TECHNICAL SPECIAL PROVISION

FOR

Network Devices:

Financial Project ID:
435443-2-52-01

ORANGE COUNTY & SEMINOLE COUNTY

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T684 Network Devices

T684-1 Managed Field Ethernet Switch (MFES) Description: Provide a hardened MFES that is powered by cabinet power supply and provides Power-over-Ethernet (POE) connections. The MFES will be compatible with FDOT network protocols.

> **T684-1.2 MFES Device Details:** The device will be 1.7 inches in height, 10.6 inches in width, and 8.4 inches in depth. The device will weigh 4.62 pounds. The device will operate between 0°C and 45°C (32°F and 113°F). The device will operate between 5% and 95% relative humidity, non-condensing. The device will have a minimum mean time between failures (MTBF) of 868,732 hours, as calculated using the Bellcore/Telcordia SR-332 standard for reliability prediction.

> **T684-1.3 Networking Standards:** The device will comply with all applicable IEEE networking standards for Ethernet communications, including but not limited to:
>> * IEEE 802.1AB standard for link layer discovery protocol (LLDP) and link layer discovery protocol for media endpoint devices (MED).
>> * IEEE 802.1D-2004 standard for media access control (MAC) bridges used with the rapid spanning tree protocol (RSTP).
>> * IEEE 802.1p standard for mapping to priority queue and quality of service (QOS).
>> * IEEE 802.1Q-2005 standard for virtual local area network (VLAN) bridges.
>> * IEEE 802.1w standard for rapid spanning tree protocol (RSTP).
>> * IEEE 802.1X standard for port-based network access control (PNAC).
>> * IEEE 802.3 standard for local area network (LAN) and metropolitan area network (MAN) access and physical layer specifications. (10BASE-T).
>> * IEEE 802.3ab standard for gigabit Ethernet over copper (1000BASE-T).
>> * IEEE 802.3ad standard regarding dynamic and static link aggregation.
>> * IEEE 802.3af standard regarding POE.
>> * IEEE 802.3at standard regarding Power-over-Ethernet plus (POE+).
>> * IEEE 802.3u supplement standard regarding 100Base TX/100Base FX.
>> * IEEE 802.3x standard regarding flow control with full duplex operation.
>> * IEEE 802.3z standard regarding gigabit Ethernet (1000BASE-SX/TX).
>> * IEEE 802.3 MAU MIB standard regarding managed objects for medium attachment units (MAUs) and management information base (MIB).
>> * IEEE 802.1AE- MACsec (HW-capable) standard regarding security requirements for protecting data traversing Ethernet LANs.
>> * IEEE 802.3az-2010 – EEE (HW-capable) standard for information technology and energy-efficient operation of Ethernet.

T684-1.4 Optical Ports: The device will provide a minimum of two optical 100Base FX ports capable of transmitting data at one gigabit per second. The optical port will operate at distances of up to 70 km. The optical ports will operate based on the following:

- 10 km operating parameters:
  Optical Transmit (Tx):
      Wavelength: 1310 nm
      Power Range: -11 to -3 dBm

  Optical Receive (Rx):
      Wavelength: 1310 nm
      Power Range: -19 to -3 dBm

- 70 km operating parameters:
  Optical Transmit (Tx):
      Wavelength: 1550 nm
      Power Range: -2 to 3 dBm

  Optical Receive (Rx):
      Wavelength: 1550 nm
      Power Range: -24 to -3 dBm

T684-1.5 POE Ports: The device will provide four POE class 3 ports and two POE+ ports with an internal power supply. The internal power supply for POE and POE+ ports will have a power budget of 68W.

T684-1.6 Copper Ports: The device will provide a minimum of twelve 10/100/1000 Mbps copper ports and two copper 10/100/1000 Mbps uplink ports. All copper ports will be Type RJ-45 and will auto-negotiate speed and duplex.

T684-1.7 Management Capability: The device features will include, but not be limited to:

Layer 2 Switching

- 802.1s MSTP and 802.1x authentication
- Auto medium dependent interface (MDI)/medium dependent interface crossover (MDIX)
- Bridge protocol data unit (BPDU) guard and root guard
- Dual mode VLANS
- MAC-based VLANS and dynamic MAC-based VLAN activation
- Dynamic VLAN and dynamic voice VLAN assignment

- Fast Port Span
- Generic attribute registration protocol (GARP) VLAN registration protocol
- Internet group management protocol (IGMP) snooping (v1/v2/v3), proxy for static groups, v2/v3 fast leave, and tracking
- Inter-packet gap (IPG) adjustment
- Link fault signaling (LFS)
- MAC address locking, MAC port security, MAC-layer filtering, filtering on source and destination MAC address, and MAC learning disable
- Multicast Listener Discovery (MLD) snooping (v1/v2)
- Multi-device authentication
- Per-VLAN spanning tree (PVST/PVST+/PVRST)
- Mirroring: Port-based, Access Control List based (ACL-based), MAC filter-based, and VLAN-based
- Port loop detection
- Private VLAN
- Protected link groups
- Protocol VLAN (802.1v) and subnet VLAN
- Remote fault notification (RFN)
- Single-instance spanning tree
- Single-link link aggregation control protocol (LACP)
- Trunk groups
- Uni-directional link detection (UDLD)

Layer 3 Routing

- IPv4 and IPv6 static routes
- Port-based ACL
- Host routes
- Up to 255 virtual interfaces
- Routed interfaces
- Route-only support
- IP helper
- Routing between directly connected subnets
- Equal cost multi-pathing (ECMP)
- Layer 3/Layer 4 ACLs

The device will provide the following management and control features:

- Auto configuration and configuration logging
- Digital optical monitoring (DOM)
- Display of log messages on multiple terminals

- Embedded web management and dynamic host configuration protocol (DHCP) server
- Industry-standard command line interface (CLI)
- Key-based activation of optional software features
- Integration with HP OpenView for Sun Solaris, HP-UX, IBM AIX, and Windows
- MIB support for metro ring protocol (MRP), port security, MAC authentication, MAC-based VLANs
- Out of band Ethernet Management
- Request for Comments (RFC) :
    - 783 Trivial File Transfer Protocol (TFTP)
    - 854 TELNET Client and Server
    - 951 Bootstrap Protocol (Bootp)
    - 1157 Simple Network Management Protocol (SNMP) v1/v2c
    - 1213 MIB-II
    - 1493 Bridge MIB
    - 1516 Repeater MIB
    - 1573 SNMP MIB II
    - 1643 Ethernet Interface MIB
    - 1724 Routing Information Protocol (RIP) v1/v2 MIB
    - 1757 Remote Network Monitoring (RMON) MIB
    - 2068 Embedded Hypertext Transfer Protocol (HTTP)
    - 2131 DHCP Server and DHCP Relay
    - 2570 SNMPv3 Intro to Framework
    - 2571 Architecture for Describing SNMP Framework
    - 2572 SNMP Message Processing and Dispatching
    - 2573 SNMPv3 Applications
    - 2574 SNMPv3 User-based Security Model
    - 2575 View-based Access Control Model SNMP
    - 2818 Embedded HTTPS
    - 3176 sFlow
- Simple network time protocol (SNTP)
- Multiple syslog servers

T684-1.8 Electrical Specifications: The MFES device will operate between 100V and 240V, and use no more than 1.8 amps.

T684-2 Warranty: The MFES will include a limited lifetime warranty for all component parts, and a minimum of three years technical support. The Contractor will not purchase the equipment prior to the issuance of Notice to Proceed. The Contractor will assign to the Department the above manufacturer's or other seller's warranties that come with those products, material or supplies. Assignment of such warranties will be effective on the date of Final Acceptance. To the extent that any of such warranties do not extend to subsequent purchasers or owners or such warranties contain a limitation on assignment, the Contractor

agrees that the Contractor purchased the products, materials, and supplies, on behalf of the Department with the intent that the Department be the original end user of the product and intended recipient of any warranties. All documents associated with or describing any such warranties will be delivered to the Department along with the other project final acceptance documents and will be deemed to be a part of the required final acceptance documentation. Contractor will not take any action or fail to act in any way which voids any such warranties. All subcontracts, if any, will contain a similar provision which requires subcontractors to assign any such warranties to the Department.

T684-3 Method of Measurement:
The quantity to be paid for will be the Contract unit price for each MFES device, furnished and installed, placement, testing of all materials and equipment, and for all tools, labor, equipment, hardware, operational software packages and firmware, supplies, support, personnel training, shop drawings, warranty documentation, and incidentals necessary to complete the work.

T684-4 Basis of Payment:
Price and payment will be full compensation for all work specified in the Technical Special Provision.

Payment will be made under:

Item No. 684-1-1 Managed Field Ethernet Switch – Furnish & Install