

STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
KANSAS	87 N-0673-01	2017	86	99

Mount the ground level network interface, power supply, and grounding block in the cabinet or data closet at the site. Contact Engineer to coordinate FCC required prior coordination notice and FCC License Application. Contact Engineer to obtain network configuration information including: IP addresses, VLAN tags and security key info for equipment installed.

Connect the P2P Ethernet radio to the Ethernet switch or other Ethernet-enabled device at the site.

**17.4 TESTING/SUBMITTALS**

Develop a test plan to demonstrate that each P2P Ethernet Radio is providing a wireless link capable of a continuous data rate of 100 Mbps. Complete a minimum 15-day test period before final acceptance. Submit test plan to the Engineer for approval. Incorporate any changes requested by the Engineer into the test plan and test each link. Document all test results and submit these to the Engineer for approval. Provide an Excel spreadsheet (electronically) that details all equipment received and installed as well as all configuration settings, including VLAN's.

**18.0 POINT TO MULTIPOINT (P2M) ETHERNET RADIO**

**18.1 DESCRIPTION**

Furnish, install, configure, and test a P2M Ethernet Radio. Ensure that the P2M radio provides an acceptable wireless Ethernet communication link when combined with another P2M radio.

**18.2 SPECIFICATIONS AND REQUIREMENTS**

Provide wireless equipment that meets the following specifications and requirements:

- Operates in unlicensed frequency band, 5.15-5.35 GHz, 5.47-5.725 GHz, 5.725-5.850 GHz or in the 4.94-4.99 GHz band
- Radio Access Method: Time Division Duplex (TDD)
- Channel: 10 MHz, 20 MHz
- Central Frequency Resolution: 5 MHz, 10 MHz
- Typical Sensitivity (dBm at antenna port):

Modulation	1	2	3	4	5	6	7	8
Level* 20 MHz	-89	-88	-86	-84	-81	-77	-73	-71
Level* 10 MHz	-92	-91	-89	-87	-84	-80	-76	-74

\*Modulation Level combines modulation scheme and coding gain.
- Modulation Scheme (Adaptive): OFDM: BPSK, QPSK, QAM16, QAM64
- VLAN Support: Based on IEEE 802.1q, QinQ 802.3ad
- Layer-2 Traffic Prioritization: Based on IEEE 802.1p
- Layer-3 Traffic Prioritization: IP ToS according to RFC791 and DSCP according to RFC2474
- Layer-4 Traffic Prioritization: UDP/TCP port range
- Security: WEP 128-bit authentication, AES128, WEP 128, and certified FIPS-197 mode built-in encryption.
- Remote Management Access: From wired LAN or wireless link
- Management Access Protection: Multilevel password; configuration of remote direction (from Ethernet only, wireless only, or both sides); configuration of IP addresses of authorized stations
- Software Upgrade: via TFTP and FTP
- SNMP Agents: SNMP v1 client, MIB II, Bridge MIB
- Allows Quality of Service (QoS) management
- Ethernet Interface: 10/100 BaseT RJ-45 port
- Operating Temperature, SU/AU Outdoor Units: -35° C to 55° C
- Power over Ethernet (POE)
- Point-to-Multipoint (P2M)
- Minimum rated/actual bandwidth of 54/24 Mbps
- EMC and Radio: FCC Part 15 compliant

**18.3 CONSTRUCTION**

Install P2M Ethernet Radios at locations as shown on the plans.

Provide for all radio channel planning, communication path work, power level settings, antenna positioning (X, Y and Z axis including tilt), Radio Frequency Interference (RFI) and Electro-Magnetic Interference (EMI) resolution so that fully functional, operational, and secure communication links are provided. A design plan has been provided in the plan set but it is understood that that design may need to change based on field conditions encountered. Take into consideration existing unlicensed radio networks operated by others. Install the radios and orient to maximize the Signal-to-Noise Ratio (SNR) levels. Reference and follow installation guidelines provided by the radio manufacturer. Provide all antennas, pipes, mounts, cabling, lightning protection, grounding, configuration, and testing to provide a fully functional system.

Furnish all tools, equipment, materials, supplies, and manufactured articles and all operations necessary to install wireless equipment and construct, configure, and test the wireless communications facilities as shown on the plans and as specified herein. Use stainless steel for all hardware and fasteners.

Provide surge protection (Transtector Model TSJ GbE PoE or equivalent) on all P2M radio cables entering a cabinet or data closet.

Mount the P2M Radio Outdoor Unit/Antenna as high on the supporting structure as practical, while remaining within the 30 degree protected radius beneath the air terminal (if installed). Do not allow the mounting of the radio to interfere with the camera lowering device or with the lightning air terminal.

Use outdoor-plant rated industrial Cat 5e cable (Commscope 2003 Black or approved equivalent) with shielded RJ-45 end connectors (Digi-Key A9115-ND or approved equivalent) between the radio outdoor unit and the cabinet or data closet surge protector.

Mount the network interface, power supply, surge suppression, and grounding block neatly in the cabinet or data closet at the site. Contact Engineer to obtain network configuration information including; IP addresses, VLAN tags, and security key info for equipment installed. Connect the P2M Ethernet radio to the Ethernet switch or other Ethernet-enabled device at the site.

Apply permanent external labeling on radio equipment in the cabinet according to information to be provided by the engineer.

**19.0 ITS COMMUNICATIONS INTEGRATION**

**19.1 DESCRIPTION**

This work consists of the installation of communication equipment and configuration of hardware settings and software parameters (both wireless and fiber optic), such as IP addressing and serial port definitions, VLAN definitions and network management parameters of KDOT furnished and Contractor furnished communications equipment as defined herein, in KDOT designated facilities, or ITS cabinets as shown on the Plans, or as directed by the Engineer.

Configure all communication equipment based on a template provided by the Engineer for each type of ITS component such as Ethernet switches, modems, CCTV cameras, and DMS.

Provide a complete, functional, wireless, fiber optic, and electronic communications system, including all necessary cables, connections, surge suppressors, antenna alignments and configurations in accordance with the KDOT and equipment manufacturers' specifications and as specified on the Plans and Specifications. Provide equipment as specified on the Plans and Specifications, integrate, test, demonstrate, and receive KDOT's approval of the complete system.

Provide troubleshooting, reinstallation, and reconfiguration of all KDOT furnished and Contractor furnished communication equipment in the event of communication equipment failure. Receive approval by the Engineer for any reconfiguration.

There will be no separate payment for troubleshooting, reinstallation, or reconfiguration of devices. If an issue outside of contractor control causes delay of more than 8 hours in completing integration, additional payment may be requested from KDOT.

**19.1.1 CERTIFICATION OF CONTRACTOR PERSONNEL**

Use a CISCO certified technician, or in the presence of and under the responsible charge of an employee or subcontractor who is a CISCO certified technician, for all configuration of Cisco switches. Before starting work, provide the Engineer with the names of the personnel assigned to perform switch configuration and a copy of their certification card.

**19.2 MATERIALS**

**19.2.1 GENERAL**

Supply all tools, equipment, materials, supplies, and manufactured articles and perform all operations necessary to install KDOT furnished equipment and construct the communications facilities as shown on the Plans and as specified herein, or as directed by the Engineer.

**19.2.2 CONNECTORS, CABLES AND ADAPTERS**

Incidental items include all connectors, adaptors, and cables, including but not limited to serial cables, alarm cables, all power cables for Cisco equipment, DC power cables, AC power cables, fiber optic jumpers, DS-1 cables, Ethernet cables, interface cables, located within and between all ITS cabinets and KDOT designated facilities. There will be no separate payment for incidental items. Use outdoor-rated for cables exposed to weather conditions or installed in field cabinets.

**19.3 CONSTRUCTION REQUIREMENTS**

**19.3.1 GENERAL**

Furnish all tools, equipment, materials, supplies, and manufactured articles and perform all operations necessary to install KDOT-furnished equipment and Contractor-furnished equipment and construct the communications facilities as shown on the Plans and as specified herein.

**19.3.2 KDOT FURNISHED EQUIPMENT**

Receive and review the installation wiring diagrams from the KDOT-furnished communication equipment suppliers. Use these drawings to make necessary terminations to all KDOT-furnished and Contractor-furnished communication equipment.

**19.3.3 COMMUNICATION SCHEMATIC DRAWINGS**

Submit as-built communication schematic drawings to the Engineer based on the actual connections made in the field and in the KDOT designated facility. Include in the as-built communication schematic drawings all equipment, both KDOT-furnished and Contractor-furnished. Leave a copy of these approved drawings in each respective ITS cabinet or KDOT designated facility. Use documentation format as specified in these specifications.

**19.3.4 NETWORK CONFIGURATIONS**

KDOT will provide IP addressing and configuration files for each KDOT-furnished communication equipment type. Make all necessary network configurations. Coordinate with KDOT and receive approval for any downtime necessary to connect the new network components.

**19.3.5 COORDINATION**

Provide a skilled staff member to attend a coordination meeting prior to installation of communication equipment.

**19.4 INTEGRATION WITH CENTRAL SOFTWARE**

Ensure proper integration and functionality with systems as identified by KDOT or City of Wichita. Ensure continuity of functions currently in place, and prevent disruption of service for any sites not included in the plans. Coordinate with KDOT or City of Wichita to identify affected systems and devise methods to prevent service interruptions. Ensure proper integration and functionality with:

- For systems integrating with KDOT ATMS, the MIST CCTV management software and BARCO video wall display in Wichita, KS.

Perform software integration testing in coordination with KDOT or City of Wichita on ATMS and video distribution systems. Configure both KDOT-furnished and Contractor-furnished equipment as needed in order to achieve functionality prescribed by KDOT. Travel to site locations as many times as required to test and configure equipment to provide a working communication system with KDOT or City of Wichita central software. Complete integration prior to final acceptance.

**20.0 ITS COMPONENT TESTING**

**20.1 DESCRIPTION**

Test all ITS devices and communication links installed in this project. Demonstrate functionality of each device using a test plan provided by KDOT. Test plans will include a list of items to be tested, a test method (observation, calculation, or demonstration), an expected result, and an obtained result. Seek KDOT approval for input or specific procedures or for modifications to the test plan.

First, test each unit with its vendor software, then coordinate with KDOT to test with KDOT ATMS software, finally check transmission at site and at the KDOT designated facility. Demonstrate through testing that the equipment associated with each cabinet works as required. The tests described below are in addition to any other tests required herein.

**20.2 MATERIALS**

Provide all testing equipment, labor, materials and incidentals required to carry out the KDOT-provided test plan and all tests described in this section.

**20.3 CABINET LEVEL FUNCTIONAL TESTS**

Perform testing on each of the field components installed. Ensure that this testing verifies the proper functioning of the field components after installation. Perform the tests identified under this type of testing on each installed component and ensure the results are signed off by the Engineer or designated KDOT representative.

Provide copies of the test results for each component to KDOT and if requested, the test hardware and software.

**20.3.1 CCTV PAN-TILT-ZOOM (PTZ) CAMERA CONTROL TEST**

Ensure that the PTZ camera control test verifies the functionality of the installed camera controller as well as the serial communication to the camera controller. This test will use vendor test software to the CCTV camera to be commanded to turn on; turn off; send a message to the controller to pan right and left; send a message to the controller to tilt up and down; and send a message to the camera controller to zoom-in and zoom-out.

KANSAS DEPARTMENT OF TRANSPORTATION			
ITS EQUIPMENT SPECIFICATIONS			
ITS-S12 VERSION DATE: 05-29-17			
APP'D	DESIGNED	QUANTITIES	TRACED
DESIGN CK.	DETAIL CK.	QUAN. CK.	TRACE CK.