

# 1000BASE-CWDM SFP 1270nm~1610nm 80km DOM Transceiver

CWDM-SFP1G-ZX



## Application

- Gigabit Ethernet
- 1 × Fiber Channel
- CWDM Networks

## Features

- Up to 1.25Gb/s Data Links
- Hot-Pluggable
- Duplex LC connector
- Up to 80km on 9/125μm SMF
- 18-Wavelength CWDM 1270nm~1610nm Available
- CWDM DFB laser transmitter
- Single +3.3V Power Supply
- Monitoring Interface Compliant with SFF-8472
- Low power dissipation <1W typically
- Operating temperature range: 0. °C to 70. °C
- RoHS compliant and Lead Free

## Description

FS's CWDM-SFP1G-ZX CWDM Transceiver products provide optical networking equipment manufacturers with a timely and cost effective tool in supporting the unceasing demand for higher bandwidth equipment build-outs in the enterprise access and metropolitan area networks. There are 18 center wavelengths available from 1270nm to 1610nm. The 20nm channel spacing allows for un-cooled laser operation, a high yield manufacturing process, and lower cost Mux/Demux technology, thus providing a complete cost effective solution for various data and telecom applications.

## Product Specifications

### I. Absolute Maximum Ratings

| Parameter           | Symbol          | Min  | Typ. | Max | Unit |
|---------------------|-----------------|------|------|-----|------|
| Storage Temperature | T <sub>s</sub>  | -40  |      | +85 | °C   |
| Supply Voltage      | V <sub>CC</sub> | -0.5 |      | 4   | V    |
| Relative Humidity   | RH              | 0    |      | 85  | %    |

### II. Recommended Operating Environment

| Parameter                  | Symbol             | Min   | Typ. | Max                 | Unit |
|----------------------------|--------------------|-------|------|---------------------|------|
| Case operating Temperature | T <sub>c</sub>     | 0     |      | +70                 | °C   |
| Supply Voltage             | V <sub>CC</sub>    | 3.135 |      | 3.465               | V    |
| Supply Current             | I <sub>CC</sub>    |       |      | 250                 | mA   |
| Inrush Current             | I <sub>surge</sub> |       |      | I <sub>CC</sub> +30 | mA   |
| Maximum Power              | P <sub>max</sub>   |       |      | 1                   | W    |

III. Electrical Characteristics(T<sub>OP</sub> =T<sub>c</sub>, VCC = 3.135 to 3.465 Volts)

| Parameter                      | Symbol                | Min                   | Typ. | Max                   | Unit  | Ref. |
|--------------------------------|-----------------------|-----------------------|------|-----------------------|-------|------|
| Transmitter                    |                       |                       |      |                       |       |      |
| Input differential impedance   | R <sub>in</sub>       | 90                    | 100  | 110                   |       |      |
| Single ended data input swing  | V <sub>in PP</sub>    | 250                   |      | 1200                  | mVp-p |      |
| Transmit Disable Voltage       | V <sub>D</sub>        | V <sub>CC</sub> – 1.3 |      | V <sub>CC</sub>       | V     | 2    |
| Transmit Enable Voltage        | V <sub>EN</sub>       | V <sub>EE</sub>       |      | V <sub>EE</sub> + 0.8 | V     |      |
| Transmit Disable Assert Time   | T <sub>dessert</sub>  |                       |      | 10                    | us    |      |
| Receiver                       |                       |                       |      |                       |       |      |
| Single ended data output swing | V <sub>out,pp</sub>   | 300                   |      | 800                   | mv    | 3    |
| Data output rise time          | t <sub>r</sub>        |                       |      | 260                   | ps    | 4    |
| Data output fall time          | t <sub>f</sub>        |                       |      | 260                   | ps    | 4    |
| LOS Fault                      | V <sub>losfault</sub> | V <sub>CC</sub> – 0.5 |      | V <sub>CC_host</sub>  | V     | 5    |
| LOS Normal                     | V <sub>los norm</sub> | V <sub>EE</sub>       |      | V <sub>EE</sub> +0.5  | V     | 5    |
| Power Supply Rejection         | PSR                   | 100                   |      |                       | mVpp  | 6    |

**Note (1):** AC coupled.

**Note (2):** Or open circuit.

**Note (3):** Into 100 ohm differential termination.

**Note (4):** 20 – 80 %.

**Note (5):** LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

**Note (6):** All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000.

IV. Optical Parameters(T<sub>OP</sub> =T<sub>C</sub>, VCC = 3.135 to 3.465 Volts)

| Parameter | Symbol | Min | Typ. | Max | Unit | Ref. |
|-----------|--------|-----|------|-----|------|------|
|-----------|--------|-----|------|-----|------|------|

Transmitter

|                                 |                                                 |               |           |                                |     |   |
|---------------------------------|-------------------------------------------------|---------------|-----------|--------------------------------|-----|---|
| Center Wavelength               | $\lambda_c$                                     | $\lambda-6.5$ | $\lambda$ | $\lambda+6.5$                  | nm  |   |
| Spectral Width                  | $\sigma$                                        |               |           | 1                              | nm  |   |
| Side Mode Suppression Ratio     | SMSR                                            | 30            |           |                                | dB  |   |
| Optical Output Power            | P <sub>out</sub>                                | 0             |           | +4(1390~1610)<br>+5(1270~1370) | dBm | 1 |
| Optical Rise/Fall Time          | t <sub>r</sub> / t <sub>f</sub>                 |               |           | 260                            | ps  | 2 |
| Extinction Ratio                | ER                                              | 9             |           |                                | dB  |   |
| Generated Jitter (peak to peak) | J <sub>TXp-p</sub>                              |               |           | 0.07                           | UI  | 3 |
| Generated Jitter (rms)          | J <sub>TXrms</sub>                              |               |           | 0.007                          | UI  | 3 |
| Eye Mask for Optical Output     | Compliant with IEEE802.3z(class 1 laser safety) |               |           |                                |     |   |

Receiver

|                          |                  |                                  |  |                                        |     |   |
|--------------------------|------------------|----------------------------------|--|----------------------------------------|-----|---|
| Optical Input Wavelength | $\lambda_c$      | 1260                             |  | 1620                                   | nm  |   |
| Receiver Overload        | P <sub>ol</sub>  | - 8(1270~1370)<br>- 1(1390~1610) |  |                                        | dBm | 4 |
| RX Sensitivity           | Sen              |                                  |  | -30/31(1270~1370)<br>-28/29(1390~1610) | dBm | 4 |
| RX_LOS Assert            | LOS <sub>A</sub> | -40                              |  |                                        | dBm |   |
| RX_LOS De-assert         | LOS <sub>D</sub> |                                  |  | -31(1279~1370)<br>-27(1390~1610)       | dBm |   |
| RX_LOS Hysteresis        | LOS <sub>H</sub> | 0.5                              |  |                                        | dB  |   |

General Specifications

|                                                    |                  |    |      |                   |      |  |
|----------------------------------------------------|------------------|----|------|-------------------|------|--|
| Data Rate                                          | BR               |    | 1.25 |                   | Gb/s |  |
| Bit Error Rate                                     | BER              |    |      | 10 <sup>-12</sup> |      |  |
| Max. Supported Link Length on 9/125μm SMF@1.25Gb/s | L <sub>MAX</sub> |    | 80   |                   | km   |  |
| Total System Budget                                | LB               | 24 |      |                   | dB   |  |

- Note (1):** The optical power is launched into SMF.
- Note (2):** 20-80%.
- Note (3):** Jitter measurements taken using Agilent OMNIBERT 718 in accordance with GR-253.
- Note (4):** Measured with PRBS 27 -1 at 10-12 BER

V. Pin Assignment

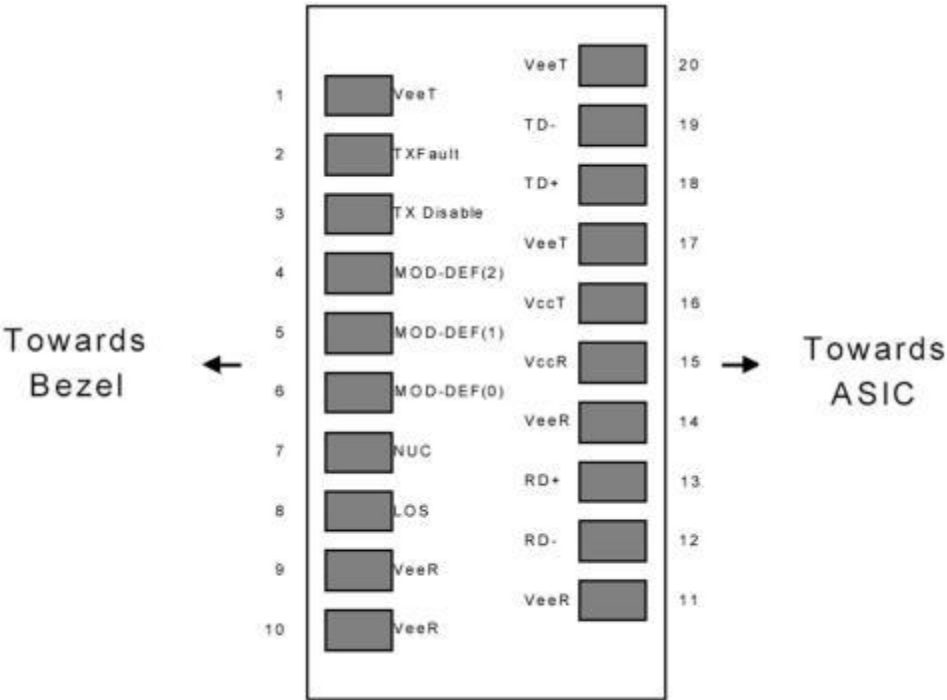


Diagram of Host Board Connector Block Pin Numbers and Names

VI. Pin Function Definitions

| Pin NO. | Name        | Function                     | Plug Seq | Notes |
|---------|-------------|------------------------------|----------|-------|
| 1       | VeeT        | Transmitter Ground           | 1        | 1     |
| 2       | TX Fault    | Transmitter Fault Indication | 3        |       |
| 3       | TX Disable  | Transmitter Disable          | 3        | 2     |
| 4       | MOD-DEF2    | Module Definition            | 2        | 3     |
| 5       | MOD-DEF1    | Module Definition 1          | 3        | 3     |
| 6       | MOD-DEF0    | Module Definition 0          | 3        | 3     |
| 7       | Rate Select | Not Connected                | 3        | 4     |
| 8       | LOS         | Loss of Signal               | 3        | 5     |
| 9       | VeeR        | Receiver Ground              | 1        | 1     |
| 10      | VeeR        | Receiver Ground              | 1        | 1     |
| 11      | VeeR        | Receiver Ground              |          | 1     |
| 12      | RD-         | Inv. Received Data Out       | 3        | 6     |
| 13      | RD+         | Received Data Out            | 3        | 6     |
| 14      | VeeR        | Receiver Ground              | 3        | 1     |
| 15      | VccR        | Receiver Power               | 2        | 1     |
| 16      | VccT        | Transmitter Power            | 2        |       |
| 17      | VeeT        | Transmitter Ground           | 1        |       |
| 18      | TD+         | Transmit Data In             | 3        | 6     |
| 19      | TD-         | Inv. Transmit In             | 3        | 6     |
| 20      | VeeT        | Transmitter Ground           | 1        |       |

**Note (1):** Circuit ground is internally isolated from chassis ground.

- Note (2):** Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
- Note (3):** Should be pulled up with 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V.
- Note (4):** MOD\_DEF(0) pulls line low to indicate module is plugged in.
- Note (5):** Rate select is not used
- Note (6):** LOS is open collector output. Should be pulled up with 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
- Note (7):** AC Coupled.

VII. SFP Module EEPROM Information and Management

The SFP modules implement the 2-wire serial communication protocol as defined in the SFP -8472. The serial ID information of the SFP modules and Digital Diagnostic Monitor parameters can be accessed through the I2C interface at address A0h and A2h. The memory is mapped in Table 1. Detailed ID information (A0h) is listed in Table 2. And the DDM specification at address A2h. For more details of the memory map and byte definitions, please refer to the SFF-8472, “Digital Diagnostic Monitoring Interface for Optical Transceivers”. The DDM parameters have been internally calibrated.

Table 1. Digital Diagnostic Memory Map (Specific Data Field Descriptions)

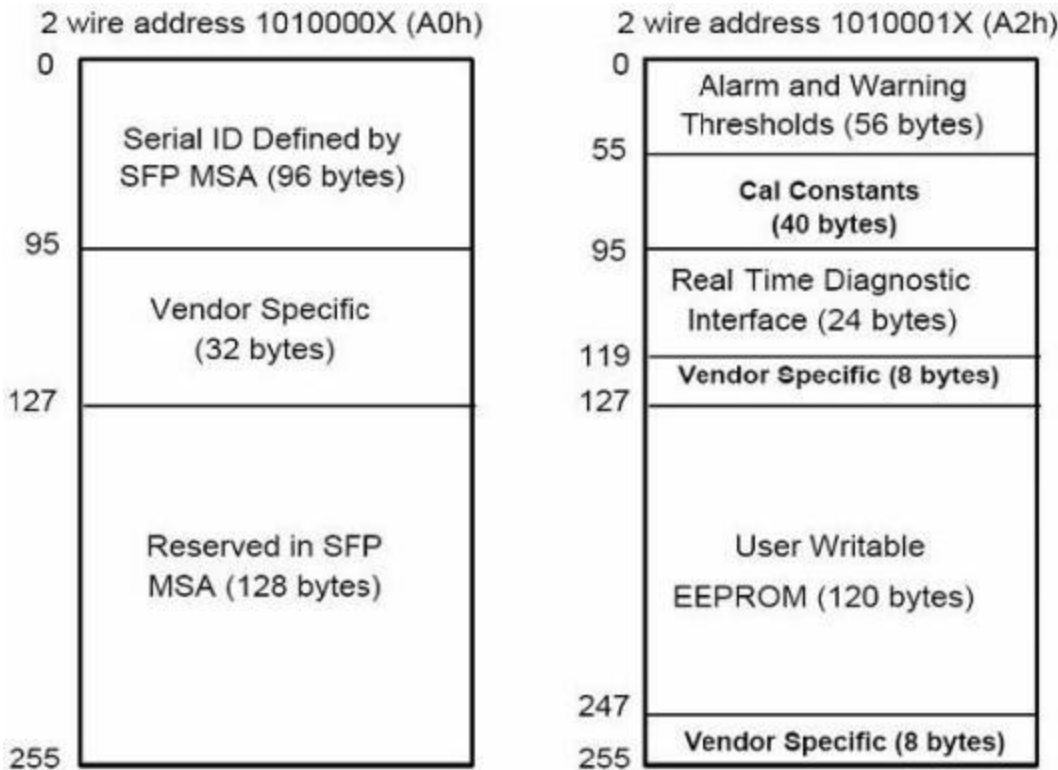


Table 2 - EEPROM Serial ID Memory Contents (A0h)

| Data Address   | Length (Byte) | Name of Length | Description and Contents                                 |
|----------------|---------------|----------------|----------------------------------------------------------|
| Base ID Fields |               |                |                                                          |
| 0              | 1             | Identifier     | Type of Serial transceiver (03h=SFP)                     |
| 1              | 1             | Reserved       | Extended identifier of type serial transceiver (04h)     |
| 2              | 1             | Connector      | Code of optical connector type (07=LC)                   |
| 3-10           | 8             | Transceiver    |                                                          |
| 11             | 1             | Encoding       | NRZ(03h)                                                 |
| 12             | 1             | BR, Nominal    | Nominal baud rate, unit of 100Mbps                       |
| 13-14          | 2             | Reserved       | (0000h)                                                  |
| 15             | 1             | Length(9um)    | Link length supported for 9/125um fiber, units of 100m   |
| 16             | 1             | Length(50um)   | Link length supported for 50/125um fiber, units of 10m   |
| 17             | 1             | Length(62.5um) | Link length supported for 62.5/125um fiber, units of 10m |
| 18             | 1             | Length(Copper) | Link length supported for copper, units of meters        |
| 19             | 1             | Reserved       |                                                          |
| 20-35          | 16            | Vendor Name    | SFP vendor name: FS                                      |
| 36             | 1             | Reserved       |                                                          |
| 37-39          | 3             | Vendor OUI     |                                                          |
| 40-55          | 16            | Vendor PN      | Part Number: "CWDM-SFP1G-ZX-xx" (ASCII)                  |
| 56-59          | 4             | Vendor rev     |                                                          |
| 60-62          | 3             | Reserved       |                                                          |

|                           |     |           |                                                                                                      |
|---------------------------|-----|-----------|------------------------------------------------------------------------------------------------------|
| 63                        | 1   | CCID      | Least significant byte of sum of data in address 0-62                                                |
| Extended ID Fields        |     |           |                                                                                                      |
| 64-65                     | 2   | Option    | Indicates which optical SFP signals are implemented(001Ah = LOS, TX_FAULT, TX_DISABLE all supported) |
| 66                        | 1   | BR, max   | Upper bit rate margin, units of %                                                                    |
| 67                        | 1   | BR, min   | Lower bit rate margin, units of %                                                                    |
| 68-83                     | 16  | Vendor SN |                                                                                                      |
| 84-91                     | 8   | Date code | FS's Manufacturing date code                                                                         |
| 92-94                     | 3   | Reserved  |                                                                                                      |
| 95                        | 1   | CCEX      | Check code for the extended ID Fields (addresses 64 to 94)                                           |
| Vendor Specific ID Fields |     |           |                                                                                                      |
| 96-127                    | 32  | Readable  | FS specific date, read only                                                                          |
| 128-255                   | 128 | Reserved  |                                                                                                      |

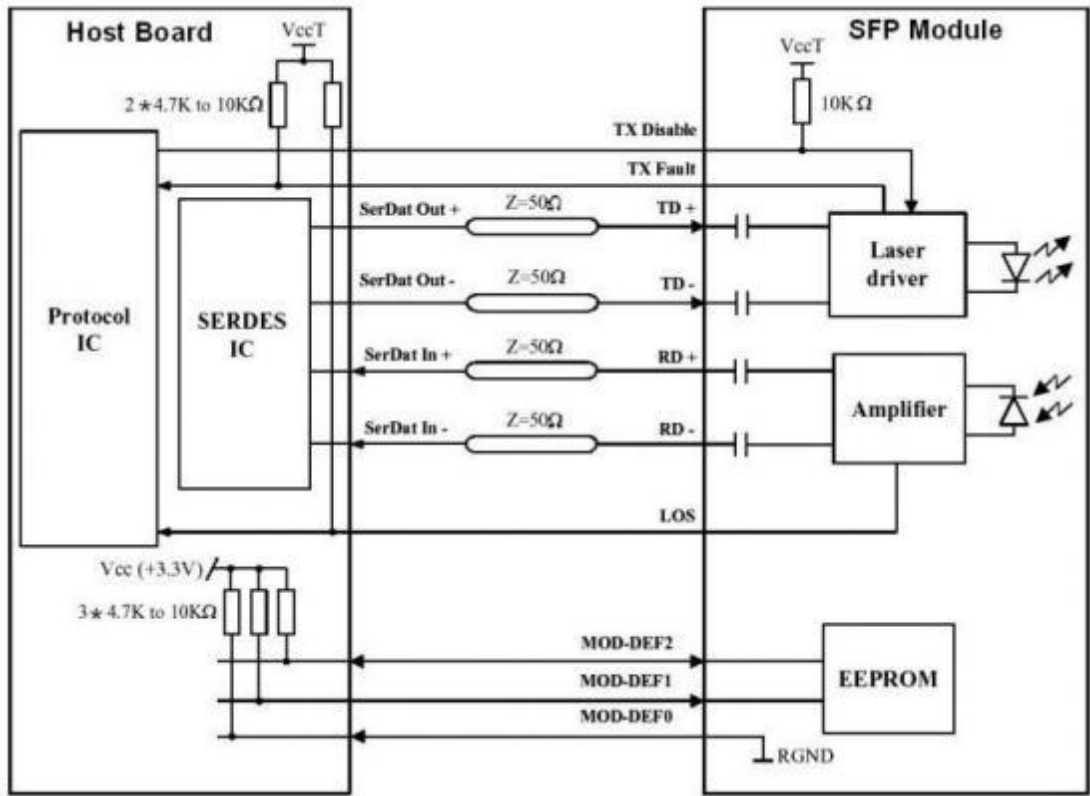
VIII. Digital Diagnostic Monitor Characteristics

| Data Address | Parameter                        | Accuracy | Unit |
|--------------|----------------------------------|----------|------|
| 96-97        | Transceiver Internal Temperature | ±3.0     | C    |
| 98-99        | VCC3 Internal Supply Voltage     | ±3.0     | %    |
| 100-101      | Laser Bias Current               | ± 10     | %    |
| 102-103      | Tx Output Power                  | ±3.0     | dBm  |
| 104-105      | Rx Input Power                   | ±3.0     | dBm  |

IX. Regulatory Compliance

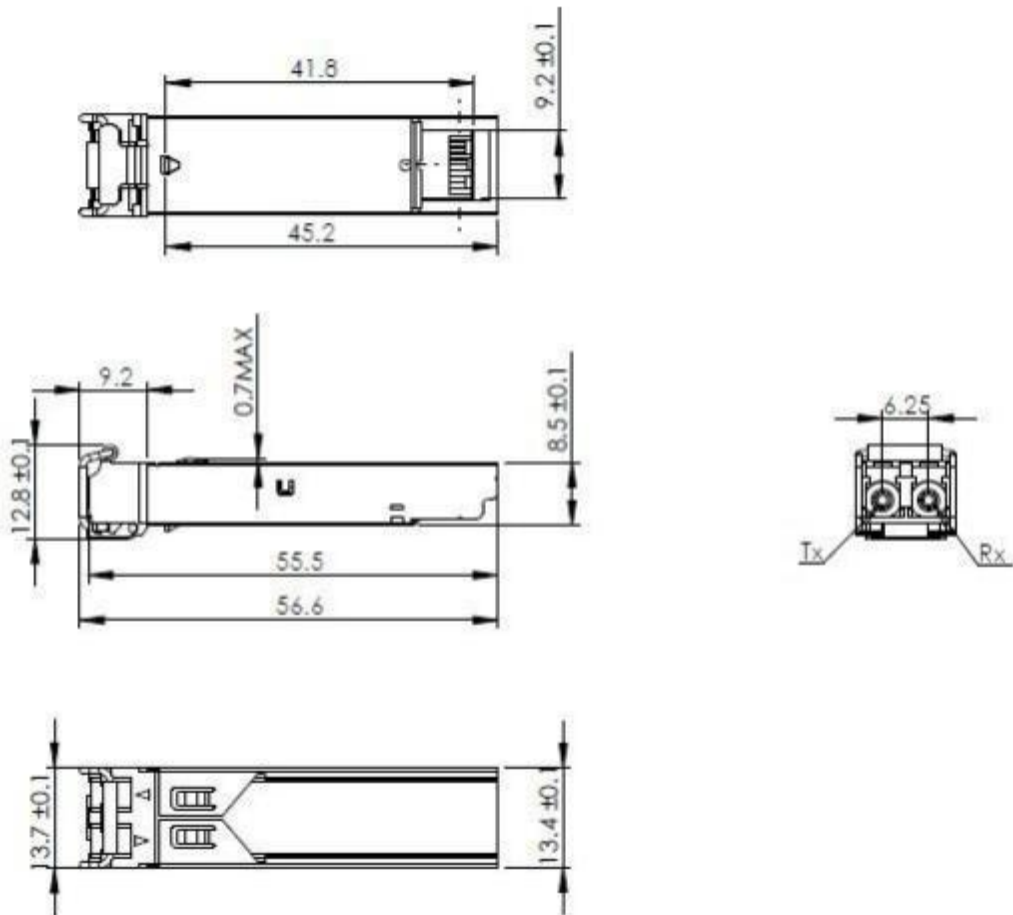
|                                                          |                                                            |                                       |
|----------------------------------------------------------|------------------------------------------------------------|---------------------------------------|
| Electrostatic Discharge(ESD) to the Electrical Pins      | MIL-STD-883EMethod 3015.7                                  | Class 1(>1000 V)                      |
| Electrostatic Discharge (ESD)to the Duplex LC Receptacle | IEC 61000-4-2GR-1089-CORE                                  | Compatible with standards             |
| ElectromagneticInterference (EMI)                        | FCC Part 15 Class BEN55022 Class B (CISPR 22B)VCCI Class B | Compatible with standards             |
| Laser Eye Safety                                         | FDA 21CFR 1040.10 and 1040.11EN60950, EN (IEC) 60825-1,2   | Compatible with Class 1 laserproduct. |

X. Recommended Circuit



SFP Host Recommended Circuit

XI.Mechanical Dimensions



## 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



Force<sup>10</sup> S60-44T

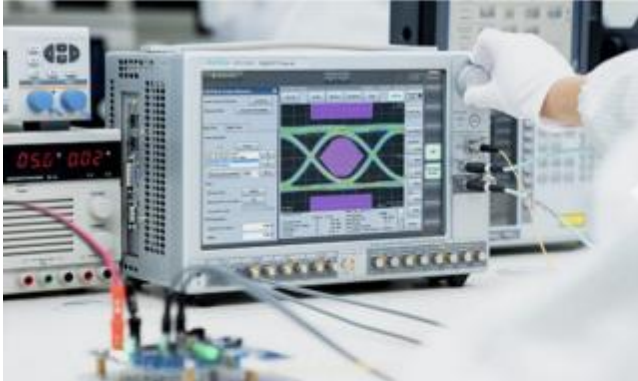


HUAWEI S6720-30L-HI-24S

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 Single Quality Testing

Equipped with the all-in-one tester integrated 4ch BERT & sampling oscilloscope, and variable optical attenuator 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 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 Networks Master Pro.

- Ethernet
- Fiber Channel
- SDH/SONET
- CPRI



### 4. Optical Spectrum Evaluation

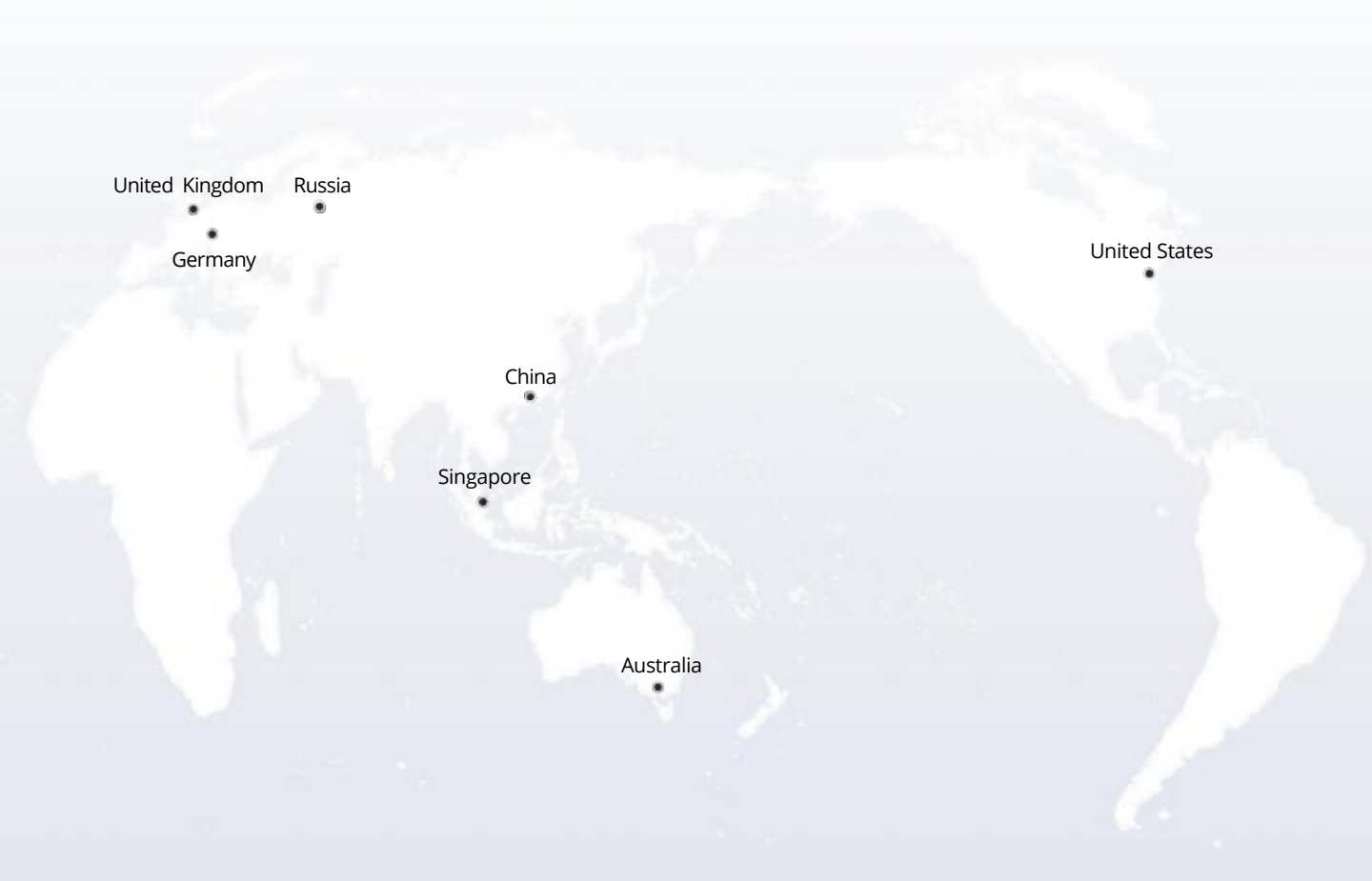
Evaluate various important parameters with the Optical Spectrum Analyzer to meet the industry standards.

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



Order Information

| Part Number   | Description                                           |
|---------------|-------------------------------------------------------|
| CWDM-SFP1G-ZX | SFP, 1000Base, CWDM 1270nm-1610nm, SMF, 80km, LC, DOM |



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