# SECTION 405050 DATA RADIO SYSTEM

## PART 1 - GENERAL

A. Description

1. This section describes requirements for materials, testing, and installation of Data Radio System.

B. Related Work Specified Elsewhere

1. PCIS General Requirements: 405000.

2. Programmable Logic Control System: 405040.

3. Control Panels: 405080.

C. Scope of Work

1. For City of Santa Maria system Contractor shall work with the City of Santa Maria in order to coordinate interfacing with the existing radio and SCADA systems.

2. For NCSD system Contractor shall provide complete integration with the existing NCSD radio and SCADA systems.

## PART 2 - MATERIALS

A. Data Radio

1. Spread spectrum radios shall meet FCC rules Part 15.247 and IC TRC-76 for unlicensed radio operation in the 902-928 MHz. The radios shall meet the following specific requirements:

   a. All radios shall be capable of operating as a stand alone Multiple Address System (MAS).

   b. The radio shall use the spread spectrum Frequency Hopping technique for data communications.

   c. The radio shall be capable of operating two RS-232 asynchronous ports and one 10BaseT port.

d. The Access Point and Remote radios shall be interchangeable such that all radios are identical.

e. Transmit power shall be adjustable from 0.1 watt to the FCC maximum of 1.0 watt.

2. The radios Ethernet port shall operate using standard IP protocols, which include TCP, UDP, ARP & DHCP.

3. The radios shall have an internal terminal server, to allow communications between serial and IP equipment.

4. The radios shall have two firmware images that can be downloaded remotely.

5. Radio System Diagnostics

a. The radio system shall provide integral diagnostic capability to allow the user to verify communications reliability between the master and remote radios. Diagnostic data shall be obtainable without interrupting or slowing the users data communications (non-intrusive).

b. Diagnostics shall be available through a terminal server sessions, telnet session. The radios also shall have an embedded web server so diagnostics can be retrieved via a web browser.

c. The radios management system shall be based on industry standard SNMPv1, MIBII & Enterprise MIB.

d. Radio performance statistics shall be maintained by the Access Point and remotes. This performance statistics shall include the following:

(1) Packets received;

(2) Packets sent;

(3) Bytes received;

(4) Bytes sent;

(5) Packets dropped;

(6) Received errors;

(7) Retries;

(8) Retry errors.

6. The following local diagnostic information shall be available from each radio via the diagnostic port:

    a. Received Signal Strength;

    b. Signal to Noise Ratio;

    c. Wireless & Ethernet Packet Statistics;

    d. Event Log;

    e. Remote and Endpoint listing;

7. Radio diagnostics shall be an integral part of the radio and shall operate with a standard IBM compatible PC with Windows NT & 2000 platforms.

8. Radio System Specifications: The radio system shall meet the following specifications. If any specification is not met in its entirety, the supplier must clearly identify the specific area of non-conformance as an exception to the specification.

    a. General

        (1) Data Rate: 512 Kbps /256 Kbps, user configurable air link. 1,200 bps -115,200 bps serial ports.

        (2) Frequency range: 902-928 MHz, FCC Part 15 Spread Spectrum Band

        (3) Frequency Hopping Range: 80 channels / frequencies

        (4) Channel Band Width: 316.5 kHz

        (5) Dwell time per hop: User selectable

    b. User Interface

        (1) Ethernet: 10BaseT, RJ45;

        (2) Serial Ports: RS-232 asynchronous DB-9 DCE & DTE

    c. Transmitter

        (1) Power Output: 0.1 watt to 1.0 watt (+20 dBm to +30 dBm), user settable

        (2) Duty Cycle: Continuous

        (3) Transmitter Keying: Data activated

d. Receiver Bit Error Rate

(1) -100 dBm @ 256kbps, less than $10^{-6}$ BER;

(2) -92 dBm @ 512kbps, less than $10^{-6}$ BER.

e. Primary Power

(1) Voltage: 13.8 Vdc nominal (10.5 Vdc - 30.0 Vdc Operating Range)

f. Environmental

(1) Humidity: 95% at 104 °F; non-condensing

(2) Temperature Range: –22 °F to 140 °F

(3) Case: Die-cast aluminum

9. Manufacturer

a. Provide spread spectrum Ethernet radios manufactured by Microwave Data Systems (MDS), as follows:

(1) Type iNET 900 II for Santa Maria ICP

(2) Type iNET 900, for NCSD ICP

B. Yagi Antennas

1. Yagi Antenna shall be fabricated of 6061-T6 aluminum rod and seamless drawn pipe. Aluminum materials shall be gold anodized for maximum reliability and corrosion resistance. Hardware of fastenings shall be stainless steel. Heavy aluminum alloy mounting casting allows installation for either vertical or horizontal polarization.

2. Internal balun, coax feed, and connectors shall be sealed in foam potting system to prevent moisture penetration. Following specifications apply:

a. Frequency range to match radio frequency.

b. Gain (over dipole): 10 dB.

c. VSWR: 1.5:1 maximum.

d. Impedance: 50 Ω.

e. Front-to-Back Ratio: 20 dB minimum.

f. Maximum Power Input: 100 W.

g. Polarization: Vertical or horizontal.

h. Termination: Type N female.

i. Mounting: Maximum 2.375-inch O.D. pipe.

3. Manufacturer/Model: Scala/TY-900, or equal.

C. Transmission Lines and Associated Devices

1. Transmission Line (Coaxial Cable) and Connectors:

a. One-Half-Inch Foam Dielectric Heliax Cable from the ICP to the antenna. Manufacturer/catalog number Andrew/LDF4-50A.

b. One-Quarter-Inch Superflexible Foam Dielectric Heliax Cable: Equipment connection only, 36-inch lengths. Manufacturer/catalog number Andrew/FSJ1-50A.

2. Antenna Support Structure Grounding

a. Ground System: Each antenna support (pipe extension) shall be equipped with a ground connection bonded to the antenna support mast and connected either to an ICP ground, when the antenna is the ICP mounted, or to a driven 10-foot by 3/4-inch copper-clad steel ground rod at the base of the antenna support structure. The grounding conductors shall be sized no smaller than #6 AWG bare copper and shall be installed without sharp bends. All ground conductor connections shall be either clamped or exothermically welded with no dissimilar metals. The antenna support ground system shall be connected at a single point to the facility power service ground using a conduit protected ground wire sized to be equivalent to the facility service ground. The radio rack or enclosure shall be equipped with a ground terminal and a single conduit protected ground wire sized no smaller than # 6 AWG.

3. Antenna Transmission Line Surge Protection Requirements:

a. Antenna cable outer conductor shall be grounded to a facility common ground (for the wall mounted antenna masts), or to the pole ground (for the pole mounted antennas). Use grounding kits by Andrew Series SureGround Plus.

b. An antenna transmission line shall be equipped with a flange style surge protector installed on a ground bus with a bonded ground

connection at the radio equipment rack or enclosure. Following characteristics and specifications apply:

(1) Maximum Surge: 50,000 A.

(2) Turn On Volts D-C: 600 V typical.

(3) Turn On Time: 2.5 nanoseconds after voltage wave front reaches DC threshold.

(4) Connectors: Type N female.

(5) Dimensions: 2.45 inches by 1.75 inches by 1.5 inches.

c. Surge Protectors - Manufacturer/Model Number PolyPhaser/IS-50NX-C2 (50 W).

D. Antenna Tower (Universal Towers)

1. Antenna tower shall be made of anodized 6061-T6 aluminum with stainless steel hardware.

2. Tower shall withstand loading imposed by antenna square footage, 70 MPH wind speed, and antenna mounting accessories per UBC requirements.

3. The tower shall meet UBC seismic requirements for the installation area.

4. Tower package shall include a hinge base system for the tower installation and tilting.

5. The tower shall meet the following minimum requirements:

a. Antenna area – 4.5 sf

b. Bottom of the antenna elevation – 30 ft

c. Seismic Zone – 4, Soil Type D

6. The tower shall be by Universal Towers, or equal.

7. Submit calculations for the design of the tower, anchorage, and supporting reinforced concrete footing. Calculations shall be stamped and signed by a civil or structural engineer registered in California. Minimum compressive strength for concrete footing f'c = 3000 psi (28 days).

E. Spare Parts

The Contractor shall furnish to the Owner all necessary spare parts of components required to maintain the system. Prior to final acceptance of work,

the Contractor shall provide a spare parts listing of all necessary spare parts and quantities for review by the Owner's Representative. The spare parts shall include the following minimum requirements:

| **Part Description** | **Quantity** |
|---|---|
| Radio Transceiver | 1 for each ICP |

The Contractor shall deliver to the Owner all the required spare parts upon final acceptance of the work. The spare parts shall not be used as replacement parts during the guarantee period.

PART 3- EXECUTION

Refer to Section 405000.

END OF SECTION