LICENSED MICROWAVE POINT-TO-POINT 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.

LICENSED MICROWAVE POINT-TO-POINT RADIO (LICENSED PTP) SALT TEST PROCEDURE

TEST #	SALT TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL
Licensed PTP 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 Licensed PTP. The system integrator will use a laptop to perform this test. Using the manufacture's software, the integrator will be able to verify the Licensed PTP is operational.* ***General Verification****: For each test below, complete the Licensed PTP 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 Licensed PTP being tested.*			
Licensed PTP Information			
1.	Verify Licensed PTP Information using the manufacturer software or device label.	**Manufacturer: _____** **Model: _____** **Serial Number: _____** **Firmware Ver: _____**	Pass / Fail
2.	Verify transmit frequency range.	**Transmit High: _____** **Transmit Low: _____**	Pass / Fail
3.	Verify receive frequency range.	**Receive High: _____** **Receive Low: _____**	Pass / Fail
4.	Verify bandwidth range.	**Bandwidth High: _____** **Bandwidth Low: _____**	Pass / Fail
5.	Manufacturer's commissioning of Licensed PTP equipment.	Manufacturer confirmation of full operation of all Licensed PTP -associated equipment.	Pass / Fail
Equipment Verification			
6.	Verify Licensed PTP controller is securely mounted in cabinet/rack.	Licensed PTP controller is securely mounted in cabinet/rack.	Pass / Fail
7.	Verify Licensed PTP radio is securely and properly mounted on communication tower.	Licensed PTP radio is securely mounted on communication tower with galvanized and thick-walled pipe or equivalent (approved by Engineer) and stiff-arm bracing.	Pass / Fail
8.	Verify Licensed PTP antenna is securely and properly mounted on communication tower.	Licensed PTP antenna is securely mounted on communication tower with galvanized and thick-walled pipe or equivalent (approved by Engineer) and stiff-arm bracing.	Pass / Fail

TEST #	SALT TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL
9.	Verify the installation of ice shields.	Ice shields properly cover the antennas. Ice shields are securely mounted on communication tower.	Pass / Fail
10.	Verify power supply energizes the system. *Includes Power over Ethernet (POE) injector & POE surge protector, if applicable	UL PMP is accessible through its Graphical User Interface (GUI). *POE components properly function.	Pass / Fail
11.	**If using non-integrated antenna network radio** Verify the installation and connection to the external antenna.	Connection is made with the manufacturer recommended radio frequency (RF) transmission line and non-solder appropriate connectors. **Transmission line type: _____** Antenna connections are weather proofed for RF connections. Presence of polyphaser lightning protection and proper grounding.	Pass / Fail
12.	**If using non-integrated antenna network radio** Using appropriate RF testing equipment, verify the RF transmission line.	RF transmission line passes basic continuity testing. Must be 0 ohms from shield to shield and from conductor to conductor and open from conductor to shield. (Meets manufacturer's recommended passing criteria).	Pass / Fail
13.	**If using integrated antenna network radio** Using appropriate CAT6 testing equipment, verify the CAT6 transmission line.	CAT6 transmission line passes NDOT Ethernet Cable Testing. (Meets manufacturer's recommended passing criteria).	Pass / Fail
14.	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
15.	Verify grounding kits are installed on CAT6 or transmission line of both non-integrated and integrated antenna radios.	Grounding kits are properly installed.	Pass / Fail
16.	Using a meter, verify the system is properly bonded to earth ground.	Meter reading of 5 Ohms or less.	Pass / Fail
17.	Verify Licensed PTP operations locally via User Interface (UI).	Licensed PTP turns on/off via User Interface (UI).	Pass / Fail

TEST #	SALT TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL
18.	Ensure all network radios are operating at highest bandwidth achievable at the expected RSSI values according to the path analysis or the manufacturer recommended RSSI values.	Network radios operate at highest bandwidth achievable at the expected RSSI values according to the path analysis or the manufacturer recommended RSSI, whichever range is better.	Pass / Fail
Verification of Settings			
19.	Verify Communication Settings are set to appropriate values per the IP plan.	**IP: _____** **MASK: _____** **GATEWAY: _____** **UDP/TCP PORT: _____**	Pass / Fail

Signatures

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

Integrator Signature	
NDOT RE Signature	
NDOT TOTS 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 (FMS).

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 Licensed Point-To-Point Microwave is defined as:

3.5.1. Any failure of the equipment associated with the PRIMARY FUNCTION of the Licensed Point-To-Point Microwave.

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.

LICENSED MICROWAVE POINT-TO-POINT RADIO (LICENSED PTP) SST TEST PROCEDURE

TEST #	SST TEST PROCEDURE	EXPECTED RESULT	PASS / FAIL

Licensed PTP 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 Licensed PTP. The system integrator will use an Operator Workstation at the TMC/ROC to perform this test.*

General Verification*: For each test below, complete the Licensed PTP 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 Licensed PTP being tested.*

System Licensed PTP Information

1.	Verify network connectivity by issuing a ping test from the Licensed PTP workstation located at the TMC/ROC.	Licensed PTP responds to the ping test.	Pass / Fail
2.	Conduct throughput testing.	Throughput testing results fall within manufacturer's recommended levels.	Pass / Fail
3.	Verify latency when located at the TMC/ROC.	Latency is below 50 milliseconds (ms).	Pass / Fail
4.	Verify maximum transmission unit (MTU) & if it will support shortest path bridging (SPB) protocol (IEEE 802.1aq) to form an adjacency.	MTU: _____ MTU supports SPB.	Pass / Fail
5.	Verify access to the Web User Interface (UI) from the TMC/ROC.	Web User Interface (UI) is accessible.	Pass / Fail
6.	If full streaming video is implemented, verify video to TMC/ROC.	Video is visually free of ghosting, hesitation, and pixilation when viewing from TMC/ROC. Refer to NDOT Video Testing Requirement (Fixed / PTZ CCTV)	Pass / Fail / N/A
7.	Verify ping to end-devices.	End-devices respond to ping.	Pass / Fail

SST DAY	DATE	PERFORMED BY(Integrator)	INTL	WITNESSED BY(NDOT)	INTL
1					
8					
15					
22					

29					
36					
45					

Integrator Signature	
NDOT RE Signature	
NDOT TOTS Signature	