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FINAL REPORT FOR:

CUSTOMER NAME: Schneider Electric India Pvt. Ltd.
L3, Verna Industrial Estate,
Verna, Goa, India 403722

PRODUCT NAME: 24 Channel Link System SM
Configuration

Tested To:

ANSI/TIA 568 C.0
Generic Telecommunications Cabling for Customer Premises
February 2009

**Annex E (Informative) Guidelines for Field-Testing Length, Loss & Polarity
Of Optical Fiber Cabling for Attenuation Loss Testing**

Date: April 24, 2013
Project: G101095365
Report: 101095365LEX-001

Responsible Engineer:  **Date:** 4/24/2013
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Approved By:  **Date:** 4/24/2013
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Table 1: History of Revision

Revision	Date	Section #	Description of Revision
Original	April 24, 2013	All	Original Document Issued

Declaration of Compliance

The 24 Channel Link System SM Configuration was evaluated and found to be **compliant** with all applicable criteria of ANSI/TIA 568 C.0 Generic Telecommunications Cabling for Customer Premises, February 2009, Annex E (Informative) Guidelines for Field-Testing Length, Loss & Polarity of Optical Fiber Cabling for Attenuation Loss Testing.

Sample Condition and Receive Date

Schneider Electric India Pvt. Ltd. selected and provided the test samples for evaluation to the criteria of ANSI/TIA 568 C.0. The samples arrived on 4/4/2013. The equipment tested was the 24 Channel Link System SM Configuration.

1 ANSI/TIA 568 C.0 Generic Telecommunications Cabling for Customer Premises

1.1 Annex E (Informative) Guidelines for Field-Testing Length, Loss & Polarity of Optical Fiber Cabling for Attenuation Loss Testing

1.1.1 Attenuation Loss Testing

1.1.1.1 Conformance Criteria

The cable link system shall not exhibit a change greater than the value stated in Table 2 for the singlemode test condition and the corresponding product type evaluation.

For this evaluation, the criteria is for a Ethernet 10GBASE-LX4 system measured at 1310 nm TIA 492CAAA (OS1) having a maximum channel value of 6.3 dB as indicated by the matching values in Table 2.

Table 2: ANSI/TIA 568 C.0 - Table 7 - Maximum Supportable Distances and Attenuation for Optical Fiber Applications by Fiber Type

Application	Parameter Nominal wavelength (nm)	Multimode						Single-mode	
		62.5/125 µm TIA 492AAAA (OM1)		50/125 µm TIA 492AAAB (OM2)		850 nm laser- optimized 50/125 µm TIA 492AAAC (OM3)		TIA 492CAA (OS1)	TIA 492CAAB (OS2)
		850	1300	850	1300	850	1300	1310	1550
Ethernet 10/100BASE-SX	Channel attenuation (dB)	4.0	-	4.0	-	4.0	-	-	-
	Supportable distance m (ft)	300 (984)	-	300 (984)	-	300 (984)	-	-	-
Ethernet 100BASE-FX	Channel attenuation (dB)	-	11.0	-	6.0	-	6.0	-	-
	Supportable distance m (ft)	-	2000 (6560)	-	2000 (6560)	-	2000 (6560)	-	-
Ethernet 1000BASE-SX	Channel attenuation (dB)	2.6	-	3.6	-	4.5	-	-	-
	Supportable distance m (ft)	275 (900)	-	550 (1804)	-	800 (2625)	-	-	-
Ethernet 1000BASE-LX	Channel attenuation (dB)	-	2.3	-	2.3	-	2.3	4.5	-
	Supportable distance m (ft)	-	550 (1804)	-	550 (1804)	-	550 (1804)	5000 (16405)	-
Ethernet 10GBASE-S	Channel attenuation (dB)	2.4	-	2.3	-	2.6	-	-	-
	Supportable distance m (ft)	33 (108)	-	82 (269)	-	300 (984)	-	-	-
Ethernet 10GBASE-LX4	Channel attenuation (dB)	-	2.5	-	2.0	-	2.0	6.3	-
	Supportable distance m (ft)	-	300 (984)	-	300 (984)	-	300 (984)	10000 (32810)	-
Ethernet 10GBASE-L	Channel attenuation (dB)	-	-	-	-	-	-	6.2	-
	Supportable distance m (ft)	-	-	-	-	-	-	10000 (32810)	-
Ethernet 10GBASE-LRM	Channel attenuation (dB)	-	1.9	-	1.9	-	1.9	-	-
	Supportable distance m (ft)	-	220 (720)	-	220 (720)	-	220 (720)	-	-
Fibre Channel 100-MX-SN-I (1062 Mbaud)	Channel attenuation (dB)	3.0	-	3.9	-	4.6	-	-	-
	Supportable distance m (ft)	300 (984)	-	500 (1640)	-	860 (2822)	-	-	-

Application	Nominal wavelength (nm)	850	1300	850	1300	850	1300	1310	1550
Fibre Channel 100-SM-LC-L (1062 Mbaud)	Channel attenuation (dB)	-	-	-	-	-	-	7.8	-
	Supportable distance m (ft)	-	-	-	-	-	-	10000 (32810)	-
Fibre Channel 200-MX-SN-I (2125 Mbaud)	Channel attenuation (dB)	2.1	-	2.6	-	3.3	-	-	-
	Supportable distance m (ft)	150 (492)	-	300 (984)	-	500 (1640)	-	-	-
Fibre Channel 200-SM-LC-L (2125 Mbaud)	Channel attenuation (dB)	-	-	-	-	-	-	7.8	-
	Supportable distance m (ft)	-	-	-	-	-	-	10000 (32810)	-
Fibre Channel 400-MX-SN-I (4250 Mbaud)	Channel attenuation (dB)	1.8	-	2.1	-	2.5	-	-	-
	Supportable distance m (ft)	70 (230)	-	150 (492)	-	270 (886)	-	-	-
Fibre Channel 400-SM-LC-L (4250 Mbaud)	Channel attenuation (dB)	-	-	-	-	-	-	7.8	-
	Supportable distance m (ft)	-	-	-	-	-	-	10000 (32810)	-
Fibre Channel 1200-MX-SN-I (10512 Mbaud)	Channel attenuation (dB)	2.4	-	2.2	-	2.6	-	-	-
	Supportable distance m (ft)	33 (108)	-	82 (269)	-	300 (984)	-	-	-
Fibre Channel 1200-SM-LL-L (10512 Mbaud)	Channel attenuation (dB)	-	-	-	-	-	-	6.0	-
	Supportable distance m (ft)	-	-	-	-	-	-	10000 (32810)	-
FDDI PMD ANSI X3.166	Channel attenuation (dB)	-	11.0	-	6.0	-	6.0	-	-
	Supportable distance m (ft)	-	2000 (6560)	-	2000 (6560)	-	2000 (6560)	-	-
FDDI SMF-PMD ANSI X3.184	Channel attenuation (dB)	-	-	-	-	-	-	10.0	-
	Supportable distance m (ft)	-	-	-	-	-	-	10000 (32810)	-

1.1.1.2 Sample Size

One 24 Channel Link System SM Configuration was tested for compliance to ANSI/TIA 568 C.0.

1.1.1.3 Test Method

I. Test Methodology and Setup

1. The RIFOCS test system was setup and allowed to stabilize for 1 hour prior to testing.
2. One ST/LC SM 2 mm jacketed cable launch lead was connected to the RIFOCS 1310 nm source.
3. One ST/LC SM 2 mm jacketed cable launch lead was connected to the RIFOCS detector.
4. Per ANSI/TIA 568 C.0, Section E, the following test method steps were established. All references from this test method to clause and sub-clause refer directly back to this standard and section for development of the procedures used.

5. The basic steps taken to measure and calculate singlemode cabling attenuation include:
 - a. Verifying test jumper quality (once before testing; see clause E.5.1.2)
 - b. Setting the reference (once before testing; see clause E.5.1.4.2)
 - c. Measuring link attenuation (each link; see clause E.5.1.4.3)
 - d. Calculating link attenuation (each link; see clause E.5.1.5).

II. Verifying Test Jumper Reference Quality

1. The following procedure verified that test jumpers are in acceptable condition for singlemode cabling.
2. To verify that the test jumper was in acceptable condition, the light source was referenced to the optical power meter with the launch (see Figure 1).
3. The test jumper (J1) was disconnected from the power meter (only) and a second test jumper (J2) was inserted by connecting it to (J1) with a mating adapter and then to the power meter to record the measurement (see Figure 2).
4. Both ends of J2 were disconnected, the ends were interchanged, reconnected and the measurement was read again.
5. The resulting measurements were within the appropriate connector loss specification for reference quality test jumpers ≤ 0.1 dB.

III. Setting the Reference

1. The first jumper (J1) having one non-overlapping 30 mm (1.2 inches) wrap of singlemode fiber on a mandrel was connected to the 1310 nm source.
2. The resulting measurements recorded as the initial, or P1, measurements.

IV. Measuring Link Attenuation

1. TIA-526-7, Method A-1 was used to test singlemode cabling attenuation.
2. The 24 Channel Link System SM Configuration was setup per the manufacturer's instructions. All connections were cleaned, mated and verified to be functional prior to the beginning of testing.
3. The reference measurements were established prior to each connection to verify there was no change or drift from the initial reference measurements.
4. The link measurement was then performed on the first channel by disconnecting this test jumper from the optical meter (only), placing a second jumper (J2) previously verified as reference quality on the optical meter, and then measuring the link attenuation by connecting the test jumper of the source to one end of the cabling link and the test jumper of the meter to the other end of the cabling link.

5. The resulting measurements recorded as the final, or P2, measurements in the forward direction.
6. Both ends of the cabling link were disconnected, the ends were interchanged, reconnected and the measurement was read again.
7. The resulting measurements recorded as the final, or P2, measurements in the reverse direction.

V. Calculating Link Attenuation

1. The following formula is used to calculate the loss on each channel:
 - a. Initial measurements of launch lead (P1) minus Final measurements of individual link channel (P2) = Loss of link channel in dB.
2. The loss for each channel is calculated in the forward and reverse directions, as well as an averaging of these losses for complete channel loss calculations.
3. The loss for each channel, as well as the measurement direction the loss was calculated in, was reported individually in the **Test Results** section of this report.

1.1.1.4 Test Configurations and Conditions

The test was conducted at lab ambient atmospheric conditions; $23 \pm 2^{\circ}\text{C}$, $\sim 75\%$ RH.

Optical measurements were taken at 1310 nm.

The launch lead used was verified to be reference quality per the standard.

The test condition setup and referencing is demonstrated in Figure 1.

The test measurement configuration is demonstrated in Figure 2.

The customer's equipment individual part identification numbers are listed in Table 3.

Figure 1: Launch Lead Reference and Verification

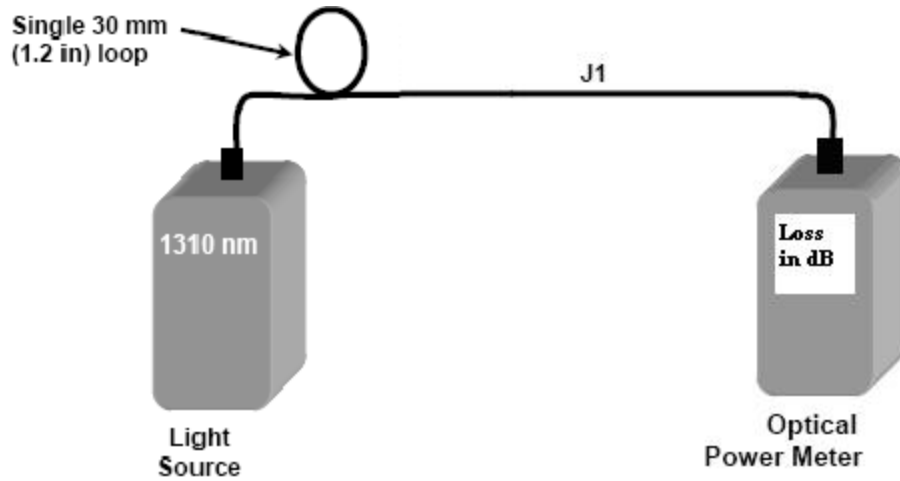


Figure 2: Cable Link Channel Testing Configuration

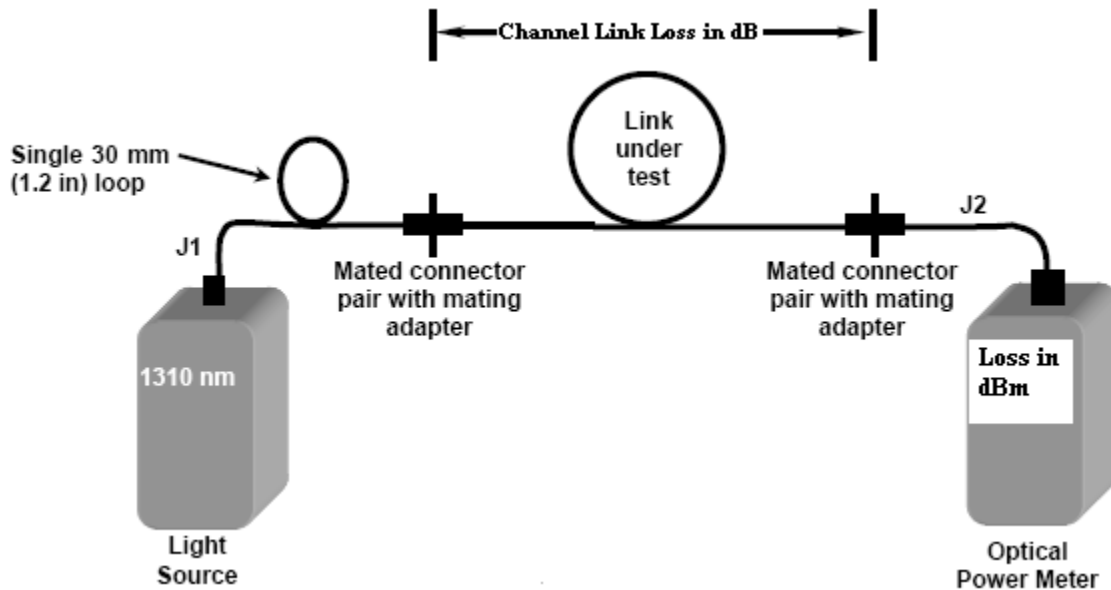


Table 3: Part Numbers and Quantities

Item	Smartlink Part Number	Description	Qty
1	DFCAO09GST24	DIGILINK SM 300 Meter 24 Fiber Cable	1
2	DFPCD1LCLC02	DIGILINK SM Duplex LCLC Fiber Patch Cord	2
3	DFPGS1LCXX01	DIGILINK SM Pigtail	48
4	DFBOX24RXXXX	DIGILINK Fiber 24 Port Rack Mount LIU	2
5	DFADLCTYPDZS	DIGILINK Fiber Adaptor	24
6	DFPNLLC06X	DIGILINK Fiber Adaptor Module Panel	4

1.1.1.5 Test Equipment Used

Attenuation Loss Testing					
Equipment Type	Manufacturer	Model Number	Local ID Number	Last Cal Date	Next Cal Date
Fiber Optic Cleaning Reels	CLETOP	Type A	NA	NA	NA
1310 nm (±20 nm) LED Source	RIFOCS	655R	1999	NA	NA
InGaAs Power Meter	RIFOCS	675RE	1999	10/11/2012	10/11/2013
SuperController	RIFOCS	671	1999	10/11/2012	10/11/2013
Mandrel Wrap Tool (Mandrel Size = 30 mm)	Intertek	NA	NA	NA	NA
Optical Fiber Singlemode 9/125 μm 2 mm Jacketed Cable (Launch Lead)	FIS	T3L8S1FIS 9/1252M	NA	NA	NA

NA: Not Applicable

1.1.1.6 Summary of Test Results

Conformance/Nonconformance

Criteria	Conforms? C/NC
<p>The cable link system shall not exhibit a change greater than the value stated in Table 2 for the singlemode test condition and the corresponding product type evaluation.</p> <p>For this evaluation, the criteria is for a Ethernet 10GBASE-LX4 system measured at 1310 nm TIA 492CAAA (OS1) having a maximum channel value of 6.3 dB as indicated by the matching values in Table 2.</p>	C

Actual Sample Size and Test Method Deviations

One 24 Channel Link System SM Configuration was tested for compliance to this section. There were no deviations from, additions to, or exclusions from, the documented test method here.

Failure History

There was no history of failure for the testing in this section.

Disposition of Nonconformance

There was no failure for the testing in this section.

Test Data

Table 4: Insertion Loss Forward Reading at 1310 nm

Test Performed By:			Test Date		
Paul Alt			4/12/2013		
Test Channel	Test Configuration	Directional Reading	Max Value (dB)	Loss Criteria	Complies? Y/N
1	24 Channel SM (OS1)	Forward	-0.46	$\leq \pm 6.30$ dB	Y
2	24 Channel SM (OS1)	Forward	-0.95	$\leq \pm 6.30$ dB	Y
3	24 Channel SM (OS1)	Forward	-1.62	$\leq \pm 6.30$ dB	Y
4	24 Channel SM (OS1)	Forward	-0.83	$\leq \pm 6.30$ dB	Y
5	24 Channel SM (OS1)	Forward	-0.93	$\leq \pm 6.30$ dB	Y
6	24 Channel SM (OS1)	Forward	-4.55	$\leq \pm 6.30$ dB	Y
7	24 Channel SM (OS1)	Forward	-0.60	$\leq \pm 6.30$ dB	Y
8	24 Channel SM (OS1)	Forward	-2.86	$\leq \pm 6.30$ dB	Y
9	24 Channel SM (OS1)	Forward	-0.49	$\leq \pm 6.30$ dB	Y
10	24 Channel SM (OS1)	Forward	-0.63	$\leq \pm 6.30$ dB	Y
11	24 Channel SM (OS1)	Forward	-0.45	$\leq \pm 6.30$ dB	Y
12	24 Channel SM (OS1)	Forward	-0.82	$\leq \pm 6.30$ dB	Y
13	24 Channel SM (OS1)	Forward	-0.94	$\leq \pm 6.30$ dB	Y
14	24 Channel SM (OS1)	Forward	-0.55	$\leq \pm 6.30$ dB	Y
15	24 Channel SM (OS1)	Forward	-0.75	$\leq \pm 6.30$ dB	Y
16	24 Channel SM (OS1)	Forward	-0.65	$\leq \pm 6.30$ dB	Y
17	24 Channel SM (OS1)	Forward	-3.69	$\leq \pm 6.30$ dB	Y
18	24 Channel SM (OS1)	Forward	-0.76	$\leq \pm 6.30$ dB	Y
19	24 Channel SM (OS1)	Forward	-0.82	$\leq \pm 6.30$ dB	Y
20	24 Channel SM (OS1)	Forward	-0.59	$\leq \pm 6.30$ dB	Y
21	24 Channel SM (OS1)	Forward	-0.51	$\leq \pm 6.30$ dB	Y
22	24 Channel SM (OS1)	Forward	-0.52	$\leq \pm 6.30$ dB	Y
23	24 Channel SM (OS1)	Forward	-0.36	$\leq \pm 6.30$ dB	Y
24	24 Channel SM (OS1)	Forward	-0.96	$\leq \pm 6.30$ dB	Y

Table 5: Insertion Loss Reverse Reading at 1310 nm

Test Performed By:			Test Date		
Paul Alt			4/12/2013		
Test Channel	Test Configuration	Directional Reading	Max Value (dB)	Loss Criteria	Complies? Y/N
1	24 Channel SM (OS1)	Reverse	-0.39	$\leq \pm 6.30$ dB	Y
2	24 Channel SM (OS1)	Reverse	-1.15	$\leq \pm 6.30$ dB	Y
3	24 Channel SM (OS1)	Reverse	-1.45	$\leq \pm 6.30$ dB	Y
4	24 Channel SM (OS1)	Reverse	-0.91	$\leq \pm 6.30$ dB	Y
5	24 Channel SM (OS1)	Reverse	-0.95	$\leq \pm 6.30$ dB	Y
6	24 Channel SM (OS1)	Reverse	-4.58	$\leq \pm 6.30$ dB	Y
7	24 Channel SM (OS1)	Reverse	-0.64	$\leq \pm 6.30$ dB	Y
8	24 Channel SM (OS1)	Reverse	-2.93	$\leq \pm 6.30$ dB	Y
9	24 Channel SM (OS1)	Reverse	-0.51	$\leq \pm 6.30$ dB	Y
10	24 Channel SM (OS1)	Reverse	-0.72	$\leq \pm 6.30$ dB	Y
11	24 Channel SM (OS1)	Reverse	-0.48	$\leq \pm 6.30$ dB	Y
12	24 Channel SM (OS1)	Reverse	-1.02	$\leq \pm 6.30$ dB	Y
13	24 Channel SM (OS1)	Reverse	-1.10	$\leq \pm 6.30$ dB	Y
14	24 Channel SM (OS1)	Reverse	-0.57	$\leq \pm 6.30$ dB	Y
15	24 Channel SM (OS1)	Reverse	-0.87	$\leq \pm 6.30$ dB	Y
16	24 Channel SM (OS1)	Reverse	-0.75	$\leq \pm 6.30$ dB	Y
17	24 Channel SM (OS1)	Reverse	-3.78	$\leq \pm 6.30$ dB	Y
18	24 Channel SM (OS1)	Reverse	-0.86	$\leq \pm 6.30$ dB	Y
19	24 Channel SM (OS1)	Reverse	-0.95	$\leq \pm 6.30$ dB	Y
20	24 Channel SM (OS1)	Reverse	-0.70	$\leq \pm 6.30$ dB	Y
21	24 Channel SM (OS1)	Reverse	-0.56	$\leq \pm 6.30$ dB	Y
22	24 Channel SM (OS1)	Reverse	-0.71	$\leq \pm 6.30$ dB	Y
23	24 Channel SM (OS1)	Reverse	-0.50	$\leq \pm 6.30$ dB	Y
24	24 Channel SM (OS1)	Reverse	-1.04	$\leq \pm 6.30$ dB	Y

Table 6: Insertion Loss Average Reading at 1310 nm

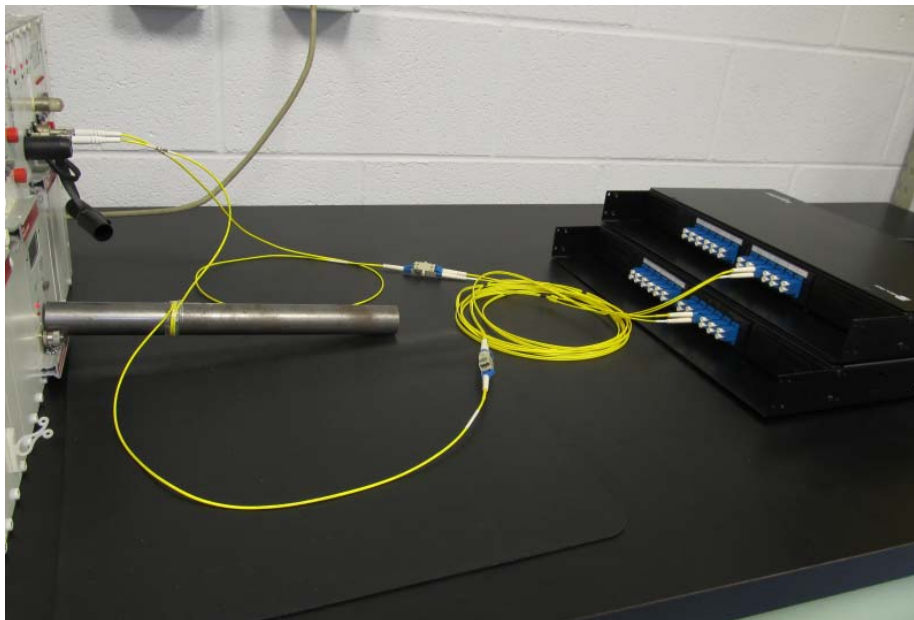
Test Performed By:			Test Date		
Paul Alt			4/12/2013		
Test Channel	Test Configuration	Directional Reading	Max Value (dB)	Loss Criteria	Complies? Y/N
1	24 Channel SM (OS1)	Average	-0.43	$\leq \pm 6.30$ dB	Y
2	24 Channel SM (OS1)	Average	-1.05	$\leq \pm 6.30$ dB	Y
3	24 Channel SM (OS1)	Average	-1.54	$\leq \pm 6.30$ dB	Y
4	24 Channel SM (OS1)	Average	-0.87	$\leq \pm 6.30$ dB	Y
5	24 Channel SM (OS1)	Average	-0.94	$\leq \pm 6.30$ dB	Y
6	24 Channel SM (OS1)	Average	-4.57	$\leq \pm 6.30$ dB	Y
7	24 Channel SM (OS1)	Average	-0.62	$\leq \pm 6.30$ dB	Y
8	24 Channel SM (OS1)	Average	-2.90	$\leq \pm 6.30$ dB	Y
9	24 Channel SM (OS1)	Average	-0.50	$\leq \pm 6.30$ dB	Y
10	24 Channel SM (OS1)	Average	-0.67	$\leq \pm 6.30$ dB	Y
11	24 Channel SM (OS1)	Average	-0.47	$\leq \pm 6.30$ dB	Y
12	24 Channel SM (OS1)	Average	-0.92	$\leq \pm 6.30$ dB	Y
13	24 Channel SM (OS1)	Average	-1.02	$\leq \pm 6.30$ dB	Y
14	24 Channel SM (OS1)	Average	-0.56	$\leq \pm 6.30$ dB	Y
15	24 Channel SM (OS1)	Average	-0.81	$\leq \pm 6.30$ dB	Y
16	24 Channel SM (OS1)	Average	-0.70	$\leq \pm 6.30$ dB	Y
17	24 Channel SM (OS1)	Average	-3.74	$\leq \pm 6.30$ dB	Y
18	24 Channel SM (OS1)	Average	-0.81	$\leq \pm 6.30$ dB	Y
19	24 Channel SM (OS1)	Average	-0.89	$\leq \pm 6.30$ dB	Y
20	24 Channel SM (OS1)	Average	-0.65	$\leq \pm 6.30$ dB	Y
21	24 Channel SM (OS1)	Average	-0.54	$\leq \pm 6.30$ dB	Y
22	24 Channel SM (OS1)	Average	-0.62	$\leq \pm 6.30$ dB	Y
23	24 Channel SM (OS1)	Average	-0.43	$\leq \pm 6.30$ dB	Y
24	24 Channel SM (OS1)	Average	-1.00	$\leq \pm 6.30$ dB	Y

Photographs:

Figure 3: 24 Channel Link System SM Configuration Test Setup



Figure 4: 24 Channel Link System SM Configuration Panel Setup



References**External Reference Documents**

- ANSI Z136.2 ANS For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources
- ANSI/TIA-568-C.0 General Telecommunications Cabling for Customer Premises
- ANSI/TIA/EIA 604-10A-2002 Fiber Optic Connector Intermateability Standard, Type LC
- ANSI/TIA 604-10B-2008, FOCIS-10 - Fiber Optic Connector Intermateability Standard, Type LC (revision and redesignation of ANSI/TIA 604-10A-2002)
- IEEE C2-2007, National Electrical Safety Code® (NESC®)
- IEEE 802.3-2005, Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
- IEC 61918-2007, Industrial Communication Networks - Installation of Communication Networks in Industrial Premises
- NFPA 70, National Electrical Code®
- TIA-492AAAA, Detail Specification For 62.5- μm Core Diameter/125- μm Cladding Diameter Class IA Graded-Index Multimode Optical Fibers
- TIA-492AAAB, Detail Specification For 50- μm Core Diameter/125- μm Cladding Diameter Class IA Graded-Index Multimode Optical Fibers
- TIA-492AAAC, Detail Specification For 850-nm Laser-optimized, 50- μm Core Diameter/125- μm Cladding Diameter Class IA Graded-Index Multimode Optical Fibers
- TIA-492CAAA, Detail Specification For Class IVA Dispersion-Unshifted Single-Mode Optical Fibers
- TIA-492CAAB, Detail Specification For Class IVA Dispersion-Unshifted Single-Mode Optical Fibers With Low Water Peak
- TIA TSB-31-C, Telephone Terminal Equipment Rationale and Measurement Guidelines for US Network Protection 51

Intertek Documents

- LEX-OE-FIB-179, Fiber Training Program Description
- LEX-OE-FIB-178, General Fiber Safety Policy
- LEX-OE-FIB-185, Fiber Optic Handling Safety Rules and Practices for Optical Fiber Components and Systems Procedures
- LEX-OE-FIB-037, Fiber Optic Insertion Loss and Reflectance Measurements