SECTION 27 2133 – HIGH DENSITY WI-FI NETWORK – PERFORMANCE SPECIFICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Specification Description
B. Contractor Qualifications
C. Submittal Requirements
D. Closeout Submittals
E. Equipment General Specifications
F. Quality Assurance
G. Warranty and Service

1.02 DESCRIPTION

A. The Owner herewith requests proposals for the design, engineering, installation, commissioning, testing, tuning, optimization, and acceptance of the systems described in these specifications from the interested persons (each a "Vendor," with the selected Vendor, if any, being "the Contractor"). Prices quoted shall be all-inclusive and represent complete installation at the site shown on the forthcoming drawings and in the attached specifications. The Contractor shall be responsible for all parts, labor, and all other associated apparatus necessary to completely install, test, and turn-over for acceptance to the Owner turnkey, fully operational systems. The system is intended to be expandable to provide a fully high-density, ubiquitous solution venue wide. The areas of scope for the initial implementation are the following:
   1. Entries (support for ticketing and security)
   2. Event floor (support for promoter and artist access)
   3. Back of house (support for operations, team, promoter, artist, etc.)

B. These systems include, but are not limited to, the following:
   1. High Density Wireless Network
   2. Associated Servers, Core Switching, Edge Switching
   3. Intrusion Detection / Firewall
   4. Wi-Fi User Onboarding Service
   5. Wi-Fi Analytics
   6. Fiber Optic Backbone
   7. Horizontal Cabling - UTP
   8. Racks, Enclosures, Power Conditioning, UPS
   9. Cable Management
   10. Infrastructure Pathways
   11. Electrical Circuits

C. Contractor is responsible for providing all equipment as described and listed in the project RFP Bid Form document. All additional equipment needed to provide a complete turn-key system shall be listed by the Contractor in the "Additional Items Required" section of the RFP Bid Form document.

D. Contractor is responsible for supplying complete and fully operational system(s) as intended by the RFP documents and any subsequent addendums. Prior to executing a contract for the project, contractor is responsible for notifying Owner of any equipment omissions in the RFP documents that may prevent the completion of fully operational system(s). If the Contractor fails to notify Owner of any equipment

omissions, Contractor shall assume responsibility for providing the required equipment at no additional cost to Owner.

E. Contractor shall field verify all work-site conditions prior to submitting shop drawings.

F. All equipment (except Owner Furnished (OFE)) and materials shall be new (latest version at time of RFP) and shall conform to applicable UL, EIA, TIA, or ANSI guidelines. Remanufactured or "B" stock equipment will not be accepted without prior written consent from the Owner. Evidence of unauthorized remanufactured or "B" stock equipment on the project site will be deemed evidence of the Contractor's Failure to Perform the Work.

G. Contractor shall take care during installation to prevent scratches, dents, chips, or disfiguration.

H. Alternative solutions will be evaluated and must be submitted on a separate Proposal Pricing Form marked as "Voluntary Alternate". Alternates must include device data sheets and a narrative description of the alternate solution.

I. Contractor will provide and install specified signal transmission equipment.

J. Contractor will provide and install "Head End" equipment listed in the RFP Bid Form and Technical Specifications.

K. Contractor will provide single-line schematic drawings of all systems being provided and installed. Include existing systems in the updated drawings where new system device(s) may interface. Provide floor plans, elevations, and eat maps as required, including 3D or isometric views showing this work.

L. Contractor is responsible for the provision and installation of all secondary structural steel (i.e., conduit and raceway supports, hardware mounting systems, etc.), as well as mounting brackets and hardware required to accommodate the new system(s). This includes all labor, materials, equipment, tools, transportation, and project management required to complete fully operational system(s) for the project.

M. Contractor is responsible for assembly, secondary modifications (if necessary) and mounting of all system(s) components to new and/or existing structures.

N. Owner will provide Primary Power at defined demarcation points as shown in the project drawings.

O. Contractor is responsible for all power and electrical distribution from demarcation points (Secondary Power) to new system(s).

P. Contractor will provide all Secondary Power connections/terminations required to power new system(s).

Q. Contractor may utilize available existing conduits for low voltage cabling with the Owner's permission. Additional conduits and raceways required to complete a pathway to each system component will be furnished and installed by Contractor.

R. Contractor is responsible to furnish, install, and terminate all required cabling needed to make new and related existing system(s) complete and fully operational.

S. Contractor shall grant Owner a license to use all proprietary software provided with this RFP for the life of the system(s).

1.03 CONTRACTOR QUALIFICATIONS

A. Owner seeks to contract with a qualified contractor for full performance of the work as described in this RFP. This will include the option to obtain a long-term service contract and support for all equipment supplied by the selected contractor. To ensure the chosen contractor has the long-term interests of Owner in mind, the following shall be required to submit an RFP for this project. Failure to submit acceptable responses to the listed requirements shall eliminate a contractor from consideration. The Owner, in its sole discretion, shall reserve the right to waive any or all requirements listed below:

1. The Proposer shall be or shall sub-contract with a certified dealer as required by the specified equipment manufacturers and provide evidence upon request by Owner or Owner's Consultant.
2. Contractor shall provide a list of a minimum of three (3) facilities (facility, contact name, title, address, and current phone number) where the contractor has provided equipment and services of equivalent size and scope within the last five (5) years.
3. Contractor will provide a minimum of one (1) facility (facility, contact name, title, address, and current phone number) where the contractor has provided equipment and services of equivalent size and scope that is at least five (5) years old.
4. Contractor is required to provide a Letter of Surety from their bonding agent, stating their ability to provide a 100% payment and performance bond if they are the successful Proposer.
5. Contractor must provide a direct service employee or certified Contractor capable of providing maintenance response within 24 hours of a call for service.
6. Contractor must have a minimum of 6 years in the high-density Wi-Fi business.

1.04 SUBMITTAL REQUIREMENTS

A. Contractor is required to provide electronic submittals and shop drawings to the Owner within fifteen (15) calendar days of date shown on award notice, acknowledged with a binding letter of intent.
   1. Contractor is responsible to ensure that the dimensions and specifications of each component and all systems fit within the building allowances.
   2. Contractor will advise the Owner of any discrepancy that may affect the installation. If Contractor fails to notify Owner of any discrepancies, Contractor assumes responsibility for providing the required equipment and labor to correct such discrepancies at no additional cost to Owner.
   3. The following required submittals will be defined by guidelines established by the Owner and shall include, but not be limited to:
      a. One (1) set of electronic shop drawings, product data, and samples in PDF format, compiled in one file within thirty (30) calendar days of date shown on the Contract Award Notice, and prior to ordering equipment.
      b. Catalog data sheet pdf files, bound into a single file with title page, space for submittal stamps, and divider pages between sections.
      c. A complete list of proposed equipment with reference to its corresponding specification paragraph number, or equipment title in specification paragraph order. Denote all approved substitutions.
      d. Point-to-point wiring diagrams and an associated table of wire lists identifying every connection. Include all terminated system devices and ancillary components.
         1) Indicate locations of all components.
         2) Identify cables by types and wire numbers.
         3) Provide complete, detailed wiring diagrams for systems based on the contract documents. Include cable types, identification numbers, detailed connections, connector types, and cable lengths.
   4. Drawings shall comply with ANSI and International Electro Technical Commission recommendations and standards as appropriate. Provide drawing set cover sheet clearly dimensioning all cable details for each cable type and connector utilized in the system.
      a. Structural drawings (where applicable) for all secondary engineered steel framing required for this scope of work.

b. Structural drawings submitted shall include attachments to primary steel structure and method of attachment for all required components. A licensed/registered engineer in the state of the project shall stamp and seal all structural drawings.

5. Conduit riser diagrams showing required conduits and junction boxes along with types and quantities of cables contained in each conduit. Show details of weatherproofing, lightning protection and grounding, strain relief and cable support, fire stop protection, and wall penetrations.
6. Rack elevations indicating the proposed arrangement of mounted equipment. BTU load, weight, electrical power load and circuit information for each piece of equipment shall also be included in the rack elevation drawing.
7. Detail drawings of all custom fabricated items and approved equipment modifications. Include complete parts lists, schematic diagrams, and all dimensions required for proper assembly.
8. Drawings shall indicate proposed color selections and finishes for all exposed surfaces and custom fabricated items. Submit actual color/finish samples, wall plates, and custom labels upon request.
9. A list of all lower tier subcontractors and suppliers. List must include lower tier subcontractor's qualifications indicating performance of work similar to past projects of this type and scope.
10. A project schedule in Gantt chart format outlining equipment delivery dates and installation start and finish dates. Project schedule shall be broken down into sufficient detail (work task and duration) to permit Owner the ability to monitor installation progress daily.
11. Copies of all required business and Contractor licenses.
12. Copies of proof of insurance.
13. Approval of submitted items indicates only the acceptance of the manufacturer and quality. Specific requirements, arrangements, and quantities must comply with the intent of the Contract Documents as interpreted by the Owner unless specifically approved in writing.
14. Submittals that are incomplete, deviate significantly from the requirements of the Contract Documents, or contain numerous errors will be returned without review for rework and re-submittal, and may result in back charges to the Contractor.

1.05 CONTRACT CLOSEOUT SUBMITTALS

A. When the installation is substantially complete, including the Testing Reports in Part 3.11 of this document, Contractor must submit to the Owner an electronic file (pdf format) of contract closeout submittals for review. After review and approval of the closeout document set, Owner will return to Contractor the file with comments for updating. Contractor will return a final updated set of closeout submittals to Owner (electronic copy) in PDF format, and one (1) electronic copy of As-Built files in .dwg format (or current format approved by Owner) as related to discipline. Closeout submittals will include, but not be limited to:

1. Project Record Drawings (As-Built Drawings) including wiring schedules, final device locations in plan-view, final device locations in reflected ceiling plan-view, final device locations in section and elevation view, secondary steel structural drawings (plans and elevations), custom plate and panes details, system schematic diagrams, electrical power schematic drawings, rack elevation detail drawings, and channel plan per AP.
2. Electronic and hard copy of Operation & Maintenance Manual. (See section B. below)
3. A list of all equipment provided and its location within the facility. List must include manufacturer name, model identifier, serial number, and any other pertinent information needed to obtain service, maintenance, and/or replacement.
4. A list of all Subcontractors who performed work for Contractor during installation. List must include company name, physical company address, phone number, and contact person(s).

5. Copies of all software, settings, and programs used in the control and operation of this system.
6. Copies of all equipment registration documentation.
7. Test reports for all new copper and fiber optic cable installed under this scope of work. Test reports must indicate that end-to-end signal loss does not exceed applicable industry standards.
8. Bowl area must include RF test from reports from a minimum of 2 locations per section.
9. Heat maps of final optimized configurations (PDF and native format).

B. Operation & Maintenance Manual
   1. Upon substantial completion but prior to onsite training with the Owner, Contractor will provide one (1) printed hard copy [final] Operation & Maintenance Manual (O&M Manuals) and one electronic PDF copy. O&M Manuals must have tab dividers and be logically organized to provide easy access to information without the need to research through the entire manual. All documents provided in the O&M Manual will be written in English and provide sufficient detail for an individual with knowledge of the provided systems. Contents of the O&M Manual will include, but not be limited to:
      a. Table of Contents.
      b. All relevant configuration files.
      c. Description / overview of system(s) including key features and operational procedures.
      d. Full start up procedure for all systems equipment and any additional networking components written under the assumption that all equipment was in full powered-off mode.
      e. Full shutdown procedure for all systems equipment written under the assumption that the facility is in an extended power failure situation.
      f. Owner's Manuals for all third party and "off the shelf" type equipment provided by Contractor, e.g., KVM's, media converters, network switches/routers, and UPS battery backups.
      g. Small scale plans showing locations and circuit numbers for all system outlets and receptacles.
      h. Single-line block diagrams showing all major components of the systems.
      i. All third-party equipment and "off the shelf" equipment warranties and a notarized System Warranty.

1.06 EQUIPMENT GENERAL SPECIFICATIONS

A. All equipment and materials, except owner furnished, will be new and the latest version at the time of RFP and must conform to applicable UL, ULC, CSA or ANSI provisions. Re-manufactured or "B" stock equipment will not be accepted without prior written consent from the Owner. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site will be deemed evidence of the Contractor's failure to perform the work. Contractor must take care during installation to prevent scratches, dents, chips or disfiguration of equipment and materials supplied. All damaged equipment and/or materials will be repaired or replaced at Owner's discretion. Contractor will perform either option selected by Owner at no additional cost to the Owner.
   1. All cabling [power and data] must be labeled at each end of the cable with a description in English and a reference to a wire designation on a wiring diagram. These diagrams must be part of the Project documentation submitted to the Owner at time of acceptance.
   2. Each device will meet all published manufacturer's specifications. Verify performance as required.
   3. Provide an uninterruptable power supply (UPS) at the bottom of each specified equipment rack as noted herein. The UPS will be connected to all specified processor driven equipment including but not limited to fiber optic, and network devices. UPS will have the capability of providing

power to all equipment within the rack for a period of 15 minutes in the event of a power failure at the facility.

4. Install all rack-mounted equipment with Middle Atlantic Products HP Series truss head screws or approved equal.
5. Some rack-mounted equipment may require shaft locks, security covers, or removal of knobs. Provide and install during acceptance testing.
6. Enclosures exposed to the outdoors, or not contained within a suitably controlled telecom room, must be NEMA 4X rated or approved equal. Provide adequate environmental conditioning and control to ensure long-term equipment survivability.
7. Under-seat APs must be able to withstand pressure washing. Maximum pressure washing PSI will be less than 4,000 with nothing less than a 15-degree washer tip and greater than 24 inches away from the access point.
8. Under-seat APs must be able to withstand commercially available cleaning agents and solvents to clean the access point.
9. Provide labeling at the front and rear of all rack-mounted signal equipment. Mount labels on the equipment chassis and attach in a neat and permanent manner. Label equipment with schematic enumeration reference, and with descriptive information regarding its function or area it is serving. Similarly, provide self-adhesive labels at the rear only of equipment mounted in furniture consoles.
10. All labeling will be 1/8” block lettering unless noted otherwise. On dark panels or pushbuttons, letters will be white. Letters will be black on stainless steel, brushed natural aluminum plates or light-colored surfaces.
11. Mounting hardware exposed to the weather will be aluminum, brass epoxy painted galvanized steel or stainless steel. Apply corrosion inhibitor to all threaded fittings where applicable.
12. Unless directed otherwise, equipment racks will be Middle Atlantic Products model WRK-44-32, or approved equal, with accessories as noted below. Quantity of racks will be as required to house all equipment supplied under this scope of work. Any unused rack mounting spaces will have color matching blank panels to fully enclose the rack assembly. Multiple racks will be anchored together using appropriate ganging hardware. Standard solid rear doors will be replaced with vented rear doors unless noted otherwise.
    a. Provide two (2) side panels per individual stand-alone rack or series of racks ganged together. The intent is to have an enclosed rack system. A single stand-alone rack will have two (2) side panels and a series of three (3) racks ganged together will also have two (2) side panels. Side panels will be Middle Atlantic Products model SPN-44-32 or approved equal.
    b. Provide Middle Atlantic Products model MW-4QFT-FC integrated fan top, or approved equal, for each rack. Fan must be thermostatically controlled to ensure in-rack temperatures of less than 68 degrees Fahrenheit.
    c. Provide Middle Atlantic Products in-rack vertical power strip. Power strip will have enough receptacles to accommodate all equipment housed in the associated rack with a minimum of two spare receptacles per rack.
    d. Provide Middle Atlantic Products model PDLT-815RV-RN horizontal rack-mount power/lighting, 8 Outlet, 15A, surge protection accessory power strip as necessary.
13. Any rear-mounted rack equipment will be placed so the equipment does not block access to the back of front-mounted equipment.

14. Contractor will exercise care when wiring racks to avoid damaging cables and equipment. Contractor will install grommets around cut-outs and knockouts where conduit or chase nipples are not installed.
15. Power wiring and signal/data wiring will be installed on opposite sides of rack. Contractor may determine which side is used for power and which side for signal. Method will be kept the same for the entire installation if multiple racks are required. Contractor will exercise care when wiring racks to avoid damaging cables and equipment.
16. Any equipment mounted above seating areas and venue floor is required to be secondarily fastened to structure using aircraft cable and appropriate fasteners. Cable sizing and fasteners must be capable of supporting a minimum of five (5) times the weight of affixed devices and eight (8) times the weight of movable devices.

1.07 QUALITY ASSURANCE

A. All requirements of the latest published editions of the following standards will apply, unless otherwise noted. In the event of conflict between cited or referenced standards, the more stringent will govern.
   1. National Electric Code (NEC).
   2. National Electrical Manufacturers Association (NEMA).
   3. American National Safety Institute (ANSI).
   4. Occupational Safety and Health Administration (OSHA).
   5. American Iron and Steel Institute (AISI).
   6. Underwriters Laboratories (UL).
   7. Federal Communications Commission (F.C.C.) Rules and Regulations, Part 76.
   8. American Society of Testing Materials (A.S.T.M.).
   9. Electronic Industries Association (E.I.A.).
   10. Telecommunications Industries Association (T.I.A.).

B. Review all architectural, civil, structural, mechanical, electrical, and other project documents relative to this work.

C. Verify all dimensions and site conditions prior to starting work.

D. Coordinate the specified work with all other trades.

E. Maintain a competent supervisor and supporting technical personnel, acceptable to the Owner during the entire installation. Change of supervisor during the project will not be permitted without prior written approval from the Owner.

F. Provide all items not indicated on the drawings or mentioned in the specifications that are necessary, required, or appropriate for this work to realize a complete and fully operational system that performs in a stable and safe manner.

G. Review project documentation and continuously make known any conflicts discovered.

H. Provide all items necessary to complete this work to the satisfaction of the Owner without additional expense. In all cases where a device, item, or equipment is referred to in singular number or without quantity, each such reference will apply to as many such devices or items as required to complete the work.

I. Provide additional support or positioning members as required for the proper installation and operation of equipment, materials and devices provided as part of this work and approved by the Owner, without additional cost to the Owner.

J. Regularly examine all construction, and the work of others, which may affect Contractors work to ensure proper conditions exist at the site for equipment and devices before their manufacture, fabrication, or installation.

K. Contractor will be responsible for the proper fitting of the systems, equipment, materials, and devices provided as part of this work.

L. Promptly notify the Owner in writing of any difficulties that may prevent proper coordination or timely completion of this work. Failure to do so will constitute acceptance of construction as suitable in all ways to receive this work, except for defects that may develop in the work of others after its execution.

M. After installation, submit photographs showing cable entries and terminations within equipment racks, enclosures, and pedestals at the job site.

1.08 WARRANTY AND SERVICE

A. Contractor will warrant labor, equipment, and materials for twenty-four (24) months following the date of Final Acceptance of permanent system installation.

B. During the warranty period the system must be free of defects and deficiencies and conform to the drawings and specifications with respect to the quality, function, and characteristics stated.

C. Contractor is responsible to repair or replace defects that occur in labor, equipment, and materials within the warranty period.

D. On-site labor will be included during the warranty period for all work beyond simple component replacement. Simple component replacement will be defined as all equipment that does not require tools to perform the equipment replacement.

E. Failed parts will be returned to the Contractor for repair at a service facility located in the United States. Contractor will identify the location of its service facility in the documentation provided when submitting an RFP for this work.

F. The Contractor will replace failed parts that cannot be repaired.

G. Upon receipt of a failed part, Contractor will return a repaired or replacement part to the Owner within fifteen (15) business days from receipt of failed part.

H. Contractor will provide at least one local service employee or local authorized service agent for servicing and repair of all equipment during the warranty period. Local service employee or local authorized service agent will be located within 75 miles of Owner's facility.

I. The local service employee or local authorized service agent will be the entity responsible for providing the following emergency response availability:

1. Telephone service assistance and technical support from 8am to 11pm local time at Owner's facility, 7-days per week.
2. Answer all service calls and requests for information within one (1) hour during the warranty period.
3. A parts exchange program, including same day shipment of exchange parts. The manufacturer will keep a ready stock of key assemblies available to ship to the facility upon notice of a parts failure if part is not available in spare parts inventory at Owner's facility.
4. The advance replacement should contain all shipping information and packaging necessary to return the defective part or assembly back to Contractor at no cost to the Owner.

J. Warranty will cover all equipment, including processors, controllers, operating systems, and software.

K. Warranty will include two annual on-site system check-ups by a qualified technician who is a full-time employee of the Contractor. Visit to occur approximately 3 weeks prior to the start of the second and third years or as determined by the Owner.

L. Check-up will include all regular maintenance; a complete inspection of all systems, parts replacement where required and a complete written report of all findings.

END OF PART 1 GENERAL

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. See accompanying Bid Form for pricing submission format.

B. Basis Form is intended to include all major system component categories. Contractor is responsible for including all miscellaneous components to provide a complete and fully operational system.

C. Provide, installation, commission, configure, all Wi-Fi system components.

D. Expected Solution Performance

1. System proposal is to be all inclusive and turnkey including, but not limited to, all switching, routing, servers, security devices, infrastructure, and networked managed uninterruptable power.
2. It is expected that the Contractor will base headend component selection and system design on total occupancy of 14,000 spectators and their multiple associated devices in all public areas including surrounding areas (plazas), and elevators. Headend hardware will only be licensed for the base scope defined in section 1.02, but future ready for venue wide deployment.
    a. Assume ~300 BOH staff and operations.
    b. Assume on boarding across entries of 14,000 users within 30 minutes.
3. The Contractor is responsible for determination and verification of the number and type of access points to be deployed. Locations are expected to be a mixture of under seat, handrail (possible reuse), cable tray, exterior, and finished ceiling, and parapet installations based upon coverage needs.
4. Contractor is required to provide any mounting and or custom enclosures as part of their proposed solution. Enclosures shall be survivable of regular pressure washing – reference Sections 1.06.7/1.06.8.
5. Contractor is required work with the Owner to determine quantities of SSIDs broadcasted and non-broadcasted, based upon their proposed solution and forthcoming needs of the Owner.
6. Current SSIDs.
    a. BSWA Production 2
    b. EventsandArtists
    c. GAD-Admin2
    d. TM Presence 2
    e. BSWA Video
    f. Levy Ops
    g. Levy POS
7. Contractor shall be cognizant and present means by which to minimize rogue traffic and bandwidth conservation such as, but not restricted to, HTTP caching proxy, blocking external streaming sources, and QoS traffic shaping.

8. The Contractor is responsible for turnkey system performance and is required to independently determine the actual system load for their proposed system, based upon the Owner's stated performance requirements. Coverage area is bowl seating, suite areas, business operations, BOH operations, concourses, premium areas, truck dock, media, elevator cabs, POS, exterior plazas, portable show spares, entrances and hallways leading toward suites, bottom and top of escalators, outside ticket scanning locations, and additional access points at outside ticket scanning locations to support mobile tickets on attendee devices, etc. System shall be engineered to cover all areas of the facility. Contractor will be responsible for ensuring that any wireless point of sale solution authenticates, operates and roams seamlessly throughout the coverage areas.
    a. Note - outside ticket scanning locations have separate, dedicated APs to support patrons attending the venue so they can use Wi-Fi to load their mobile tickets on their phones prior to getting their mobile ticket scanned.
9. Throughput and Capacities:
    a. Minimum provided throughput per user - Internet 11 Mbps
    b. Total spectators in seated and standing coverage areas 14,000 - Future
    c. Average operations staff presence in BoH areas 300
    d. Signal to Noise Ratio NTE -65dBm
    e. Minimum concurrent connections 85% 11,900
    f. Wi-Fi 6E or better
10. Connectivity for both ticketing hardware and fan mobile devices at all current and potential primary and secondary ticket scanning locations
11. Contractor will ensure best coverage opportunity for future in-seat connectivity.
12. Contractor will consider current phase & future expansion in the design that requires connectivity
13. Contractor will ensure all edge ports supply sufficient PoE power budget for full endpoint functionality.

E. System topology is to be redundant with fault detection and notification, as well as implement redundant hardware power supplies to provide for minimal possibility of system outage.

F. The Contractor shall provide adequate high-density wireless network and backbone to maintain the level of throughput required for all services, inclusive of event day wireless.

G. The Contractor shall assume station cabling is to be of Category 6a UTP or better, providing a minimum of a Gigabit physical copper backbone to all edge devices.

H. Contractor will reuse enclosures where appropriate and add remote telecom enclosures (wall-mount, etc.) where applicable to support distribution.

I. Ancillary networked services supported by high density wireless network, but not restricted to:
    1. VoIP
    2. AoIP
    3. Life Services (Security, Fire, and Mechanical)
    4. Video Conferencing
    5. Point of Sale
    6. Broadcast
    7. Audiovisual Systems
    8. Ticketing
    9. Mobile App
    10. Web Services

2.02 SOFTWARE ENVIRONMENT

A. The following applications and features, including, but not limited to, represent current desired capabilities of the Owner.

B. Management
   1. RF Performance
   2. Client RF health
   3. SNR
   4. Speed statistics

C. Firewall
   1. App performance
   2. Usage by device
   3. Destinations, WLAN
   4. Users or roles

D. RF Capacity
   1. Network-wide AP threshold and usage statistics

E. Anomaly Detection
   1. Current client count and network usage statistics compared to 40 week rolling average

F. Watched Clients
   1. SNR, speed and health statistics for VIPs/problem prone clients

G. Client On-boarding
   1. Captive Portal
   2. Policy Manager
   3. Real-time visibility and analysis
   4. Identity Stores
   5. Enterprise Data

H. PCI Compliance for POS
   1. Network Policies
   2. Device Policies

I. Visitor Engagement
   1. Mobility Context
   2. Location Services
   3. Impact the Customer experience

J. Mobile Engagement Technologies
   1. Services
   2. Network
   3. Applications

K. Virtual Beacons

L. BTLE

M. Contractor to provide metrics from monitoring consoles to substantiate performance:
   1. Number of connections
   2. Connection device type
   3. Authentication time
   4. Bandwidth per user

5. Total bandwidth
6. Dropped connections
7. Issues and resolution

N. Contractor will demonstrate with Owner representative present: In-game:
1. Seamless roaming
2. Bandwidth to device per section/area

2.03 ACCEPTABLE MANUFACTURERS: ALPHABETICALLY

A. Acceptable Manufacturers
1. Aruba/HPE
2. Cisco
3. Extreme
4. Fortinet
5. Ruckus

END OF PART 2 PRODUCTS

PART 3 EXECUTION

3.01 SCOPE OF WORK

A. The following outlines the turnkey delivery and installation responsibilities that define the project scope of work. All work outlined in this section is the responsibility of the Contractor unless otherwise noted. Contractor is required to provide all labor, materials, tools, supervision, and equipment to perform the following:

1. Contractor is required to correspond with the project electrical contractor to confirm system power, conduit, and cabling work associated with this project.
2. Contractor is responsible for assembly, secondary modifications and mounting of all components onto existing structures within the facility.
3. Provide and install all equipment listed in the Bid Form document. Include all equipment not specifically listed but required to provide a completely functional system as part of this RFP.
4. Furnish manufacturer provided training on the operation of the new system(s).
5. Provide all required permits and licenses.
6. Provide on-site installation supervisor per Section 1.7.E.
7. Coordinate work with other trades and coordinate scheduling with the construction supervisor to minimize delays.
8. Deliver all Equipment to site and convey to appropriate locations within site as directed by Owner.
9. Store all Equipment in a safe and secure manner until installed, or otherwise directed by Owner. Coordinate onsite storage container or available space in facility.

3.02 GROUNDING AND SHEILDING

A. Mount and enclose all electrical and electronic equipment in metal enclosures and equipment racks.

B. Use EMT type conduit for all cabling outside of equipment racks, except where plenum rated cabling is used above lay-in ceilings, cable trays, and designated raceways. Rigid type conduit will be used for underground raceways.

C. Use flexible conduits and PVC fittings to provide insulated connections of the building electrical raceways to equipment racks. Mount all equipment racks at the job site in a manner which provides electrical isolation from the building structure and electrical raceways.

D. Provide a single Technical Ground at Equipment racks where necessary.

3.03 WIRING PRACTICES/INSTALLATION

A. Provide rated cable for work to meet NEC codes.

B. Provide wet rated electrical power cords that connect to the nearest electrical outlet provided by others if environmental conditions require. Appropriate AC power connections are to be field verified.

C. Cables will be bundled, supported, and professionally installed. Include service and drip loops as necessary.

D. In all applicable instances use Neutrik or Switchcraft signal connectors that are gold plated. Use Hubbell or equivalent electrical connectors for power. Use West Penn, Belden, or Corning fiber connectors.

E. Where specific instructions are not given, perform all wiring in strict adherence to standard engineering practices in accordance with the references listed in Section 1.7.

F. Group all cables into the following classifications by power level or signal type:

1. DC Control Circuits: -20dBm.

2. Copper Data.
3. Fiber Data.
4. AC Power Circuits.

G. Separate wiring of differing classifications by at least six (6) inches, wherever possible. Wherever lines of differing classification must come closer together than six (6) inches, cross them perpendicular to each other.

H. Neatly harness wires together within racks by power level classification using horizontal and vertical wiring supports as required. Rigidly support all wires with fixed connection points. Leave service loops of sufficient lengths to allow rack hinges or slides to fully extend to facilitate access to rear panel connectors from the front of each rack. Do not use self-adhesive tie-wrap pads for support of cables unless fastened with screws.

I. Observe consistent polarity throughout the systems as follows:
1. Use approved transformers as directed to reduce objectionable system noise to acceptable levels.

J. Exercise care in wiring to avoid damaging the cables and equipment. Use grommets around cut-outs and knockouts where conduit or chase nipples are not installed.

K. All fiber splicing will utilize the fusion splice method. The maximum allowable loss per fusion splice will be 0.5 dB.

L. Pull mandrel one size smaller than the conduit, through entire length of all underground conduits.

M. Cable pulling lubrication must be utilized when pulling cable in conduits.

N. A dynamometer must 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 must not be exceeded.

O. Pulling grips suitable for use with fiber cables will be applied to the ends of the cable. Consult cable manufacturer to determine appropriate pulling grip and method of attachment. Breakaway or fuse links will be used at the pulling grip. Ensure that the correct fuse pin is installed in the fuse link.

P. The bend radius for all cables will conform to manufacturer's specifications.

3.04 CABLING PERFORMANCE SPECIFICATIONS

A. The UTP cabling system proposed for this project shall meet the following minimum system (cable and hardware combined) industry standard compliance requirements as evidenced by 3rd party verified lab test results (i.e., ETL labs) submitted with bid. Systems performing below these levels shall not be accepted. UTP cabling to be provided shall be Belden 10GXS13 002 – Color Red. Belden connectors, patch panels, and patch cords to be used in accordance with referenced cable to provide a complete and certifiable Belden cabling system(s).
1. NEC/(UL) Specification: CMP
2. NEC Articles: 800
3. CEC/C(UL) Specification: CMP/CMR Respectively
4. ISO/IEC 11801 Ed 2.2 (2011) Class EA
5. CPR Euro class: Eca
6. Data Category: Category 6a
7. ANSI Compliance: S-116-732-2013 Category 6a, ANSI/NEMA WC-66 Category 6a
8. Telecommunications Standards: ANSI/TIA-568-C.2 Category 6a
9. IEEE Specification: IEEE 802.3bt Type 1, Type 2, Type 3, Type 4
10. Other Specification: Verified Channel/Category 6a.
11. Other Standards: C(UL)US CMP 105C OR (UL) CMP-LP (0.6) OR CL3P-LP (0.6)

B. All fiber optic cable proposed for this installation shall meet or exceed the following industry compliance standards. Indoor fiber optic cabling to be provided shall be Belden FISD0XXPK (where XX indicates strand count). Indoor/outdoor fiber optic cabling to be provided shall be Belden FISD0XXAJ (where XX indicates strand count). Belden connectors, LIUs, and patch cords to be used in accordance with referenced cable to provide a complete and certifiable Belden or approved alternate cabling system(s).
   1. Mode Field Diameter: 9.2
   2. Fiber Core Diameter: 8.2/125µm
   3. Max Attenuation at 1310 nm: 0.5 dB/km
   4. Max Attenuation at 1550 nm: 0.5 dB/km
   5. Wavelength: 1310 nm / 1550 nm
   6. 10 Gigabit Ethernet Performance: 10,000 m / 40,000 m
   7. 1 Gigabit Ethernet Performance: 5,000 m /
   8. Fiber optic cable maintenance loops shall be a minimum of one (1) meter at the work area outlet and three (3) meters at the wiring closet.
   9. All fiber optic terminations and splices shall be done via fusion splice method.

3.05 HORIZONTAL CABLE SUBSYSTEMS

A. Where connectors must be installed into surface mounted raceway, the Contractor shall provide the appropriate faceplate as well as any necessary adapters to facilitate the installation of the connectors specified in this section directly into the raceway. Surface mounted boxes shall not be accepted as mounting devices on surface raceways.

B. At the wiring closet, each UTP cable shall be terminated onto an approved connector and loaded into an approved modular patch panel or equivalents. All patch panels shall be modular, front-access, high density patch panels. No fixed-port 110-style panels shall be accepted. Contractor shall provide required patch panels ports plus 20 percent for future growth. Patch panel ports provided as excess for future growth need not be populated with connectors. However, all excess ports not populated shall have installed a single blank insert.

C. A two-rack-space horizontal wire management panels shall be installed for every 48-port patch panel. All wire management panels shall be made of flexible finger-duct with covers. D-ring wire management systems shall not be accepted.

3.06 LABELING

A. Label products in a logical, legible, and permanent manner corresponding to the Drawings. Wording, format, style, color, and arrangement of text will be subject to the consultant's approval.

B. Submit samples and labeling schedule for approval upon request. Labeling will be verified at final system adjustment and equalization.

C. Label all wall plates for input, output, and control receptacles as well as connector mounting plates in all boxes using 1/8" lettering of contrasting color, as approved.

D. Use self-adhering labels, squarely and permanently attached, to label the following:
   1. Patch panel designation strips.
   2. Front and back of all rack mounted equipment including controls.
   3. Barrier strips, terminals, transformers, switches, relays, volume controls and similar devices.

E. Label pushbutton switches with lettering of contrasting color.

F. Label all permanently installed wires 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.

G. Label all portable equipment with block letters using initials and/or words. Label all portable cables similarly with printed heat-shrinkable tags located 12 inches from the male connector end. Verify lettering through the consultant prior to engraving or printing.

H. Label access panels and backboards with designations corresponding to the drawings.

3.07 ENGINEERING

A. Contractor will provide stamped and sealed engineered drawings of all mounting locations. Engineer must be certified in the state of the project.

B. Contractor will provide stamped and sealed engineered drawings of all device mounting and rigging assemblies. Engineer must be certified in the state of the project.

C. Owner must approve all drawings in writing prior to the fabrication and installation of any equipment.

D. Engineered drawings must include both structural and electrical.

E. The Contractor is solely responsible for verification of the integrity of all engineering calculations. Contractor is responsible for verification of all information provided or implied.

3.08 STRUCTURAL CONSIDERATIONS

A. Contractor is responsible to design, engineer, build, deliver, install, integrate, and commission complete a turnkey system(s) as specified with all required sub-structure needed to support devices and associated components.

B. Contractor will verify all field conditions and coordination prior to installation.

C. Mount all system(s) devices, fiber interfaces, UPS, and other required devices to make for a complete operating system.

D. Contractor is responsible for design and erection of all mounting equipment, material, and hardware related to the new equipment.

E. Mounting equipment, material, and hardware will be fabricated using structural steel and/or aluminum (optional). Contractor will provide necessary protective separation when connecting dissimilar metals to prevent galvanic corrosion.

F. Bolted and/or field welded connections will be subject to special inspection by an independent testing & inspection agency certifying that bolted and/or welded connections meet the minimum requirements of the engineered structural drawings, the governing building code, or as required by the building official; whichever is more restrictive. Inspections will take place prior to painting any connection.

G. Documentation will be provided to Owner verifying acceptable results from all special inspections. All items failing inspection will be repaired or replaced and re-inspected at no additional cost to the Owner.

H. All components that are painted or otherwise finished for exterior service conditions will be warranted to be free of rust or other defects for a period of ten years.

I. All welders must be certified, and certificates must be on site and available for inspection as requested.

J. To minimize fading or oxidation, all finishes must be primed and coated. All areas of the secondary support structure must be primed and painted to match.

3.09 ELECTRICAL AND DATA

A. The electrical design and installation of all branch circuits by the Contractor will comply with NEC, state, and local codes, as well as Owner regulations and guidelines.

B. The Contractor is required to provide signal and data one-line diagrams.

C. Single-mode fiber tested will not have a signal dB loss greater than 0.1dB per 600 feet (200m) for 1310nm fiber or a loss greater than 0.1 dB per 750 feet (250m) for 1550nm fiber.

3.10 AESTHETIC CONSIDERATIONS

A. Contractor will assume premium finishes on all elements not yet defined.

B. For Owner's approval prior to contract award, the Contractor must provide a comprehensive outline of intended finish details of all equipment that will be in public viewing areas. Failure to submit these details prior to contract award will make Contractor responsible for all finishes as required by Owner at no additional cost to Owner.

C. No exposed bolts or unfinished surfaces are permitted on equipment that is within public view. Any part of the secondary steel frame exposed to public view will be covered with flashing or structure if requested by Owner.

D. The Contractor will not visibly display its trademarks or insignia on any of the Equipment or structural elements within public view.

3.11 FINAL ADJUSTMENT AND EQUALIZATION

A. Ensure that the system is free from oscillation, noise, hiss, buzzes, or other extraneous noises. Coordinate with LED board contractor (or Owner) to identify structure rattles so they may be eliminated during testing phase.

B. Schedule a time for the Owner's representative or consultant to be present at system Final Adjustment and Equalization. Notify the Owner at least two weeks in advance.

C. Furnish a technician who is familiar with the system to assist the consultant during Final Acceptance and Adjustment.

D. Record final settings on all equipment and submit with contract closeout documents.

3.12 TRAINING

A. The Contractor, at its own expense, will provide designated Owner employee, operator, and maintenance training.

B. Training will be performed at the site by a qualified technician and will occur either during installation of the equipment or immediately thereafter. O&M Manuals per Section 1.5.B will be provided to Owner prior to training.

C. The training will cover the operation, routine maintenance, and troubleshooting of the system and control equipment.

D. Furnish manufacturer provided training on the operation of the new system(s).

E. Training will consist of at least 24 hours over the course of 3 days of instruction.

F. Contractor will video record all training sessions and submit recorded training sessions to Owner in electronic format with O&M Manuals.

G. Contractor will be required to have a systems operator on site for the first event and continue to be on site for three (3) consecutive problem free major events as approved by the Owner. "Problem-free" constitutes an event where the system, and any other components installed by the Contractor, perform without failure during an event. It will be required that each successful event will be "signed off" by the Owner until three (3) consecutive events are achieved.

H. Warranty period will commence at the conclusion of the third consecutive successful event.

3.13 TESTING AND ACCEPTANCE

A. Contractor must demonstrate the full capabilities of the provided systems and prove performance meets contractual specifications.

B. Confirmation will be required for, but not limited to the following functions:
   1. Operation of each system component including:
      a. Back-up systems
      b. Control system(s) functionality
      c. Integration with existing systems

C. Contractor must provide all necessary testing equipment for acceptance.

D. Upon notice from the Contractor of substantial completion and at a time to be mutually agreed upon, the Contractor will arrange for testing of all operations of the systems comprised in scope of work at the time of substantial completion.

E. The following items must be completed and signed off by an appointed Owner's official before the Owner will deem the system "Accepted":
   1. The Owner will not be responsible for any added costs resulting from an unsuccessful acceptance test.
   2. Acceptance of the system includes, but is not limited to, the completed installation of all physical components and the issuance of the Certificate of Approval for code compliance by the Code Authority having Jurisdiction.
   3. Tests of the system will not occur until after the system has been installed, and all work has been completed.

F. Document all acceptance testing, calibration, and corrective procedures described herein. Include the following information:
   1. Performance date of the given procedure.
   2. Conditions related to the performance of the procedure.
   3. Type of procedure, and description.
   4. Parameters measured and their values, including reference values measured prior to calibration (or correction), as applicable.
   5. The names of personnel conducting the procedure.
   6. The equipment used to conduct the procedure.

G. Upon completion of initial tests and adjustments, submit written report of tests to the Owner along with all documents, diagrams, and recorded drawings required herein.

H. Final Procedures.
   1. Perform all "punch-list" work to correct inadequate performance or unacceptable conditions, as determined by the Owner representative, at no additional expense to the Owner.
   2. Furnish all portable equipment to the Owner along with complete inventory documentation. All portable equipment will be presented in the original manufacturers packing, complete with all included instructions, miscellaneous manuals, and additional documents.
   3. Test and demonstrate portable equipment or systems as requested by the Owner.
   4. Provide new acceptance testing in the same format as initial test reports.
   5. Check, inspect, and if necessary, adjust all systems, equipment, devices, and components specified, at the Owner's convenience, approximately thirty (30) days after the Owners acceptance.
   6. Upon completion of the Work, the Owner may elect to verify test data as part of 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.

END OF PART 3 EXECUTION