User Guide

TN-SFP-BC55 and TN-SFP-BC55-I

SFP Transceiver Modules

- 1.25Gbps/125Mbps bi-directional data link
- Integrated OTDR (Optical Time-Domain Reflectometer) function
- Integrated Reflection Immune Operation – any network type
- SFF-8472 Digital Diagnostic Function (DMI)
- MSA and RoHS Compliant (all models)

Contents

Introduction

The Transition Networks TN-SFP-BC55 and TN-SFP-BC55-I automatically detect, locate and report Optical Fiber Faults. The ODTR data readout requires additional software support from the switch (Transition Networks S4224) or NID (Transition Networks S3290-xx). The TN-SFP-BC55/-I allows fiber integrity checking and fault-reporting from the service providers, to reduce the Opex (cost per install and cost per repair) for network implementation.

The TN-SFP-BC55-I integrates OTDR functionality into the Transition Networks S4224 CE Switch and S3290-xx NID to provide a cost-effective solution for fiber fault determination, localization, cost reduction, and time-to-repair for customer services.

Model Numbers

The two models are typically used in pairs (one of each model), but it is not a requirement. Not all features are supported when not used in pairs of one of each model.

TN-SFP-BC55-I	SFP w/OTDR 1000Base-LX/100Base-FX / 1550nm single fiber single mode (LC) / [40km/24.9mi.,] Link Budget: 20.0dB
TN-SFP-BC55	SFP w/ Reflection Immune Operation, 1000Base-LX/100Base-FX, 1550nm single fiber single mode (LC) [40km/24.9mi.,] Link Budget: 20.0dB

The OTDR function can be deployed in two configurations: *Both end* and *Single end*, but the use of TN-SFP-BC55-I requires software support from the host device and light pulse is only sent from the TN-SFP-BC55-I. The *Both end* configuration uses a TN-SFP-BC55-I with a TN-SFP-BC55-I. A *Single end* configuration uses a TN-SFP-BC55-I with a TN-SFP-BC55. See OTDR SFP Feature Cross-Reference on page 38 to compare and contrast model features.

Functions

- Monitors optical fiber links providing fault detection
- Uses pulses of light to measure distance to reflection of damaged fiber
- Uses standards-based protocols for network monitoring and troubleshooting
- Provides Gb Ethernet demarc / end-to-end service assurance / reduced MTTR
- Captures, saves, and reports on up to 16 refelctions and up to 10 captures via CLI or Web GUI
- Lets you create a "birth certificate" to use as a baseline for measurement

Features

- Compliant with IEEE 802.3z, 1000Base-LX, and IEEE802.3 100Base-FX
- 55 dB Dynamic Range for the OTDR
- Dead Zone of 30 meters or less
- Resolution of 10 meters or better
- Accuracy of 50 meters or better / Absolute accuracy of +/- 100 meters (at full distance)
- Class 1 Laser International Safety Standard IEC 60825 Compliant

Dynamic Range is the max fiber cable length that the longest pulse width can reach in dB.
Dead Zone is the length of time the detector is temporary blinded by a high amount of reflected light, until it recovers and can read light again. **Resolution** is the ability to distinguish between two points on the cable, like intermediate patchcords or closely spaced splices. **Accuracy** is the correctness of the measurement (the difference between the measured value and the true value of the event being measured).

Note: It is important that every fiber connector be inspected and cleaned prior to mating. See Clean the Optical Fiber Connections on page 12.

Benefits

- Small Footprint with integrated network monitoring
- Single Wavelength Operation in Legacy and UPC connector Networks
- Physical layer Fault Detection
- Distributed remote fiber monitoring
- No additional special equipment

TN-SFP-BC55/-I Reflection Immune Operation

Single Fiber Single Wavelength (SFSW) Transceivers transmit and receive at the same wavelength, on single fiber, doubling the optical fiber plant capacity. SFSW transceivers offer many potential benefits to the Network Operator (e.g., seamless CWDM integration, half the fiber, half the CWDM passives, and easier fiber management).

Open connectors, fiber faults and intermittent connections which commonly occur in field deployments, create optical reflections of varying intensities. SFSW transceivers can be susceptible to signals generated by these reflections in the optical fiber cable plant. For example, the reflection from an open non-angle polished (PC or UPC - Blue) optical connector is about 15 dB. The reflected signal may return to the receiver section of the originating transceiver at power levels well within the operating sensitivity range of the receiver. This may cause the originating transceiver to detect this false signal, appearing to the network switch (or any host equipment) as though it was receiving a viable signal. But in fact, an optical loopback condition is created in the network, wreaking havoc with network operations.

Since SFSW transceivers suffer such drawbacks in the presence of optical reflections, their application in real-world conditions has been limited compared to that of their two-wavelength single fiber or two-fiber cousins. Because SFSW transceivers offer so many potential benefits to the Network Operator, a comprehensive solution to the reflection sensitivity problems would provide significant benefits.

Transition Network's TN-SFP-BC55/-I SFPs with Reflection Immune Operation technology solve the SFSW reflection problems. Transition Network's TN-SFP-BC55/-I SFP Transceivers now incorporate Reflection Immune Operation. This feature lets our TN-SFP-BC55/-I SFPs recognize reflected signals and avoid ever reporting a link based on a false reflected signal.

Integrated into the TN-SFP-BC55/-I SFP Transceiver hardware and firmware, this operation is totally automatic in operation and is transparent to the host network equipment and optical network (PC and UPC Blue or APC Green optical connector types). Now for the first time, TN-SFP-BC55/-I SFP Transceivers may be substituted anywhere a standard two-fiber SFP Optical Link exists.

With Reflection Immune Operation, all of the benefits of SFSW Links are available, without the reflection-induced drawbacks.While the mechanism of is quite sophisticated, the general approach may be understood by the following simple explanations.

Initial Link Start-Up

When first plugged in, or powered up, the TN-SFP-BC55/-I Transceivers on either end of the Link initiate a specific sequence. First, the receiver section becomes active, while the transmitter remains off. The receiver listens for an incoming signal. Since its own transmitter is off, if the receiver detects an inbound signal, and knows that it must be legitimate because it can only be coming from the remote transceiver. Then the local transmitter section becomes active and a link is established between the local and remote transceivers.

The remote transceiver goes through the same sequence. Random timing delays and proprietary algorithms are built into the start-up sequences, to guarantee linking (each transceiver ensures that the incoming signal is from an external source). The extra processing guarantees data link, under any circumstances, between two transceivers, within less than 700 mSec. The overall timing delay in such an event is well within the typical delays inherent in network "handshake" protocols, so all of this remains invisible to network operation and the network users.

Interruption of Established Link

The case where a Link is functioning correctly but then is interrupted is a bit more complex (for the SFP, not for the network operator or users).

The case of a PC or UPC Blue connector being inadvertently opened somewhere in the span of the Link presents a different scenario since the reflected signal can be similar, or identical, in amplitude to the incoming signal from the other side. The SFP deploys sophisticated digital filtering schemes which allow it to distinguish between the original inbound signal from a remote source, and a signal reflected back to the originating local transceiver. Any interruption of the optical Link will cause brief fluctuation in the optical power levels due to temporary interference patterns in the connector. Fast optical power changes below 0.25 dB are detected and processed by the SFP. Following such a brief disruption, the SFP protocol analyzes the signal origin, and distinguishes between a fluctuation in the link (e.g., due to an intermittent change in a patch panel) and an open link with reflection.

Summary

The network operator and network users may enjoy the benefits of SFSW operation without any of the drawbacks associated with legacy systems. This operation resolves self-reflection from an open connector and/or other reflectors. Only remote data is transferred into the host equipment. In designing a network, overall ORL (Optical Return Loss) must be accounted for since it may affect the sensitivity of the data receiver. The user must ensure that the supplier tests and guarantees the link budget within the ORL performance of the operational network.

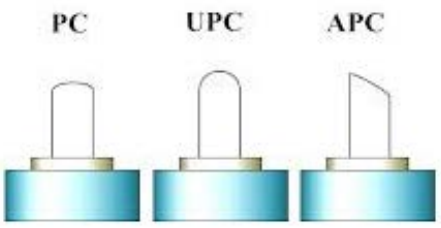
For more information on Transition Networks' SFP Transceivers, visit www.transition.com.

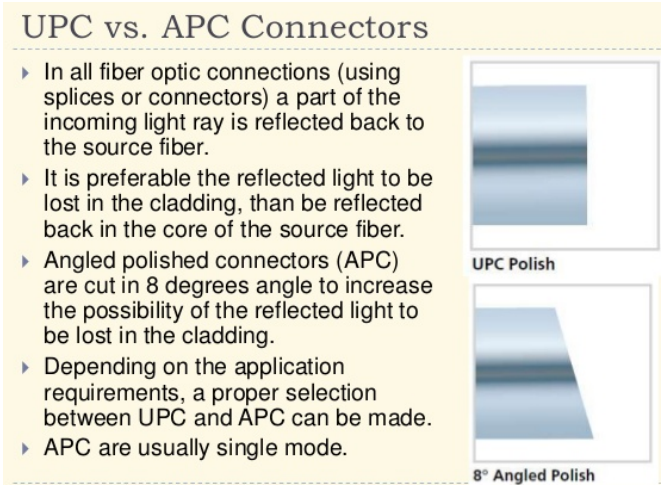
TN-SFP-BC55-I

TN-SFP-BC55

Connector Types PC/UPC/APC

Optical network (PC and UPC Blue or APC Green optical connector types) are described and shown below.





A Connector
SC
FC
LC
MU
ST
E2=E2000
D4

B Endface 1#
PC
UPC
APC

C Connector
SC
FC
LC
MU
ST
E2=E2000
D4

D Endface 2#
PC
UPC
APC

E Cable Type
S=simplex
D=Duplex

F Fiber mode
SM=Singlemode
MM=Multimode

G Cable Diameter
30=ϕ3.0
20=ϕ2.0
09=ϕ0.9

H Cable Length
L=1,2,3.....

Specifications and Standards

The **TN-SFP-BC55 and TN-SFP-BC55-I** were designed to meet these standards and specifications. Model differences are noted.

Standards	IEEE 802.3™, IEEE 802.3z
Compliance	SFF-8472 Digital Diagnostic Function (DMI) Small Form Factor – SFP (fits MSA specified SFP Slots) Class 1 Laser International Safety Standard IEC 60825 Compliant (IEC 60825-1; FDA CDRH 21-CFR 1040.10 Class 1) Full Duplex, Single Wavelength Back-to-Back to 80 Km (no “Pad”) RoHS Compliant
Voltage	3.3v
Power Consumption	<1 Watt for data transport mode, and max power consumption in OTDR mode is less than this
Optical Power Budget	Up to 25 dB
Weight	0.8 Oz. (22.67 Grams)
Shipping Weight	10-Pack=9.6 Oz. (272.15 Grams)
Operating Temp	-20°C to +70°C
Storage Temp	-40°C to +85°C
MTBF	600,000 hours
Warranty	1 Year Warranty

Common Characteristics (-20°C to +70°C)

Transmitter:

Parameter	Symbol	Min	Typ	Max	Units
Power Supply Voltage	VccTX	3.15	3.3	3.45	V
Power Supply Current	IccTX	-	-	140	mA

Receiver:

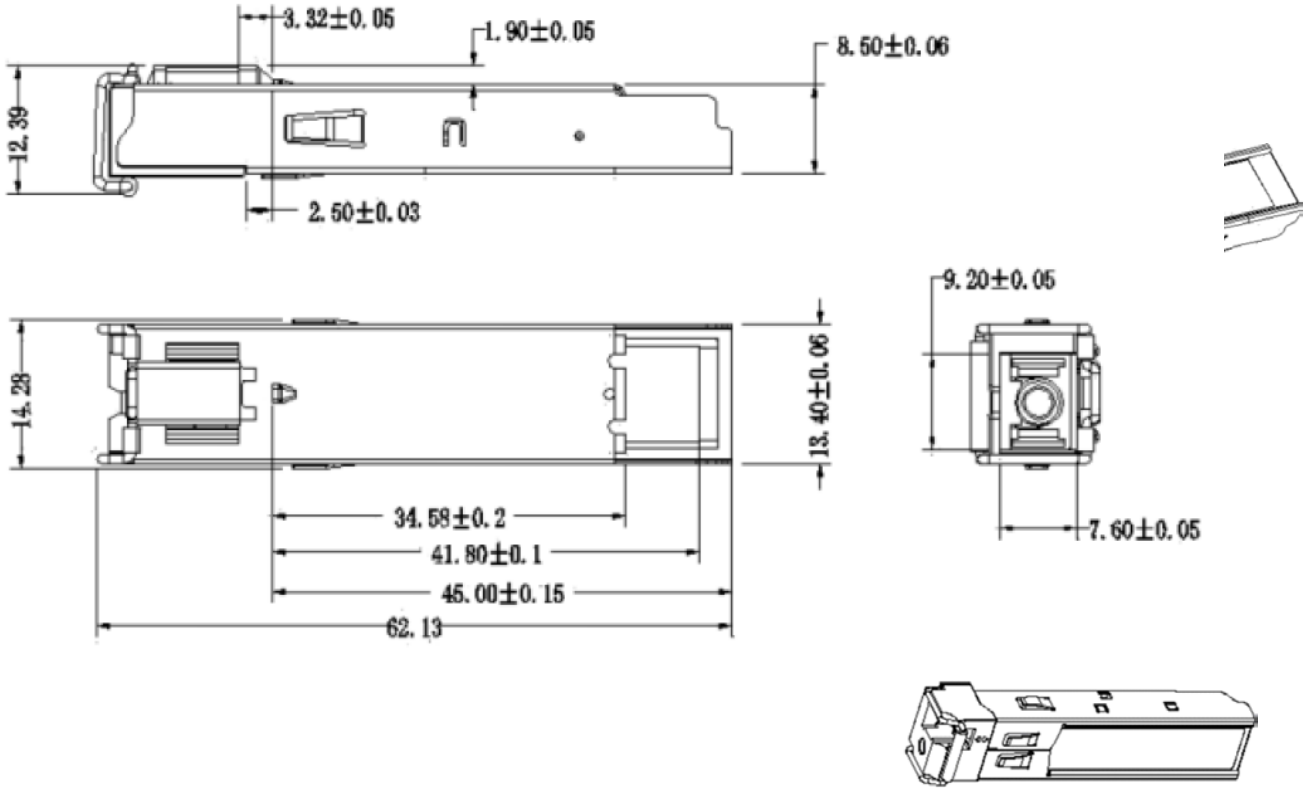
Parameter	Symbol	Min	Typ	Max	Units
Power Supply Voltage	VccRX	3.15	3.3	3.45	V
Power Supply Current	IccRX	-	-	110	mA

Absolute Maximum Ratings

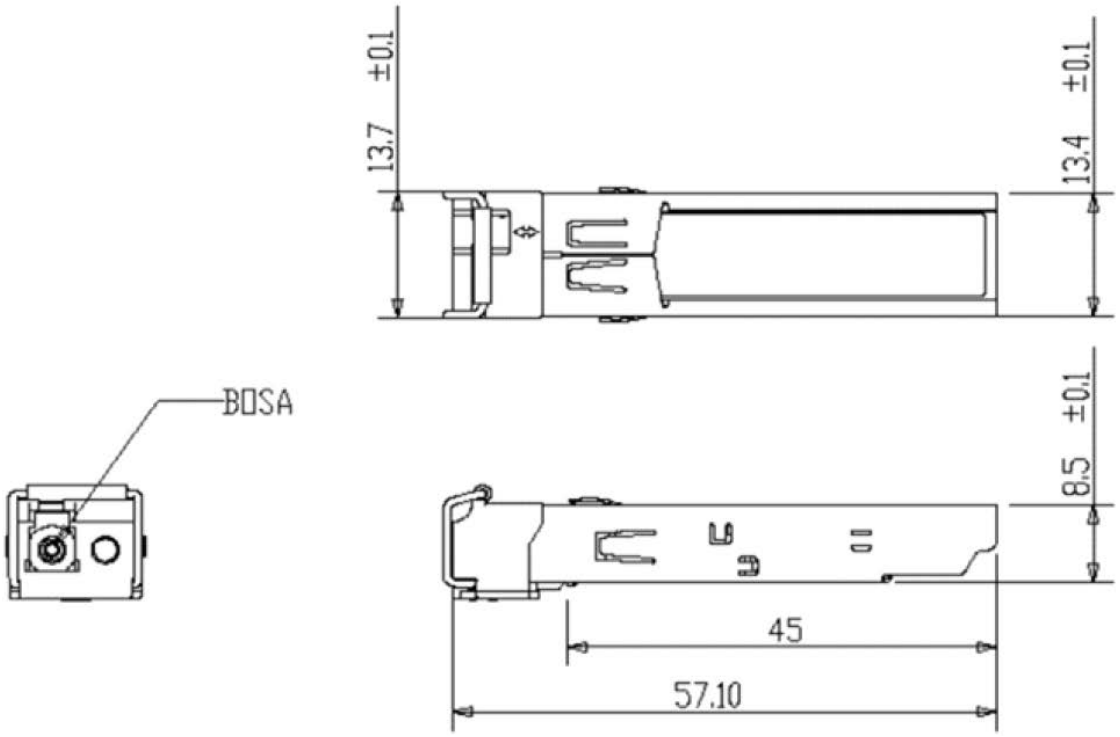
Parameter	Symbol	Min	Max	Units
Storage Temperature (Case)	T_S	-40	85	°C
Operating Temperature (Case)	T_O	-20	70	°C
Relative Humidity	RH	5	95	%
Power Supply Voltage	Vcc	0	3.6	V
Input Voltage		GND	Vcc	V

Dimensions

SC Receptacle Dimensions (TN-SFP-BC55)



LC Receptacle Dimensions (TN-SFP-BC55-I)



Optical Specifications

The Optical Specs for all Transition Networks' SFPs are listed at www.transition.com/sfp.pdf.

Site Planning

The Fiber Optic Association, Inc. provides FOA Technical Bulletins that should be used as references for the design and planning of the network. These documents can be downloaded from the FOA Tech Topics website at www.thefoa.org.

Related Manuals

The following TN S4224, S3290-xx, and ION manuals are available; other envronments may exist.

- S3290 Quick Start Guide (33615), Install Guide (33594), Web User Guide (33595), and CLI Reference (33596)
- S4224 Quick Start Guide (33636), Install Guide (33534), Web User Guide (33535), and CLI Reference (33536)
- ION System x323x Remotely Managed NID User Guide (33342)
- ION Systems CLI Reference Manual (33461)
- ION x222x & x32xx Multi-port NIDs Installation Guide (33433)

Applications

TN-SFP-BCxxxx is an intelligent Small Form-Factor Pluggable (SFP) with integrated Optical Time Domain Reflectometer (OTDR) capability. It offers a simple way of assessing or monitoring the status of the physical fiber optic infrastructure and measuring the distance to a fiber break.

The SFPs are Single Fiber, Single Wavelength Transceivers and are intended only for such applications / uses. These SFPs can be used for:

- Network Security / Maintenance
- Business Class Service
- Metro-Ethernet Direct
- Wireless Backhaul
- Central Office Cross-Connect
- Electrical Power Utilities

Use the TN-SFP-BC55-I OTDR SFP with the S4224 and S3290-xx switches (firmware version 2.2.5 and higher) in a central office connected to either:

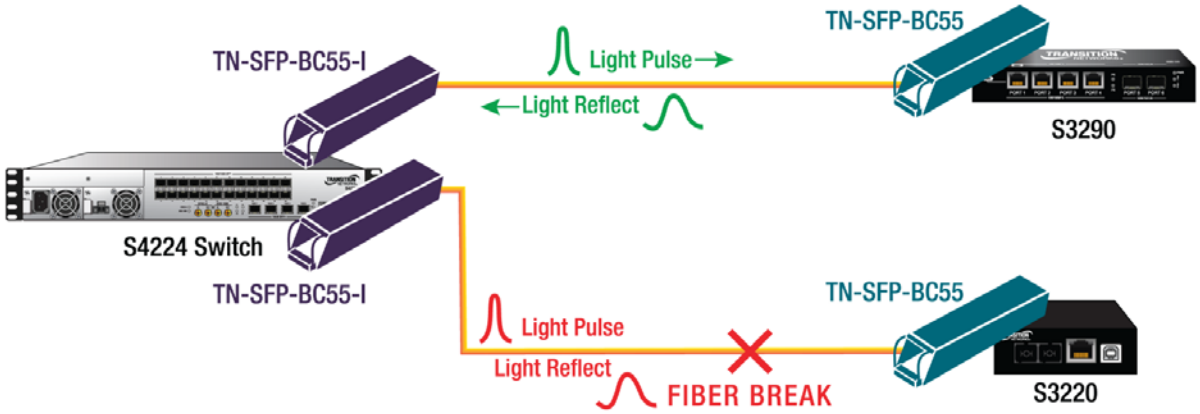
- a TN-SFP-BC55 in the SFP slot of a remote Transition Networks media converter, or
- a TN-SFP-BC55-I OTDR SFP in an S4224 or S3290-xxx at the remote end.

The TN-SFP-BC55-I works in the S4224 or S3290, and the TN-SFP-BC55 works in an S4224 or S3290, or an ION S3230, S3220, or S2220. The TN-SFP-BC55-I does not work in ION at this time.

Application: Fiber Connections with SFPs with OTDR

The figure below shows SFPs used to measure the length of optical fiber cables at installation (Birth Certificate) and to determine the location of a break in the fiber cable.

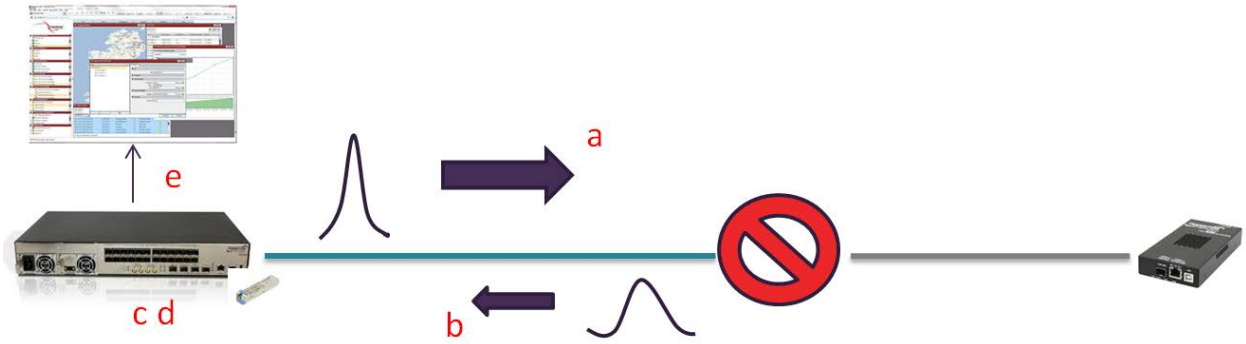
Typical “Single-ended” Deployment connecting a Central Office’s S4224 + OTDR SFP (single fiber, 1550nm) to a Remote customer site’s S3290 or ION S32xx Media Converter + SFP (single fiber, 1550nm).



The TN-SFP-BCxxxx will detect and locate the distance to the fiber break automatically, and will switch from OTDR mode to data transmit without manual intervention. You can manually run an OTDR test on either end of fiber link where the OTDR SFP is deployed (an OTDR SFP is required only on one end in a typical deployment).

Application: Fiber Fault with OTDR SFP

An optical time-domain reflectometer (OTDR) is an optoelectronic instrument used to characterize an optical fiber. An OTDR is the optical equivalent of an electronic time domain reflectometer. It injects a series of optical pulses into the fiber under test and extracts, from the same end of the fiber, light that is scattered (Rayleigh backscatter) or reflected back from points along the fiber. The scattered or reflected light that is gathered back is used to characterize the optical fiber. This is equivalent to the way that an electronic time-domain reflectometer measures reflections caused by changes in the impedance of the cable under test. The strength of the return pulses is measured and integrated as a function of time, and plotted as a function of fiber length (Wikipedia). For more information see the Fiber Optic Association (the professional society of fiber optics) at www.thefoa.org/index.html.



a) SFP sends light pulse, which travels to the fault.

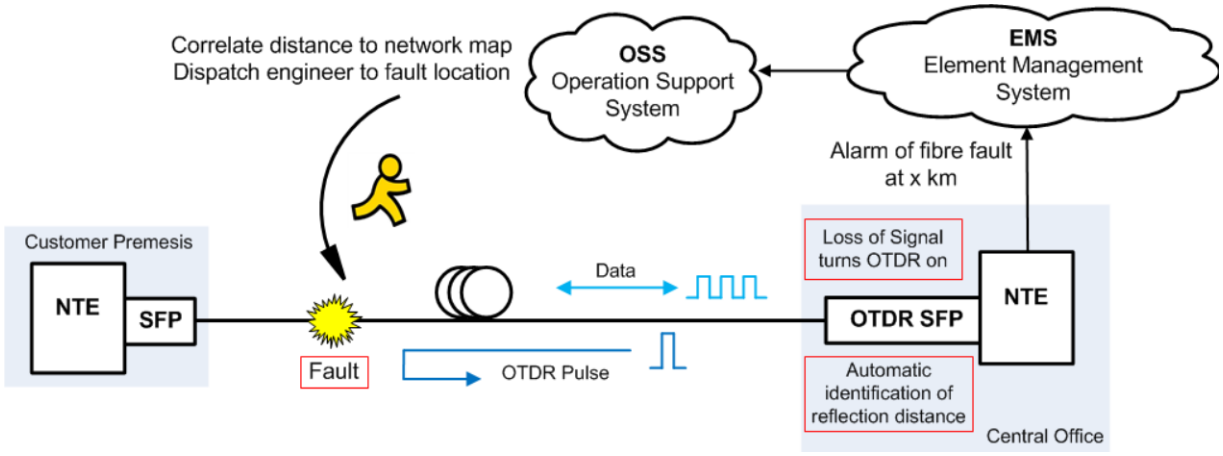
b) Light reflects back from fault.

c) SFP measures the round-trip travel time and stores it in memory.

d) SFP reports the failure status and distance to the switch.

e) Switch records the OTDR data (TX and RX Power, Fiber link status, Fiber distance) in DDMI information (on the S3290 or S4224 CLI, Web GUI, or SNMP, or an EMS).

The figure below shows the process for quick dispatch of an appropriate engineer to the fibre fault location. This is achieved by the removal of human intervention until the alarm reaches the operations support system. This allows the SP to gain improvements compared to the current method of sending an engineer with a field OTDR to the central office or customer premises to identify the fault.



I. SFPs with built-in OTDR allow the CSP to record a “Birth Certificate” at the time of install:
- So every install has a "working state" OTDR reading;
- OTDR reading is just as important as the RFC2544 Birth Certificate.

II. During a Link “down” event, an OTDR SFP can quickly and categorically allow the CSP to discern between:
- a Fiber break, and
- a problem with the Equipment at Customer Premises.

III. After a Fiber Break event, an OTDR SFP will help the CSP:
- More quickly dispatch the right team for the right problem;
- Avoid dispatching additional team which cannot fix the problem; and
- Reduce MTTR (Mean-Time-To-Repair or Recover).

SFP Unpacking

Before you start installing the TN-SFP-BC55 or TN-SFP-BC55-I, verify that the package contains the following items:

- One TN-SFP-BC55 or TN-SFP-BC55-I
- One Anti Static Foam Pouch
- One Product Support Postcard, 33504
- Two protective foam pieces

Please notify your sales representative immediately if any of the above items is missing or damaged. Save the packaging for possible future use.

Single Pack

10-Pack

Clean the Optical Fiber Connections

Every time an optical fiber connection is made or un-made, both sides of the connection must be cleaned. The cleaning process is not complete until each side is visually inspected using a video camera or scope to confirm that both sides of the connection are clean.

Dirty connections will display reflective events long before attenuation events will be detected. Since the single fiber, single wavelength TN-SFP-BC55/-I is sensitive to reflections, cleanliness is very is important. The TN-SFP-BC55/-I can tell the communications service provider (CSP) where there are dirty connections and help direct the CSP technician to the trouble spots. Without the TN-SFP-BC55/-I you may not know until the Link goes down, and then it's too late!

Summary: the connection (receptacle, etc.) is not clean until it is visually inspected and confirmed to be clean.

See the Fiber Optic Association, Inc. *Cleaning Fiber Optic Connections* page on the FOA website at www.thefoa.org/tech/ref/termination/cleaning.html for more information.

Cleaning Process*: Inspect, Clean, Re-inspect, Connect*

Fiber inspection and cleaning are simple steps with immense benefits.

Always inspect both connectors before mating. Mating dirty connectors will cross-contaminate both connectors. Hard contaminates will scratch and pit the ferrule end face. Inspect before mating to prevent permanent damage to connectors, reduce troubleshooting time, reduce material costs, and improve signal quality.

Make fiber optic cleanliness a priority. Develop inspection and cleaning procedures, and train your team regularly on how to inspect and clean your connectors.

Cleaning Best Practices: Many tools exist to clean fiber. Many companies have their own "best practices". Dry clean first, then try wet cleaning. Always finish with a dry cleaning process.

Important Standards Regarding End Face Quality and Cleaning

- IEC 61300-3-35: Fibre Optic Interconnecting Devices and Passive Components – Basic Test and Measurement Procedures
- IPC 8497-1: Cleaning Methods and Contamination Assessment for Optical Assembly
- IEC 62627 (DTR): Fibre Optic Interconnecting Devices and Passive Components – Fibre Optic Connector Cleaning Methods
- IEC 61300-3-3 has developed zones for setting requirements for connector's endface quality.
- IEC 62627 – DTR scope is intended to emphasize the need for cleaning fibre optic connectors as well as describing the some of the current tools and methods for proper cleaning.
- IPC-8497-1 scope is intended to describe the methods of inspecting and cleaning all optical interfaces so their interconnectivity does not result in loss of optical signal. (IPC-8497-1 is a summary of both IEC standards (IEC 62627 – DTR and IPC-8497-1).

The IEC Standards are available for download from several sources including the ANSI Standards Store.

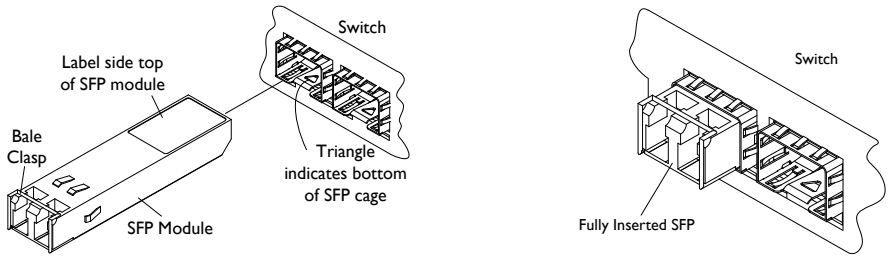
SFP Installation

Cautions

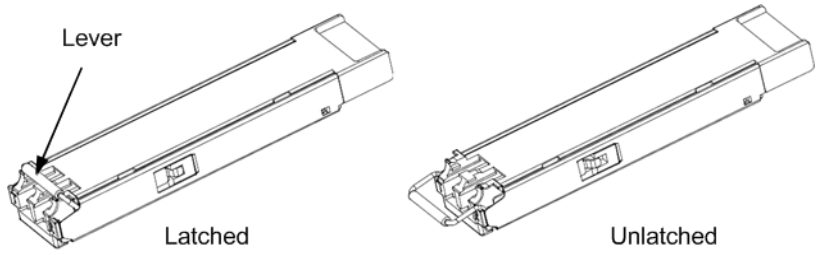
- The SFP tranceiver module is keyed to only be installed one way. However, if forced the wrong way, damage may occur. See S4224 Note below for SFP port orientation.
- Avoid getting dust or other contaminants into the fiber bore of the SFP transceiver module, as this will cause the optics to not operate properly.
- Clean the optic surfaces of the optical fiber before you plug them back in to the optical bores of another SFP tranceiver module.
- Each port must match the wavelength specifications on the other end of the cable, and the cable must not exceed the specified cable length for reliable communications.

Installing an SFP Module

1. Attach an ESD-preventive wrist strap to your wrist and to the ESD ground connector or a bare metal surface on your chassis.
2. Remove the SFP transceiver module from its protective packaging. Note: Do not remove the optical bore dust plugs until directed to do so in a later procedure.
3. Check the slot orientation. **S4224 Note**: odd numbered SFP slots are “upside down” compared to even numbered slots.
4. Position the SFP device at the desired installation slot, with the label facing correctly.
5. Carefully slide the SFP device into the slot, aligning it with the internal installation guides.



6. Ensure that the SFP device is firmly seated against the internal mating connector. To verify that the SFP is seated and latched properly. **a**) Grasp the SFP by the sides and try to remove it without releasing the latch. **b)** If the SFP can not be removed, it is installed and seated properly. If the SFP can be removed, reinsert it and press harder with your thumb; repeat if necessary until it is latched securely into the socket.



7. Connect the fiber cable to the fiber port connector of the SFP device. Make sure the SFP release latch is in the up (closed) position when you insert the cable connector into the SFP.
8. Remove the dust plug from the connector. Save the dust plug for future use.
9. Attach an appropriate cable into the SFP module port.
10. Attach the other end of the cable into the other device.
11. Observe the connected device’s status LED(s). See the related manual for details.

Fiber Cable Physical Characteristics

The fiber cable physical characteristics must meet or exceed IEEE 802.3ae specifications:

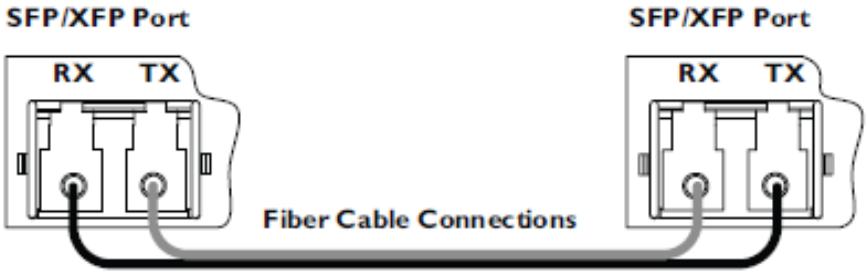
- Single mode fiber (recommended): 9 µm
- Multimode not recommended

Warning: Visible and invisible laser radiation when open. DO NOT stare into laser beam or view directly with optical instruments. Failure to observe this warning could result in damage to your eyes or blindness.

Connecting Fiber Cables

To install the fiber cable, do the following:

1. Locate the appropriate fiber cable. Install an SFP before connecting the fiber optic cable.
2. Install the cable as shown below.



Removing an SFP Module

Caution: Be careful when removing the SFP or SFP+ from a device. Some SFP transceiver module temperatures may exceed 160°F (70°C) and be too hot to touch with bare hands. **Note**: Do not remove and replace the SFP modules more often than necessary; excessive SFP removing and replacing can shorten the SFPs useful life.

1. Attach an ESD-preventive wrist strap to your wrist and to the ESD ground connector or a bare metal surface on your chassis.
2. For future reattachment of fiber-optic cables, note which connector plug is send (TX) and which is receive (RX).
3. Remove the SFP transceiver module:

   a. If the SFP transceiver module has an **actuator button latch**, gently press the actuator button on the front of the SFP transceiver module until it clicks and the latch mechanism releases the SFP transceiver module from the socket connector. Grasp the actuator button between your thumb and index finger, and carefully pull the SFP transceiver module straight out of the module slot.

   b. If the SFP transceiver module has a **bail clasp latch**, pull the latch out and down to eject the SFP transceiver module from the socket connector. If the bail clasp latch is obstructed and you cannot use your index finger to open it, use a small, flat-blade screwdriver or other long, narrow instrument to open the bail clasp latch. Grasp the SFP transceiver module between your thumb and index finger, and carefully remove it from the socket.
4. Inspect, clean, and then replace the Dust Plug.
5. Place the removed SFP/SFP+ transceiver module in an antistatic bag or other protective package.
6. Clean fibers are necessary for achieving accurate OTDR results. See Clean the Optical Fiber Connections on page 12.

Prerequisites and Restrictions

This section provides configuration prerequisites and restrictions. For the latest feature information and caveats, see the release notes for your particular device and software release. The prerequisites and restrictions below apply to both the S3290 and the S4224 unless otherwise noted.

NTP Server

An NTP server is required for accurate timestamping. NTP is configurable via the S3290 and the S4224 web GUI and/or CLI.

NTP (Network Time Protocol) is a protocol for synchronizing the clocks of computer systems over packet-switched, variable-latency data networks. The NTP system is used primarily when data transfer is handled via the Internet.

If NTP is not configured, then the Timestamp will be the device default of the year 1970 and the elapsed time since last reboot.

If your S3290 or S4224already has an NTP server, see the S3290 or S4224 Web User Guide or CLI Reference for NTP configuration vuia the web UI or CLI.

If your system does not already have an NTP server, there are several dowload options available:

The NTP Pool Project home page is at http://www.pool.ntp.org/en/.

See the NTP Terms of Service at http://www.pool.ntp.org/tos.html.

Additional Resources

The home of the Network Time Protocol project R&D is ntp.org (http://www.ntp.org/).

The United States NTP Pool - us.pool.ntp.org is at http://www.pool.ntp.org/zone/us.

The NIST Internet Time Servers webpage lists the time servers used by the NIST Internet Time Service (ITS) at http://tf.nist.gov/tf-cgi/servers.cgi.

OTDR SFP Behavior

The TN-SFP-BCxx-I works in the S4224 and S3290; the TN-SFP-BCxx works in the S4224, S3290, S3230, S3220, and S2220. The TN-SFP-BCxx can work with any SFP slot of the device which complies to the MSA standard (SFF-8472), such as Switches, NID and Media converters.

The OTDR SFP can be identifed in the DMI module of all supported devices.

The OTDR SFP operates at the specified wavelengths per the accepted ITU CWDM wavelengths (1271, 1291, 1311, 1331, 1351, 1371, 1391, 1411, 1431, 1451, 1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611).

The OTDR SFP only accepts SC/UPC or LC/UPC connector types.

An OTDR Test is run every time the supported device is powered up and OTDR is run by the OTDR SFP (warm start/cold start). You can initiate cold start and warm restart and verify the OTDR test result via Web, CLI, and SNMP.

No OTDR Test is run when the link is up, since the OTDR test turns off data transmission.

An OTDR Test is run one time when the link goes down (fiber break, remote SFP pulled, remote device loses power) and the OTDR test is run by the OTDR SFP.

The OTDR information is displayed on the Device per port via Web, CLI, and SNMP (Device ID (system name, Device Serial number IP, MAC address, port #), OTDR SFP Part number, and Serial number, Date and time per OTDR data set, Tx Power, Rx Power, and all reflections).

An OTDR Test displays multiple (up to 16) reflections on the supported Device via Web, CLI, and SNMP.

An OTDR Test produces and displays multiple sets (10 data sets plus Birth certificate) of OTDR data per Device port that has an OTDR SFP in it on the supported Device via Web, CLI, and SNMP.

You can view and delete multiple reflections (up to 16) on the supported Device via Web, CLI, and SNMP.

You can view a Timestamp in OTDR data sets via Web, CLI, and SNMP. NTP or another supported timing protocol can be configured so that a timestamp can be viewed on each set of OTDR data.

You can set via Web, CLI, and SNMP one of the data sets as the original “birth certificate” and it will not be overwritten unless you chose to overwrite it.

You can overwrite (change) the “birth certificate” data on the Device via Web, CLI, and SNMP if there is a change in the network configuration.

You can download and store the OTDR information per port as a .PDF file to a local computer via Web, CLI, and SNMP. The content of the download file is the same content as webpage.

The OTDR SFP will send an SNMP trap with OTDR data that you can receive on a trap receiver (EMS/NMS, etc.).

Link Conditions and OTDR Functions

Link Condition	OTDR Function (Response)
Power Up	OTDR Test runs one time.
Link Up	OTDR Test runs one time.
Link Down	In Link mode; OTDR test will not run.
Reboot	OTDR Test runs one time.
Cold Start	OTDR Test runs one time.
Warm Start	OTDR Test runs one time.
Remote SFP Disconnected	In Link mode; OTDR test will not run.

Configuration via Web Interface

This section shows and describes the S4224 DDMI OTDR web interface. The web interface for the S3290 is nearly identical; differences are noted where they occur.

DDMI (Digital Diagnostic Monitoring Interface)

The following DMI port screen and explanation table contains brief definitions of the DMI support offered on some SFP Transceiver Modules. **Note:** This feature is not available on all devices and may vary between products. **Note**: S3290 or S4224 firmware version v2.2.5 is required. See the related S3290 or S4224 manual for more information.

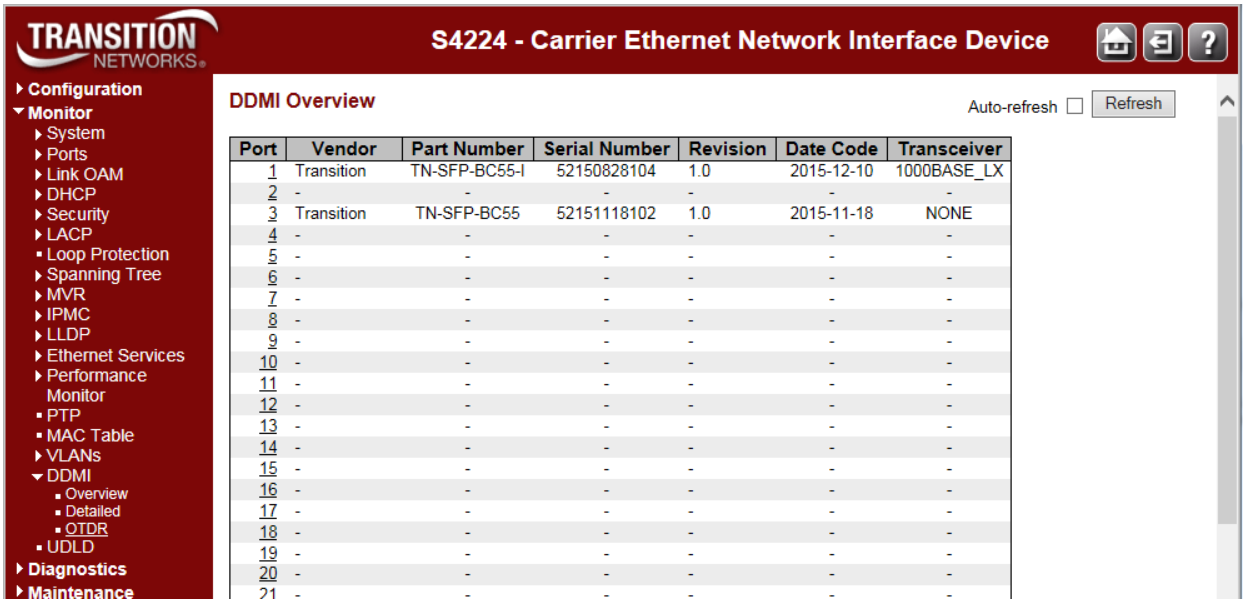
DDMI OTDR Process

1. Verify the S3290 or S4224 is at v 2.2.5 or above at **Monitor** > **System** > **Information** or using the `show version brief` CLI command.
2. Enable DDMI Configuration Mode from the **Configuration** > **DDMI** > **General** menu path.
3. Set the DMI Rx Power Intrusion Threshold (in uW) as desired from the **Configuration** > **DDMI** > **Thresholds** menu path.
4. Navigate to **Monitor** > **DDMI** > **OTDR** with a TN-SFP-BC55-I in slot 1 and a TN-SFP-BC55 in slot 3.
5. Click the linked Port number (e.g., Port 3) to display the Transceiver and DDMI information specific to that port.
6. Navigate back to **Monitor** > **DDMI** > **OTDR**.
7. Capture Reflections.
8. Save Data.
9. Download Report. When you click the **Download Report** button, a dialog box displays with the message "*Do you want to open or save OTDR Report .txt (249 bytes) from 192.168.1.110?*. Click the desired button (**Open**, **Save**, or **Cancel**). Follow the on-screen prompts.

The section below provides the procedure with accompanying screen shots and parameter descriptions.

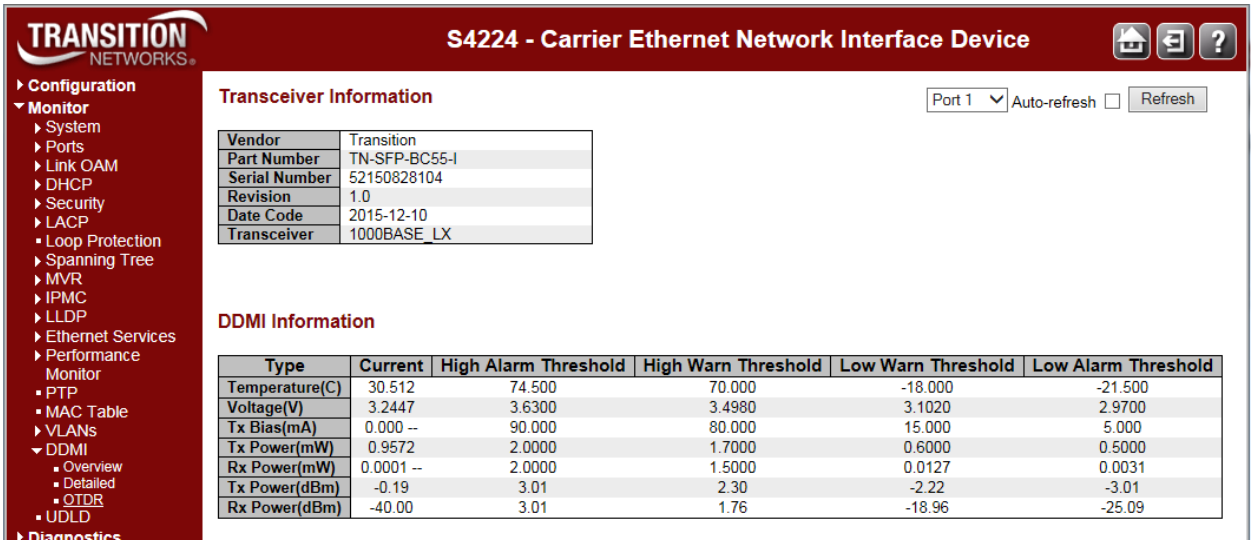
Monitor > DDMI > OTDR

The screen below shows the **Monitor** > **DDMI** > **OTDR** page with a TN-SFP-BC55-I in slot 1 and a TN-SFP-BC55 in slot 3:



Port	Vendor	Part Number	Serial Number	Revision	Date Code	Transceiver
1	Transition	TN-SFP-BC55-I	52150828104	1.0	2015-12-10	1000BASE_LX
2	-	-	-	-	-	-
3	Transition	TN-SFP-BC55	52151118102	1.0	2015-11-18	NONE
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
11	-	-	-	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	-	-	-	-	-	-
16	-	-	-	-	-	-
17	-	-	-	-	-	-
18	-	-	-	-	-	-
19	-	-	-	-	-	-
20	-	-	-	-	-	-
21	-	-	-	-	-	-

Click the linked Port number (Port 1 above) to display the Transceiver and DDMI Information specific to that port.



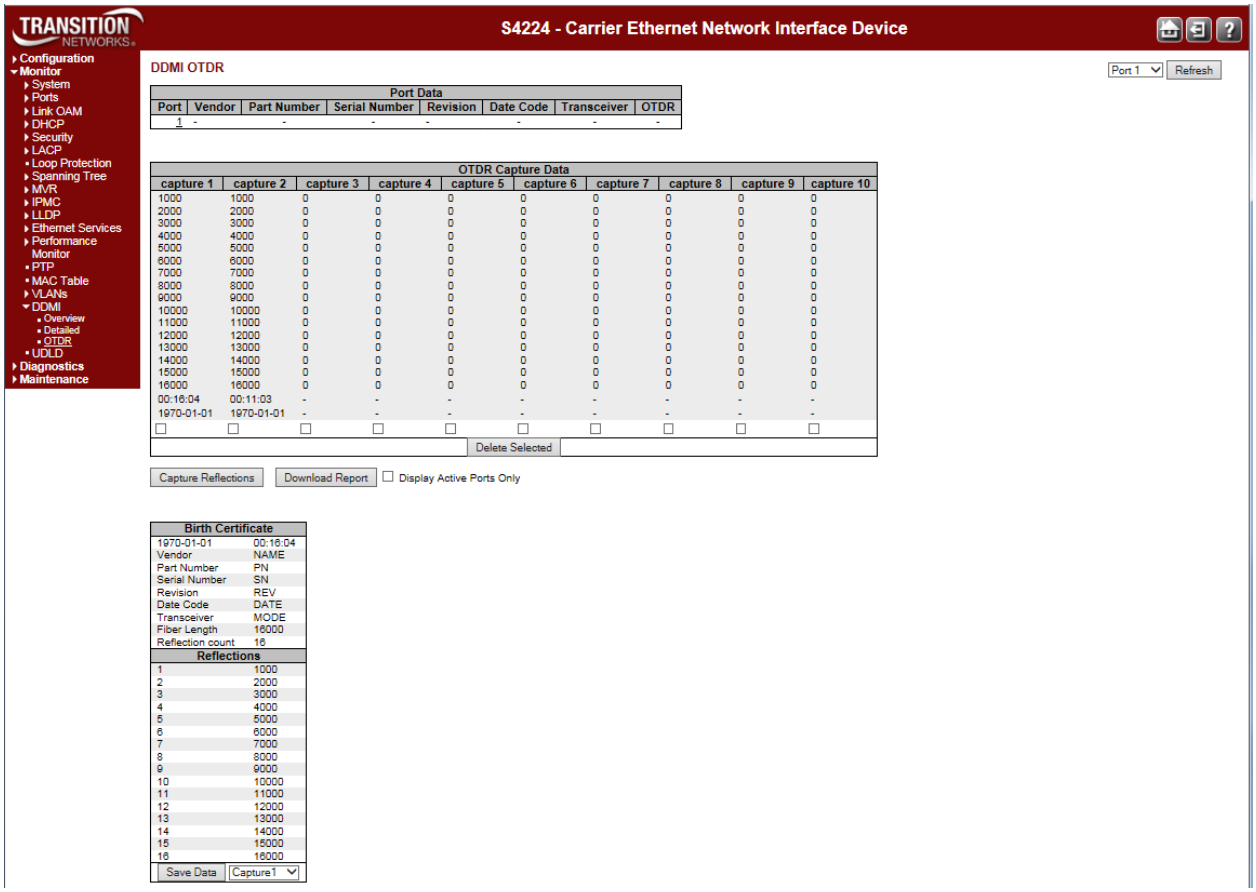
Vendor	Transition
Part Number	TN-SFP-BC55-I
Serial Number	52150828104
Revision	1.0
Date Code	2015-12-10
Transceiver	1000BASE_LX

DDMI Information

Type	Current	High Alarm Threshold	High Warn Threshold	Low Warn Threshold	Low Alarm Threshold
Temperature(C)	30.512	74.500	70.000	-18.000	-21.500
Voltage(V)	3.2447	3.6300	3.4980	3.1020	2.9700
Tx Bias(mA)	0.000 --	90.000	80.000	15.000	5.000
Tx Power(mW)	0.9572	2.0000	1.7000	0.6000	0.5000
Rx Power(mW)	0.0001 --	2.0000	1.5000	0.0127	0.0031
Tx Power(dBm)	-0.19	3.01	2.30	-2.22	-3.01
Rx Power(dBm)	-40.00	3.01	1.76	-18.96	-25.09

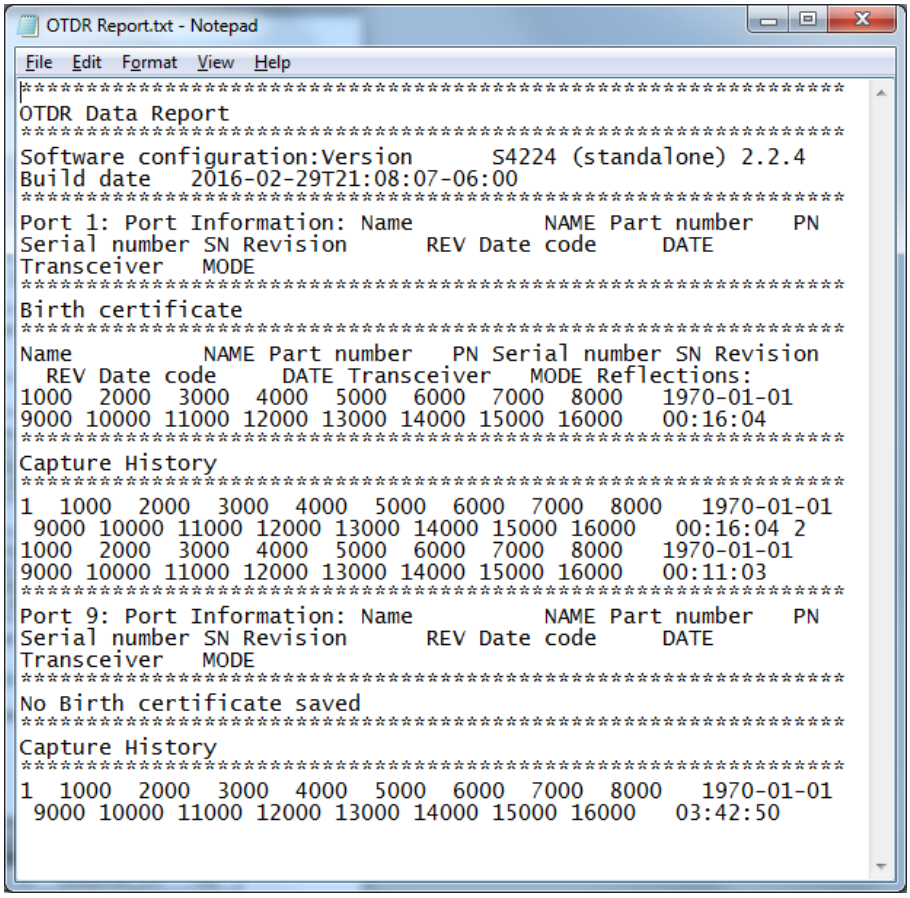
Monitor > DDMI > OTDR

1. Capture Reflections
2. Save Data
3. Download Report
4. Open or Save Report



Open or Save Report message:

Sample *OTDR Report.txt* format in Notepad:



The DDMI OTDR Monitor page parameters and buttons are described below.

Port Data

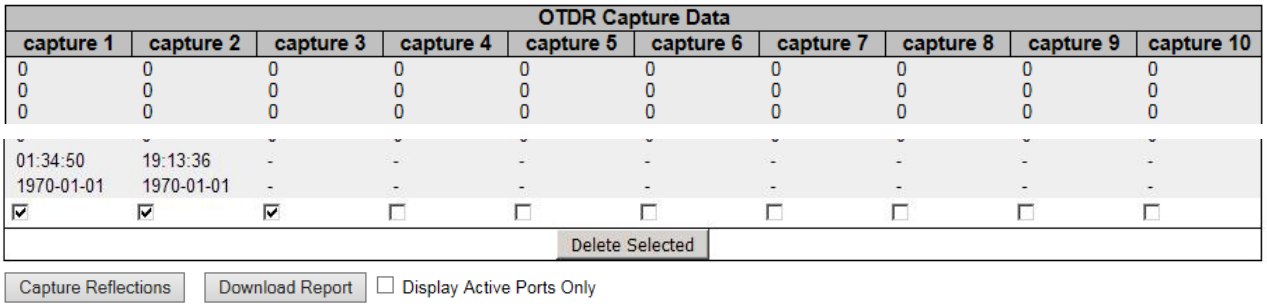
The OTDR port data is shown and described below.

Port Data							
Port	**Vendor**	**Part Number**	**Serial Number**	**Revision**	**Date Code**	**Transceiver**	**OTDR**
1	Transition	TN-SFP-BC55-I	52150828104	1.0	2015-12-10	1000BASE_LX	Yes

Parameter	Description
Port	The port number (linked) currently being monitored (e.g., Port 1 above). Click the linked port number to display that port's specific data.
Vendor	The SFP vendor's name (i.e., *Transition*).
Part Number	The SFP vendor Part number (e.g., *TN-SFP-BC55-I or TN-SFP-BC55*).
Serial Number	The SFP vendor Serial number (e.g., *52151118104*), where 52 is the prefix followed by YY (year), MM (month), DD (day), and SSS (daily serial number up to 999).
Revision	The SFP vendor Revision level for part number (e.g., *1.0*).
Date Code	The vendor's manufacturing date code (e.g., *2015-11-18*).
Transceiver	The Transceiver compatibility (e.g., *1000BASE_SX* or *10G* or *NONE*).
OTDR	Displays ***Yes*** if OTDR capable, otherwise ***No*** (read only field).

OTDR Capture Data

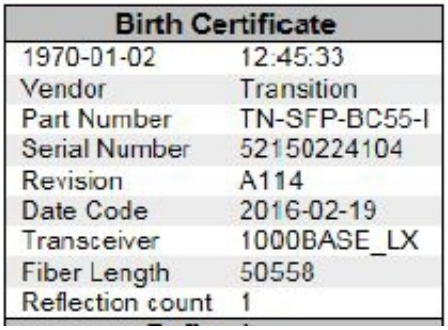
The OTDR capture data is shown and described below.



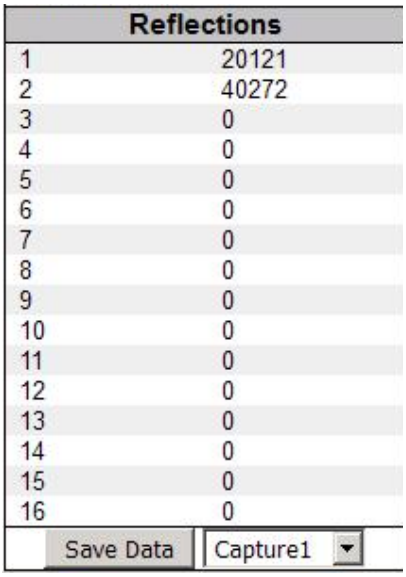
Parameter	Description
capture*x*	Click the **capture*x*** button to collect an instance of OTDR capture data.
Delete Selected	Select a checkbox for one or more tests and click to delete the selected test(s).
Capture Reflections	Click the **Capture Reflections** button to capture the reflection data. The page displays up to 10 capture datasets. Be sure to delete unneeded captures before you reach the tenth capture.
Download Report	Click the **Download Report** button to to open or save *OTDR Report .tx*t. See “Sample OTDR Report” on page 34 for report content and format.
Display Active Ports Only	**Check** the checkbox to only display the active ports (ports with an OTDR SFP currently installed). **Leave unchecked** (default) to display both the active ports and the inactive ports (ports that had an OTDR SFP installed but have since had it removed from the port, but the data remains displayed).

Birth Certificate and Reflections Data

The OTDR Birth Certificate and Reflections data is shown and described below. The Birth Certificateprovides the Vendor, Part Number, Serial Number, Revision, Date Code, Transceiver, Fiber Length, and Reflection Count as described below.



Birth Certificate	
1970-01-02	12:45:33
Vendor	Transition
Part Number	TN-SFP-BC55-I
Serial Number	52150224104
Revision	A114
Date Code	2016-02-19
Transceiver	1000BASE_LX
Fiber Length	50558
Reflection count	1



Reflections	
1	20121
2	40272
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
Save Data	Capture1

Parameter	Description
Vendor	The SFP vendor's name (e.g., *Transition*).
Part Number	The SFP vendor Part number (e.g., *TN-SFP-BC55-I or TN-SFP-BC55*).
Serial Number	The SFP vendor Serial number (e.g., *52151118104*), where 52 is the prefix followed by YY (year), MM (month), DD (day), and SSS (daily serial number up to 999).
Revision	The SFP vendor Revision level for part number (e.g., A114).
Date Code	The vendor's manufacturing date code (e.g*., 2016-02-19*).
Transceiver	The Transceiver compatibility (e.g., *1000BASE_SX* or *10G* or *NONE*).
Fiber Length	The total fiber length (e.g., *50558* meters). Displays Distance in Meters to the Farthest or Indexed Reflection. Retained in memory until uOTDR runs again.
Reflection Count	The recorded number of reflections (e.g., *1*).

Parameter	Description
Reflections	The second column displays the number of Link Down conditions detected over the total fiber length (e.g., *2 meters*). Displays the total number of detected reflections. The first column displays the reflection instance number (1-16).
Save Data	Click the **Save Data** button to save the captured data for reporting purposes.
Capture*x*	Use the **Capture*x*** dropdown to select the saved capture instance (e.g., *Capture1*).

Configuration via CLI

The TN-SFP-BC55/I supports these S3290 / S4224 CLI commands to show and configure OTDR:

```
# otdr ?
    capture         Capture OTDR reflections for a port
    certificate     Display Birth Certificate for a port
    delete          Delete a capture
    deletedb        Delete OTDR Database
    ports           Display ports with OTDR SFP
    reflections     Display OTDR reflections for a port
    report          Display report active
    save            Save a report to a file on a TFTP server
    setcert         Set a capture as the birth certificate
    testcapture     Fake Capture OTDR reflections for a port
# otdr
```

These TN S3290xx and S3224 CLI commands are described below.

```
  # platform debug allow
  # show interface x transceiver length
  # otdr capture <port_nbr>
  # otdr certificate <portno>
  # otdr delete <port_no> <capture_no>
  # otdr deletedb
  # otdr ports
  # otdr reflections <port_nbr>
  # otdr report <1 for Active ports, 0 for all ports>
  # otdr save <report_name> <tftp_url> <activeOnly>
  # otdr setcert <port_no> <capture_no>
  # otdr testcapture <port_nbr>
  # show ddmi current mode
  (config)# ddmi  =  DDMI Information OTDR Show
```

Command: **Read and Display Current DDMI Information**

Syntax: **platform debug allow**

Description: DDMI debug read command to read and display the DDMI info for both a0 and a2. You can read the a2 space as well (substitute a2 for a0). The last integer is a count. If you put a 10 there, it will read the memory 10 times and display it each time.

Warning: The use of 'debug' commands may negatively impact system behavior. Do not enable unless instructed to. (Use the '**platform debug deny**' command to disable debug commands.)

Note: 'debug' command syntax, semantics and behavior are subject to change without notice.

Mode: # <Debug>

Example: Use the **`platform debug allow`** command to display the DDMI info for both a0:

```
s4224--24# platform debug allow

WARNING: The use of 'debug' commands may negatively impact system behavior. Do not enable unless
instructed to. (Use 'platform debug deny' to disable debug commands.)

NOTE: 'debug' command syntax, semantics and behavior are subject to change without notice.

s4224--24# debug ddmi i2c GigabitEthernet 1/6 a0 1
% DDMI is enabled, disabling now.
Read a0 for port 6:
Offset   0: 0x03 0x04 0x07 0x00 0x00 0x00 0x01 0x20
Offset   8: 0x40 0x0c 0x01 0x01 0x0d 0x00 0x00 0x00
Offset  16: 0x32 0x1e 0x00 0x00 0x54 0x72 0x61 0x6e
Offset  24: 0x73 0x69 0x74 0x69 0x6f 0x6e 0x20 0x20
Offset  32: 0x20 0x20 0x20 0x20 0x00 0x00 0xc0 0xf2
Offset  40: 0x54 0x4e 0x2d 0x53 0x46 0x50 0x2d 0x53
Offset  48: 0x58 0x44 0x20 0x20 0x20 0x20 0x20 0x20
Offset  56: 0x30 0x30 0x30 0x30 0x03 0x52 0x00 0x20
Offset  64: 0x00 0x1a 0x00 0x00 0x38 0x36 0x37 0x32
Offset  72: 0x39 0x34 0x31 0x20 0x20 0x20 0x20 0x20
Offset  80: 0x20 0x20 0x20 0x20 0x31 0x33 0x30 0x38
Offset  88: 0x32 0x32 0x20 0x20 0x68 0xf0 0x01 0x78
Offset  96: 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
Offset 104: 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
Offset 112: 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
Offset 120: 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
Offset 128: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 136: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 144: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 152: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 160: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 168: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 176: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 184: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 192: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 200: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 208: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 216: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 224: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 232: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 240: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0xff
Offset 248: 0xff 0xff 0xff 0xff 0xff 0xff 0xff 0x00
% re-enabled DDMI.
s4224--24#
```

Command: **Display OTDR SFP Tranceiver Information**

Syntax: **show interface x transceiver data**

Description: This command displays OTDR transceiver and DDMI information.

Mode: #

Example: Use the **`show interface`** command to show SFP Tranceiver Information for three ports; the example below shows:

- Port 1 has a TN-SFP-BC55-I installed
- Port 3 has a TN-SFP-BC55 installed:
- Port 2 is empty, so a message displays saying "*% No SFP module is detected*".

```
# show interface g 1/1-3 transceiver

GigabitEthernet 1/1
------------------------------
Tranceiver Information
================================================================================
Vendor              : Transition
Part Number         : TN-SFP-BC55-I
Serial Number       : 52150224104
Revision            : A114
Date Code           : 2016-02-19
Transceiver         : 1000BASE_LX

DDMI Information
++ : high alarm, +  : high warning, -  : low warning, -- : low alarm.
Tx: transmit, Rx: receive, mA: milliamperes, mW: milliwatts.
================================================================================
               current   High Alarm   High Warn    Low Warn      Low Alarm
                          Threshold    Threshold    Threshold     Threshold
-------------  --------  ----------   ----------   ----------    --------
Temperature(C) 30.696      74.500       70.000       -18.000      -21.500
Voltage(V)     3.2568      3.6300       3.4980       3.1020       2.9700
Tx Bias(mA)    0.000 --    90.000       80.000       15.000       5.000
Tx Power(mW)   0.8597      2.0000       1.7000       0.6000       0.5000
Rx Power(mW)   0.0001 --   2.0000       1.5000       0.0127       0.0031
Tx Power(dBm)  -0.66     3.01         2.30         -2.22        -3.01
Rx Power(dBm)  -40.00    3.01         1.76         -18.96       -25.09


GigabitEthernet 1/2
------------------------------
Tranceiver Information
================================================================================
Vendor              : TRANSITION
Part Number         : TN-SFP-BC55
Serial Number       : 52151118102
Revision            : 1.0
Date Code           : 2015-11-18
Transceiver         : NONE

DDMI Information
++ : high alarm, +  : high warning, -  : low warning, -- : low alarm.
Tx: transmit, Rx: receive, mA: milliamperes, mW: milliwatts.
================================================================================
               current   High Alarm   High Warn    Low Warn      Low Alarm
                          Threshold    Threshold    Threshold     Threshold
-------------  --------  ----------   ----------   ----------    --------
Temperature(C) 30.433      74.500       70.000       -18.000      -21.500
Voltage(V)     3.3008      3.6300       3.4980       3.1020       2.9700
Tx Bias(mA)    0.000 --    90.000       80.000       15.000       5.000
```

```
Tx Power(mW)   0.7705      2.0000       1.7000       0.6000       0.5000
Rx Power(mW)   0.0480      2.0000       1.5000       0.0158       0.0031
Tx Power(dBm)  -1.13     3.01         2.30         -2.22        -3.01
Rx Power(dBm)  -13.19    3.01         1.76         -18.01       -25.09


GigabitEthernet 1/3
------------------------------
% No SFP module is detected

#
```

Command: **Display OTDR SFP Tranceiver Length**

Syntax: **show interface x transceiver length**

Description: This command displays the current cable length and any reflections.

Mode: #

Example: Use the **`show interface`** command to display the current cable length in meters and any reflections that are detected:

```
# show interface * transceiver length?
show interface ( <port_type> [ <plist> ] ) transceiver [ length ]
# show interface * transceiver length?
    length
    <cr>
# show interface GigabitEthernet 1/1-2 transceiver length
% DDMI is enabled, disabling now.
Current cable length is 0m with 0 reflections
Reflection -1 is at 0m (readrefl=0)
Reflection -2 is at 0m (readrefl=0)
Reflection -3 is at 0m (readrefl=0)
Reflection -4 is at 0m (readrefl=0)
Reflection -5 is at 0m (readrefl=0)
Reflection -6 is at 0m (readrefl=0)
Reflection -7 is at 0m (readrefl=0)
Reflection -8 is at 0m (readrefl=0)
Reflection -9 is at 0m (readrefl=0)
Reflection -10 is at 0m (readrefl=0)
Reflection -11 is at 0m (readrefl=0)
Reflection -12 is at 0m (readrefl=0)
Reflection -13 is at 0m (readrefl=0)
Reflection -14 is at 0m (readrefl=0)
Reflection -15 is at 0m (readrefl=0)
Reflection -16 is at 0m (readrefl=0)
Reflection -17 is at 0m (readrefl=0)
Reflection -18 is at 0m (readrefl=0)
Reflection -19 is at 0m (readrefl=0)
Reflection -20 is at 0m (readrefl=0)
-- more --, next page: Space, continue: g, quit: ^C
```

Command: **Capture OTDR Reflections for a Port**

Syntax: **otdr capture** <port_nbr>

Description: This command captures and saves a specified port's reflection data. Capture up to 10 capture datasets. Be sure to delete unneeded captures before you reach the tenth capture.

Mode: #

Example: Use the **`otdr capture`** command to capture and save OTDR reflection data for a specified port.

```
# otdr capture?
otdr capture <port_nbr>
# otdr capture 1 ?
    <cr>
# otdr capture 1
Reflection saved in capture 0
# otdr capture 3
Failed to capture reflections
# otdr capture 2
Reflection saved in capture 0
#
```

Command: **Display Birth Certificate for a Port**

Syntax: **otdr certificate** <portno>

Description: This command displays Birth certificate data for a specified port.

Mode: #

Example: Use the **`otdr certificate`** command to display Birth certificate data for port 1:

```
# otdr certificate ?
    <word>    Port number
# otdr certificate 1
SHOW BIRTH CERTIFICATE!
Birth certificate for port 1:
-------------------------------------
Name:          NAME
Part_nbr:      PN
Serial number: SN
Revision :     REV
Date code:     DATE
Transceiver:   MODE
-------------------------------------
Timestamp:     1970-01-01 00:16:04
-------------------------------------
Reflections:
1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000 13000 14000 15000
 16000
-------------------------------------
#
```

Command: **Delete a Capture**

Syntax: **otdr delete** <port_no> <capture_no>

Description: This command deletes a specified capture number / port number.

Mode: #

Example 1: Use the **otdr delete** command to delete a specified capture instance.

```
# otdr delete 0 ?
    <word>    Capture number to delete
# otdr delete 1 0
Invalid capture number
# otdr delete 1 1
capture 1 on port 1 deleted
#
```

Example 2: Use the **otdr delete 1 4** command to delete a captured reflection, and then show that it (#4) is gone using the **show otdr reflections** command:

```
# otdr delete 1 4
# sh interface GigabitEthernet 1/1 otdr length
# otdr delete 1 4
capture 4 on port 1 deleted
# sh interface GigabitEthernet 1/1 otdr reflections
                                     ^
% Invalid word detected at '^' marker.

#
```

Command: **Display Ports with OTDR SFP**

Syntax: **otdr ports**

Description: This command displays which ports have an OTDR SFP inserted. This command scans the ports for OTDR SPF devices and displays them by switch or NID port number.

Mode: #

Example: Use the **otdr ports** command to display which ports contain an OTDR SFP:

```
# otdr ports
OTDR Ports: 1 2
#
# otdr ports
OTR Ports: 2 27
# otdr ports
OTDR Ports: 1
#
```

Messages: Displays the message *No OTDR Ports found* if none of the ports have an OTDR SFP inserted.

Command: **Display OTDR Reflections for a specified port**
Syntax: **otdr reflections** <port_nbr>
Description: This command shows OTDR reflections for a specified port.
Mode: #
Example: Use the **`otdr reflections 1`** command to display OTDR reflections for port 1:

```
# otdr reflections ?
    <word>    Port number
# otdr reflections 1
Reflections for port 1:
       1     2     3     4     5     6     7     8     9    10    11    12    13
    14    15    16
--------------------------------------------------------------------------------
------------------
 1  1000  2000  3000  4000  5000  6000  7000  8000  9000 10000 11000 12000 13000
 14000 15000 16000  1970-01-01 00:16:04
 2  1000  2000  3000  4000  5000  6000  7000  8000  9000 10000 11000 12000 13000
 14000 15000 16000  1970-01-01 00:11:03
#
```

Command: **Display OTDR Report** and **Display OTDR Report Active**

Syntax: **otdr report** <word> (1 for Active ports, 0 for all ports)

Description: The **`otdr 0`** command will display the OTDR Data Report to the consolefor all ports, whether Active or not. .

The **`otdr 1`** command will display the OTDR Data Report to the console for just the Active ports. When you remove an OTDR SFP from the host device the OTDR SFP data still displays.

Mode: #

Example: Use the **otdr report** command to display the OTDR Data Report for the switch or NID port (S4224 port 1 in the example below):

```
# otdr report
************************************************************
OTDR Data Report
************************************************************
Software configuration:
Version      S4224 (standalone) 2.2.5
Build date   2016-03-03T15:37:35-06:00
************************************************************
Port 1:

Port Information:
Name          Transition
Part number   TN-SFP-BC55-I
Serial number 52151118104
Revision      A114
Date code     2016-02-19
Transceiver   1000BASE_LX

------------------------------------------------------------
Birth certificate:
Name          Transition
Part number   TN-SFP-BC55-I
Serial number 52151118104
Revision      1.0
Date code     2015-11-18
Transceiver   1000BASE_LX

Reflections:
     1000  2000  3000  4000  5000  6000  7000  8000   1970-01-01
     9000 10000 11000 12000 13000 14000 15000 16000   00:16:04
************************************************************
Capture History
************************************************************
 1  1000  2000  3000  4000  5000  6000  7000  8000   1970-01-01
    9000 10000 11000 12000 13000 14000 15000 16000   00:16:04
 2  1000  2000  3000  4000  5000  6000  7000  8000   1970-01-01
    9000 10000 11000 12000 13000 14000 15000 16000   00:11:03
 3  1000  2000  3000  4000  5000  6000  7000  8000   1970-01-01
    9000 10000 11000 12000 13000 14000 15000 16000   00:19:19
```

Command: **OTDR Save Report**

Syntax: **otdr save** <name> <location>

Description: This command will create and save a report to a TFTP server that is properly configured and running.

Mode: #

Example: Use the **otdr save** command to create an OTDR report and save it to a specified TFTP server URL:

```
# otdr save ?
    <word32>    Name of existing report to save
# otdr save abc ?
    <word>    TFTP server URL on the form tftp://server[:port]/path-to-file
# otdr save abc tftp://192.168.5.2/tftpboot/OTDR_Report
SAVE A REPORT!#
#
```

Command: **OTDR Set Birth Certificate**

Syntax: **otdr setcert** <port_no.> <cert_no.>

Description: This command sets the birth certificate on a selected port to capturea specified Birth Certificate number.

Mode: #

Example: Use the **otdr setcert** command to set the birth certificate on port 1 to capture Birth Certificate number 8:

```
# otdr setcert ?
    <word>    Port number
# otdr setcert 1 8
SET BIRTH CERTIFICATE!
port_no=1
capture_no=8
iport=0
capture=7
#
```

Command: **DDMI Information OTDR Show**

Syntax: **ddmi** <cr>

Description: This command displays DDMI OTDR information.

Mode: (config)#

Example: Use the **config ddmi** command to display DDMI OTDR information:

```
(config)# ddmi ?
    <cr>
(config)# ddmi?
    ddmi    DDMI Information OTDR Show
    <cr>
(config)# ddmi?
ddmi
(config)# ddmi
(config)#
```

Command: **Show Current OTDR Mode**

Syntax: **ddmi** <cr>

Description: This command displays the current OTDR mode (enabled or disabled).

Mode: #

Example: Use the **`show ddmi`** command to display the current OTDR mode:

```
(config)# show ddmi?
(config)# do show ddmi
Current mode: Enabled
(config)# end
# show ddmi
Current mode: Enabled
#
```

Command: **Delete OTDR Database**

Syntax: **otdr deletedb** <>

Description: This command deletes the OTDR Database (e.g., in response to the message "*Failed to open OTDR DB*").

Example: Use the **`otdr deletedb`** command to delete an unneeded or corrupted database.

```
# otdr deletedb ?
    <cr>
# otdr deletedb?
    deletedb    Delete OTDR Database
    <cr>
# otdr deletedb
OTDR Database deleted
#
```

Command: **Fake Capture OTDR Reflections for a Port**

Syntax: **otdr testcapture** <port_nbr>

Description: This command displays a fake OTDR capture.

Example: Use the **`otdr testcapture`** command to display fake OTDR capture data:

```
# otdr testcapture 9
Reflection saved in capture 1
Reflections Captured:
       1     2     3     4     5     6     7     8     9    10    11    12    13    14    15    16
-------------------------------------------------------------------------------------------------------
 1  1000  2000  3000  4000  5000  6000  7000  8000  9000 10000 11000 12000 13000 14000 15000 16000
1970-01-01 03:42:50
-------------------------------------------------------------------------------------------------------
#
```

Configuration via SNMP

A trap is set whenever a capture is generated with the physical port number of the OTDR SFP. Contact Transition Networks for additional information. See Contact Us on page 45.

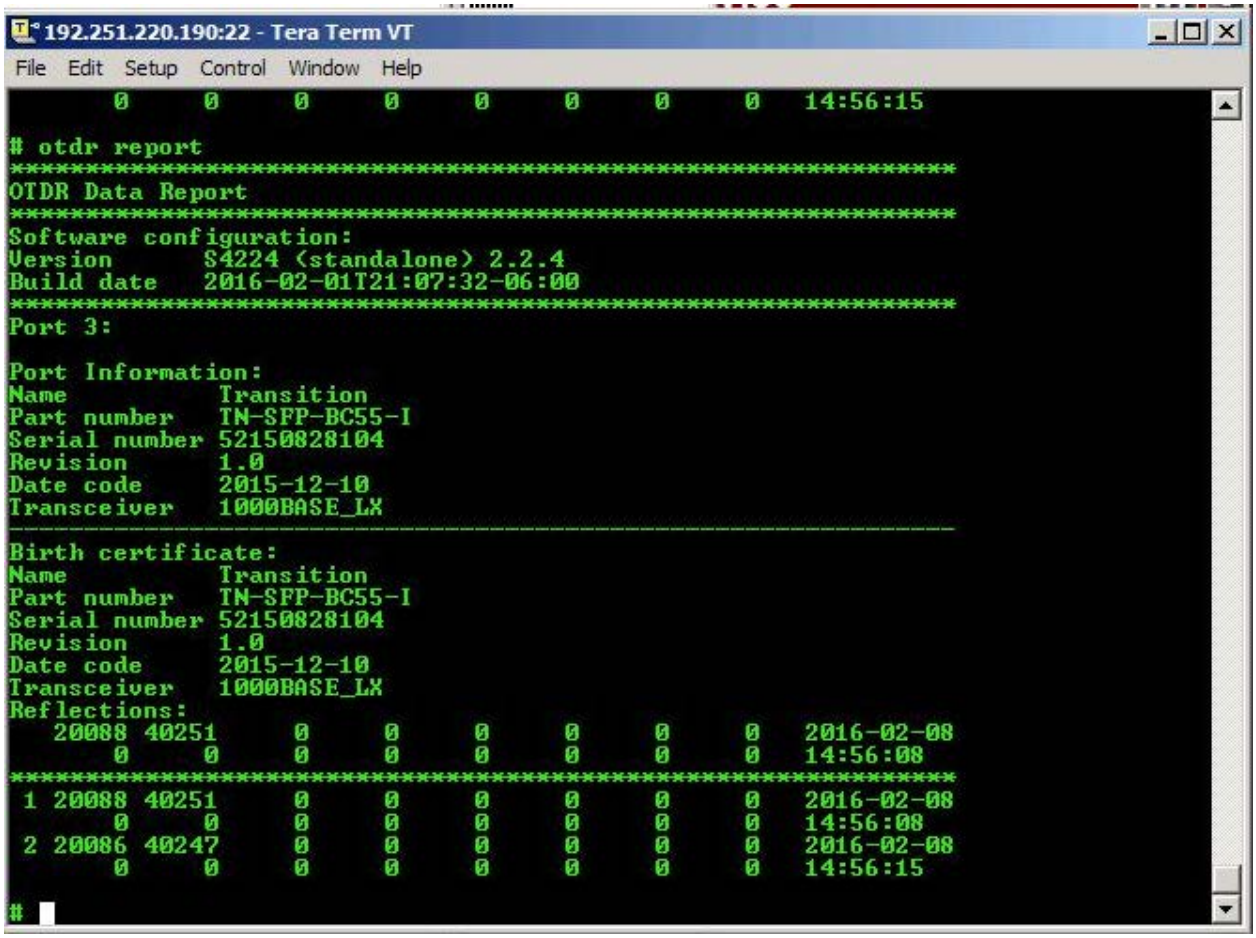
Sample OTDR Reports

Several sample S4224 OTDR Data Reports are shown below.

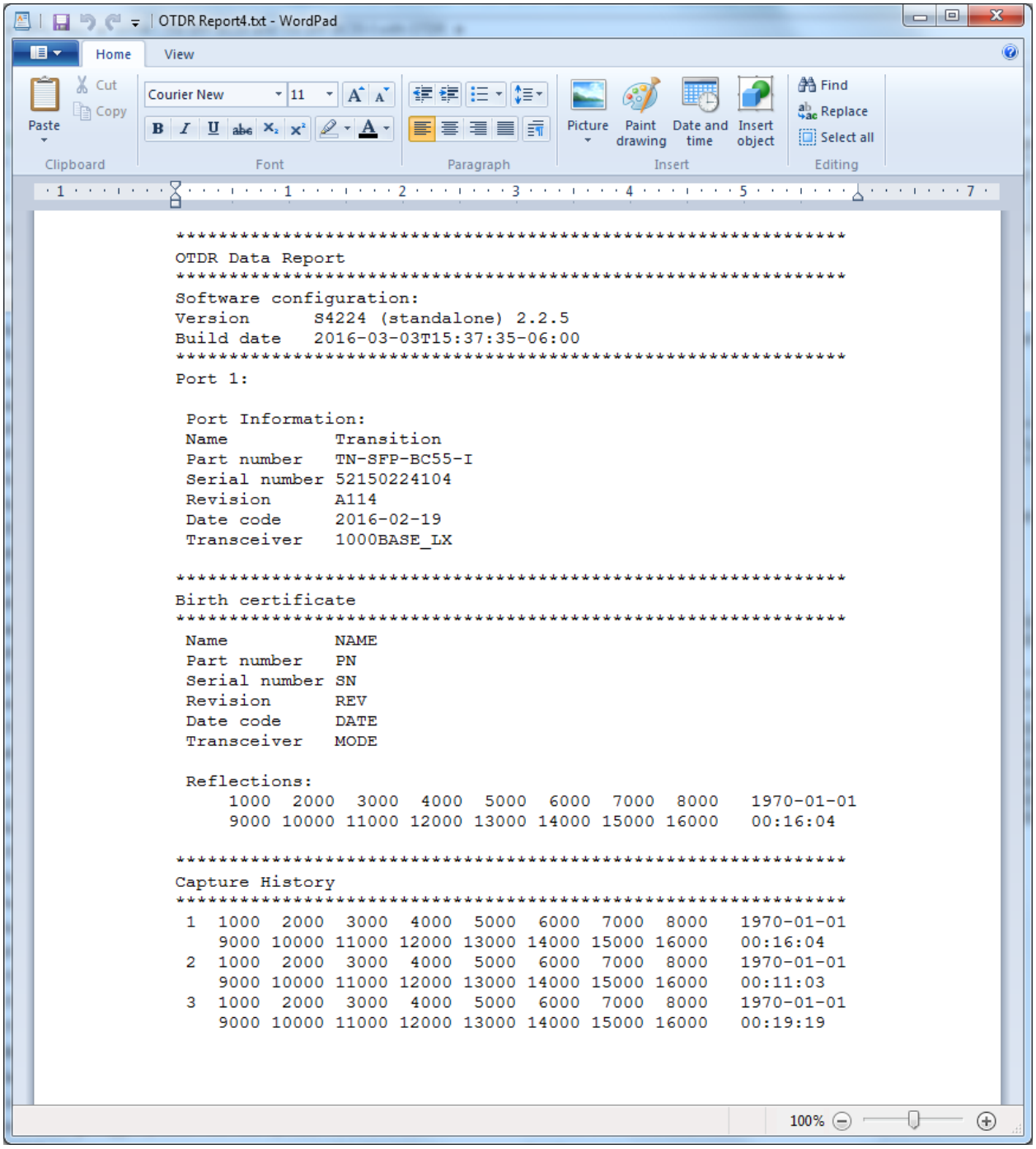
```
************************************************************
OTDR Data Report
************************************************************
Software configuration:
Version      S4224 (standalone) 2.2.4
Build date   2016-02-28T21:07:53-06:00
************************************************************
Port 1:

Port Information:
Name          Transition
Part number   TN-SFP-BC55-I
Serial number 52150828104
Revision      1.0
Date code     2015-12-10
Transceiver   1000BASE_LX
------------------------------------------------------------
No Birth certificate saved
************************************************************
 1 20086 40260     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:03:25
 2 20090 40264     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:03:30
************************************************************
Port 3:

Port Information:
Name          Transition
Part number   TN-SFP-BC55-I
Serial number 52150828104
Revision      1.0
Date code     2015-12-10
Transceiver   1000BASE_LX
------------------------------------------------------------
Birth certificate:
Name          Transition
Part number   TN-SFP-BC55-I
Serial number 52150828104
Revision      1.0
Date code     2015-12-10
Transceiver   1000BASE_LX
Reflections:
   20084 40257     0     0     0     0     0     0   2016-02-10
       0     0     0     0     0     0     0     0   19:20:27
************************************************************
 1 20084 40257     0     0     0     0     0     0   2016-02-10
       0     0     0     0     0     0     0     0   19:20:27
************************************************************
Port 4:

Port Information:
```

```
Name
Part number
Serial number
Revision
Date code
Transceiver   DDMI: Unknown err
----------------------------------------------------------------
No Birth certificate saved
****************************************************************
 1 20160 40272     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:08:56
 2 20158 40270     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:08:59
 3 20160 40274     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:09:02
 4 20158 40272     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:09:04
 5 20160 40276     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:09:06
 6 20158 40272     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:09:12
 7 20158 40272     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:09:14
 8 20158 40272     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:09:17
 9 20160 40272     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:09:19
10 20156 40270     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:09:25
****************************************************************
Port 8:

Port Information:
Name
Part number
Serial number
Revision
Date code
Transceiver   DDMI: Unknown err
----------------------------------------------------------------
No Birth certificate saved
****************************************************************
 1 20088 40260     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:20:25
 2 20090 40262     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:20:30
 3 20092 40264     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:20:32
 4 20090 40264     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:20:34
 5 20090 40260     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:20:37
 6 20088 40260     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:20:46
 7 20094 40262     0     0     0     0     0     0   1970-01-01
       0     0     0     0     0     0     0     0   00:21:27
```

Sample OTDR Report (TeraTerm)



Sample OTDR Report (WordPad)



OTDR SFP Feature Cross-Reference

Feature	TN-SFP-BC55-I	TN-SFP-BC55-I
Single Fiber, Full Duplex, CWDM - SFC	✓	✓
Specified Signal Rate	1.25.Gbps	1.25.Gbps
Networking Standard	Gigabit Ethernet	Gigabit Ethernet
Wavelength	1551 nm	1551 nm
ITU CWDM Channel	15	15
Optical Connector Receptacle	LC/UPC	SC/UPC
Micro OTDR SFP	✓	
Reflection Immune Operation	✓	✓
Optical Link “Birth Certificate” Support	✓	✓
Digital Diagnostic Monitoring (DDM)	✓	✓
Link Distance - 40 Km Class	✓	✓
OTDR Dynamic Range - Minimum 55 dB	✓	
Central Office - CO	✓	
Customer Premises - CPE		✓
S4224 Series CE Access/Aggregation Switch	✓	
S3220 Series Standalone GbE Remotely Managed NID		✓
S3290 Series CE NID	✓	✓

Troubleshooting

Cleaning Instructions for the OTDR SFP and Fiber

If any errored reflections or inaccurate reflections are recognized this should be the first step in the troubleshooting process. Inspect and clean both connectors in pairs.

It is important that every fiber connector be inspected and cleaned prior to mating.

Numerous tools and cleaning products are available for cleaning with a fiber cleaner for the fiber head as well as for cleaning with a ferrule cleaner. Cleaning products can include cartridge and pocket style cleaners, lint−free wipes, lint−free swabs, lint−free wet wipes, lint−free swabs, manual advance cleaners, etc. from a wide array of vendors.

This section is provided as a general guideline and not as a complete process or procedure, as no known cleaning method is 100% effective. Dirt is the single biggest problem with fiber optics. Inspect and clean connectors. Inspect and clean again until they are perfect. Inspect and clean both ends in pairs. Clean the connectors, the mating adapters, and the transceiver ports.

Have a cleaning policy in place including a checklist of items tailored to your specific site requirements. Keep records for future troubleshooting (e.g., where cable is run, splice and termination locations, make and model of components, OTDR data, cleaning performed, etc.).

Follow industry safety precautions! Warning: Invisible laser radiation might be emitted from disconnected fibers or connectors. Do not stare into beams directly or view with optical instruments. Always turn off any laser sources before you inspect fiber connectors, optical components, or bulkheads. Always make sure that the cable is disconnected at both ends or that pluggable transceiver is removed from the device. Always wear the appropriate safety glasses when required for your area. Never look into a fiber with the device lasers on. Always follow proper proper grounding procedures. Never connect a fiber to a fiberscope with the device lasers on.

See the FOA video *Visual Inspection of Fiber Optic Connectors Using A Microscope* at https://www.youtube.com/watch?v=IyumH8CiUPQ&feature=youtube.

1. Inspect the endface with a fiberscope.
    a. If the endface is clean, plug it into a clean mating connector.
    b. If the endface is not clean, dry clean it.
2. Inspect the endface with a fiberscope.
    a. If the endface is clean, plug it into a clean mating connector.
    b. If the endface is not clean, dry clean it.
3. Inspect the endface with a fiberscope.
    a. If the endface is clean, plug it into a clean mating connector.
    b. If the endface is not clean, wet clean it and then immediately dry clean it.
4. Inspect the endface with a fiberscope.
    a. If the endface is clean, plug it into a clean mating connector.

Notes:

- Before wet cleaning, make sure it does not leave a residue on the endface to avoid equipment damage. Wet cleaning is not recommended for bulkheads and receptacles as equipment damage can occur.
- Follow the directions that came with the tools and cleaning products.
- Always keep a clean protective cap on unplugged fiber connectors and store unused protective caps in a resealable container to prevent contamination.
- Always discard used cleaning amterials properly.

Error Messages and Recovery Procedures

Message: *Current cable length is x um with d reflections*
Reflection n is at xum (readrefl=x)
Reflection saved in capture x
Meaning: The command was successful.
Recovery: No action required.

Message: *Failed to get DDMI configuration.*
Failed to set DDMI configuration.
Failed to read transceiver ID for port x
Failed to read current cable length for port x
Failed to capture reflections
Meaning: The DDMI OTDR command failed.
Recovery: 1. Verify the SFP is a TN-SFP-BC55 or TN-SFP-BC55-I. 2. Verify that DDMI OTDR is enabled. 3. Make sure the optical fiber connections are clean. 4. Contact TN Support.

Message: *Invalid port number*
Invalid capture number
No OTDR Ports found
Not OTDR Capable
OTDR test failed
capture contains no reflection data
iport x a2 read fail, first fail occurs at x-th times
Read a2 for port x
re-enabled DDMI.
Meaning: The DDMI OTDR command failed.
Recovery: 1. Verify the correct port number or capture number was entered. 2. Verify the device / port is OTDR capable. 3. Make sure the optical fiber connections are clean. 4. Re-try the capture operation. 5. Contact TN Support.

Message: *Transceiver in port x is not supported*
Meaning: The SFP transceiver in port x is not supported.
Recovery: 1. Verify the SFP is a TN-SFP-BC55 or TN-SFP-BC55-I. 2. Verify that DDMI OTDR is enabled. 3. Make sure the optical fiber connections are clean. 4. Contact TN Support.

Message: *DDMI is enabled, disabling now.*
DDMI is disabled.
Meaning: Informational message.
Recovery: None.

Problem: Link LED rarely displays on device which hosts the device, the same link displays consistently with a different OTDR SFP. The behavior is very consistent.

Cause: Dirty TN-SFP-BC55x optical receptacle. See figures below.

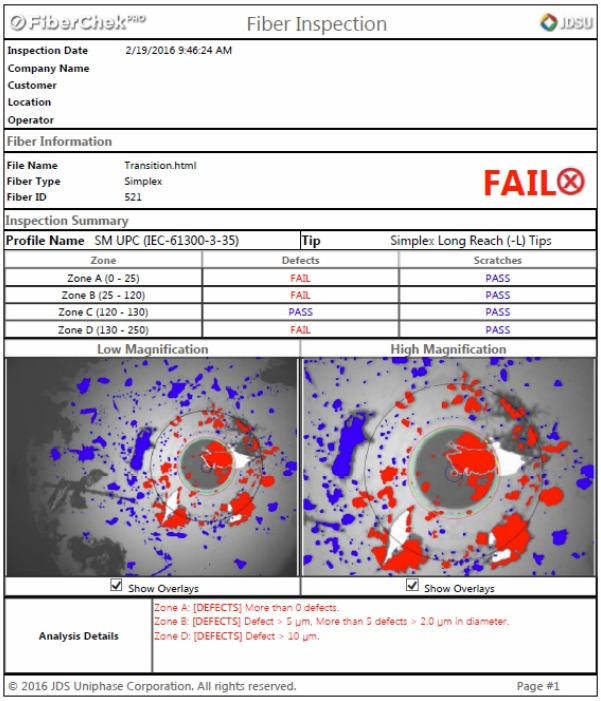
Recovery: 1. Clean the TN-SFP-BC55x optical receptacle. See Clean the Optical Fiber Connections on page 12.

Problem: When trying to capture distance information on the S4224 or S3290, many short distances (e.g., 15) are captured as opposed to the actual distance of the fiber. The behavior is very consistent.

Meaning: Dirty TN-SFP-BC55x optical receptacle. See figures below.

Recovery: 1. Clean the TN-SFP-BC55x optical receptacle. See Clean the Optical Fiber Connections on page 12.

These are classic symptoms of a very dirty OTDR SFP optical receptacle. The figure below left is looking into the LC/UPC receptacle of a returned TN-SFP-BC55-I. Below right shows the same LC/UPC receptical after proper cleaning:


FiberChek PRO Fiber Inspection JDSU

Inspection Date 2/19/2016 9:46:24 AM
Company Name
Customer
Location
Operator

Fiber Information

File Name Transition.html
Fiber Type Simplex
Fiber ID 521

FAIL

Inspection Summary

Profile Name SM UPC (IEC-61300-3-35) Tip Simplex Long Reach (-L) Tips

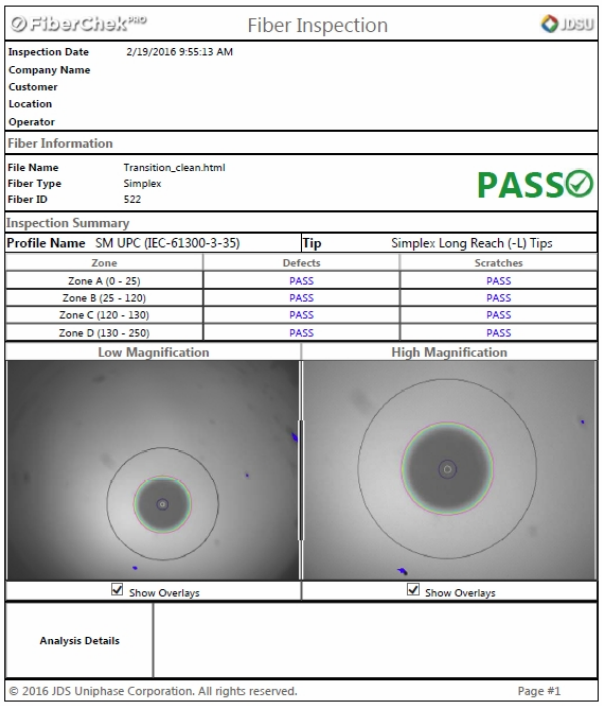
Zone	Defects	Scratches
Zone A (0 - 25)	FAIL	PASS
Zone B (25 - 120)	FAIL	PASS
Zone C (120 - 130)	PASS	PASS
Zone D (130 - 250)	FAIL	PASS

Low Magnification High Magnification

Show Overlays Show Overlays

Analysis Details
Zone A: [DEFECTS] More than 0 defects.
Zone B: [DEFECTS] Defect > 5 µm, More than 5 defects > 2.0 µm in diameter.
Zone D: [DEFECTS] Defect > 10 µm.

© 2016 JDS Uniphase Corporation. All rights reserved. Page #1


FiberChek PRO Fiber Inspection JDSU

Inspection Date 2/19/2016 9:55:13 AM
Company Name
Customer
Location
Operator

Fiber Information

File Name Transition_clean.html
Fiber Type Simplex
Fiber ID 522

PASS

Inspection Summary

Profile Name SM UPC (IEC-61300-3-35) Tip Simplex Long Reach (-L) Tips

Zone	Defects	Scratches
Zone A (0 - 25)	PASS	PASS
Zone B (25 - 120)	PASS	PASS
Zone C (120 - 130)	PASS	PASS
Zone D (130 - 250)	PASS	PASS

Low Magnification High Magnification

Show Overlays Show Overlays

Analysis Details

© 2016 JDS Uniphase Corporation. All rights reserved. Page #1

General Troubleshooting

Document the fiber optic network. Good documentation is invaluable in upgrading, troubleshooting or restoring a network. See http://www.thefoa.org/user/index.html.

Many factors can affect OTDR test accuracy. Variations in fiber optic cable structures affect accuracy. Differences between fiber types and manufacturing processes can contribute to differing OTDR results, as can physical issues like cable slack or aerial sag. Understanding that fiber length and cable length are not the same is also important when trying to locate a fault or break.

Fiber that gets rerouted after installation may be subject to macrobends caused by the fiber being moved and then bent. Tie wraps that are too tight can also cause macrobends. Dirty or damaged connectors and poor splices can cause loss in a fiber link, as can bad connectors, kinks in a cable, counterfeit cable, improper pulling techniques, preparation for or actual splicing or termination, bad processes or damage after termination, or fiber break in the back of the connector.

1. Determine if the problem is with one or all the fibers in the cable.
2. For high loss fibers, start with microscope inspection of terminations for proper polish, dirt, scratches or damage.
3. Check the design specifications and installation documentation.
4. Interview the installer to discover processes that may lead to issues in installation, such as pulling methods, lubrication, intermediate pulls, splicing or termination methods.
5. Check for patchcord problems (connector problems, caused by damage due to handling or numerous matings).

Note: after completing tests, troubleshooting and repairs, update documentation to reflect procedure changes and any changes to the network. If the fix is to switch to spare fibers and suspect fibers are not fixed, note that on documentation to prevent future problems.

See http://www.thefoa.org/user/index.html for more troubleshooting information.

Troubleshooting Procedures

1. Clean the connections; see Clean the Optical Fiber Connections on page 12.
2. Verify the SFP application; see "Applications" on page 9.
3. Verify proper SFP installation; see "SFP Installation" on page 14.
4. Verify the SFP Installation Cautions (e.g., clean the optics, etc.); see Cautions on page 14.
5. Make sure your site meets the Prerequisites and Restrictions on page 16.
6. Verify the SFP configuration. See Configuration via Web Interface on page 16 or Configuration via CLI on page 21.
7. Verify the related S3290-xx or S4224 device firmware version. Upgrade the S3290-xx or S4224 device firmware if required. See the related Release Notes for firmware upgrade procedures.
8. Verify the related S3290-xx or S4224 device configuration. See "Related Manuals" on page 8.
9. Perform the basic S3290 or S4224 troubleshooting procedures. Refer to the related device's Install Guide.
10. If the default timestamp with the year 1970 or 1999 displays, indicating the NTP time server was not active at device power up, configure an NTP time server. See NTP Server on page 16.
11. Verify that the optical fiber type (manufacturer and specs) matches the SFP calibration. Record your model and System Information and then contact Transition Networks Tech Support.

For More Information

Technical information in this document is subject to change without notice. For more information see the TN SFP Line Card or the SFP/XFP Landing page.

The Fiber Optic Association, Inc. provides a Technical Bulletin on "*Guidelines For Testing And Troubleshooting Fiber Optic Installations*" at http://www.thefoa.org/tech/guides/TT3.pdf. There are other FOA Technical Bulletins that should be used as references for the design and planning of the network. These documents can be downloaded from the FOA Tech Topics website.

Related Links

ANSI/TIA/EIA-568-B.3 - TIA/EIA STANDARD for Optical Fiber Cabling Components at http://www.csd.uoc.gr/~hy435/material/TIA-EIA-568-B.3.pdf

American National Standards Institute (ANSI) at www.ansi.org

Canadian Standards Association International (CSA) at www.csa-international.org

The Institute of Electrical and Electronic Engineers, Inc (IEEE) at www.ieee.org

National Electrical Manufacturers Association (NEMA) at www.nema.org

Society of Cable Telecommunications Engineers at www.scte.org

Telcordia Technologies (formerly Bellcore) at www.telcordia.com

Underwriters Laboratories, Inc. (UL) at www.ul.com

Record Model and System Information

After performing the troubleshooting procedures above, and before calling or emailing Tech Support, record as much information as possible in order to help the Tech Support Specialist.

Model #: _____ Serial #: _____ _____

Your Transition Networks service contract #: _____

Describe the problem: _____

_____

_____

_____

Describe any action(s) already taken to resolve the problem (e.g., changing mode, resetting, etc.):

_____

_____

_____

The model # and serial # of all other Transition Networks products in the network: _____

_____

_____

Describe your network environment (layout, cable type, cable distance, etc.): _____

_____

_____

Transition Networks device history (have you returned the device before, is this a recurring problem, etc.):

_____

_____

_____

Any previous Return Material Authorization (RMA) numbers: _____

_____

List TN or third party equipment in the network: _____

_____

_____

Describe SMF Optical Fiber Type and Manufacturer (e.g., commonly Corning SMF-28 optical fiber, or a different optical fiber, e.g. Sumitomo): _____

_____

_____

Other network, deployment, or operating environment requirements or issues out of the ordinary (e.g., vibrations, tropical humidity, elevations above 5,000M, any special / national conditions, fiber curl, temperature dependence, temp - humidity cycling, water immersion, damp heat, UV light, corrosion, fungus conditions, etc.): _____

_____

_____

_____

_____

When and how was the last optical fiber cleaning performed? _____

_____

Contact Us

Technical Support Technical support is available 24-hours a day:

US and Canada: 1-800-260-1312

International: 00-1-952-941-7600

Transition Now

Chat live via the Web with Transition Networks Technical Support.

Log onto www.transition.com and click the **Transition Now** link.

Web-based Seminars

Log onto www.transition.com and click the **Learning Center** link.

E-Mail

Ask a question by sending an e-mail to our tech support staff at techsupport@transition.com .

Address

Transition Networks
10900 Red Circle Drive
Minnetonka, MN 55343, U.S.A.
Telephone: 952-941-7600
Toll free: 800-526-9267
Fax: 952-941-2322

Compliance Information

Class I Laser Compliance

This product has been tested and found to comply with the limits for FDA Class I laser for IEC60825, EN60825, and 21CFR1040 specifications.

Translated Safety Warnings

Warning Class I laser product.
Waarschuwing Klasse-I laser produkt.
Varoitus Luokan I lasertuote.
Attention Produit laser de classe I
Warnung Laserprodukt der Klasse I.
Avvertenza Prodotto laser di Classe I.
Advarsel Laserprodukt av klasse I.
Aviso Produto laser de classe I.
¡Advertencia! Producto láser Clase I.
Varning! Laserprodukt av klass I.
Aviso Produto a laser de classe I.
Advarsel Klasse I laserprodukt.

FCC Regulations

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at the user's own expense.

Canadian Regulations

This digital apparatus does not exceed the Class A limits for radio noise for digital apparatus set out on the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la Class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

European Regulations

Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Achtung !

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten. In diesem Fäll is der Benutzer für Gegenmaßnahmen verantwortlich.

Attention !

Ceci est un produit de Classe A. Dans un environment domestique, ce produit risque de créer des interférences radioélectriques, il appartiendra alors à l'utilsateur de prende les measures spécifiques appropriées.

In accordance with European Union Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003, Transition Networks will accept post usage returns of this product for proper disposal. The contact information for this activity can be found in the 'Contact Us' portion of this document.

Der Anschluss dieses Gerätes an ein öffentlickes Telekommunikationsnetz in den EGMitgliedstaaten verstösst gegen die jeweligen einzelstaatlichen Gesetze zur Anwendung der Richtlinie 91/263/EWG zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über Telekommunikationsendeinrichtungen einschliesslich der gegenseitigen Anerkennung ihrer Konformität.

CAUTION: RJ connectors are NOT INTENDED FOR CONNECTION TO THE PUBLIC TELEPHONE NETWORK. Failure to observe this caution could result in damage to the public telephone network.

Der Anschluss dieses Gerätes an ein öffentlickes Telekommunikationsnetz in den EGMitgliedstaaten verstösst gegen die jeweligen einzelstaatlichen Gesetze zur Anwendung der Richtlinie 91/263/EWG zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über Telekommunikationsendeinrichtungen einschliesslich der gegenseitigen Anerkennung ihrer Konformität.

Compliance Declarations Summary

Declaration	Supporting Information
SFP Multi-Source Agreement (MSA)	SFF-8472 Revision 12.2, INF-8074
FDA CDRH 21-CFR 1040.10 Class 1 (laser safety	Self Certification
IEC 60825-1 (laser safety)	Self Certification
UL60950 (safety)	N/A due to no power supplies in design (if host device is compliant, by default the SFP is compliant)

Record of Revisions

Rev	Date	Notes
A	3/30/16	Initial production release for TN-SFP-BC55-I and TN-SFP-BC55 at v x114.