

Special Specification 6077

5 GHz Ethernet Radio



1. DESCRIPTION

- 1.1. Furnish and install 5 GHz Ethernet Radios as shown on the plans, as detailed in this Special Specification and as directed by the Engineer.
- 1.2. Provide an interference analysis for each Department 5 GHz Ethernet Radio location to identify potential sources of interference. Adjust antenna polarities and channel plans on equipment to minimize interference from other sources. If the interference analysis shows possibility for interference at the Department sites, conduct in-field monitoring to determine if actual interference exists.

2. MATERIALS

- 2.1. **General Requirements.** All materials furnished, assembled, fabricated or installed under this Item shall be new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications. The 5 GHz Ethernet Radio shall include all materials, incidentals and labor necessary for a complete and operational radio, including, but not limited to, antenna, enclosures, cabling, connectors, power supplies, harnesses, chassis, and mounting hardware.
- 2.2. **Functional Requirements.** The Ethernet Radio shall operate in unlicensed frequency bands and shall support high data rates, high spectral efficiency, and multi-path conflicts. The Ethernet Radio shall:
- Function as a wireless bridge using a standard 10/100 BaseT (RJ-45) Ethernet interface, providing connectivity up to a minimum of 10 miles in line-of-sight (LOS) conditions
 - Function as a wireless bridge using a standard 10/100 BaseT (RJ-45) Ethernet interface, providing connectivity up to a minimum of 10 miles in line-of-sight (LOS) conditions
 - Be operational in harsh and adverse outdoor environments and weather conditions
 - Provide high capacity, point-to-point wireless link throughput speeds of 54 Mbps, supporting data, video and voice, at a minimum
 - Support Ethernet bridging and backhauling in 5 GHz bands
 - Utilize Orthogonal Frequency Division Multiplexing (OFDM) modulation
 - Provide Forward Error Correction (FEC) to address multi-paths and interference
 - Provide adaptive modulation for automatic modulation selection to maximize data rates and spectral efficiency
 - Provide AES 128 bit or WEP 128 bit key encryption (selectable)
 - Support dynamic frequency selection (DFS) and automatic transmit power control (ATPC)
 - Provide automatic clear channel selection (ACCS) with built-in spectrum analyzer
 - Provide built-in remote diagnostics and carrier-class network management system
 - Utilize CAT-5E, or other cable as shown on plans, cables and connectors
- 2.3. **Technical Requirements.** The Ethernet Radio shall have the following features:
- Frequency: 5.730-5.845 GHz
 - Radio Type: Point to Point Backhaul with Integrated Antenna
 - Channel Bandwidth: 5-20 MHz
 - Modulation: BPSK, QPSK, 16QAM, 64QAM, OFDM

- Sensitivity (dBm at antenna port): -97 to -69, adaptive
- Integrated Antenna: 23 dBi, 8° - 10° vertical, flat panel, EN 302 085, Class TS 1, 2, 3, 4, 5 compliant
- Data Communications Standard Compliance: IEEE 802.3 CSMA/CD
- VLAN Support: Based on 803.1q
- Security: Association protocol – ESSID, WEP 128, AES 128, IP level filtering for user addresses or protocols, access direction and IP address filtering for management
- Configuration Management: Telnet or SNMP configuration utility
- Remote Management Access: Wired LAN, wireless link
- Management access protection: Multi-level password, Configuration of remote access direction (from Ethernet only, from wireless link only or from both sides), Configuration of IP addresses of authorized stations
- Allocation of IP parameters: configurable or automatic (DHCP client)
- Software Upgrade and Configuration Up/Download: FTP/TFTP download
- Power consumption: 50 W Maximum
- Input power: AC, 100-240 VAC, 50-60 Hz
- Indoor – Outdoor Cable: CAT-5E shielded, 200 ft max, or as shown on plans
- Indicators: Power Status, Ethernet and W-Link LED
- Data Connectors: RJ-45
- Dimensions: 13.75 x 13.75 x 3.5 in (± 1 in), 12 lbs. maximum
- Operating temperature: -22°F to 140°F
- Operating humidity: 5% - 95% non-condensing, weather protected
- Radio Standard/Regulation: FCC part 15, ETSI: EN 301 753, EN 301 893, EN 300440-1/2
- EMC Standard/Regulation: FCC part 15 class B, ETSI EN 301 489-1
- Safety Standard/Regulation: UL 60950-1, EN 60950-1
- Lightning Protection Standard/Regulation: EN 61000-4-5, Class 3 (2kV)
- Environmental Operation: ETS 300 019 part 2-4 class 4
- Environmental Transportation: ETS 300 019-2-2 class 2.3
- Environmental Storage: ETS 300 019-2 class 1.2E

- 2.4. **Power Requirements.** The equipment operations shall not be affected by transient voltages, surges and sags normally experienced on commercial power lines. It is the Contractor's responsibility to check the local power service to determine if any special design is needed for the equipment. The extra cost, if required, shall be included in the bid of this item.
- 2.4.1 **Primary Input Power Interruption.** The equipment shall meet all the requirements in Section 2.1.4, "Power Interruption", of the National Electrical Manufacturers Association (NEMA) Standard TS1 for Traffic Control System.
- 2.4.2 **Power Service Transients.** The equipment shall meet the requirements of Section 2.1.6, "Transients, Power Service", of the NEMA Standard TS1.
- 2.4.3 **Wiring.** All wiring shall meet the requirements of the National Electric Code. All wires shall be cut to proper length before assembly. No wire shall be doubled-back to take up slack. Wires shall be neatly laced into cable with nylon lacing or plastic straps. Cables shall be secured with clamps. Service loops shall be provided at all connections. Payment for this item will be subsidiary to Ethernet Radio System.
- 2.4.4 **Transient Suppression.** All DC relays, solenoids and holding coils shall have diodes or other protective devices across the coils for transient suppression.
- 2.4.5 **Power Service Protection.**

- The equipment shall contain readily accessible, manually re-settable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection
- Circuit breakers or fuses shall be provided and sized such that no wire, component, connector, PC board or assembly shall be subjected to sustained current in excess of their respective design limits upon the failure of any single circuit element or wiring

2.4.6 **Surge Protection.** The equipment and installation shall have sufficient surge suppression to protect the equipment from power transients and lightning strikes. Payment for this item will be subsidiary to Ethernet Radio.

2.4.7 **Electric Circuit Breaker.** The equipment shall include the installation of an electric circuit breaker at existing electric service locations as shown on the plans. This electric circuit breaker shall be provided in addition to the breaker installed for power service protection within the cabinet.

2.4.8 **Fail Safe Provision.** The equipment shall be designed such that the failures of the equipment shall not cause the failure of any other unit of equipment.

2.5 Mechanical Requirements

2.5.1 **Modular Design.** The Ethernet Radio shall be modular in design to allow major portions to be readily replaced in the field. Modules and assemblies shall be clearly identified with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.

2.5.2 Connectors and Harnesses.

- All external connections shall be made by means of weather-resistant connectors. The connectors shall be keyed to preclude improper hookups. All wires to and from the connectors shall be color-coded and/or appropriately marked.
- Connecting harnesses of appropriate length and terminated with matching connectors shall be provided for interconnection with the communications system equipment.
- All pins and mating connectors shall be corrosion resistant. Connectors utilizing solder type connections shall have each soldered connection covered by a piece of heat shrink tubing securely shrunk to insure that it protects the connection.

2.6 **Environmental Design Requirements.** The equipment shall meet all its specified requirements during and after subjecting to any combination of the following conditions:

Equipment	Radio and Antenna System
Operating Temperature	-22°F to +140°F
Operating Humidity	5%-95% non-condensing, weather protected

3. CONSTRUCTION

3.1 General.

- The equipment design and construction shall utilize the latest available techniques with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.
- The equipment shall be designed for ease of maintenance. All component parts shall be readily accessible for inspection and maintenance.

- 3.2 **Electronic Components.** All electronic components shall comply with Special Specification, "Electronic Components".
- 3.3 **Mechanical Components.**
- All external screws, nuts and locking washers shall be stainless steel; no self-tapping screws shall be used unless specifically approved by the Engineer.
 - All parts shall be made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass.
 - All materials used in construction shall be protected from fungus growth and moisture deterioration.
 - Dissimilar metals shall be separated by an inert dielectric material.
- 3.4 **Documentation Requirements.** Documentation requirements shall be in accordance with Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Article 4.
- 3.5 **Testing.** Testing shall be in accordance with Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Article 2.
- 3.6 **Training.** Training shall be in accordance with Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Article 3.
- 3.7 **Warranty.** Warranty shall be in accordance with Special Specification, "Testing, Training, Documentation, Final Acceptance and Warranty", Article 5.

4. MEASUREMENT

This Item will be measured as each 5 GHz Ethernet Radio furnished, installed, made fully functional and tested in accordance with the Special Specifications.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "5 GHz Ethernet Radio". This price will include all equipment described under this Item with all cables and connectors; all documentation and testing and shall also include the cost of furnishing all labor, materials, warranty, training, equipment, and incidentals.