FIELD HARDENED ETHERNET SWITCH TEST PLANS

1. DEVICE NAMING COORDINATION

1.1. The System Integrator shall coordinate with the TMC/ROC to identify the device names for each device.

1.2. The System Integrator shall then send a request to TOTS to identify the network name, IP address, and any pertinent configuration information.

2. EXPLANATION – STANDALONE (SALT) TESTING

2.1. The System Integrator shall work with the DEVICE VENDOR (if required by the testing form) and complete the NDOT specified SALT tests (non-network) on each unit of equipment after installation.

2.2. Conduct SALT testing on each unit of equipment as outlined on the NDOT provided testing form.

2.3. The System Integrator shall coordinate through the Resident Engineer and the Construction Crew to have an appropriate NDOT representative present for the onsite inspection.

2.4. The System Integrator shall submit the DEVICE vendor commissioning documents with the SALT testing to the Engineer for review and approval.

2.5. Supply a bucket truck and operator, or suitable equivalent equipment necessary to carry out procedures as required by the testing documents, at no direct payment.

!!!***THIS TEST PROCEDURE ONLY APPLIES TO FIELD HARDENED ETHERNET SWITCHES THAT COMMUNICATE BACK TO THE TRAFFIC OPERATIONS TECHNOLOGY SECTION (TOTS)***!!!

FOR ALL OTHER SWITCHES, CONTACT AGENCY WHOSE NETWORK THEY WILL COMMUNICATE ON FOR TESTING PROCEDURES

FIELD HARDENED ETHERNET SWITCH (FHES) SALT PROCEDURE

TEST #	SALT TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL / NA
Switch Name:		**IP Address:**	**GPS:**
TOTS Network Name:		**Associated Cabinet Name:**	
Purpose and General Verification			
System Integrator: *This SALT tests the proper installation of a functional FHES. The system integrator will use a laptop to perform this test. Using a terminal emulator, the integrator will be able to verify the FHES. is operational.* ***General Verification****: For each test below, complete the FHES SALT Matrix, circling the "Pass" or "Fail" in the appropriate cell. Only indicate a "Pass" on this form if the entire matrix column related to the tested function passes for EACH FHES being tested.*			
Equipment Information			
1.	Verify Switch information.	**Manufacturer:** _____ **Model:** _____ **Serial Number:** _____ **Firmware Ver.:** _____ **MAC Address:** _____	Pass / Fail
Equipment Verification			
2.	Determine what method is used to connect the switch the network.	Circle One: Fiber Radio Cell modem	
3.	Verify switch is securely mounted in cabinet.	Switch is securely mounted in cabinet.	Pass / Fail
4.	Verify switch power supply(s) is(are) present and energizes the unit.	Power supply(s) is(are) present and energizes switch.	Pass / Fail
5.	Verify the system is properly bonded to Earth ground.	Resistance to ground shall be 5 Ohms or less on meter.	Pass / Fail
6.	Verify switch has been properly labeled with IP address, MAC Address, Serial number, Hostname	Required information has been affixed to the device using white labels with black lettering.	Pass / Fail

7.	Verify all cabling is labeled with the to/from on each end and at any major transition point and is neatly managed throughout the cabinet.	All premise or inside plant cables originating and ending in the cabinet are properly terminated and labeled. Labeling material rated for Outside Plant (OSP) use. Cables are neatly managed using adjustable hook-and-loop fastener straps.	Pass / Fail
8.	Verify access to the switch via the console port.	Switch is accessible via console port.	Pass / Fail
9.	Verify access to the switch by using the correct login credentials.	Switch is accessible with credentials provided by NDOT Traffic Operations Technology Section (TOTS). Username: _____ Password: _____	Pass / Fail
10.	Verify the switch has a configuration file. Issue command "show configuration snapshot" to display current configuration.	Switch has a valid configuration file. Configuration file will be provided by NDOT Traffic Operations Technology Section (TOTS).	Pass / Fail
11.	Verify VLAN/ISID settings.	All necessary VLANs/ISIDs shall be tagged or untagged as per the configuration file.	Pass / Fail
12.	Verify port/linkagg interface settings.	For each port/linkagg interface that is being used, the device type VLAN/ISID must be a member of that port as untagged.	Pass / Fail
13.	Verify running configuration matches certified configuration.	Running and certified configurations are synchronized and has been saved.	Pass / Fail
Verification of Network Settings			
14.	Verify Communication Settings are set to appropriate values per the IP plan.	IP: _____ MASK: _____ GATEWAY: _____	Pass / Fail

Signatures

DATE	**AGENCY/FIRM**	**PERFORMED BY** (Print Name) (Integrator)	**INTL**	**AGENCY/FIRM**	**WITNESSED BY** (Print Name) (NDOT)	**INTL**

Integrator Signature	

NDOT Signature	

3. EXPLANATION - SUBSYSTEM (SST) TESTING

3.1. At the beginning of the SST phase, the System Integrator shall submit, in PDF format and original signed hard copies of the certified SALT results for approval by the Engineer.

3.2. The Engineer shall approve all SALT testing prior to the System Integrator starting the SST testing.

3.3. Conduct SST testing in accordance with NDOT's testing documentation for all field and related equipment once the system has been interconnected to form a complete subsystem (i.e. Network connectivity).

3.4. The SST test shall demonstrate connectivity to all field equipment utilizing NDOT's current freeway management system.

3.5. The SST test consists of a 45-day period of operations without major failure of equipment. The Resident Engineer can require the SST be restarted if any major failure occurs. A major failure for the Field Hardened Ethernet Switch is defined as:

3.5.1. Any failure of the equipment associated with the PRIMARY FUNCTION of the Field Hardened Ethernet Switch.

3.6. Demonstrate that the total system (hardware, firmware, software, materials, and construction) are properly installed, free from problems, exhibits stable and reliable performance, and meets project requirements.

3.7. Once per week, the System Integrator shall demonstrate that all system functions tested in the SST are operational and meets requirements.

3.8. The System Integrator shall coordinate through the Resident Engineer and the Construction Crew to have an appropriate NDOT representative present for the onsite inspection.

3.9. The System Integrator must provide proof that each device has been tested each week for the duration of the testing period witnessed by an NDOT representative.

3.10. The testing time must be scheduled a minimum of one week prior and coordinated and approved by the Resident Engineer and the Construction Crew.

!!!***THIS TEST PROCEDURE ONLY APPLIES TO FIELD HARDENED ETHERNET SWITCHES THAT COMMUNICATE BACK TO THE TRAFFIC OPERATIONS TECHNOLOGY SECTION (TOTS)***!!!

FOR ALL OTHER SWITCHES, CONTACT AGENCY WHOSE NETWORK THEY WILL COMMUNICATE ON FOR TESTING PROCEDURES

FIELD HARDENED ETHERNET SWITCH (FHES) SST PROCEDURE

TEST #	SST TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL

Switch Name:		**IP Address:**		**GPS:**	
TOTS Network Name:		**Associated Cabinet Name:**			

Purpose and General Verification

System Integrator: *This SST tests the proper installation of a functional Field Hardened Ethernet Switch. The system integrator will use an Operator Workstation at the TMC/ROC to perform this test.*

General Verification*: For each test below, complete the FHES SST Matrix, circling the "Pass" or "Fail" in the appropriate cell. Only indicate a "Pass" on this form if the entire matrix column related to the tested function passes for EACH FH.E.S. being tested.*

1.	Verify network connectivity by issuing a ping test to the switch.	Switch responds to the ping test.	Pass / Fail
2.	Verify access to the switch via SSH.	Switch is accessible via SSH from the TOTS network.	Pass / Fail
3.	Verify remote access to the switch by using the correct login credentials.	Switch is remotely accessible with the credentials provided by the configuration file: Username: _____ Password: _____	Pass / Fail
4.	Verify the switch has a configuration file. Issue command "show configuration snapshot" to display current configuration.	Switch has a valid configuration file.	Pass / Fail
5.	Verify switch is configured correctly by issuing a ping test to all end-devices connected to switch.	End-devices are responding to the ping requests.	Pass / Fail

Signatures

SST DAY	DATE	PERFORMED BY (Print Name) (Integrator)	INTL	WITNESSED BY (Print Name) (NDOT)	INTL
1					
8					
15					

22					
29					
36					
45					
Integrator Signature					
NDOT Signature					