cables from SU 229 to the Contractor provided NEMA enclosure mounted to the radio mast.
   i. Contractor shall provide and install (2) Cat 6 OSP patch cable from the NEMA enclosure mounted to the radio mast to the radio uplink port.
   j. Contractor shall provide (2) Cisco GLC-T copper transceivers and deliver them to UNLV.

G. Architecture (ARC)
   a. ARC will use Cat 6 cabling for power and fiber cabling for data transport.
   b. Contractor shall provide and install a roof pad for a non-penetrating roof sled
   c. Contractor shall provide and install a non-penetrating roof sled and 3” O.D. rigid steel galvanized mast with threaded cap.
d. Contractor must certify the installed solution to withstand up to 100 mile per hour wind force at the location identified in Exhibit B

e. Contractor shall provide and install (1) 2” conduit from ARC 237 IDF to the radio location on the roof
   i. The conduit path is not identified and must be verified by the contractor.
   ii. A roof penetration is required to complete this run. The roof must be repaired and the penetration sealed to meet UNLV standards. A weatherhead or other approved waterproof fittings must be installed above the roof.

f. Contractor shall provide and install one (1) Customer specified wireless radio per manufacturer’s Installation User Manual to Contractor installed mast.

g. Contractor shall provide and install one (1) Siklu power injector in ARC 237 and power the injector from the existing UPS.

h. Contractor shall provide and install (1) 6-strand OSP Single-mode fiber cable from ARC 237 to the Contractor provided NEMA enclosure mounted to the radio mast.

i. Contractor shall provide and install (2) Cat 6 OSP cables from ARC 237 to the Contractor provided NEMA enclosure mounted to the radio mast.

j. Contractor shall provide and install (1) outdoor rated Single-mode LC-LC fiber patch cords.
   i. The patch cords will patch the radio into the fiber enclosure located in the NEMA 4 enclosure mounted to the mast.

k. Contractor shall provide and deliver to UNLV:
   i. (2) 1m indoor rated LC-LC OS2 Single-mode fiber optic patch cords.
   ii. (2) 2m indoor rated LC-LC OS2 Single-mode fiber optic patch cords.
   iii. The patch cord will patch the fiber enclosure located in the IDF to the UNLV network.

l. Contractor shall provide (1) Silku EH-SFP-SM fiber optic transceiver and install it in the radio fiber port

m. Contractor shall provide (1) Cisco GLC-LH-SMD fiber optic transceiver and deliver it to UNLV.

Additional Requirements

A. Contractor shall align all radios and complete initial network setup with UNLV provided information

B. Commissioning and Acceptance
   a. Contractor shall complete the Commissioning and Acceptance Form from the Siklu EH-2200F Installation User Manual and deliver it to Technical Point of Contact.
   b. It is the Contractor’s responsibility to resolve any connectivity related issues that surface during commissioning including bandwidth and packet loss issues.
   c. Contractor shall provide FCC registration information to customer.
Accepted Materials

A. Data Cabling and Related Materials
   a. Contractors must meet requirements identified in UNLV Campus Wiring Specification and select from approved manufacturers.

B. Wireless Radio
   a. Manufacturer: Siklu
   b. Model: EH-2200FX
   c. Radio size: 1 foot
   d. Configured with (2) SFP ports, (2) RJ-45 ports
   e. Licensed Throughput: 1Gbps (Full Duplex)
   f. Encryption: 256-bit AES
   g. Support: 3-year Advanced Replacement Warranty
   h. FCC Licensing (The contractor is responsible for providing a 10-year FCC license)

C. PoE injector
   a. Manufacturer: Siklu
   b. Model: EH-60W-AC-PoE-US

D. Fiber optic transceivers
   a. Single-Mode:
      i. Outdoor (radio) - Silku EH-SFP-SM
      ii. Indoor: Cisco GLC-LH-SMD
   b. Copper
      i. Indoor: Cisco GLC-T
Exhibits

1. Exhibit A - GRS-to-SU / PHQ-to-SU / PHQ-to-TAC
2. Exhibit B - CAEO-to-DAY / CAEO-to-ARC
3. Exhibit C - Typical installation - NEMA 4 Enclosure

Typical Installation - NEMA 4 Enclosure

- 1. Contractor Provided and Installed
- 2. 6-Strand OSP Fiber optic cable *Where required
- 3. 2-strand OSP fiber optic patch cord, LC-LC *Where required
- 4. (2) Cat6 OSP cables
- 5. Cat5 OSP patch cord
- 6. Nema 4 Enclosure - 12”x-12”x6” or approved equivalent

Fiber Enclosure *Where required
4. Exhibit D - Typical installation - Roof

Typical Installation - Roof

1. Contractor Provided and Installed
2. 6-Strand OSP Fiber optic cable
   *Where Required
3. 2-strand OSP fiber optic patch cord, LC-LC *Where Required
4. (2) Cat6 OSP cables
5. Cat6 OSP patch cord
6. Radio mounting hardware:
   Mast, sled, pad, misc.
7. Weatherhead or other approved waterproof fitting.
8. Possibly existing - Refer to written specification
9. Min. 16 AWG Ground Cable - Run to nearest building ground
5. Exhibit E - Typical installation - IDF

**Typical Installation - IDF**

- Contractor Provided and Installed
- Contractor Provided, Customer installed
- Customer Provided, Customer installed
- Cat6 patch cords
- Fiber optic patch cords “Where required”
- 19” 1RU vented shelf
- Siklu PoE injector
- Power Cable
- UPS
- (2) Cat6 OSP cables
- 6-Strand SM OSP fiber optic cable “Where required”

To NEMA 4 Enclosure on Roof
6. Exhibit F - Network Equipment Parts List
   a. This list does not contain conduit, conduit fittings, junction boxes, masts, sleds, cabling, cat6 components, fiber components, etc.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Description</th>
<th>Part Number</th>
<th>Quantity</th>
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<tr>
<td></td>
<td>- AES Encryption Feature Option</td>
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</tr>
<tr>
<td></td>
<td>- 3-year Advanced Replacement Warranty</td>
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</tr>
<tr>
<td></td>
<td>- FCC 10-year License</td>
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<td></td>
</tr>
<tr>
<td>Siklu</td>
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<td>EH-60W-AC-PoE-US</td>
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<td>Cisco</td>
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<td>- 1m indoor rated LC-LC OS2 Single-mode fiber optic patch cords</td>
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