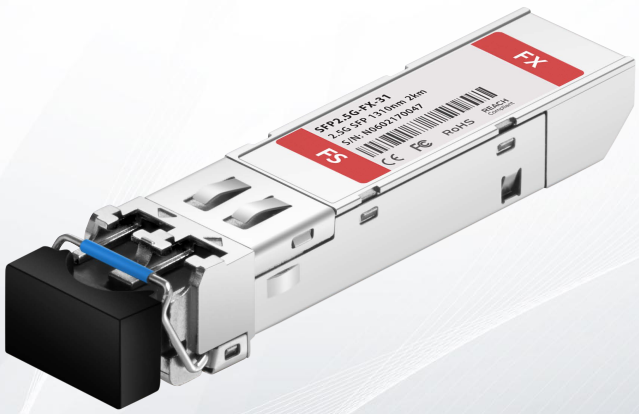
2.5GBASE-IX SFP 1310nm 2km DOM Duplex LC SMF Transceiver

SFP2.5G-FX-31



Application

- SONET OC-48 /SDH STM -16
- 2x Fiber Channel Applications
- Switch to Switch Interface
- Switched Backplane Applications

Standards

- SFP MSA (INF-8074i)
- GR-253-CORE
- ITU-T G.957
- FC-PI v2.0
- SFF-8472 v9.5

Features

- 1310nm Fabry-Perot laser transmitter
- Up to 2.5Gbps Data Rate
- Duplex LC Receptacle Optical Interface Compliant
- Single +3.3V Power Supply
- DDM Function Implemented
- External Calibration
- Hot-pluggable
- Serial ID Module on MOD(0-2)
- International Class 1 Laser Safety Certified
- Operating Temperature range: -10℃ ~ +70 ℃
- 2km on 9/125um SMF
- RoHS Compliant

Description

The 2.5GBASE-IX SFP transceiver supports up to 2km link lengths over single-mode fiber (SMF) using a wavelength of 1310nm via a LC connector. This transceiver is compliant with SFP MSA(INF-8074i), GR-253-CORE, ITU-T G.957, FC-PI v2.0 and SFF-8472 v9.5 standards. The built-in digital diagnostic monitoring (DDM) allows access to real-time operating parameters. It is suitable for SONET OC-48 SR-1/ SDH STM-16 I-16, 2x fiber channel applications, switch to switch interface, switched backplane applications.

Product Specifications

I. Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature Range	Ts	-40	85	℃
Relative Humidity	RH	5	95	%
Power Supply Voltage	Vcc	-0.5	4	V

II. Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min.	Typical	Max.	Unit
Case Operating Temperature Range	Tc	-10	-	70	oC
Power Supply Voltage	Vcc	3.135	3.3	3.465	V
Data Rate		-	2.48832/2.125	-	Gbps

III. Optical Characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter						
Launch Optical Power	Po	-10	-	-3	dBm	
Center Wavelength Range	lc	1266	-	1360	nm	
Extinction Ratio	EX	8.2	-	-	dB	
Spectral Width (-20dB)	Dl	-	-	4	nm	
Total transmitter Jitter	Tp-p	-	-	0.1	ps	1
Relative Intensity Noise	RIN	-	-	-120	dB/Hz	2
Eye Diagram	Complies with STM-16 eye masks when filtered					
Optical Rise/Fall Time	Trise/Tfall	-	-	150	ps	
Dispersion Penalty	-	-	-	1	dB	
Pout of OFF transmitter	Poff	-	-	-45	dBm	
Receiver						
Center Wavelength Range	lc	1250	-	1620	nm	
Receiver Sensitivity	S	-20	-	-18	dBm	3
Overload Input Optical Power	Pin	-3	-	-	dBm	
Optical De-assert	--	-	-	-20	dBm	
Optical Assert	-	-35	-	-	-	
LOS Hysteresis	-	0.5	3	5	dB	4

IV. Electrical Characteristics

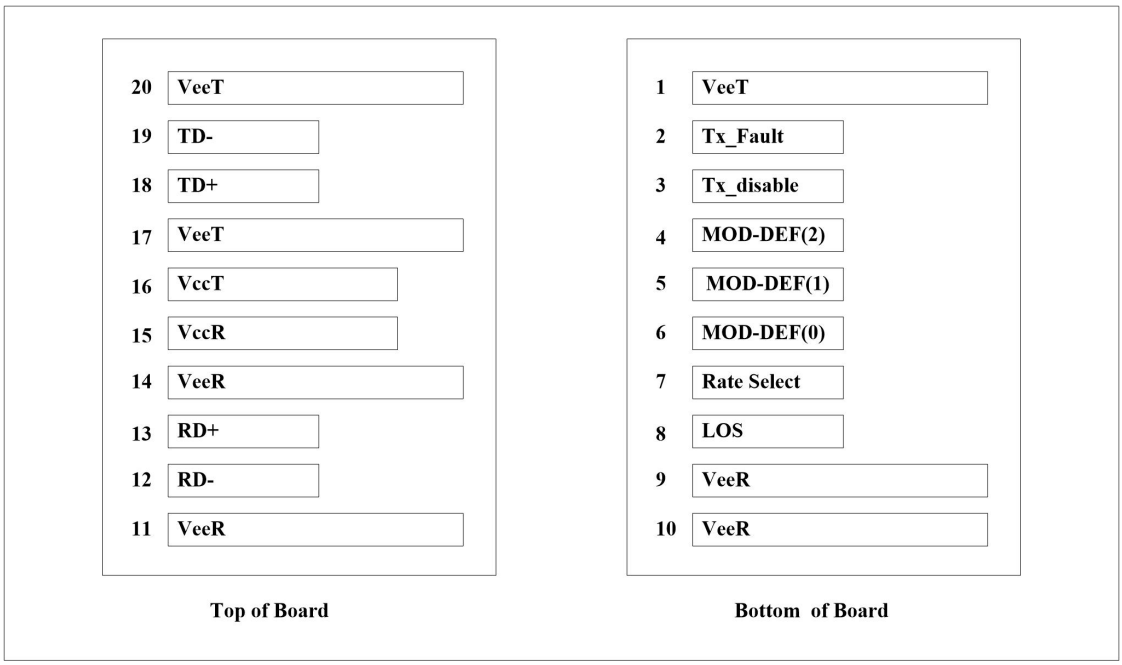
The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Current	Icc	-	-	300	mA	5
Single Ended Data Input Swing	-	150	-	1100	mV	
Single Ended Data Output Swing	-	300	-	600	mV	
TX_fault /LOS output (TTL)	VOH	2.0	-	Vcc	V	
	VOL	0	-	0.8	V	
TX_disable input (TTL)	VOH	2.0	-	Vcc	V	
	VOL	0	-	0.8	V	

Notes:

1. For the jitter measurements, the device was driven with SONET OC-48 data pattern with 223-1 PRBS payload.
2. RIN is the laser noise, integrated over a specified bandwidth, measured relative to average optical power with 12dB return loss.
3. Measured with a PRBS 223-1 test pattern, @2.5Gb/s, EX=10dB, BER<10-12.
4. The LOS Hysteresis to minimize “chatter” on the output line. In principle, Hysteresis alone does not guarantee chatter-free operation
5. The supply current includes SFP module’s supply current and test board working current.

V. Pin Assignment and Pin Description



As Viewed Through Top of Board

Pin	Symbol	Name/Description	Engagement Order	Notes
1	VeeT	Transmitter Ground	1	
2	TX Fault	Transmitter Fault Indication	3	1
3	TX Disable	Transmitter Disable-Module disables on high or open	3	2
4	MOD-DEF2	Module Definition 2-Two wire serial ID interface	3	3
5	MOD-DEF1	Module Definition 1-Two wire serial ID interface	3	3
6	MOD-DEF0	Module Definition 0-Two wire serial ID interface	3	3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	4
9	VeeR	Receiver Ground	1	
10	VeeR	Receiver Ground	1	

Pin	Symbol	Name/Description	Engagement Order	Notes
11	Veer	Receiver Ground	1	
12	RD-	Inverse Received Data out	3	5
13	RD+	Received Data out	3	5
14	VeeR	Receiver Ground	1	
15	VccR	Receiver Power —— +3.3V±5%	2	6
16	VccT	Transmitter Power —— +3.3 V±5%	2	6
17	VeeT	Transmitter Ground	1	
18	TD+	Transmitter Data In	3	7
19	TD-	Inverse Transmitter Data In	3	7
20	VeeT	Transmitter Ground	1	

Notes:

1. TX Fault is open collector/drain output which should be pulled up externally with a 4.7K – 10KΩresistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

2. TX Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7 – 10K resistor.

Low (0 – 0.8V): Transmitter on

Between (0.8V and 2V): Undefined

High (2.0 – VccT): Transmitter Disabled

Open: Transmitter Disabled

3. Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7 - 10K resistor on the host board to supply less than VccT+0.3V or VccR+0.3V.

Mod-Def 0 is grounded by the module to indicate that the module is present.

Mod-Def 1 is clock line of two wire serial interface for optional serial ID.

Mod-Def 2 is data line of two wire serial interface for optional serial ID.

4. LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7 – 10K resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

5. RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω differential at the user SERDES. The AC coupling is done inside the module and thus not required on the host board.

6. VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ± 5% at the SFP connector pin.

7. TD-/+: These are the differential transmitter inputs. They are AC coupled differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on host board.

VI. Principle Diagram

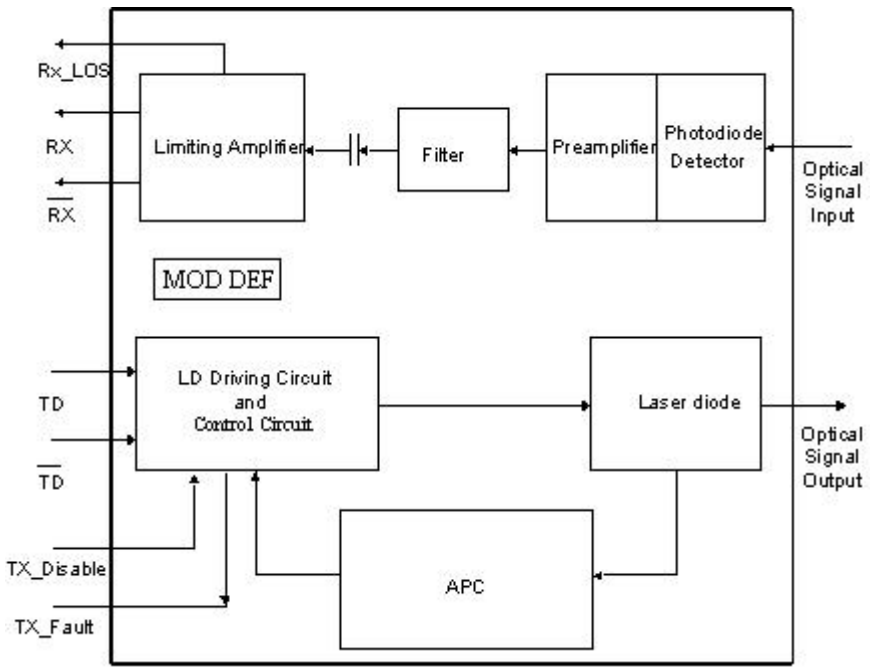


Figure1. Principle Diagram

VII. Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

Data Address	Field Size(bytes)	Name	Contents and Description
		Alarm and Warning Thresholds	
00-01	2	Temperature High Alarm	Set to 85℃
02-03	2	Temperature Low Alarm	Set to -5℃
04-05	2	Temperature High Warning	Set to 75℃
06-07	2	Temperature Low Warning	Set to 0℃
08-09	2	Vcc High Alarm	Set to 3.6 V
10-11	2	Vcc Low Alarm	Set to 3.0 V
12-13	2	Vcc High Warning	Set to 3.5 V
14-15	2	Vcc Low Warning	Set to 3.1 V
16-17	2	Bias High Alarm	2x IBias(25℃)+20
18-19	2	Bias Low Alarm	25% x IBias(25℃)
20-21	2	Bias High Warning	2 x IBias(25℃)+10
22-23	2	Bias Low Warning	50% x IBias(25℃)
24-25	2	TX Power High Alarm	Manufacture measurement plus 2dB
26-27	2	TX Power Low Alarm	Manufacture measurement minus 2dB
28-29	2	TX Power High Warning	Manufacture measurement plus 1dB
30-31	2	TX Power Low Warning	Manufacture measurement minus 1dB
32-33	2	RX Power High Alarm	Overload input optical power

Data Address	Field Size(bytes)	Name	Contents and Description
34-35	2	RX Power Low Alarm	Maximum receiver sensitivity
36-37	2	RX Power High Warning	Overload input optical power minus 3dB
38-39	2	RX Power Low Warning	Maximum receiver sensitivity plus 3dB
40-55	16	Reserved	
		Calibration Constants	
56-59	4	RX Power Calibration Data4	Single precision floating-point numbers(various values at each device)
60-63	4	RX Power Calibration Data3	
64-67	4	RX Power Calibration Data2	Single precision floating-point numbers(various values at each device)
68-71	4	RX Power Calibration Data1	
72-75	4	RX Power Calibration Data0	
76-77	2	Bias Calibration Data1	0100 (fixed)
78-79	2	Bias Calibration Data0	0000(fixed)
80-81	2	TX Power Calibration Data1	0100 (fixed)
82-83	2	TX Power Calibration Data0	0000(fixed)
84-85	2	Temperature Calibration Data1	0100 (fixed)
86-87	2	Temperature Calibration Data0	0000(fixed)
88-89	2	Vcc Calibration Data1	0100 (fixed)
90-91	2	Vcc Calibration Data0	0000(fixed)
92-94	3	Reserved	

Data Address	Field Size(bytes)	Name	Contents and Description
95	1	Check Sum	Checksum of bytes 0-94
		Real Time Diagnostic Monitor Interface	
96-97	2	Measured Temperature	Yield a 16-bit A/D value (see VIII.)
98-99	2	Measured Vcc	Yield a 16-bit A/D value (see VIII.)
100-101	2	Measured Bias	Yield a 16-bit A/D value (see VIII.)
102-103	2	Measured TX Power	Yield a 16-bit A/D value (see VIII.)
104-105	2	Measured RX Power	Yield a 16-bit A/D value (see VIII.)
106-109	4	Reserved	
110	1	Logic Status	See IX.
111	1	AD Conversion Updates	See IX.
112-119	8	Alarm and Warning Flags	See X.
		Vendor Specific	
120-122	3	Vendor Specific	Don't Access
123-126	4	Password Entry	Write only
127	1	Table Select Byte	Write/read
128-247	120	User writable EEPROM	Write/read
248-255	8	Vendor Specific	Don't Access

The measured values located at bytes 96-105(in the 2 wire address 0xA2) are raw A/D values (16-bit integers) of transceiver temperature, supply voltage, laser bias current, laser optical output power and received power. All the measured values are "Externally Calibrated", and then it is necessary to convert raw A/D values to real world units by the manner as shown in VI.

VIII. Real Time Diagnostic Monitor Values

Byte	Name	Description
96	Temperature MSB	Internally measured transceiver temperature. Compliant with External Calibration of SFF-8472.
97	Temperature LSB	
98	Vcc MSB	Internally measured supply voltage. Compliant with External Calibration of SFF-8472.
99	Vcc LSB	
100	Laser Bias MSB	Measured Laser bias current. Compliant with External Calibration of SFF-8472.
101	Laser Bias LSB	
102	Tx Power MSB	Measured Tx power. Compliant with External Calibration of SFF-8472.
103	Tx Power LSB	
104	Rx Power MSB	Measured Tx power. Compliant with External Calibration of SFF-8472.
105	Rx Power LSB	

This transceiver implements two optional status bytes, “Logic States” at byte 110(0xA2)” and “A/D Updated” at byte 111(0xA2) as shown in IX.. “A/D Updated” status bits allow the user to verify if an update from the analog-digital conversion has occurred of the measured values, temperature, Vcc, laser bias, Tx power and Rx power. The user writes the byte to 0x00. Once a conversion is completed for a given value, its bit will change to ‘1’

IX. Logic Status and AD Conversion Updates

Byte	Bit	Name	Description
110	7	Tx Disable State	Optional digital State of the Tx Disable input pin.
110	6	Soft Tx Disable Control	Not supported.
110	5	Reserved	

Byte	Bit	Name	Description
110	4	Rx Rate Select State	Not supported.
110	3	Soft Rate Select Control	Not supported .
110	2	Tx Fault	Optional digital state of the Tx Fault output pin.
110	1	LOS	Optional digital state of the LOS output pin.
110	0	Power on Logic	Bit will be 0 when the analog monitoring is active.
111	7	Temp A/D Valid	Indicates A/D value in Bytes 96/97 is valid.
111	6	Vcc A/D Valid	Indicates A/D value in Bytes 98/99 is valid.
111	5	Laser Bias A/D Valid	Indicates A/D value in Bytes 100/101 is valid.
111	4	Tx Power A/D Valid	Indicates A/D value in Bytes 102/103 is valid.
111	3	Rx Power A/D Valid	Indicates A/D value in Bytes 104/105 is valid.
111	2	Reserved	
111	1	Reserved	
111	0	Reserved	

Each of the measured values has a corresponding high alarm, low alarm, high warning and low warning threshold level at location 00-39(x0A2) written as the data format of a corresponding valued shown in X. Alarm and warning flags at bytes 112-119(0xA2) are defined as follows.

(1) Alarm flags indicate conditions likely to result (or have resulted) in link failure and cause for immediate action.

(2) Warning flags indicate conditions outside the guaranteed operating specification of transceiver but not necessarily causes of immediate link failures.

X. Alarm and Warning Flags

Byte	Bit	Name	Description
112	7	Temperature High Alarm	Set when temperature monitor value exceeds high alarm level.
112	6	Temperature Low Alarm	Set when temperature monitor value exceeds low alarm level.
112	5	Vcc High Alarm	Set when Vcc monitor value exceeds high alarm level.
112	4	Vcc Low Alarm	Set when Vcc monitor value exceeds Low alarm level.
112	3	Laser Bias High Alarm	Set when laser bias monitor value exceeds high alarm level.
112	2	Laser Bias Low Alarm	Set when laser bias monitor value exceeds low alarm level.
112	1	Tx Power High Alarm	Set when Tx power monitor value exceeds high alarm level
112	0	Tx Power Low Alarm	Set when Tx power monitor value exceeds low alarm level.
113	7	Rx Power High Alarm	Set when Rx power monitor value exceeds high alarm level
113	6	Rx Power Low Alarm	Set when Rx power monitor value exceeds low alarm level
113	5-0	Reserved	
114	7-0	Reserved	
115	7-0	Reserved	
116	7	Temperature High warning	Set when temperature monitor value exceeds high warning level.
116	6	Temperature Low warning	Set when temperature monitor value exceeds low warning level.
116	5	Vcc High warning	Set when Vcc monitor value exceeds high warning level.
116	4	Vcc Low warning	Set when Vcc monitor value exceeds Low warning level.
116	3	Laser Bias High warning	Set when laser bias monitor value exceeds high warning level.

Byte	Bit	Name	Description
116	2	Laser Bias Low warning	Set when laser bias monitor value exceeds low warning level.
116	1	Tx Power High warning	Set when Tx power monitor value exceeds high warning level
116	0	Tx Power Low warning	Set when Tx power monitor value exceeds low warning level.
117	7	Rx Power High warning	Set when Rx power monitor value exceeds high warning level
117	6	Rx Power Low warning	Set when Rx power monitor value exceeds low warning level
117	5-0	Reserved	
118	7-0	Reserved	
119	7-0	Reserved	

XI. Mechanical Dimensions

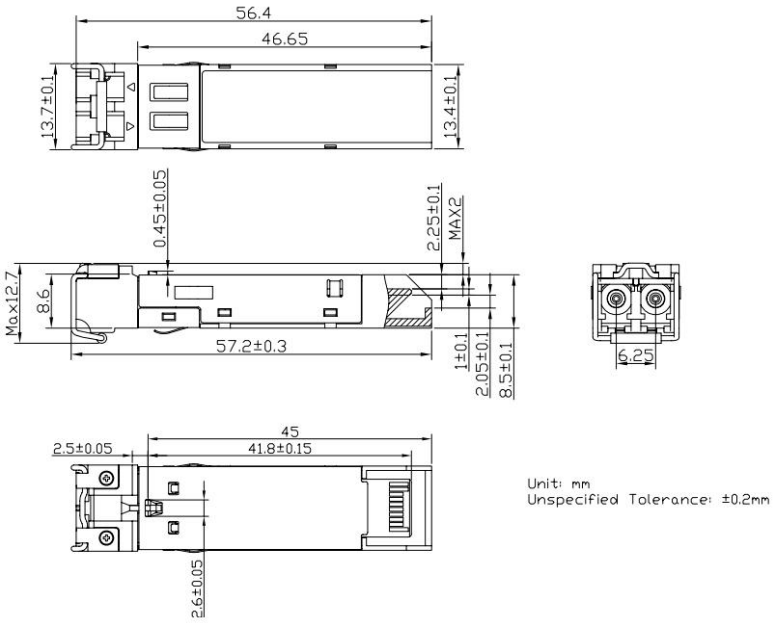


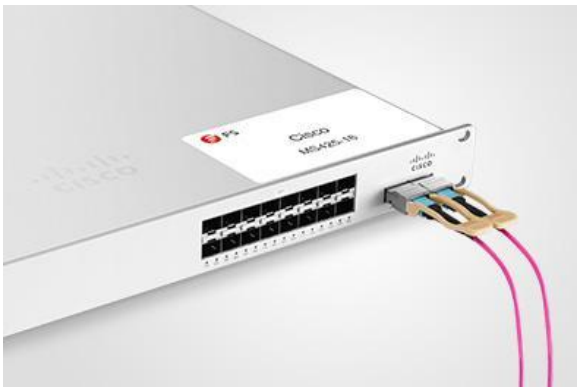
Figure2. Mechanical Outline

Test Center

I. Compatibility Testing

Each fiber optical transceiver has been tested in host device on site in FS Assured Program to ensure full compatibility with over 200 vendors.

Cisco Catalyst C9500-24Y4C



Cisco MS425-16

Brocade VDX 6940-144S

Dell EMC Networking Z9100-ON

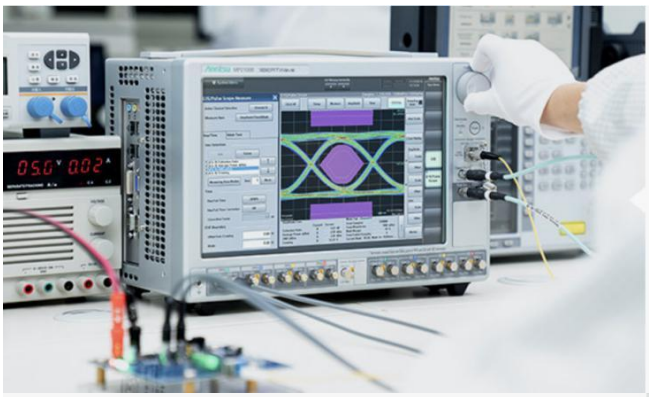
Force⑩tm S60-44T

HUAWEI S6720-30L-HI-24S

Above is part of our test bed network equipment. For more information, please click the Test Bed PDF. It will be updated in real time as we expand our portfolio.

II. Performance Testing

Each fiber optical transceiver has been fully tested in FS Assured Program equipped with world's most advanced analytical equipment to ensure that our transceivers work perfectly on your device.



1. TX/RX Signal Quality Testing

Equipped with the all-in-one tester integrated 4ch BERT & sampling oscilloscope, and variable optical attenuator to ensure the input and output signal quality.

- Eye Pattern Measurements: Jitter, Mask Margin, etc
- Average Output Power
- OMA
- Extinction Ratio
- Receiver Sensitivity
- BER Curve

2. Reliability and Stability Testing

Subject the transceivers to dramatic changes in temperature on the thermal shock chamber to ensure reliability and stability of the transceivers.

- Commercial: 0 °C to 70 °C
- Extended: -5 °C to 85 °C
- Industrial: -40 °C to 85 °C

3. Transfer Rate and Protocol Testing

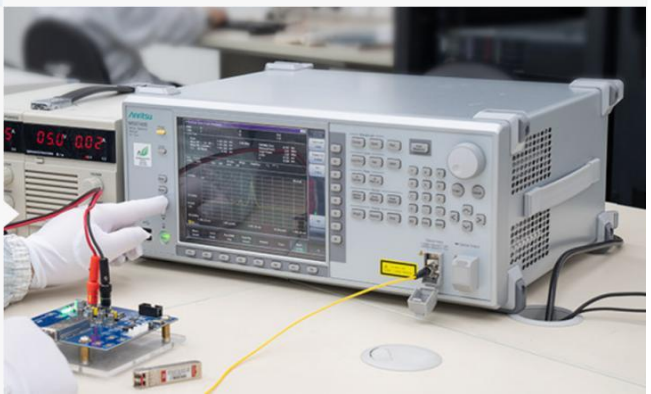
Test the actual transfer data rate and the transmission ability under different protocols with Network Master Pro.

- Ethernet
- Fibre Channel
- SDH/SONET
- CPRI

4. Optical Spectrum Evaluation

Evaluate various important parameters with the Optical Spectrum Analyzer to meet the industry standards.

- Center Wavelength, Level
- OSNR
- SMSR
- Spectrum Width



Order Information

Part Number	Description
SFP2.5G-FX-31	SFP 2.5GBASE-IX 1310nm 2km Transceiver
SFP2.5G-SX-85	SFP 2.5GBASE-SX 850nm 300m Transceiver
SFP2.5G-LX-31	SFP 2.5GBASE-LX 1310nm 15km Transceiver