## Section T684

NETWORK DEVICES

T684-1 Cellular Communications

**T684-1.1** **Description:** Furnish and install a broadband cellular modem and antenna, as shown in the Plans. Provide a system that allows cellular-based communication between signalized intersections, the existing network, and central management system of the maintaining agency.

Cellular communication shall be deployed at signalized intersections to maintain active communications for traffic signal controllers and closed-circuit television (CCTV) cameras for the duration of construction projects.

**T684-1.2** **Materials:**

**T684-1.2.1 General:** Provide a cellular modem, antenna, and all other associated components that adhere, at a minimum, to the following requirements:

**T684-1.2.2 Cellular Modem:** Use a cellular modem capable of providing 4G LTE communications and is backwards compatible with 3G/CDMA. Ensure the unit is compatible with all proposed and existing components installed at the location. Modem shall be able to provide cellular communications through AT&T, Sprint, and Verizon networks, via a removable subscriber identity module (SIM) card. SIM card shall be provided by the Department. The cellular modem shall also be equipped with redundant SIM card slots for multiple carriers in the event of a cellular provider failure or loss of signal.

Furnish and install all cabling and mounting accessories required to provide power and communication to the modem, including all cabling required to power the antenna. Ensure all cables comply with the National Electric Code (NEC) sizing requirements and meet all other applicable standards, specifications, and local code requirements. Power consumption of the unit shall not exceed 12W maximum.

**T684-1.2.2.1 Network Interface:** Ensure the cellular modem includes a minimum of two Ethernet ports, which must provide 10/100 Base connections. Verify that all copper-based network interface ports utilized registered jack (RJ)-45 connectors.

Ensure the cellular modem unit adheres, at a minimum, to the following network requirements:

1. Multi-carrier support (AT&T, Verizon, and Sprint) by software configuration
2. 4G LTE cellular network support
3. License-free enterprise software supporting advance routing protocols, VPN, logging and authentication, and stateful firewall

**T684-1.2.2.2 Protocols:** The unit shall have the ability to utilize, at a minimum, the following protocols:

1. Network: TCP/IP, UDP/IP
2. Routing: Network Address Translation (NAT), Port Address Translation (PAT), Dynamic Host Configuration Protocol, and Static Routing.
3. Application: SSH, SNMP, Radius Server Capable

**T684-1.2.2.3 Event Reporting:** The unit shall have the capability to record and report, at a minimum, the following events in plain text:

1. Event Log
2. Email Notification of Link Status Changes
3. Bandwidth Status
4. Remote Syslog Host Capable

**T684-1.2.2.4 Security:** The device shall have the following security provisions:

1. Ability to establish VPN tunnels
2. IPsec and SSL
3. Port forwarding

**T684-1.2.2.5 Mechanical Specifications:** Ensure the cellular modem is permanently marked with manufacturer name or trademark, product or part number, date of manufacture, and serial number.

Do not use self-tapping screws on the exterior of the device. Unit shall be permanently mounted to signal cabinet. No shelf mounting is allowed.

Ensure that all parts are made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum brass, or gold-plated metal.

Ensure that the dimensions of the cellular modem accommodate the unit’s installation in a traffic signal controller cabinet, as specified in the Plans.

**T684-1.2.2.6 Environmental Specifications:** Ensure the cellular modem performs all required functions during and after being subjected to the environmental testing procedures described in NEMA TS2, Sections 2.2.7, 2.2.8, and 2.2.9.

**T684-1.2.2.7 Electrical Specifications:** Cellular modem must operate on a nominal voltage of 120 V alternating current (V AC). Supply an appropriate voltage converter for units that require operating voltages of less than 120 V AC. Power consumption of the unit shall not exceed 12W maximum.

**T684-1.2.2.3 Antenna:** Use an antenna that is fully compatible with the proposed cellular modem and adheres to the following requirements:

1. Frequencies: F1 = 824 to 896 MHz; F2 = 1850 to 1990 MH
2. Voltage Standing Wave Radio (VSWR): 1.5:1 or less at resonant point
3. 50 Ω nominal impedance
4. Gain of 3.0 dB
5. Omi-directional radiation pattern
6. Vertical polarization
7. Glass-filled polypropylene radome
8. Adhesive/Screw mounting
9. 2 x Cellular (4G/3G/2G) MIMO Antennas (698~960MHz, 1710~2170MHz,2300~2700MHz, 2900-3500MHz)
10. 1 x GPS/GLONASS/GALILEO 1575.42~1602MHz Active Antenna
11. 1 x Wi-Fi 2.4GHz / 5GHz Antennas
12. 9 foot (minimum) coaxial cable length
13. IP67 Waterproof

**T684-1.3** **Installation:** Install the cellular modem within the traffic signal controller cabinet and connect all cabling in accordance with the manufacturer’s recommended installation procedure. Install the cellular modem with all necessary hardware, software, power supplies, cabling, and other associated components for a complete system.

Mount the cellular antenna on traffic signal structures, at locations as shown in the Plans, in accordance with the manufacturer’s recommended mounting and installation procedures. Install the antenna with all necessary mounting hardware, cabling, and other associated components for a complete system. Ensure the proposed location for the antenna installation possesses strong cellular signal strength, and avoid locations within close proximity to buildings or other structures that may impede signal.

Do not install device cables in the same conduit or pull boxes as power cables carrying voltage greater than 24 VDC / VAC, or current in excess of 1.5 amps. Secure cables with clamps and provide service loops at all connection locations.

In the event that power to the cellular communication system, or a subcomponent thereof, is interrupted, ensure that the equipment automatically recovers once power is restored. Ensure that all programmable system settings return to their previous configurations and the system resumes proper orientation.

Cellular communications shall be installed at all signalized intersections in which the existing network communication will be impacted or disabled for any period of time. Install cellular communications between the active traffic signal controller CCTV camera and the existing Advanced Traffic Management System (ATMS). The active traffic signal controller is defined as the unit governing real-time vehicular and pedestrian movements, regardless of whether the controller is a temporary or permanent deployment. Cellular communications shall remain active throughout the duration of construction, or until permanent communications can be re-established, to maintain network connectivity.

Following the installation and acceptance of permanent communications, e.g. fiber optics, the Contractor shall uninstall the cellular communications system and provide all devices, equipment, hardware, software, powers supplies, cabling, and other associated components to the Department.

**T684-1.3.1** **Device Configuration:** Prior to installation, the Contractor shall deliver the cellular modem for configuration to the Intelligent Transportation Systems (ITS) Information Technology (IT) Manager at FDOT District 5 Deland Office at 719 S. Woodland Boulevard, Deland, FL 32720-6834. Provide a minimum of twenty-one (21) days’ notice to the Department prior delivery of the device. The Contractor shall be responsible for delivery and retrieval of the device from the Department.

At the time of delivery, the Contractor shall provide the following information for to the Department for existing CCTV cameras and traffic signal controllers:

1. IP Address
2. Subnet Mask
3. Default Gateway

If a new traffic signal controller is installed at an intersection, the Contractor shall enable the Ethernet port communication and coordinate with the Department to obtain the IP address, subnet mask and default gateway. The Contractor shall be responsible for setting the IP address, subnet mask and default gateway for newly installed traffic signal controllers.

If a new CCTV camera(s) is installed at an intersection, the Contractor shall coordinate with the Department to obtain the IP address, subnet mask and default gateway, and configure the camera, including setting the IP address, subnet mask and default gateway, per manufacturer’s recommendations.

**T684-1.4 Testing:**

**T684-1.4.1 General:** Subject the cellular communications system to field acceptance test (FATs) Develop and submit a test plan for FATs to the Engineer for review and approval. The Engineer reserves the right to witness all FATs in person. Complete the test within five (5) calendar days.

**T684-1.4.2 Field Testing:** Once construction of the cellular communications system is complete, conduct local FATs according to the submitted testing plan. Perform, at a minimum, the following:

1. Verify that all physical construction has been completed as detailed in the Plans and per manufacturer’s recommendations.
2. Inspect the quality and tightness of ground and surge protector connections, as applicable.
3. Verify proper voltages for all power supplies and related power circuits.
4. Connect devices to the power sources.
5. Verify all connections, including correct installation of communication and power cables.
6. Verify cellular signal strength and communication connection with the network. Video transmitted via the cellular network will be free from stuttering and image freezing.

**T684-1.5 Warranty:** Ensure that the manufacturer will furnish replacements for any part or equipment found to be defective during the warranty period, at no additional cost to the Department or maintaining agency, within ten (10) days of notification.

**T684-1.6 Method of Measurement:** The Contract unit price for each cellular communications system (unit, power supply, and antenna), furnished and installed, will include furnishing, placement, and testing of all equipment and materials, and for all tools, labor, hardware, operational software packages and firmware, supplies, support, personnel training, shop drawings, documentation, and incidentals necessary to complete the work.