

APPENDIX A

SECTION 27 53 19

CELLULAR DISTRIBUTED ANTENNA SYSTEM (DAS)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This specification describes technical and performance criteria for designing and deploying an in-building Neutral Host Cellular Distributed Antenna System (DAS) capable of broadcasting cellular services within the Cooper University Healthcare Project Imagine Tower A, Haddon Avenue, Camden NJ. It is a requirement to include Verizon AT&T and T-Mobile services for this system. This project requires a fully operational, carrier-approved, on-air DAS system with no additional scope, cost, or owner-procured elements required.

This building is the first phase of future campus wide renovation and future construction. Approximately 250 square feet have been identified for carrier equipment to serve as a headend point of interface room. Each TDR/IDF room in Tower A has approximately half of one full size 7' rack available for DAS equipment. If additional space is needed the equipment would need to be wall mounted. These floorplans shall be used in the development of iBwave designs.

Future planning includes incremental projects over time to expand the neutral host DAS to serve the rest of the campus. A requirement of this RFP is to assess and evaluate this full campus approach and include infrastructure and requirements in tower A to support that future direction for a campus wide deployment.

As part of future planning, assess the high-level approach, requirements and rough order of magnitude estimates for extending service to the three (3) existing buildings at One Cooper Plaza, M.D. Anderson Cancer Center, Sheridan Pavilion, Education & Research building.

For example, identify the significant infrastructure required including the space, backbone and headend sizing to include the buildings mentioned above.

- B. Proposers shall include a breakdown of costs associated with the design and implementation of a neutral host DAS. Costs shall delineate between the owner and the DAS supplier.
- C. This specification covers the technical performance criteria for the cellular DAS and is based upon FCC compliant equipment.
- D. All equipment shall be furnished new out of the box.
- E. The DAS components specified in this document include:
1. Indoor Remote Unit (IRU) 1649
 2. DOT 4455_B25_B66A_B77D REVA.1
 3. Fiber Optic Cabling
 4. Composite Cabling

5. Miscellaneous Components

1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. In addition, the sections below will be provided to the Contractor to be used as part of their installation.
- B. Section 270500 "Common Work Results for Communications"
- C. Section 270526, "Grounding and Bonding for Communication Systems"
- D. Section 270528, "Pathways for Communication Systems"
- E. Section 270544 "Sleeves and Sleeve Seals for Communication Pathways and Cabling"
- F. Section 270553 "Identification for Communication Systems"
- G. Section 271100 "Communications Equipment Room Fittings"
- H. Section 271300 "Communications Backbone Cabling"
- I. Section 28 31 11- "Digital Addressable Fire Alarm System"

1.3 REFERENCE STANDARDS

- A. All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation, workmanship, maintenance and testing shall comply with the latest editions of the National Electrical Code, National Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractors Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the contractor shall satisfy the most stringent requirements. Equipment and cabling installation shall comply with the following standards. All publications must be of the latest issue and addenda:
 - 1. New Jersey Building Code (WBC) for Residential and Commercial Structures
 - 2. 2022 NFPA 72 as referenced by the WBC
 - 3. 2017 National Electrical Code- NFPA 70
 - 4. Federal Communications Commission (FCC) Rules, Parts 15 and 22
 - 5. ANSI/ TIA-568-E. 3: Optical Fiber Cabling Components Standard
 - 6. ANSI/TIA-569-E: Telecommunications Pathways and Spaces
 - 7. ANSI/TIA-606-D: Administration Standard for the Telecommunications Infrastructure
 - 8. ANSI/TIA-J-STD-607-E: Telecommunications Bonding and Grounding (Earthing)

9. All other applicable codes and regulations deemed necessary by the AHJ.

1.4 SYSTEM DESCRIPTION

A. Services: Upon Acceptance Testing, the DAS shall provide coverage for the WSP bands shown in the Table below.

TABLE 1 SERVICES SUPPORTED ON THE DAS

SERVICE	UPLINK, MHZ	DOWNLINK, MHZ
PCS	1850 – 1915	1930 – 1995
AWS	1710 – 1780	2110 – 2200
C-Band	3700 – 3980	3700 – 3980

B. Broadband Active Distribution: Single-mode fiber-optic cable will be used for active distribution.

C. System Management:

1. SMS: The DAS shall have a Systems Management System (SMS) capable of alarm, monitor, configuration, and control of all Active Components.
2. SNMP Integration: The DAS NMS shall be capable of integration with 3rd party SNMP based NMS products for alarm purposes and provide alarming information.

1.5 PERFORMANCE REQUIREMENTS

A. On a per channel basis, the downlink RSL for each frequency band shall meet or exceed the criteria in Table 2.

B. The Contractor shall design the system to the above assumed channel loading and frequency bands for the proposed WSP in-building coverage. Prior to installation, contractors shall confirm the channel loading and frequency use in the serving area, and shall guarantee coverage for these channels per the criteria in Table 2

C. The DAS shall deliver coverage per the criteria in Table 2

TABLE 2 SYSTEM DESIGN CRITERIA

CARRIER	BAND (MHz)	TECHNOLOGY	SIGNAL(RSRP)	WIDTH (MHZ)	Coverage Area(%)
ATT	1900	LTE (FDD)	-95dBm	20	95
	2100	LTE (FDD)	-95dBm	20	95
	3700 (C Band)	5G-NR	-100dBm	80	95
VZW	1900	LTE (FDD)	-95dBm	20	95
	2100	LTE (FDD)	-95dBm	20	95
	3700 (C Band)	5G-NR	-105dBm	100	95
TMO	1900	LTE (FDD)	-95dBm	20	95

	2100	LTE (FDD)	-95dBm	20	95
	3700 (C Band)	5G-NR	-100dBm	40	95

1.6 SUBMITTALS

A. Submittal Requirements with the Bid:

1. Certificates

- a. A certificate from the manufacturer of the equipment to be installed stating that the DAS installer is trained/ qualified on the equipment.
- b. iBWAIVE Software Certifications

2. Test Equipment

- a. Submit certificates indicating that staff is certified on required test equipment including but not necessarily limited to:
 - 1) Signal Generators
 - 2) Spectrum Analyzers
 - 3) PIM Testers
 - 4) Fluke Tester
- b. Submit current calibration data for test equipment to be used

B. Submittal Requirements Prior to Start of Construction

- 1. Statement of Work (SOW): The contractor shall submit a SOW that has been accepted by the customer or customer's designated representative.
- 2. Acceptance Test Plan (ATP): The contractor shall submit an ATP that has been accepted by the customer or customer's designated representative.
- 3. To scale floor plans showing the location of system Components.
- 4. Final RF link budget
- 5. Detailed Shop Drawings for Head-End and IDF active equipment in addition to passive component installations and grounding
- 6. Product Data Sheets for each type of equipment to be installed.

C. Test Equipment

- 1. Submit certificates indicating that staff is certified on required test equipment.
- 2. Submit current calibration data for test equipment to be used.

D. Submittal Requirements at Close Out

NEUTRAL HOST DISTRIBUTED ANTENNA SYSTEM

1. Drawings: Submit as-built drawings indicating:
 - a. Head-End/IDF Room floor plans and details showing layout and configuration.
 - b. Cable routing and Dot locations.
2. Test Reports
 - a. DAS
 - 1) Submit Commissioning report to include results of CW and optimization activities. (Include screen shots of settings at Headend)
 - 2) Submit post-activation walk test report using SeeHawk or equal equipment showing successful coverage parameters have been achieved.
 - b. Coaxial Cable Test Reports: Submit cable test results for all cable segments. Testing shall include Return Loss (RL), Distance to Fault (DTF) and Passive Intermodulation (PIM).
 - c. Category 6a Cable Test Reports: Submit cable test results for all cable segments. Testing shall include length measurement, Near-End Crosstalk, Skew, Signal-to-noise ratio and Bit Error Rate, in addition to all test results for an installed Category 6a Permanent LinkLink as specified in the ANSI/TIA-568 Series standards. See Section 271500 for additional testing parameters required for this type of cabling.
 - d. Field Reports: Submit signal loss test results using a light source and power meter, and OTDR test results for each strand of all fiber runs installed to support this system. See Section 271300 for additional testing parameters required for this type of cabling.
3. Operation and Maintenance Data: Submit hardware and software manuals for all Active Components.
4. Acceptance Certificate or Document from the AHJ
5. Warranty Documents:
 - a. Submit for all manufactured components specified in this Section.
 - b. Submit Contractor's System Warranty.
 - c. Submit Manufacturer's Warranty

1.7 SUBSTITUTIONS

- A. Contract Documents are based on equipment manufacturers as called out in the Specifications and indicated on the Drawings. No substitutions are permitted without approval from the Engineer.

1.8 ABBREVIATIONS

AHJ: Authority Having Jurisdiction
ATP: Acceptance Test Plan

AWS: Advanced Wireless Service
BBU: Baseband Unit
BOM: Bill-of-Material
DAS: Distributed Antenna System
FCC: Federal Communications Commission
GUI: Graphical User Interface
IRU: Indoor Remote Unit
LTE: Long Term Evolution
MOP: Method of Procedure
MSP: Mobile Service Provider
MTBF: Mean Time Between Failure
NMS: Network Management System
OEM: Original Equipment Manufacturer
PCS: Personal Communications System
PPCH: Power per Channel
RoF: Radio-over-Fiber
RoHS: Restriction of Hazardous Substances
RSL: Received Signal Level
RSRP: Reference Signal Received Power
SISO: Single-Input, Single-Output
SNIR: Signal-to-Noise Interference Ratio
SNMP: Simple Network Management Protocol
SOW: Statement of Work
VSWR: Voltage Standing Wave Ratio

1.9 DEFINITIONS

Acceptance: Expressed approval by the customer
Active: DAS components that require AC/DC power for operation
Carrier Approval: Expressed approval to interconnect to the MSP network
Channel: A path for an RF transmission between two points
Component: A main system element of the DAS
Contractor: The prime contractor bidding the project
Passive: DAS components that do not require AC/DC power for operation

1.10 QUALITY ASSURANCE

- A. Source Limitations:
1. Obtain equipment from a single manufacturer.
 2. Contractor must have an office within 100 miles of the project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. The work specified in this Section is acknowledged to require special skills mastered by education, experience, or both. Bidders for work described in this Section shall be or will subcontract with established DAS/RF communications contractors. The contractor shall have direct access to all tools and test equipment required to complete the work prior to submitting a bid.

1.11 WARRANTY

- A. Manufacturer Warranty:
 - 1. Splitters, Couplers and Coverage Antennas: 5-year limited warranty from date of system acceptance.
 - 2. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
 - 3. Fiber-Optic Cable: 20-year limited warranty from date of system acceptance.
 - 4. Active Components: The earliest of 1-year limited warranty from date of system installation or 15 months from date of shipment.

1.12 MAINTENANCE

- A. The Contractor shall provide a maintenance service contract, covering the system for a period of one-year with options up to five years: preventative maintenance, system monitoring, spares, fault mitigation, equipment repair, and response time.
- B. Tier 1 Critical Alarm (System Down): 4-hour onsite response, 24/7.
- C. Tier 2 Major Alarm (One Band/Sector Down): Next business day response.
- D. Annual Preventative Maintenance (PM) visit to include PIM testing and battery checks.
- E. Includes annual firmware updates for Active Components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The basis of this specification is the Ericsson Radio Dot Digital Distributed Antenna System.
- B. Acceptable manufacturers are by one of the following:
 - 1. Electronics
 - a. Ericsson Radio Dot
 - b. Ericsson Indoor Radio Unit
 - c. Panduit Corp
 - d. No substitutions
 - 2. Cables
 - a. Aircell-Trilogy
 - b. Commscope

- c. No Substitutions
- 3. Connectors
 - a. Commscope
 - b. No Substitutions

2.2 HEAD-END EQUIPMENT

2.3 RF REMOTE UNIT

- A. Ericsson Indoor Remote Unit 1649
 - 1. Model #IRU1649

2.4 RF INDOOR RADIO

- A. Ericsson Radio Dot
 - 1. Model # 4455_B25_B66A_B77D RevA.1

2.5 COAXIAL CABLES

- A. Jumper Cable
 - 1. Aircell Trilogy 1/4 ", Plenum
 - a. Model # JPF014NMNM6
 - b. N(M) Connectors
 - c. 6' Length

2.6 COMPOSITE CABLES

- A. Composite, 16F, 4U/16AWG, Plenum, Indoor
 - 1. Commscope Model #760255004 | P-016HY-8G1F30YL/4X16AWG/CTX

2.7 FIBER OPTIC SYSTEM

- A. Surface Mount Box
 - 1. Commscope Model # 760248525
- B. Patch Cord
 - 1. Commscope
 - a. Model #FPCF-APLC-S-3M
 - 1) LC/APC to LC/APC

NEUTRAL HOST DISTRIBUTED ANTENNA SYSTEM

- 2) Duplex
- 3) Singlemode
- 4) 3' Length

2. Commscope

- 1) Model #FEWLCLC42-JXF010
- 2) LC/UPC to LC/UPC
- 3) 2 Strand
- 4) Singlemode
- 5) 3M Length

3. Commscope

- a. Model # FEDWLCLC42-JXF003
 - 1) LC/UPC to LC/UPC
 - 2) 2 Strand
 - 3) Singlemode
 - 4) 1M Length

C. Fiber Optic Cabling

1. Single Mode, 8.3/125 μ M
2. Armored, UL Listed OFNP
3. 12 Strand
4. Overall Yellow Jacket
5. Manufacturer: Commscope
6. Part No. P-012-DZ-8W-FSUYL

D. Fiber Terminations

1. Commscope Splice Cassette
 - a. Model #76025401
 - b. Model #760249998

E. Fiber Connectors

1. Commscope
 - a. Model #760258741
 - 1) Type LC/APC
 - b. Model #760258745
 - 1) Type LC/UPC
 - c. Model #1933286-4
 - 1) FO Adaptor, LC Duplex

PART 3 - EXECUTION

3.1 TURNKEY DAS REQUIREMENT

- A. The Neutral Host DAS shall be delivered as a complete, turnkey system. The Contractor shall provide all labor, materials, equipment, software, carrier coordination, approvals, and services required to deliver a fully operational, on-air, carrier-accepted DAS for Verizon, AT&T, and T-Mobile at the time of Final Acceptance.
- B. Labor estimate to be included, prevailing wage for cabling installation and coordination with construction manager.
- C. No additional scope, equipment procurement, or coordination by the Owner shall be required to achieve operational service.

3.2 SIGNAL SOURCE RESPONSIBILITY

- A. The Contractor shall furnish, install, integrate, and commission the required signal source(s), including but not limited to:
 - Carrier BTS equipment
 - Small Cells
 - Baseband units
 - Donor antennas (if applicable)
- B. All costs associated with signal source equipment required to meet performance criteria shall be included in the Contractor's proposal unless explicitly provided in writing by the Wireless Service Provider.

3.3 INSTALLATION

- A. The contractor shall design, install, commission, and test the DAS in accordance with the manufacturer's instructions and recommendations.

- B. Contractor to calculate total BTU heat load and electrical load (Amps/Voltage) based on the final 3-carrier design and submit to the Engineer within 2 weeks of award.
- C. System must be connected to the facility's Emergency Power functionality (Generator/UPS) to ensure coverage during outages. (Critical for a hospital).
- D. Locate equipment at locations as per the drawings.
- E. Support cabling in compliance with NEC chapter 8 requirements, the contract drawings and manufacturers' recommendations.
- F. All work shall comply with Cooper University Health Infection Control Risk Assessment (ICRA) guidelines.
- G. Contractor must account for the use of HEPA-filtered containment carts for all ceiling access in patient care areas.
- H. Pricing must reflect after-hours work for areas designated as critical care/OR.

3.4 EQUIPMENT MOUNTING

- A. Install rack mount equipment in Head-End Room as per drawings.
- B. Install wall mount equipment in IDF's as per drawings. Coordinate locations with the CM.
- C. Install GPS Antenna on roof at optimal location to achieve cleanest GPS signal.
- D. Install Radio Dots in ceilings (not above). Coordinate locations of antennas with Architectural ceiling types and coordinated reflected ceiling plans.

3.5 EXAMINATION

- A. The contractor must examine areas and conditions under which DAS components are to be installed and notify the owner's representative, in writing of those conditions which are, in the Contractor's opinion, potentially detrimental to proper completion of the work. The Contractor shall not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the owner.
- B. Examine pathway elements intended for cable, check raceways, cable trays and other elements for compliance with space allocations, installations tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Specific items of examination shall include, but shall not necessarily be limited to, the following:
 - 1. Locations for all new Radio DOTS, cable and splitter equipment.
 - 2. The Contractor shall examine all rooms designated to house DAS equipment to ensure adequate space, power, and environment conditions to support installation.

3.6 Carrier Coordination Services

- A. Contractor shall be responsible for all negotiations with Wireless Service Providers (WSPs) to secure Retransmission Agreements.
- B. Contractor shall design the Headend to accommodate WSP-specific equipment (racks, power, cooling) based on negotiated requirements.
- C. Contractor must specify if the signal source is intended to be Off-Air (donor antennas), Small Cell, or BTS, and include costs for such equipment if not provided by the WSP.

3.7 COMMISSIONING/OPTIMIZATION

- A. Systems commissioning shall broadly consist of:
 - 1. Testing of passive infrastructure including cables, splitters/ directional couplers, antennas and testing of category cable per ANSI/ TIA if applicable.
 - 2. Optimization of Carrier signals and electronics
- B. Contractor shall provide an ATP covering the MOP for full commissioning of the system per section 1.6.D.3.
- C. Commissioning is considered complete only upon 'On-Air' acceptance by the Wireless Service Providers. Contractor shall coordinate specific walk-testing with AT&T, Verizon, and T-Mobile representatives to ensure KPI compliance.

3.8 TECHNICAL TRAINING

- A. It is the responsibility of the Contractor to notify the owner's representative at appropriate times to permit visual inspections of all DAS components. No Installation work shall be covered until a visual inspection has been completed.
- B. The Contractor shall provide a Certificate of Compliance signed by a responsible company representative after completion of the site installation. This document shall certify that each element of the installed system and wiring complies with the requirements of the Contract Documents and the certification shall be included with the final acceptance report.
- C. The Contractor shall provide training for elements of the DAS. Such training shall include management, operational and maintenance levels, and shall be provided to individuals (maximum of 3) to be designated by the owner's representative.
- D. Training shall be conducted by qualified personnel fully conversant on the equipment, materials, software, and overall operation of the installed elements. Training shall be based upon as much hands-on training as is possible. The Contractor shall provide all necessary training aids and materials, which shall include written handouts.
- E. All training shall be completed prior to Final Acceptance.

END OF SECTION 27 53 19