



SFP+ Loopback Adapter

Features and Benefits

- * SFP+ MSA Compliant
- * Data rates to 12 Gbps
- * Hot Pluggable
- * Operates on 3.3V supply
- * Serial ID
- * Mates with 20 pos SMT

Reference Information

- Form Factor: SFP+
- Housing: Die Cast
- Host Connector
 - Molex p/n 74441
- SFP+ EMI Cage
 - Molex p/n 74737

Applications

- * Telecommunication
- * Networking
- * Switches
- * Data Communication

Sales Drawing

- SD-xxxxx-xxxx



SFP+ Loopback Adapter

SFP+ General Overview

The SFP+ Loopback Module is a high performance integrated duplex serial data link for loopback communications. The loopback supports data rates of up to 12 Gbps. Applications include Fibre Channel, InfiniBand, and Gigabit Ethernet. The hot pluggable feature allows changing to/from another SFP+ compatible module without having to remove system power. Each module provides serial ID compliance.

SFP+ Loopback Options

The SFP+ Loopback Module is available as a universal loopback only at this time.

- The standard loopback was designed to test the signal integrity of the host's high speed communications.
- The universal loopback module adds an I2C port expander, and power supply load resistors to the standard loopback. The I2C port expander enables the host to test the functionality of all low speed I/O while the power supply load resistors stresses the DC supplies sources.



SFP+ Loopback Adapter

SFP+ Ordering Information

Part Numbe	Options
74765-0906	• Universal Loopback Adapter ◦ 0 dB High Speed Signal Attenuation ◦ 8-bit I2C Port Expander for Low Speed Signaling ◦ 50 uinches gold ◦ Thumb-Latch Backshe lls

Loopback Performance Specifications

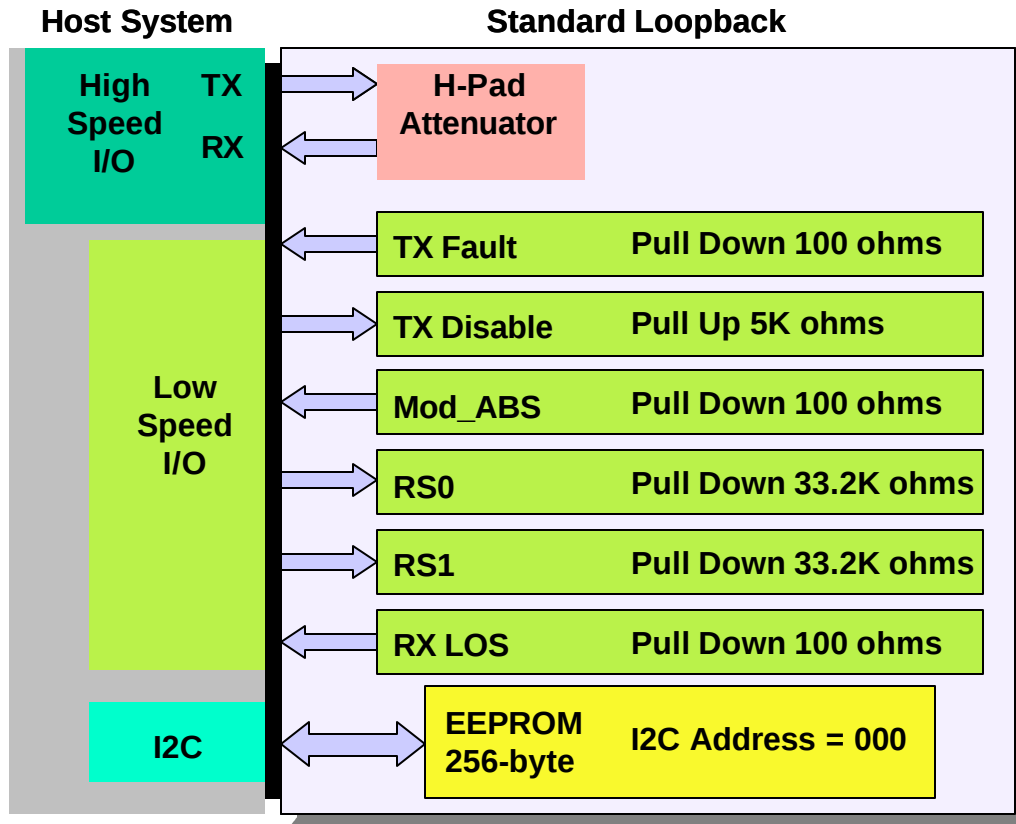
MODULE SPECIFICATIONS - RECOMMENDED OPERATING CONDITIONS

PARAMETER	MIN	TYP	MAX	UNITS	NOTES
Storage Temperature	-40		85	°C	
Ambient Operating Temperature	0		70	°C	
Data DC Voltage	-10		10	Vpk	V (Tx+,Tx-,Rx+, Rx-) to ground
Supply Voltage	3.1	3.3	3.47	Vdc	
Supply Current (loopback only)		2	30	mA	
Supply Current (universal power loading)	266	280	294	mA	

Data Path					
Baud Rate			12	Gbps	
Bit Error Rate			1E-12		Errors/Bit
Impedance			100	ohms	Differential, DC coupled



Standard Loopback Block Diagram



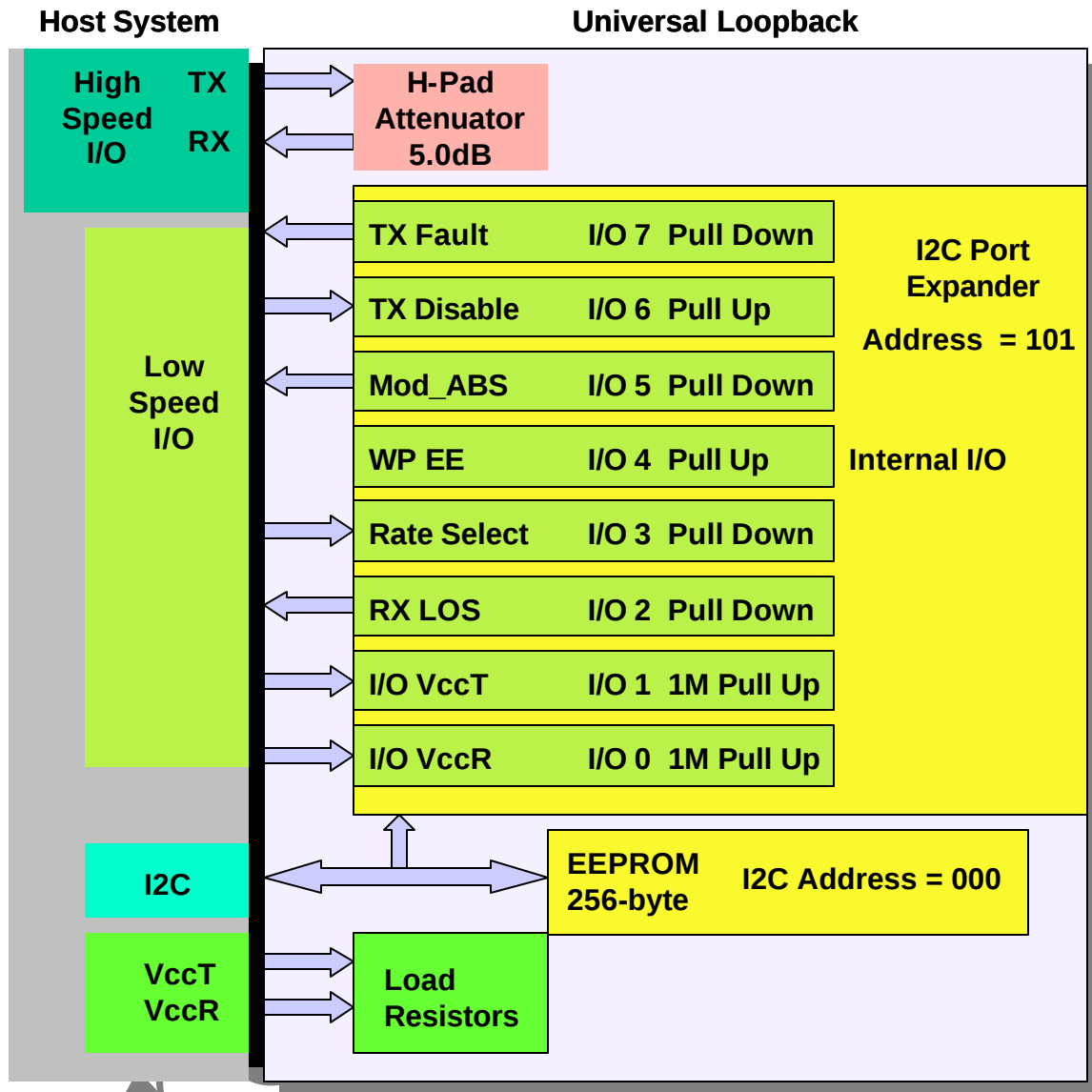
SFP+ Standard Loopback Serial ID

The 256-byte two-wire EEPROM is write protected on SFP+ Standard Loopback Module.



SFP+
Loopback
Adapter

Block Diagram with 8-bit I2C Port Expander for Low Speed Signaling



SFP+ Universal Loopback Serial ID

The 256-byte two-wire EEPROM is write protected on SFP+ Universal Loopback Module.



Printed Circuit Board Hose Connector Mating

Molex's SFP+ Loopback Adapter (p/n series 74765) contains a 0.039 inch thick printed circuit board that mates with the 20 position SMT host connector (Molex p/n 74441-0001) which complies with the SFP+ MSA recommended mating sequence. The printed circuit board pads were designed for a sequenced mating of:

- First mate – ground contacts
- Second mate – power contacts
- Third mate – signal contacts

The electrical pad layout is illustrated in Figure 1. Typical contact pad plating for the printed circuit board is 0.38 micrometers minimum hard gold over 1.27 micrometers minimum thick nickel. A diagram of the host connector is show in Figure 2. Signal inputs/outputs on the SFP+ transceiver modules from the 20-pin host connector are AC coupled and internally terminated to 100 ohms differential (TD+, TD-, RD+, RD-).

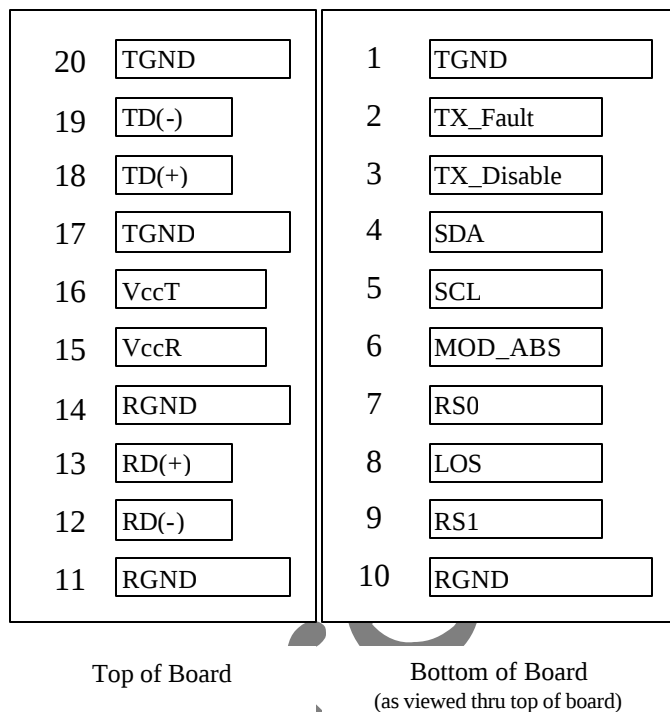


Figure 1. SFP+ Transceiver Electrical Pad Layout

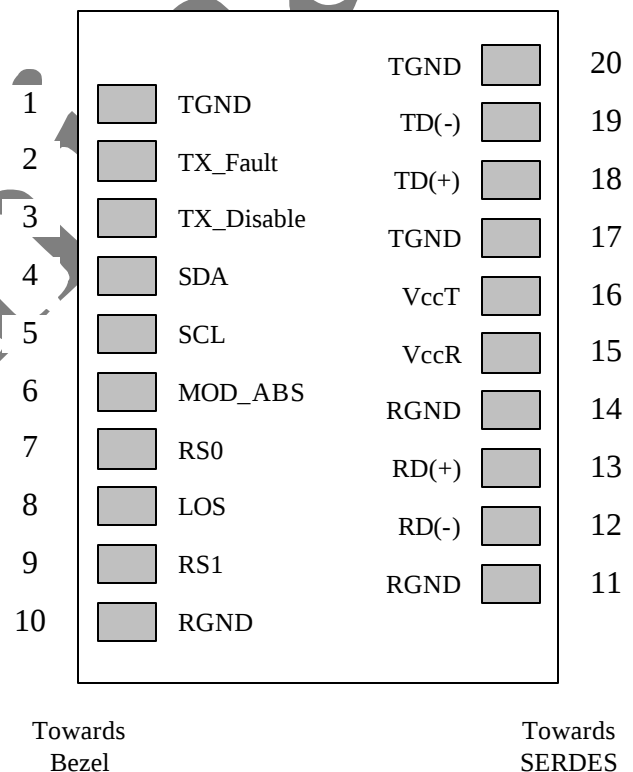


Figure 2. Diagram of the Host Board Connector Block Pin Number and Names



Power Supply Filtering Network

Recommended Power Supply Filtering Network

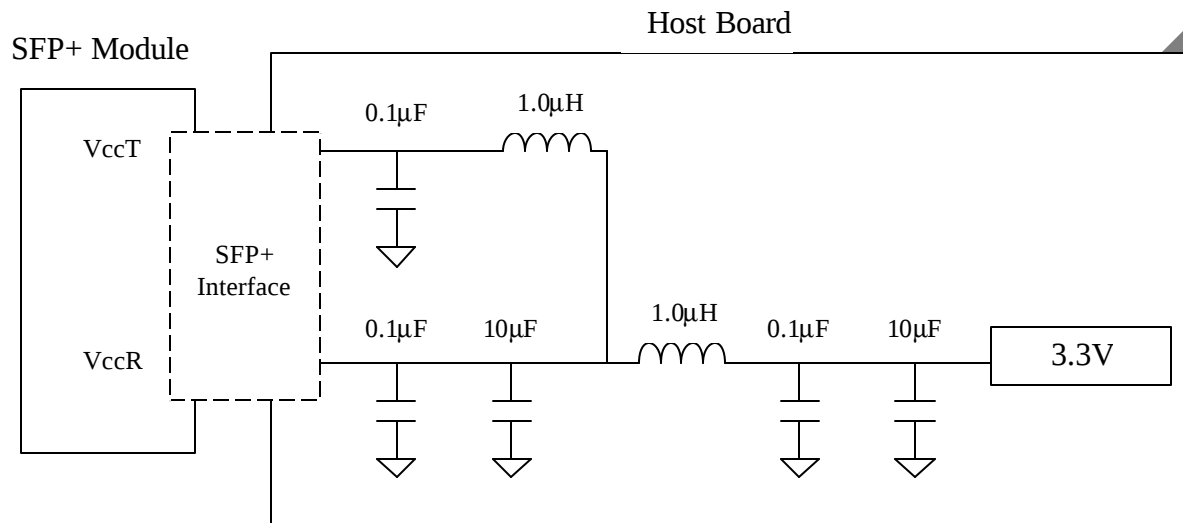


Figure 3. Recommended Host Board Supply Filtering Network

SFP+ AC Coupling

The SFP+ loopback high speed signals are internally AC coupled and terminated to 100 ohms.



Passive Electrical Interface – Pin Descriptions – Standard Loopback

Pin	Name	Description
PIN 1	TGND	Transmit ground
PIN 2	TX_FAULT	Internally tied to Transmit ground. TX_FAULT is not implemented.
PIN 3	TX_DISABLE	Internally pulled up to Vcc through a 5.11k ohm resistor. TX_DISABLE is not implemented.
PIN 4	SDA	Signal SDA (Data) of the 2-wire serial ID interface
PIN 5	SCL	Signal SCL (Clock) of the 2-wire serial ID interface
PIN 6	MOD_ABS	This pin is internally tied to Transmit ground
PIN 7	RS0	Pin is internally pulled low through a 33.2k resistor. Rate Select is not implemented.
PIN 8	LOS	Internally tied to Receiver Ground. LOS is not implemented.
PIN 9	RS1	Pin is internally pulled low through a 33.2k resistor. Rate Select is not implemented.
PIN 10	RGND	Receiver ground
PIN 11	RGND	Receiver ground
PIN 12	RD-	Differential receiver outputs. User to terminate to 100 ohms differential at SERDES.
PIN 13	RD+	Differential receiver outputs. User to terminate to 100 ohms differential at SERDES.
PIN 14	RGND	Receiver ground
PIN 15	VCCR	Receive power
PIN 16	VCCT	EEPROM power
PIN 17	TGND	Transmit ground
PIN 18	TD+	Differential transmitter inputs. Internally terminated to 100 ohms differential.
PIN 19	TD-	Differential transmitter inputs. Internally terminated to 100 ohms differential.
PIN 20	TGND	Transmit ground



Universal Loopback - I2C Port Expander Communications

The Philips PCA9557PW is an 8-bit parallel input/output port expander controlled over the I2C serial communications link. The port expander is open drain and contains registers for input, input polarity, output, and input/output configuration. I2C communications is similar to the serial ID EEPROM.

At power-on reset, all registers on the PCA9557PW return to their default states. All I/O pins default to inputs on reset or power-up.

I2C Control Byte for Port Expander:

Slave Address							R/W
0	0	1	1	A2	A1	A0	
Fixed				Programmable			

Control Register (Command Byte):

The control register is used to specify which I/O register is active.

0	0	0	0	0	0	D1	D0
---	---	---	---	---	---	----	----

D1	D0	Name	Type	Function
0	0	Register 0	Read	Input port register
0	1	Register 1	Read/Write	Output port register
1	0	Register 2	Read/Write	Polarity inversion register
1	1	Register 3	Read/Write	Input / Output configuration register

Input Register 0:

The input register is read-only. This register contains the logic level of the port expander's input or output pins.

I7	I6	I5	I4	I3	I2	I1	I0
----	----	----	----	----	----	----	----



Output Register 1:

The output register is used to set the logic level of output pins. An input pin is not effected by setting the bit in the output register.

Bit	O7	O6	O5	O4	O3	O2	O1	O0
Default	0	0	0	0	0	0	0	0

Polarity Register 2:

The polarity register sets the polarity inversion of the input pins. A zero written into the register will maintain the input pin's polarity.

Bit	N7	N6	N5	N4	N3	N2	N1	N0
Default	1	1	1	1	0	0	0	0

Configuration Register 3:

The configuration register sets the pin's direction to input or output. A zero written into the register will set the pin to an output. A one written into the register will set the pin to an input.

At power-up reset, the I/O pins will default to inputs.

Bit	C7	C6	C5	C4	C3	C2	C1	C0
Default	1	1	1	1	1	1	1	1



Reads / Writes

Reading and writing to the I2C port expander is similar to reading and writing to the serial EEPROMs. For a random read, the host issues a start, write control byte, sets the register address, issues a restart, read control byte, read the data. A random write is started with a start, write control byte, setting of the register address, and then writes the data.

Random Read

	Slave Address								Command Byte									
Start	0	0	1	1	A2	A1	A0	0	ACK	0	0	0	0	0	0	D1	D0	ACK
								Write										

	Slave Address									Read Data								
Restart	0	0	1	1	A2	A1	A0	1	ACK	Data								Stop
								Read										

Random Write

	Slave Address									Command Byte								
Start	0	0	1	1	A2	A1	A0	0	ACK	0	0	0	0	0	0	D1	D0	ACK
								Write										

Write Data								
Data								ACK Stop



Power-On I2C Port Expander Sequence

After a power-on-reset, the I2C port expander configuration and polarity must be initialized. Random writes were used to initialize the port expander.

The power-on sequence is as follows.

1. Set Configuration Register

Bus Address	0x05
Command Byte	0x03
Configuration Register	0x4B

2. Set Polarity Register to Normal

Bus Address	0x05
Command Byte	0x02
Configuration Register	0x00

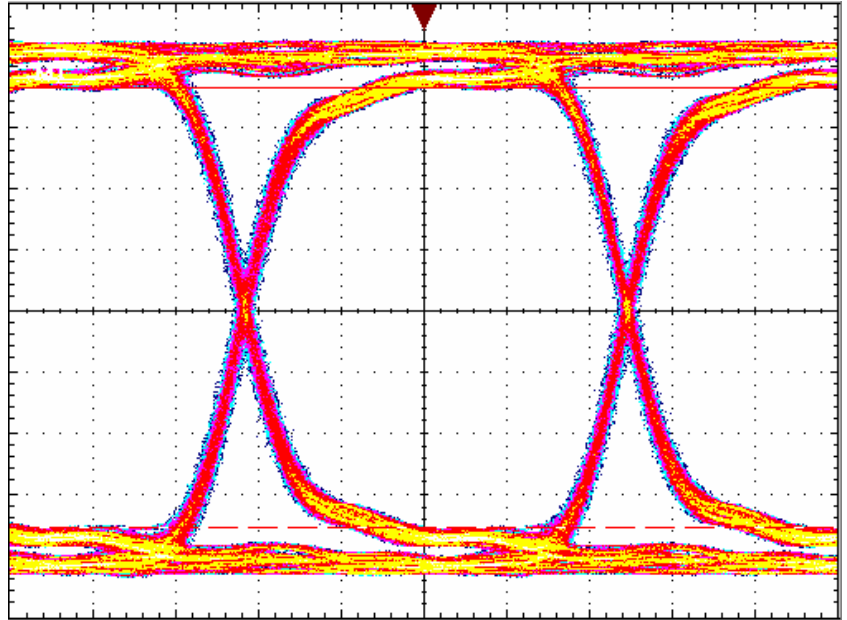


SFP+
Loopback
Adapter

Eye Diagrams

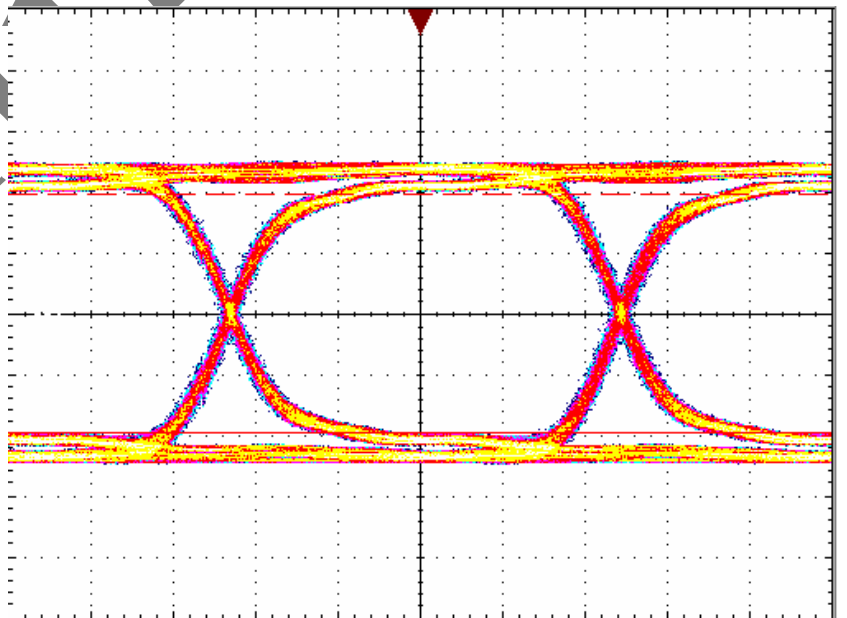
4.25Gbps, 0.0 dB, 2⁷ PRBS

Parameters	Results	Units
Rail	1096	mV _{pp}
Eye Height	898	mV _{pp}
Jitter	13	ps
Rise (20-80)	79	ps
Fall (20-80)	80	ps



4.25Gbps, 5.0 dB, 2⁷ PRBS

Parameters	Results	Units
Rail	619	mV _{pp}
Eye Height	490	mV _{pp}
Jitter	13	ps
Rise (20-80)	80	ps
Fall (20-80)	81	ps

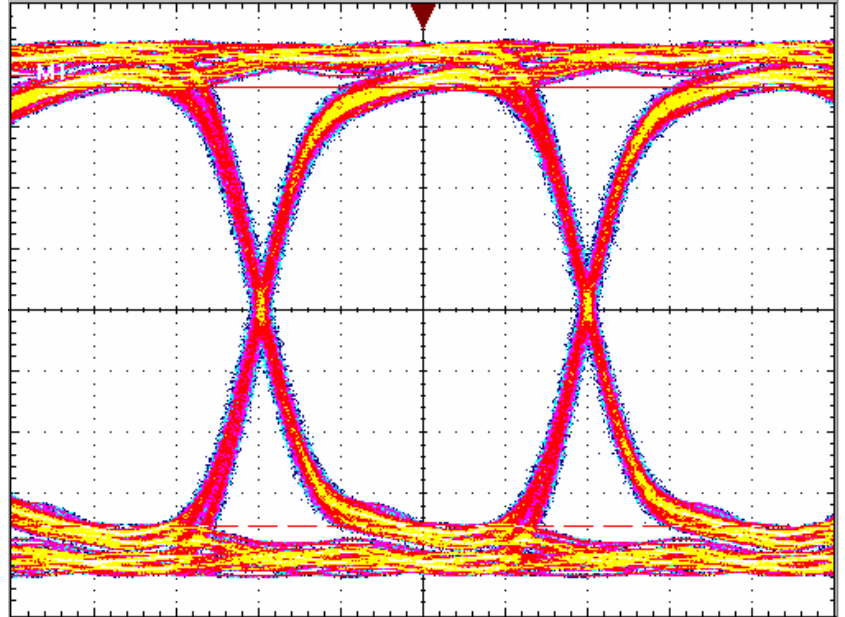




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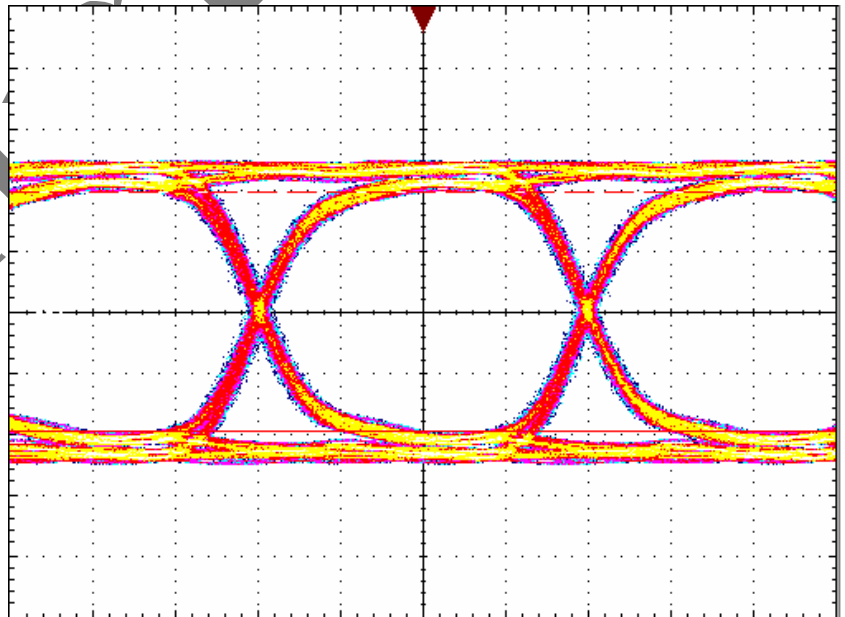
5.0Gbps, 0.0 dB, 2⁷ PRBS

Parameters	Results	Units
Rail	1100	mV _{pp}
Eye Height	899	mV _{pp}
Jitter	14	ps
Rise (20-80)	78	ps
Fall (20-80)	80	ps



5.0Gbps, 5.0 dB, 2⁷ PRBS

Parameters	Results	Units
Rail	622	mV _{pp}
Eye Height	490	mV _{pp}
Jitter	16	ps
Rise (20-80)	81	ps
Fall (20-80)	83	ps

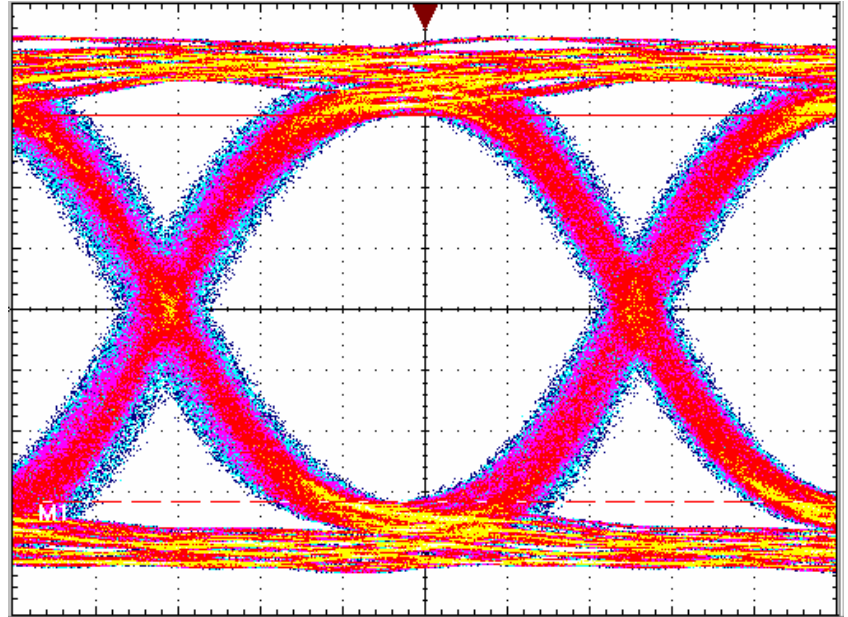




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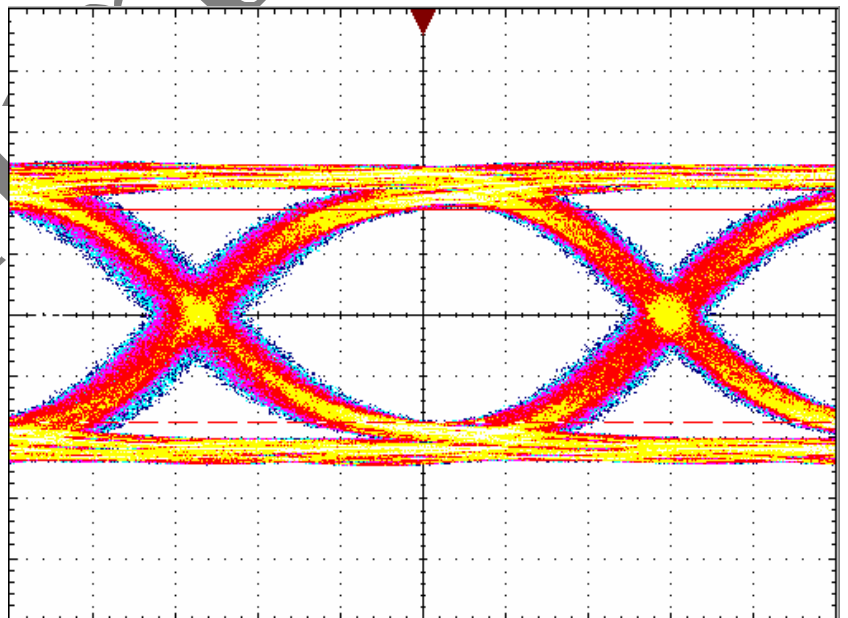
8.75Gbps, 0.0 dB, 2⁷ PRBS

Parameters	Results	Units
Rail	1100	mV _{pp}
Eye Height	794	mV _{pp}
Jitter	25	ps
Rise (20-80)	65	ps
Fall (20-80)	66	ps



8.75Gbps, 5.0 dB, 2⁷ PRBS

Parameters	Results	Units
Rail	619	mV _{pp}
Eye Height	436	mV _{pp}
Jitter	25	ps
Rise (20-80)	66	ps
Fall (20-80)	67	ps

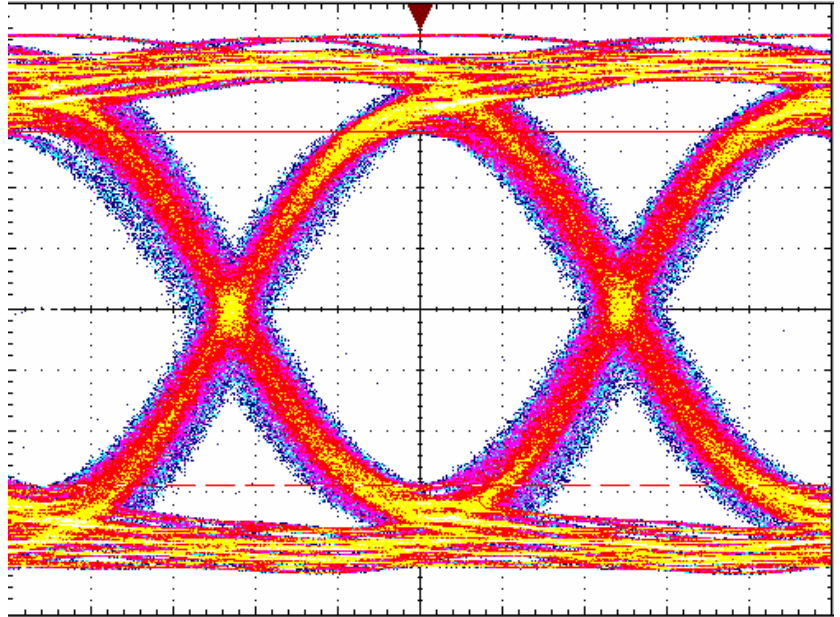




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Loopback
Adapter

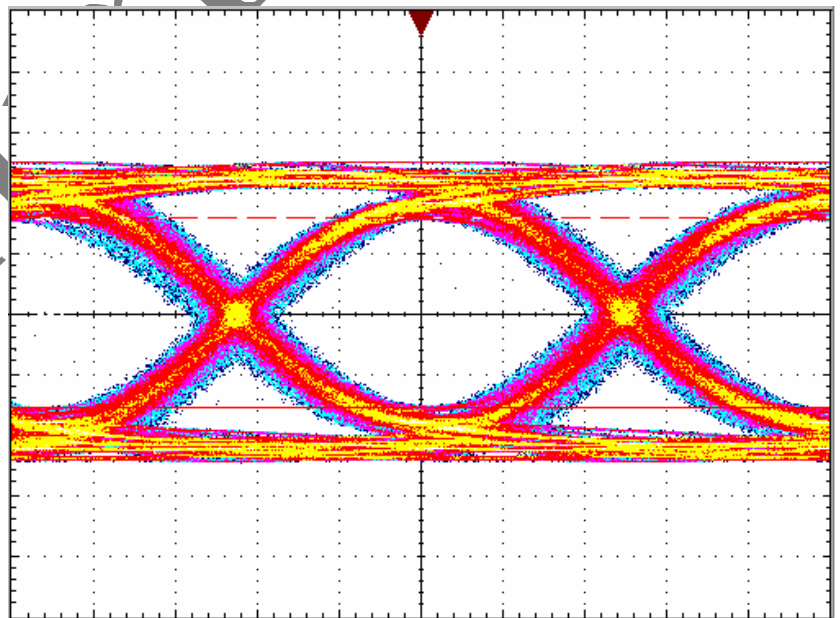
10.3Gbps, 0.0 dB, 2⁷ PRBS

Parameters	Results	Units
Rail	1106	mV _{pp}
Eye Height	726	mV _{pp}
Jitter	24	ps
Rise (20-80)	65	ps
Fall (20-80)	64	ps



10.3Gbps, 5.0 dB, 2⁷ PRBS

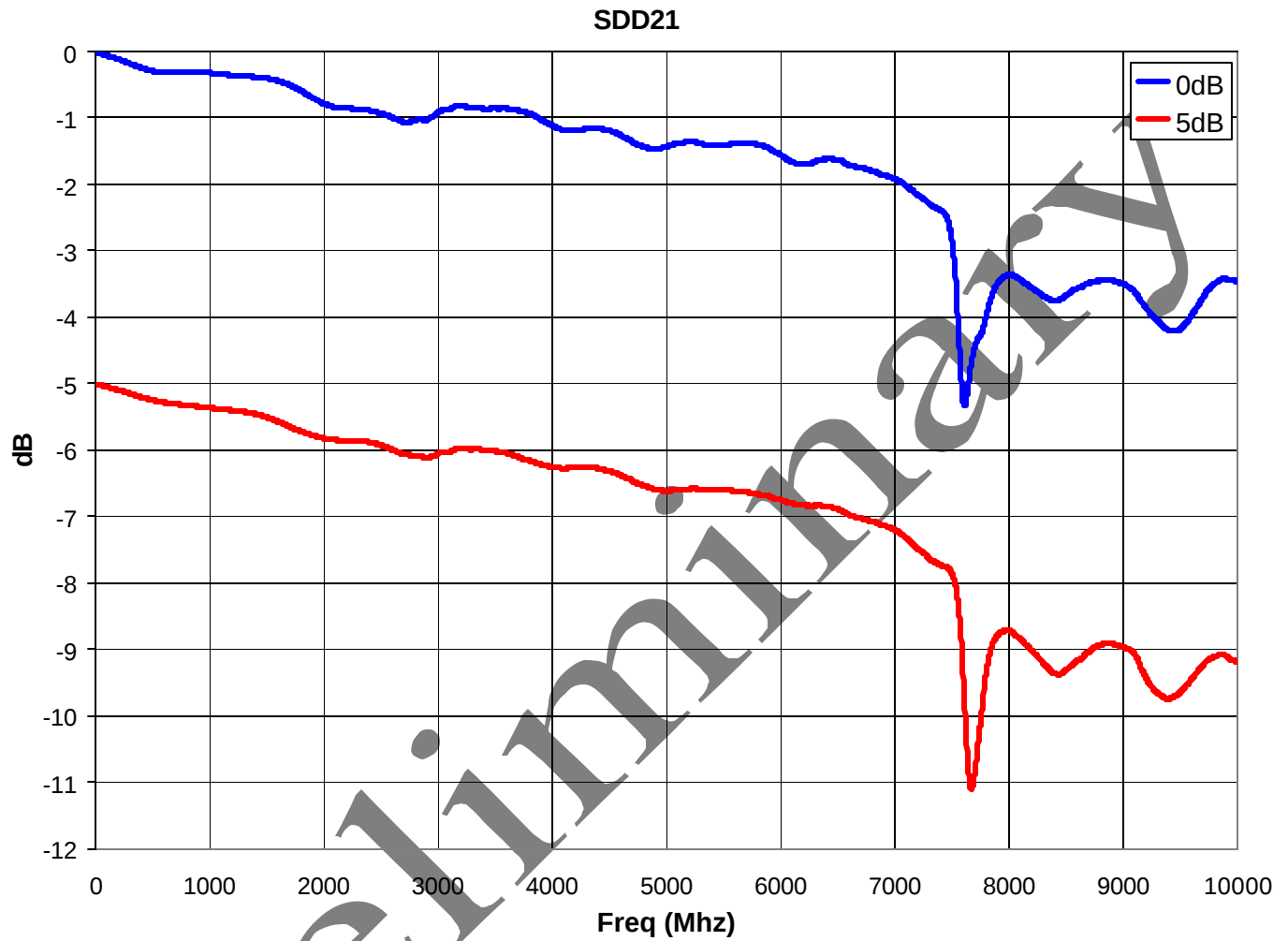
Parameters	Results	Units
Rail	622	mV _{pp}
Eye Height	392	mV _{pp}
Jitter	26	ps
Rise (20-80)	64	ps
Fall (20-80)	63	ps





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Insertion Loss – SDD21

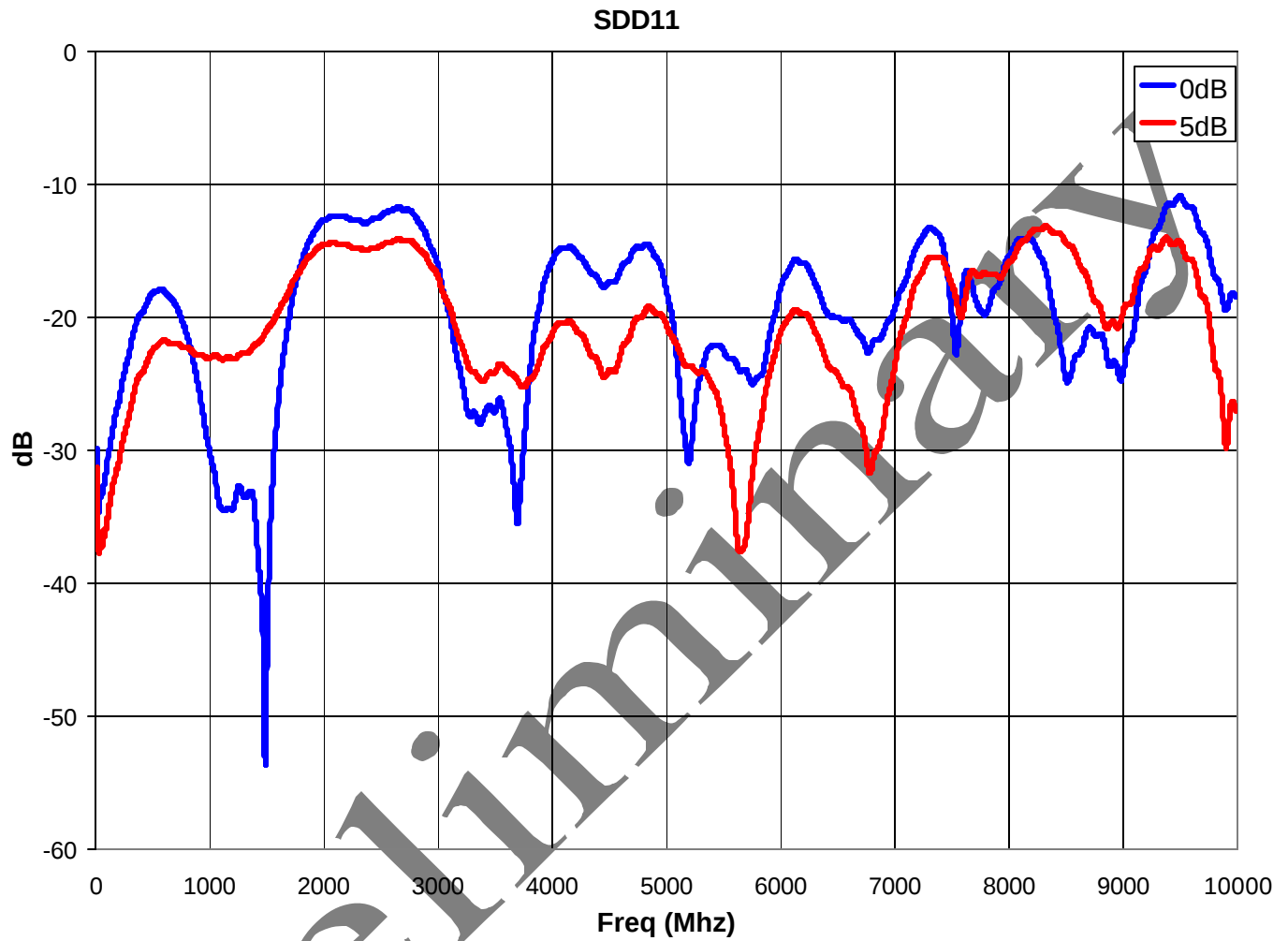


**The 7,750 MHz insertion loss dips are due to the test fixture.



SFP+
Loopback
Adapter

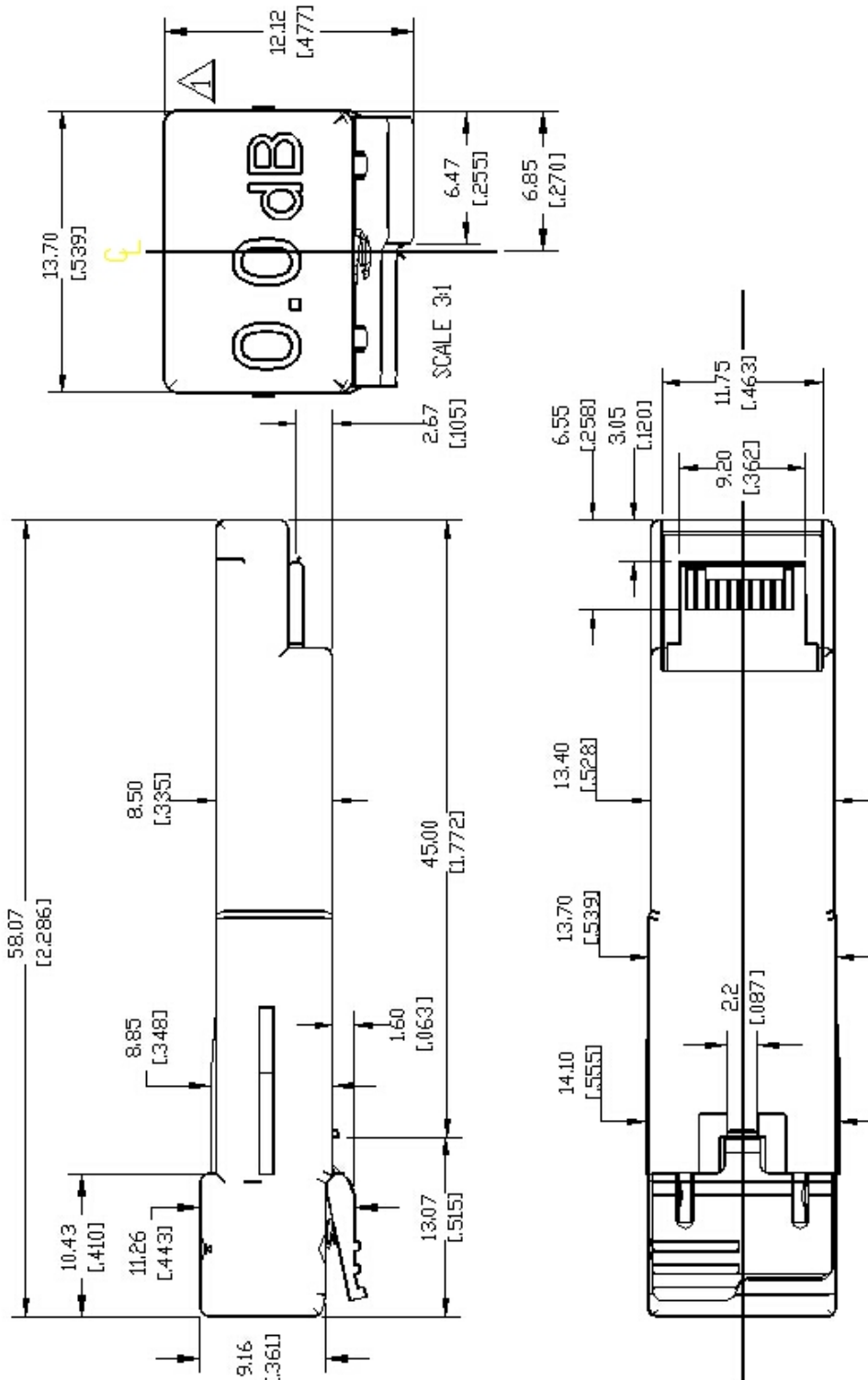
Return Loss – SDD11





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Module Dimensions





SFP+ Loopback Adapter

SFP+ Serial ID (Addresses 0 – 127)

Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	ASCII
0	03	SFP+	40	37	7	84	30	Y
1	04	Serial ID	41	34	4	85	32	Y
2	80	Vendor	42	37	7	86	30	M
3	01	Passive – IB	43	36	6	87	31	M
4	00		44	35	5	88	30	D
5	00		45	2D	-	89	33	D
6	04	1000Base-CX	46	30	0	90	00	
7	41	Link Lengths	47	30	0	91	00	
8	84	Cu Passive	48	30	0	92	00	
9	80	Twin Axial Pair	49	31	1	93	00	
10	D5	12 to 1 Mbps	50	20		94	00	
11	00	Unspecified	51	20		95	xx	CC Extended *
12	78	12000/100	52	20		96	00	
13	00		53	20		97	00	
14	00		54	20		98	00	
15	00		55	20		99	00	
16	00		56	41	Rev A	100	00	
17	00		57	20		101	00	
18	00	Cable Length	58	20		102	00	
19	00		59	20		103	00	
20	4D	M	60	00		104	00	
21	6F	o	61	00		105	00	
22	6C	l	62	00		106	00	
23	65	e	63	xx	CC Base *	107	00	
24	78	x	64	00		108	00	
25	20		65	00	No Options	109	00	
26	49	l	66	00		110	00	
27	6E	n	67	00		111	00	
28	63	c	68	35	Y	112	00	
29	2E	.	69	31	J	113	00	
30	20		70	32	U	114	00	
31	20		71	33	L	115	00	
32	20		72	34	T	116	00	
33	20		73	30	X	117	00	
34	20		74	30	X	118	00	
35	20		75	33	X	119	00	
36	00		76	32	X	120	00	
37	00	Vendor OUI	77	20		121	00	
38	09		78	20		122	00	
39	3A		79	20		123	00	
			80	20		124	00	
			81	20		125	00	
			82	20		126	00	
			83	20		127	00	

* Checksum calculated during programming.



SFP+
Loopback
Adapter

SFP+ Serial ID (Addresses 128 – 255)

Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	ASCII
128	00		172	00		216	00	
129	00		173	00		217	00	
130	00		174	00		218	00	
131	00		175	00		219	00	
132	00		176	00		220	00	
133	00		177	00		221	00	
134	00		178	00		222	00	
135	00		179	00		223	00	
136	00		180	00		224	00	
137	00		181	00		225	00	
138	00		182	00		226	00	
139	00		183	00		227	00	
140	00		184	00		228	00	
141	00		185	00		229	00	
142	00		186	00		230	00	
143	00		187	00		231	00	
144	00		188	00		232	00	
145	00		189	00		233	00	
146	00		190	00		234	00	
147	00		191	00		235	00	
148	00		192	00		236	00	
149	00		193	00		237	00	
150	00		194	00		238	00	
151	00		195	00		239	00	
152	00		196	00		240	00	
153	00		197	00		241	00	
154	00		198	00		242	00	
155	00		199	00		243	00	
156	00		200	00		244	00	
157	00		201	00		245	00	
158	00		202	00		246	00	
159	00		203	00		247	00	
160	00		204	00		248	00	
161	00		205	00		249	00	
162	00		206	00		250	00	
163	00		207	00		251	00	
164	00		208	00		252	00	
165	00		209	00		253	00	
166	00		210	00		254	00	
167	00		211	00		255	00	
168	00		212	00				
169	00		213	00				
170	00		214	00				
171	00		215	00				

* Checksum calculated during programming.