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|  | FDOT Traffic Engineering Research Laboratory (TERL)  Managed Field Ethernet Switch (MFES) Compliance Matrix | By signing this form, the applicant declares that he/she has read and understands the provisions of Sections 684 and 996 of the FDOT *Standard Specifications for Road and Bridge Construction* and all implemented modifications. The requirements listed on this matrix are derived from Sections 684 and 996, and are the basis for determining a product’s compliance and its acceptability for use on Florida’s roads. |  |  |

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| --- | --- | --- | --- |
| Date: | Click here to enter a date. | Applicant’s  Name (print): |  |
| Manufacturer: |  |  |  |
| Item, Model No.: |  | Signature: |  |

|  |  | **\*\* Greyed out rows in table below are for TERL use only \*\*** |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ID No** | **Section** | **Requirement** | **Item Comply? (Yes/No/NA)** | **Comments (Applicant must provide information as indicated)** | **TERL Evaluation Method** |
| 1 | 996-1.1 | Equipment is permanently marked with manufacturer name or trademark, part number, and serial number. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): MFES002 (Step 1) |  |  | Init.: |
| 2 | 996-3.1 | Managed Field Ethernet Switch (MFES) is capable of secure local and remote access for configuration, operation, monitoring, and firmware updates. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 1), MFES004 |  |  | Init.: |
| 3 | 996-3.2.1 | The MFES is compliant with the Code of Federal Regulations Section 200.216 Prohibition on certain telecommunications and video surveillance services or equipment |  | *Provide a signed letter of conformance that the MFES is compliant with CFR Section 200.216.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 2) |  |  | Init.: |
| 4 |  | The MFES provides wire-speed fast Ethernet connectivity at transmission rates of 100 megabits per second. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 3) |  |  | Init.: |
| 5 |  | Each MFES can be managed individually and as a group for switch configuration, performance monitoring, and troubleshooting. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 4), MFES003, MFES006 |  |  | Init.: |
| 6 |  | MFES includes Layer 2+ capabilities, including Quality of Service (QoS), IGMP v2, rate limiting, security filtering, and general management. |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): MFES003 (Step 21) |  |  | Init.: |
| 7 |  | MFES supports half and full duplex Ethernet communications. |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): MFES003 (Steps 14, 16) |  |  | Init.: |
| 8 |  | MFES provides 99.999 percent error-free operation. |  | *Provide a statement of conformance in this field.* | Compliance Matrix Review |
| TERL Test Cases (Steps): MFES001 (Step 5) |  |  | Init.: |
| 9 |  | MFES complies with Ethernet data communication requirements using single-mode fiber optic transmission medium and Category 5E copper transmission medium. |  | *Provide a statement of conformance in this field.* | Compliance Matrix Review |
| TERL Test Cases (Steps): MFES001 (Step 6) |  |  | Init.: |
| 10 |  | MFES has a minimum mean time between failures (MTBF) of ten years, or 87,600 hours, as calculated using the Bellcore/Telcordia SR-332 standard for reliability prediction. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement. A calculation method similar to the Bellcore/Telecordia method may be used.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 7) |  |  | Init.: |
| 11 | 996-3.2.2 | MFES complies with all applicable Institute of Electrical and Electronics Engineers (IEEE) networking standards for Ethernet communications, including but not limited to:   1. IEEE 802.1Q standard for Local and Metropolitan Area Networks - Bridges and Bridged Networks used with port-based Virtual Local Area Networks (VLANs) and Rapid Spanning Tree Protocol (RSTP). |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Steps 8, 9), MFES010 (Steps 1-4) |  |  | Init.: |
| 12 |  | 1. IEEE 802.1 p for QoS |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 10), MFES003 (Step 21) |  |  | Init.: |
| 13 |  | 1. IEEE 802.3 standard for Local Area Network (LAN) and Metropolitan Area Network (MAN) access and physical layer specifications. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 11) |  |  | Init.: |
| 14 |  | 1. IEEE 802.3u supplement standard regarding 100 Base TX/100 Base FX. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 12), MFES003 (Step 14) |  |  | Init.: |
| 15 |  | 1. IEEE 802.3x standard regarding flow control with full duplex operation. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 13) |  |  | Init.: |
| |  | | --- | | The following compliance matrix criteria are for MFES with Optical Ports. | | | | | | |
| 16 | 996-3.2.3 | Fiber optic link ports operate at 1,310 or 1,550 nanometers in single mode. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 14) |  |  | Init.: |
| 17 |  | Optical ports are Type ST, SC, LC, or FC only. Mechanical transfer registered jack (MTRJ) type connectors are not allowed. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): MFES002 (Step 2) |  |  | Init.: |
| 18 |  | MFES has a minimum of two optical 100 Base FX ports capable of transmitting data at 100 megabits per second. |  | *Ethernet over very high-speed digital subscriber line (EoVDSL) ports are permitted for applications where fiber optic cable is not available.* | Physical Inspection and Functional Inspection |
| *Applicant may provide comments in this field.* |
| TERL Test Cases (Steps): MFES002 (Step 3), MFES003 (Step 23) |  |  | Init.: |
| 19 |  | MFES provides optical ports designed for use with a pair of fibers; one fiber will transmit (TX) data and one fiber will receive (RX) data. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): MFES002 (Step 4) |  |  | Init.: |
| 20 |  | Optical ports have an optical power budget of at least 15 dB. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 15) |  |  | Init.: |
| The following compliance matrix criteria are for all MFES. | | | | | |
| 21 | 996-3.2.4 | MFES includes a minimum of four copper ports. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): MFES002 (Step 5) |  |  | Init.: |
| 22 |  | Copper ports are Type RJ-45 and auto-negotiate speed (i.e., 10/100 Base) and duplex (i.e., full or half). |  | *Applicant may provide comments in this field.* | Physical Inspection and Functional Inspection |
| TERL Test Cases (Steps): MFES002 (Step 6), MFES003 (Steps 14-18) |  |  | Init.: |
| 23 |  | 10/100 Base TX ports meet the specifications detailed in this section and are compliant with the IEEE 802.3 standard pinouts. |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): MFES003 (Step 2) |  |  | Init.: |
| The following compliance matrix criteria are for MFES with EoVDSL Ports. | | | | | |
| 24 |  | EoVDSL ports support standard telephone-grade twisted copper pair |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 16) |  |  | Init.: |
| 25 |  | EoVDSL port negotiates the fastest data rate possible depending on cable length and quality. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 17) |  |  | Init.: |
| The following compliance matrix criteria are for all MFES. | | | | | |
| 26 | 996-3.2.5 | MFES supports all Layer 2 management features. |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): MFES003 (Steps 1-25) |  |  | Init.: |
| 27 |  | MFES supports certain Layer 3 features related to multicast data transmission and routing, including but not limited to:   1. An MFES that is a port-based VLAN and supports VLAN tagging that meets or exceeds specifications as published in the IEEE 802.1Q standard and has a minimum 4-kilobit VLAN address table. |  | *Provide product literature, specifications, user manual, or similar information that shows the product has a minumum four kilobit VLAN address table.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Steps 18, 19), MFES007 (Steps 1-14) |  |  | Init.: |
| 28 |  | 1. A forwarding/filtering rate that is a minimum of 14,880 packets per second for 10 megabits per second and 148,800 packets per second for 100 megabits per second. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 20) |  |  | Init.: |
| 29 |  | 1. A minimum 4-kilobit media access control (MAC) address table. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 21) |  |  | Init.: |
| 30 |  | 1. Support of, at a minimum, IGMP v2. |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): MFES009 (Steps 1-13) |  |  | Init.: |
| 31 |  | 1. Support of remote and local setup and management via Secure Shell Version 2 (SSHv2) and secure Web-based graphical user interface (GUI). |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): MFES004 (Steps 1-10) |  |  | Init.: |
| 32 |  | 1. Support of the Simple Network Management Protocol (SNMP) version 1/2/3. The MFES can be accessed using the resident TIA-232 management port, or a telecommunication network. |  | *Provide product literature, specifications, user manual, or similar information that shows the product supports SNMP.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Steps 22, 22), MFES003 (Steps 1-25) |  |  | Init.: |
| 33 |  | 1. Support of Remote Authentication Dial-In User Service (RADIUS) or Terminal Access Controller Access-Control System Plus (TACACS+). |  | *Provide product literature, specifications, user manual, or similar information that shows the product supports RADIUS or TACACS+.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 24), MFES005 (Steps 1-20) |  |  | Init.: |
| 34 |  | 1. Support of remote monitoring (RMON) of the Ethernet agent and the ability to be upgraded to switch monitoring (SMON), if necessary. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 25) |  |  | Init.: |
| 35 |  | 1. Support of Secure Copy (SCP) or Secure File Transfer Protocol (SFTP) and either the network time protocol (NTP), or the Simple Network Time Protocol (SNMP). |  | *Applicant may provide comments in this field.* | Functional Inspection |
| TERL Test Cases (Steps): MFES003 (Steps 24, 25) |  |  | Init.: |
| 36 |  | MFES supports port mirroring for troubleshooting purposes when combined with a network analyzer. |  | *Provide product literature, specifications, user manual, or similar information that shows the product meets this requirement.* | Document Review and Functional Inspection |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 26), MFES008 (Steps 1-8) |  |  | Init.: |
| 37 |  | Every conductive contact surface or pin is gold-plated or made of a noncorrosive, non-rusting, conductive metal. |  | *Provide a statement of conformance in this field.* | Compliance Matrix Review |
| TERL Test Cases (Steps): MFES001 (Step 27) |  |  | Init.: |
| 38 |  | Self-tapping screws are not used on the exterior of the assembly. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): MFES002 (Step 7) |  |  | Init.: |
| 39 |  | All parts are made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass, or gold-plated metal. |  | *Provide a statement of conformance in this field.* | Compliance Matrix Review |
| TERL Test Cases (Steps): MFES001 (Step 28) |  |  | Init.: |
| 40 | 996-3.2.7 | MFES operates on a nominal voltage of 120 VAC. Supply an appropriate voltage converter for devices that require operating voltages of less than 120VAC. |  | *Environmental test reports must demonstrate that voltage converters required for 120V*AC *operation were subjected to NEMA TS2 environmental testing as part of the functional system.* | Document Review and Physical Inspection |
| TERL Test Cases (Steps): MFES001 (Step 29), MFES002 (Step 8) |  |  | Init.: |
| 41 |  | MFES has diagnostic Light Emitting Diodes (LEDs), including link, TX, RX, and power LEDs. |  | *Applicant may provide comments in this field.* | Physical Inspection |
| TERL Test Cases (Steps): MFES002 (Step 9) |  |  | Init.: |
| 42 | 996-3.2.8 | MFES operates properly 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. |  | *Provide the following:*   * *A first or third party test report that demonstrates compliance with this requirement. If a voltage converter is required for the device to operate with a 120 VAC input voltage, then the voltage converter must be tested with the device, e.g., in the temperature chamber.* * *A completed Testing Laboratory and Report Checklist.* * *A completed NEMA TS2 2.2.7-2.2.9 Checklist.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 30) |  |  | Init.: |
| 43 | 684-5.1 | MFES has a manufacturer’s warranty covering defects for 1 year from the date of final acceptance. |  | *Provide product warranty documentation that shows the product meets this requirement.* | Document Review |
| *Indicate location of requested information in submittal.* |
| TERL Test Cases (Steps): MFES001 (Step 31) |  |  | Init.: |
| 44 |  | MFES manufacturer will furnish replacements for any part or equipment found to be defective during the warranty period at no cost to the Department or the maintaining agency within 10 calendar days of notification. |  | *Provide a statement of conformance in this field.* | Compliance Matrix Review |
| TERL Test Cases (Steps): MFES001 (Step 32) |  |  | Init.: |

**Document History for:**

**Managed Field Ethernet Switch Compliance Matrix**

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| --- | --- | --- | --- | --- | --- | --- |
| Rev | Description | Authored and Checked | Reviewed | Approved | Approval Date | Rev More Stringent? |
| 1.0 | Conversion of matrix from Excel to Word and changes to match current FHWA approved specification. | D. Vollmer | J. Morgan | J. Morgan | 08/30/2012 | No |
| 2.0 | Changed document control panel to include column for “Rev more stringent?” and added Rev # to header of matrix corresponding to latest approved document. Modified disclaimer to indicate compliance matrix is governing document and referencing PCH section 7.2 in place of A601-3. | A. Burleson | J. Morgan | J. Morgan | 02/28/2013 | No |
| 3.0 | Remove warranty language. | D. Bremer | J. Morgan | J. Morgan | 05/09/2013 | No |
| 4.0 | Changed to match FA 7-30-13. | R. Meyer | D. Vollmer | J. Morgan | 08/13/2013 | No |
| 5.0 | Replaced FDOT logo with latest approved one and added CM ID # to header. Revised document approver title. | D. Bremer  K. Moser | J. Morgan | J. Morgan | 10/30/2014 | No |
| 6.0 | Updated to reflect latest FHWA approved specification (FA 1-6-15). No content change. | A. Burleson | J. Morgan | J. Morgan | 10/15/2015 | No |
| 7.0 | Updated to FA date of 8-5-19. | W. Geitz | M. DeWitt  J. Morgan | D. Vollmer | 10/04/2019 | No |
| 8.0 | Update to new 996 specification. Added compliance for all manufacturers to the John S. McCain National Defense Authorization Act. Update to FA date of 1-28-20. | W. Geitz | M. DeWitt  C. Raimer | D. Vollmer | 12/09/2021 | Yes |
| 9.0 | Added test cases and steps. Updated to FA date 10-24-22. | D. Bremer | V. Johnson  W. Geitz | D. Vollmer | 02/23/2023 | No |
| 10.0 | Updated John McCain Act to CFR 200.216. | W. Geitz | D. Bremer | M. DeWitt | 06/29/2023 | No |
| 11.0 | Updated to latest FA dates of 12-4-23 and 12-1-23 for specs 684 and 996 respectively. | W. Geitz | V. Johnson | D. Vollmer | 01/29/2024 | No |
| 12.0 | Updated to latest FA date of 10-16-24 for specs 684 and 996. | W. Geitz | D. Bremer | M. DeWitt | 06/09/2025 | No |