

## **Bare-metal Switch HW Function Test**

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### **NTC STANDARD LIB**

(NTC\_STD\_SW\_CONF\_Bare-Metal Switch HW Function Test)

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### ***Revision History***

<b><i>REV.</i></b>	<b><i>DATE</i></b>	<b><i>AUTHOR</i></b>	<b><i>REVISION DESCRIPTION</i></b>
0.01	11/03/2015	Safina Liao	Initial
0.02	11/7/2015	Safina Liao	Modify fan direction test
1.00	8/11/2016	Safina Liao	Add test cases for 100G / 25G Switch
2.00	3/21/2018	Safina Liao	Add test cases for 400G Switch; and correct typo

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# 1 Introduction

## 1.1 Objective

The purpose of this document is to outline the Bare-Metal switch HW function testing cases and Pass Criteria to ensure the Hardware functions properly before installing Network OS.

## 1.2 Scope

The test includes nine parts:

- a. LED Verification
- b. Switch ports Link status verification
- c. Switch ports Auto negotiation Test
- d. Data Transmission Test
- e. Throughput Test
- f. Latency Test
- g. USB port Test
- h. Serial Console Test
- i. Management Port Test

## 1.3 Reference

- Hardware specification

## 1.4 Terminology

- DUT Device Under Test
- IEEE Institute of Electrical and Electronic Engineers
- DAC Direct Attached Cable
- AOC Active Optical Cable
- Transceiver A transceiver is a device comprising both a transmitter and a receiver which are combined and share common circuitry or a single housing.
- 1GbE 1 Gigabit Ethernet
- 10GbE 10 Gigabit Ethernet
- 25GbE 25 Gigabit Ethernet
- 40GbE 40 Gigabit Ethernet
- 100GbE 100 Gigabit Ethernet
- 400GbE 400 Gigabit Ethernet
- PPS Packet per second, as known as FPS- Frame per second
- PSU Power Supply Unit
- PWM Pulse Width Modulation, a fan control mechanism for the rotational speed of an electric fan.
- CLI Command Line Interface

- SFP+ Enhanced Small Form-factor Pluggable
- QSFP+ Quad Small Form-factor Pluggable
- SFP28 Small Form-factor Pluggable carries 28Gbit data rate
- QSFP28 Quad SFP28
- ONIE Open Network Install Environment
- QSFP-DD QSFP Double Density

## 1.5 DUT Information

Model Name	
Description	
Diag. Version	
ONIE Version	
HW Version	
Tester	
Date	

## 2 Test Equipment

### 2.1 Equipment & Tools

#### Hardware:

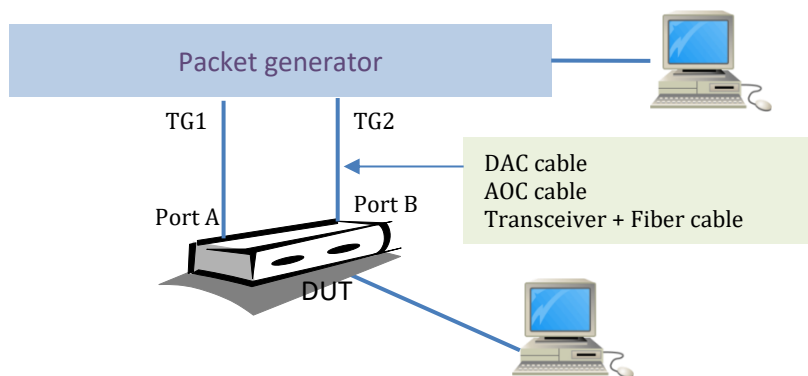
- DUT x 1
- PC x 1
- DAC cables
- QSFP to 4xSFP+ breakout cables
- AOC Cables
- Transceiver
- Fibre Cable
- Packet Generator
- QSFP-DD Cables

#### Software:

- ONIE
- Diag
- DHCP Server

### 2.2 Testing Topology

This section describes the setup and test procedure for the testing.





### 3 Test Items

#### 3.1 LED Verification

- Purpose:
  1. To check if the System LED display correctly when the system is in different state, e.g. booting up, on or off.
  2. To check if the Ethernet Port LED display correctly when it is in different state, e.g. link up, link down, PoE, or transmitting/receiving data.
  
- Resource Requirements:
  - Traffic Generator
  - PC x 1
  
- Test Setup:
  - See 2.2 Testing Topology
  
- Procedure/Expected Result:

LED	State	Expected Result	Test Result
PSU1	Normal	Green	
	Amber	Fault	
	No Power	Off	
PSU2	Normal	Green	
	Amber	Fault	
	No Power	Off	
Diag	Normal	Green	
	Amber	Fault detected	
FAN	All fans operational	Green	
	One or more fan fault	Amber	
LOC	Set by management to locate switch	Amber Flashing	
	Off	Function not active	
1GbE	Link up	Green	
	Transmitting/Receiving data	Flashing	
10GbE	Link up	Green	
	Transmitting/Receiving data	Flashing	
25GbE	Link up	Green	
	Transmitting/Receiving data	Flashing	
40GbE	Link up	Green	
	Transmitting/Receiving data	Flashing	
40GbE breakout	At least one of 10GbE link partners link up	Green	
	Transmitting/Receiving data	Flashing	
	All 10GbE link partners link down	Off	
100GbE	Link on 100G	Green	
	Transmitting/Receiving data	Flashing	
100GbE breakout	At least one of 25GbE link partners link up	Green	
	Transmitting/Receiving data	Flashing	

	All 25GbE link partners link down	Off	
400GbE	Link on 400G	Green	
	Transmitting/Receiving data	Flashing	

Note: Different product may have different definitions of LED.

## 3.2 1GbE ports Link status verification

### ■ Purpose:

To check if the DUT establishes the best possible link with a link partner

### ■ Resource Requirements:

Traffic Generator

PC x 1

### ■ Test Setup:

See 2.2 Testing Topology.

### ■ Procedure/Expected Result:

Case1: The DUT receives no signal from the link partner during initialization.

1. Power on the DUT and ensure that the device is initialized
2. Connect a cable between the DUT and traffic generator.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 1G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case2: The DUT receives signal from the link partner during initialization.

1. Connect a cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 1G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case3: Plug/un-plug Cables

1. Connect a cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Remove and hold the cable for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 1G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

### 3.3 10GbE ports Link status verification

■ Purpose:

To check if the DUT establishes the best possible link with a link partner

■ Resource Requirements:

Traffic Generator

PC x 1

■ Test Setup:

See 2.2 Testing Topology.

■ Procedure/Expected Result:

Case1: The DUT receives no signal from the link partner during initialization.

1. Power on the DUT and ensure that the device is initialized
2. Connect a DAC cable between the DUT and traffic generator.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 10G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case2: The DUT receives signal from the link partner during initialization.

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 10G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case3: Plug/un-plug Cables

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Remove and hold the cable for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 10G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

### 3.4 25GbE ports Link status verification

■ Purpose:

To check if the DUT establishes the best possible link with a link partner

■ Resource Requirements:

Traffic Generator

PC x 1

■ Test Setup:

See 2.2 Testing Topology.

■ Procedure/Expected Result:

Case1: The DUT receives no signal from the link partner during initialization.

1. Power on the DUT and ensure that the device is initialized
2. Connect a DAC cable between the DUT and traffic generator.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 25G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case2: The DUT receives signal from the link partner during initialization.

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 25G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case3: Plug/un-plug Cables

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Remove and hold the cable for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 25G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

### 3.5 40GbE ports Link status verification

■ Purpose:

To check if the DUT establishes the best possible link with a link partner

■ Resource Requirements:

Traffic Generator

PC x 1

■ Test Setup:

See 2.2 Testing Topology.

■ Procedure/Expected Result:

Case1: The DUT receives no signal from the link partner during initialization.

1. Power on the DUT and ensure that the device is initialized.
2. Connect a DAC cable between the DUT and traffic generator
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 40G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case2: The DUT receives signal from the link partner during initialization.

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 40G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case3: Plug/un-plug Cables

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Remove and hold the cable for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 40G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case4: 40GbE break out mode- The DUT receives no signal from the link partner during initialization.

1. Power on the DUT and ensure that the device is initialized and all needed drivers are loaded.
2. Connect a QSFP to 4xSFP+ DAC cable between the DUT and traffic generator.
3. Configure the 40GbE port to break out mode
4. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 10G.
5. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case5: 40GbE break out mode- The DUT receives signal from the link partner during initialization.

1. Connect a QSFP to 4xSFP+ DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Configure the 40GbE port to break out mode
4. Check local management information to verify that the link came up at the proper speed and that link auto-

negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 10G.

5. Send the DUT a series of packets and observe whether the packets are forwarded or not.

#### Case6: 40GbE break out mode- Plug/un-plug Cables

1. Power on the DUT and ensure that the device is initialized.
2. Connect a QSFP to 4xSFP+ DAC cable between the DUT and traffic generator.
3. Configure the 40GbE port to break out mode
4. Remove and hold the cable of 40GbE side for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices.
5. Remove and hold the cable of 10GbE side for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 10G.
6. Send the DUT a series of packets and observe whether the packets are forwarded or not.

### 3.6 100GbE ports Link status verification

■ Purpose:

To check if the DUT establishes the best possible link with a link partner

■ Resource Requirements:

Traffic Generator

PC x 1

■ Test Setup:

See 2.2 Testing Topology.

■ Procedure/Expected Result:

Case1: The DUT receives no signal from the link partner during initialization.

1. Power on the DUT and ensure that the device is initialized.
2. Connect a DAC cable between the DUT and traffic generator
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 100G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case2: The DUT receives signal from the link partner during initialization.

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 100G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case3: Plug/un-plug Cables

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Remove and hold the cable for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 100G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case4: 100GbE break out mode- The DUT receives no signal from the link partner during initialization.

1. Power on the DUT and ensure that the device is initialized and all needed drivers are loaded.
2. Connect a QSFP28 to 4xSFP28 breakout cable between the DUT and traffic generator.
3. Configure the 100GbE port to break out mode
4. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 25G.
5. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case5: 100GbE break out mode- The DUT receives signal from the link partner during initialization.

1. Connect a QSFP28 to 4xSFP28 breakout cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Configure the 100GbE port to break out mode
4. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 25G.



5. Send the DUT a series of packets and observe whether the packets are forwarded or not.

#### Case6: 100 GbE break out mode- Plug/un-plug Cables

1. Power on the DUT and ensure that the device is initialized.
2. Connect a QSFP28 to 4xSFP28 breakout cable between the DUT and traffic generator.
3. Configure the 100GbE port to break out mode
4. Remove and hold the cable of 100GbE side for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices.
5. Remove and hold the cable of 25GbE side for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 25G.
6. Send the DUT a series of packets and observe whether the packets are forwarded or not.

### 3.7 400GbE ports Link status verification

■ Purpose:

To check if the DUT establishes the best possible link with a link partner

■ Resource Requirements:

Traffic Generator

PC x 1

■ Test Setup:

See 2.2 Testing Topology.

■ Procedure/Expected Result:

Case1: The DUT receives no signal from the link partner during initialization.

1. Power on the DUT and ensure that the device is initialized.
2. Connect a DAC cable between the DUT and traffic generator
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 400G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case2: The DUT receives signal from the link partner during initialization.

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Check local management information to verify that the link is established at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 400G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

Case3: Plug/un-plug Cables

1. Connect a DAC cable between the DUT and traffic generator.
2. Power on the DUT and ensure that the device is initialized.
3. Remove and hold the cable for a few seconds, then reinsert. Repeat five times. Check local management information to verify that the link came up at the proper speed and that link auto-negotiation, if supported, negotiated the optimal common values for the two devices, in this case is 400G.
4. Send the DUT a series of packets and observe whether the packets are forwarded or not.

### 3.8 Throughput Test

■ Purpose:

To verify the maximum packet transmission rate

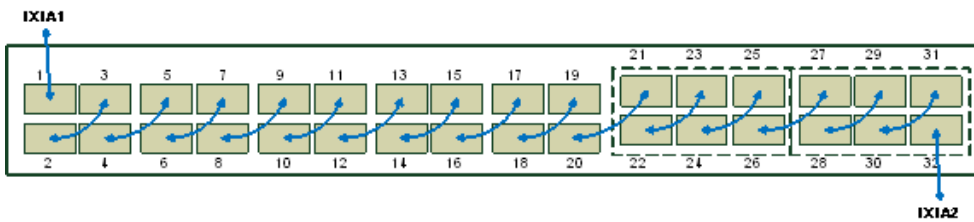
■ Resource Requirements:

Traffic Generator

PC x 1

■ Test Setup:

1. Create VLAN 1 to VLAN X
2. DUTP1 and DUTP2 join VLAN1, DUTP3 and DUTP4 join VLAN2, ....., DUTP(N-1) and DUTPN join VLANX, and PVID is also configured respectively.
3. Use IXIA RFC2544 test tools to measure the maximum packet transmission rate.



■ Procedure/Expected Result:

The following table illustrates the Maximum Frame Rates for each frame size.

Frame Size(Bytes)	Frame Rates(line rate) (Uni-directional)	Frame Rates(line rate) (Bi-directional)
64	100%	100%
128	100%	100%
256	100%	100%
512	100%	100%
1024	100%	100%
1280	100%	100%
1518	100%	100%
4096	100%	100%
9216	100%	100%

## 3.9 USB port Test

■ Purpose:

To verify the USB 2.0 flash drive can be detected and read/write works properly.

■ Resource Requirements:

USB 2.0 flash drive x 1

PC x 1

■ Test Setup:

See 2.2 Testing Topology

■ Procedure/Expected Result:

Case1: Detect Test in diag. mode

1. Insert a USB flash drive into DUT.
2. Power on the DUT and run in the diag. mode
3. Check local management information to verify if the USB flash drive is detected.
4. Remove and hold the USB flash drive for a few seconds, then reinsert. Repeat five times.
5. Check local management information to verify if the USB flash drive is detected.

Case3: Read/Write Test

1. Power on the DUT and run in the diag. mode
2. Insert a USB flash drive into DUT.
3. Check local management information to verify if the USB flash drive is detected.
4. Use diag. command to verify if the USB read and write work properly.

### 3.10 Serial Console Test

- Purpose:  
To verify the serial console can access DUT with correct baud rate.
- Resource Requirements:  
PC x 1  
Serial console cable  
Terminal tool
- Test Setup:  
See 2.2 Testing Topology

- Procedure/Expected Result:

Case1: Default Baud rate verification

1. Client uses a Tera Term or any terminal tools and sets the baud rate to 115200.
2. Client connects with the system via a serial console cable
3. Make sure the function is workable and displayed without error

### 3.11 Management Port Test

■ Purpose:

To verify the GbE management port works properly.

■ Resource Requirements:

PC x 1

DHCP Server

■ Test Setup:

See 2.2 Testing Topology.

■ Procedure/Expected Result:

Case1: To verify the management port is a GbE port with a static IP address 192.168.1.10 by default

1. Configure a PC with IP address 192.168.1.11
2. Connect the PC to DUT management port
3. Ping 192.168.1.10 from the PC and check if the PC gets response from DUT.

Case2: To verify the management port can be configured as DHCP clients and gets IP address properly.

1. Configure the management port as DHCP and connect to a DHCP server
2. Check if the management port get a dynamic IP
3. Use a PC on the same IP subnet to ping DUT
4. Check if the PC gets response from DUT.

## 3.12 Fan Test

### ■ Purpose:

To verify the Fan is hot pluggable, Fan rotation speed and direction are configurable and fan status can be read via command line in diagnostic mode.

### ■ Resource Requirements:

PC x 1

### ■ Test Setup:

See 2.2 Testing Topology

### ■ Procedure/Expected Result:

Case1: Hot plug the fan and read Fan status via command line

1. Enter diag. mode
2. Read the fan status via command line and check if the result is correct.
3. Remove one Fan from DUT and check if the fan status is correct.
4. Re-plug the fan to DUT and check if the status is correct.
5. Repeat step 3 and 4 for each fan and record the test result.

Case2: Fan rotation speed test

1. Configure fan speed to 50%
2. Observe the Fan speed is about 50%.
3. Configure fan speed to 100%
4. Observe the Fan speed is increased to 100%
5. Configure fan speed to 50% again and check if the fan is speed down.
6. Configure fan speed to 20%, the lowest fan speed can be adjusted.
7. Check if the fan speed is decreased.

Case3: Fan direction check

1. If the fan direction is "Front to Back"(depends on HW specification)
2. Check if the air flow direction is from front to back.
3. If the fan direction is "Back to Front" (depends on HW specification)
4. Check if the air flow direction is changed to from back to front

### 3.13 Power Module

- Purpose:  
To verify the PSU status can be read via command line in diagnostic mode.
- Resource Requirements:  
PC x 1
- Test Setup:  
See 2.2 Testing Topology
- Procedure/Expected Result:

State	Description
Power good	With AC power connected
Power fail	Without AC power connected
present	PSU plugged into DUT
Not present	PSU is not plugged into DUT

Case1: Read PSU status via command line

1. Plug PSU1 into the DUT with AC power.
2. Check if the PSU power state and present state are correct.
3. Plug PSU2 into DUT without AC power
4. Check if the PSU power state and present state are correct.
5. Connect AC power to PSU2
6. Unplug AC power from PSU1
7. Check if the PSU power state and present state are correct.
8. Unplug PSU1 from DUT and check if the PSU power state and present state are correct.

Case2: PSU redundancy test

1. Connect DUTPA and DUTPB to Traffic generator TG1 and TG2 respectively.
2. Plug PSU1 and PSU2 into the DUT and connect AC power to PSU1 and PSU2.
3. Check if the PSU power state and present state are correct.
4. Send traffic from TG1 and TG2
5. Unplug AC power from PSU1 and remove PSU1 from DUT
6. Check if no packet loss occurs when losing PSU1.
7. Send traffic from TG1 and TG2
8. Re-plug PSU1 with AC power
9. Check if no packet loss occurs when PSU1 is back.