



GT-17-13

10G BASE-T/Cat 6a Compliance Testing of Glenair SpeedMaster Contacts and 24AWG Aerospace Grade SF/UTP CAT 6a Cable





Revision History

Rev	Date	Approved	Description
1	01/19/2017	B. Samowitz	First Draft

1.0 Abstract

The purpose of this test is to characterize the electrical performance of the SpeedMaster Ethernet Contacts in accordance with the Category 6a cabling standard as per TIA/EIA Cat 6a F/UTP. The parameters of interest are as follows: Near-End Crosstalk (NEXT), Power Sum NEXT, Equal Level Far-End Crosstalk (ELFEXT), Power Sum ELFEXT, Return Loss, and Insertion Loss.

2.0 Test Samples

A full testing sample is called a link. A link is composed of a series of cordsets. A cordset is composed of some known length of Ethernet cable (Glenair PN: 963-003-24) terminated on each end with opposite gendered SpeedMaster Ethernet contacts (Glenair PIN: 858-100 and 858-101). Each cordset was tested alone as a link. Shown below is a schematic of a test link consisting of 5 cordsets.

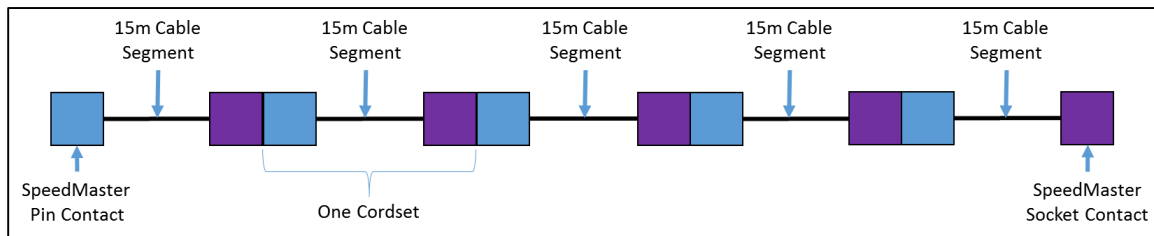


Figure 1: Sample Link Diagram

Here is the wiring configuration of the SpeedMaster contacts.

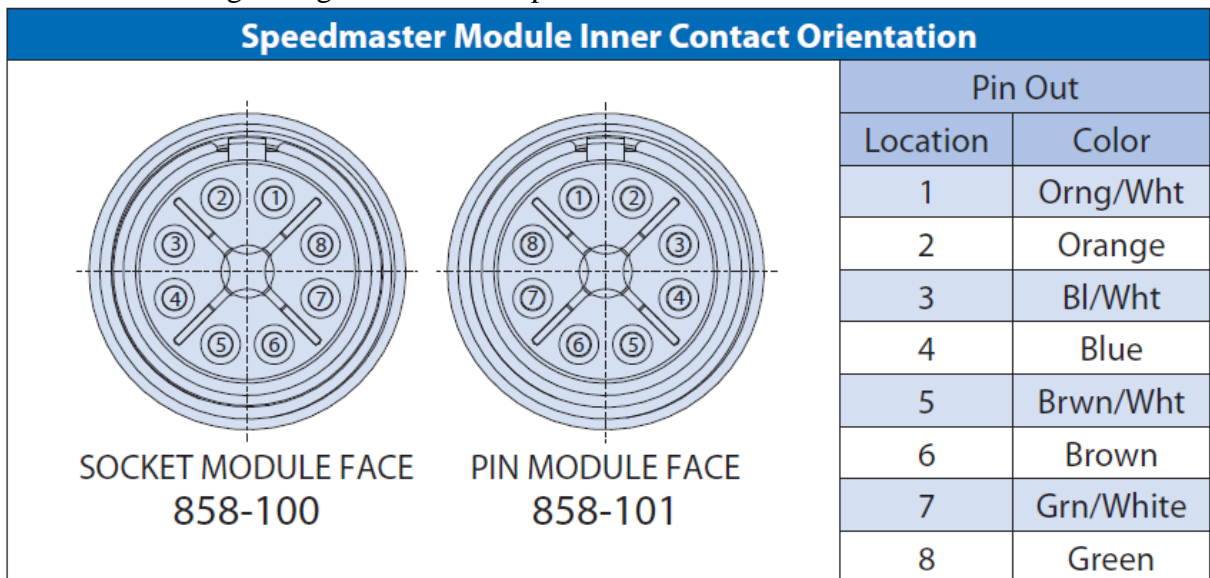


Figure 2: SpeedMaster Contacts Wiring

3.0 Test Equipment

The testing equipment is tabulated below.

Table 1: Test Equipment Information

Make	Model	Component	S/N	Calibration Date	Calibration Expiration
FlukeNetworks	DSX-5000	Main	2766352	01/16/2016	01/16/2017
FlukeNetworks	DSX-5000	Remote	2766289	01/16/2016	01/16/2017
FlukeNetworks	DSX-CHA004	Main Adapter	2791443	01/16/2016	01/16/2017
FlukeNetworks	DSX-CHA004	Remote Adapter	2791424	01/16/2016	01/16/2017

An image including this test equipment is found in Section 4.0 of this report.

4.0 Setup and Test Procedure

Below is a diagram of the test setup.

An adapter was attached to the units. At each end of the links, a 1m segment of cable acted as an adaptor between the SpeedMaster contact and the RJ45 terminal of the adapter. After selecting CAT6A as the testing standard, the tests were run and the data stored.

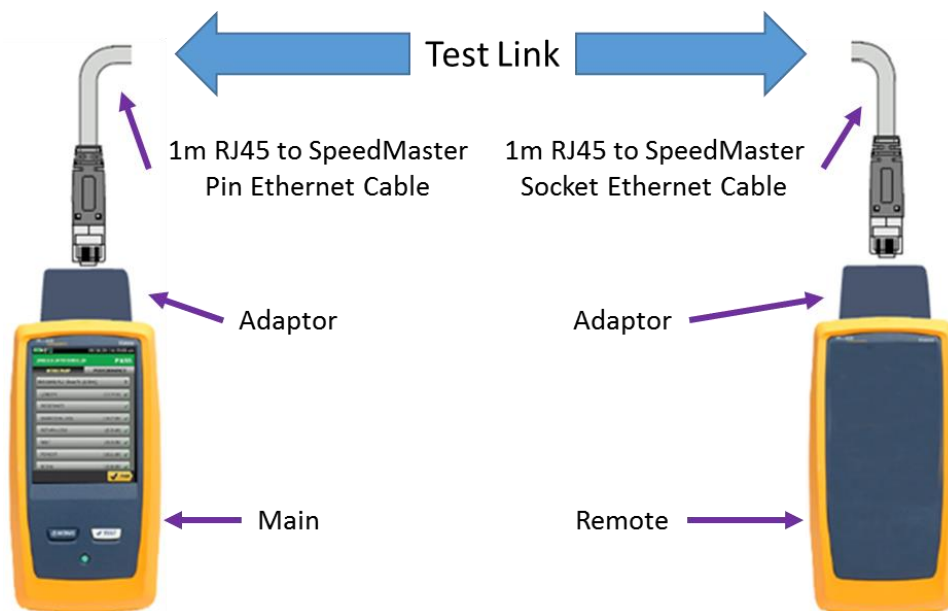


Figure 3: Test Setup



5.0 Results

Many links were tested, including individual cordsets. Included below are seven sets of data that are adequate to establish some important trends. For reference within this document, they are named with letters in order of appearance. The highlighted field is the lowest clearance parameter for that test configuration.

Table 2: Worst Case Margin Summary Link A

Link ID:	A				
Number of Cordsets:	5				
Link Length:	80m				
Worst Case Margin Summary					
Parameter	Pair	Frequency [MHz]	Value [dB]	Limit [dB]	Clearance [dB]
Insertion Loss	78	500	43.5	49.3	5.8
NEXT	12-36	24.4	58.4	50.2	8.2
PS NEXT	36	6.4	66.7	57.2	9.5
ARC-F (ELFEXT)	36-45	450	26	10.2	15.8
PS ARC-F (ELFEXT)	36	460	24.9	7	17.9
ARC-N	12-36	6.5	64.3	54.4	9.9
PS ARC-N	36	6.4	62.5	52	10.5
Return Loss	12	25.6	20.3	17	3.3

Table 3: Worst Case Margin Summary Link B

Link ID:	B				
Number of Cordsets:	4				
Link Length:	65m				
Worst Case Margin Summary					
Parameter	Pair	Frequency [MHz]	Value [dB]	Limit [dB]	Clearance [dB]
Insertion Loss	78	494	35.2	49	13.8
NEXT	12-36	39.8	54.8	46.7	8.1
PS NEXT	36	6.4	66.7	57.2	9.5
ARC-F (ELFEXT)	36-45	480	26.9	9.6	17.3
PS ARC-F (ELFEXT)	45	464	26.3	6.9	19.4
ARC-N	12-36	6.4	65	54.6	10.4
PS ARC-N	36	6.4	63.3	52	11.3
Return Loss	12	23	19.8	17.2	2.6

Table 4: Worst Case Margin Summary Link C

Link ID:	C				
Number of Cordsets:	3				
Link Length:	49m				
Worst Case Margin Summary					
Parameter	Pair	Frequency [MHz]	Value [dB]	Limit [dB]	Clearance [dB]
Insertion Loss	45	498	26.6	49.2	22.6
NEXT	12-36	39.5	54.5	46.7	7.8
PS NEXT	36	6.3	66.7	57.4	9.3
ARC-F (ELFEXT)	36-78	422	29.5	10.8	18.7
PS ARC-F (ELFEXT)	45	498	27	6.3	20.7
ARC-N	12-36	6.4	65.2	54.6	10.6
PS ARC-N	36	6.3	64.1	52.2	11.9
Return Loss	78	25.5	19	17	2

Table 5: Worst Case Margin Summary Link D

Link ID:	D				
Number of Cordsets:	2				
Link Length:	33m				
Worst Case Margin Summary					
Parameter	Pair	Frequency [MHz]	Value [dB]	Limit [dB]	Clearance [dB]
Insertion Loss	78	494	18.1	49	30.9
NEXT	12-36	387	37.3	29.1	8.2
PS NEXT	36	6.3	67.9	57.4	10.5
ARC-F (ELFEXT)	12-45	428	30.5	10.6	19.9
PS ARC-F (ELFEXT)	36	441	27.5	7.4	20.1
ARC-N	12-36	6.3	67.3	54.8	12.5
PS ARC-N	36	6.1	66.3	52.4	13.9
Return Loss	12	23	19.5	17.2	2.3



Table 6: Worst Case Margin Summary Link E

Link ID:	E				
Number of Cordsets:	1				
Link Length:	17m				
Worst Case Margin Summary					
Parameter	Pair	Frequency [MHz]	Value [dB]	Limit [dB]	Clearance [dB]
Insertion Loss	78	493	9.7	48.9	39.2
NEXT	12-36	387	35.3	29.1	6.2
PS NEXT	12	387	34.8	26.2	8.6
ARC-F (ELFEXT)	12-36	441	27.7	10.4	17.3
PS ARC-F (ELFEXT)	36	442	26.6	7.3	19.3
ARC-N	12-36	6.1	71.7	55	16.7
PS ARC-N	36	5.8	69.5	53	16.5
Return Loss	78	60.3	17.5	14.2	3.3

The data summaries here make it clear that while Return Loss always has the lowest margin, Insertion Loss becomes the limiting factor. Number of cordsets and total link length seem to have little effect on Return Loss as it varies by less than 1.5 dB within the links tested. There also seems to be minimal effect on NEXT, varying by 2.0 dB margin within the links tested.

Detailed test data sheets are shown in Appendix 1 herein.

6.0 Test Location, Date, and Personnel

Test Location: Glenair, Inc. 1220 Air Way, Glendale, CA.
 Test Dates: 01/12/2017
 Engineer: Bryan Samowitz



Appendix 1: Test Results



Cable ID: COMPLIANCE_80M

Date / Time: 01/12/2017 01:17:47 PM

Headroom 8.2 dB (NEXT 12-36)

Test Limit: TIA Cat 6A Channel

Cable Type: Cat 6 F/UTP

NVP: 70.0%

Operator: Bryan

Software Version: V3.0 Build 6

Limits Version: V3.0

Test Summary: PASS

Model: DSX-5000

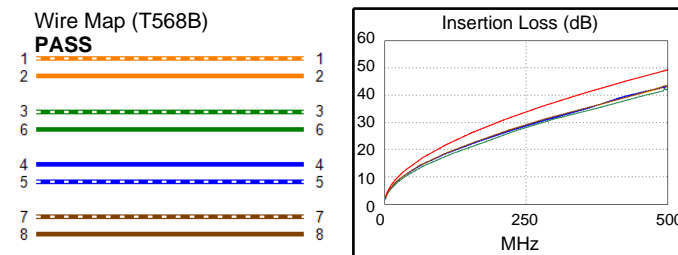
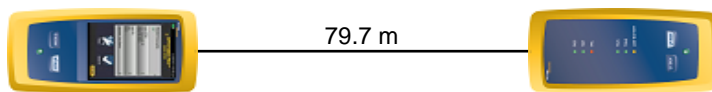
Main S/N: 2766352

Remote S/N: 2766289

Main Adapter: DSX-CHA004

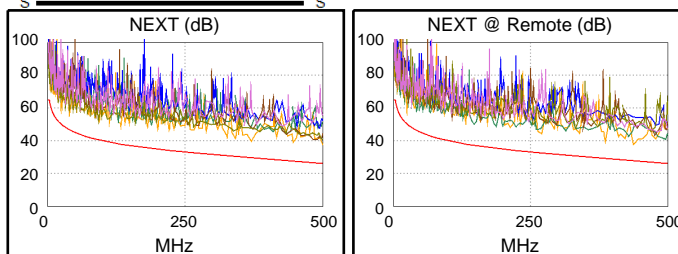
Remote Adapter: DSX-CHA004

Length (m), Limit 100.0	[Pair 45]	79.7
Prop. Delay (ns), Limit 555	[Pair 78]	399
Delay Skew (ns), Limit 50	[Pair 78]	19
Resistance (ohms)	[Pair 78]	13.4
Insertion Loss Margin (dB)	[Pair 78]	5.8
Frequency (MHz)	[Pair 78]	500.0
Limit (dB)	[Pair 78]	49.3

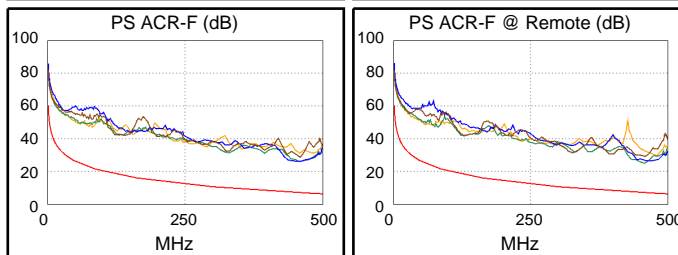


Worst Case Margin Worst Case Value

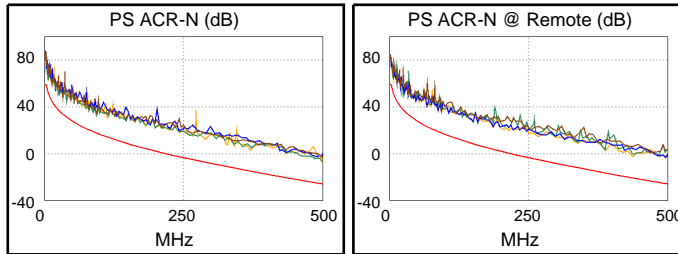
PASS	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
NEXT (dB)	8.9	8.2	11.2	10.0
Freq. (MHz)	6.4	24.4	500.0	442.0
Limit (dB)	59.8	50.2	26.1	27.6
Worst Pair	36	12	36	36
PS NEXT (dB)	9.5	10.4	12.0	12.2
Freq. (MHz)	6.4	24.4	500.0	442.0
Limit (dB)	57.2	47.5	23.2	24.6



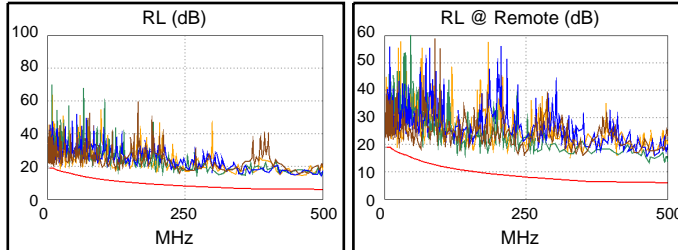
PASS	MAIN	SR	MAIN	SR
Worst Pair	36-45	36-45	36-45	36-45
ACR-F (dB)	15.8	15.9	15.9	15.9
Freq. (MHz)	450.0	461.0	456.0	461.0
Limit (dB)	10.2	10.0	10.1	10.0
Worst Pair	36	36	36	36
PS ACR-F (dB)	18.0	17.9	18.0	17.9
Freq. (MHz)	461.0	460.0	461.0	460.0
Limit (dB)	7.0	7.0	7.0	7.0



N/A	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-45
ACR-N (dB)	9.9	10.0	17.8	20.7
Freq. (MHz)	6.5	24.4	500.0	496.0
Limit (dB)	54.4	40.1	-23.2	-22.9
Worst Pair	36	12	36	12
PS ACR-N (dB)	10.5	11.7	18.6	19.6
Freq. (MHz)	6.4	24.4	500.0	482.0
Limit (dB)	52.0	37.4	-26.1	-24.7



PASS	MAIN	SR	MAIN	SR
Worst Pair	12	78	12	36
RL (dB)	3.8	3.3	7.6	7.2
Freq. (MHz)	23.8	25.6	468.0	481.0
Limit (dB)	17.1	17.0	6.0	6.0



Compliant Network Standards:

10BASE-T	100BASE-TX	100BASE-T4
1000BASE-T	10GBASE-T	ATM-25
ATM-51	ATM-155	100VG-AnyLan
TR-4	TR-16 Active	TR-16 Passive



Cable ID: COMPLIANCE_65M

Date / Time: 01/12/2017 01:25:12 PM

Headroom 8.1 dB (NEXT 12-36)

Test Limit: TIA Cat 6A Channel

Cable Type: Cat 6 F/UTP

NVP: 70.0%

Operator: Bryan

Software Version: V3.0 Build 6

Limits Version: V3.0

Test Summary: PASS

Model: DSX-5000

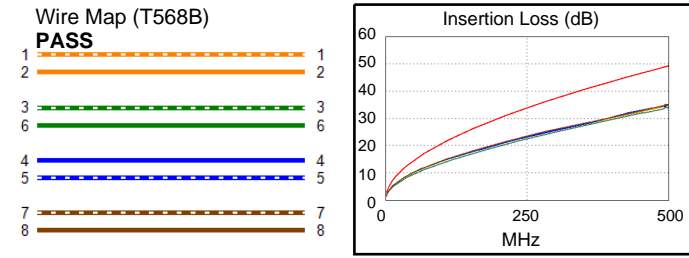
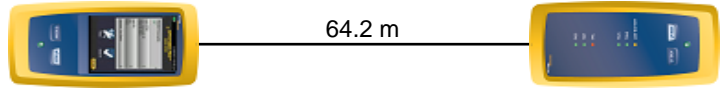
Main S/N: 2766352

Remote S/N: 2766289

Main Adapter: DSX-CHA004

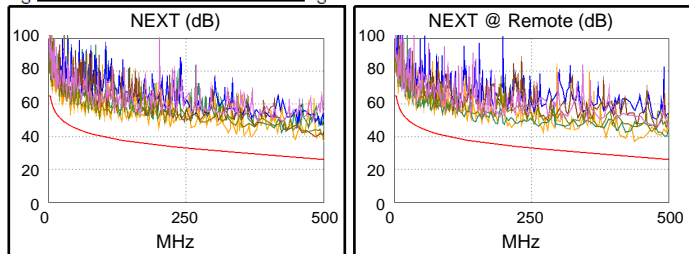
Remote Adapter: DSX-CHA004

Length (m), Limit 100.0	[Pair 45]	64.2
Prop. Delay (ns), Limit 555	[Pair 78]	320
Delay Skew (ns), Limit 50	[Pair 78]	14
Resistance (ohms)	[Pair 78]	10.7
Insertion Loss Margin (dB)	[Pair 78]	13.8
Frequency (MHz)	[Pair 78]	494.0
Limit (dB)	[Pair 78]	49.0

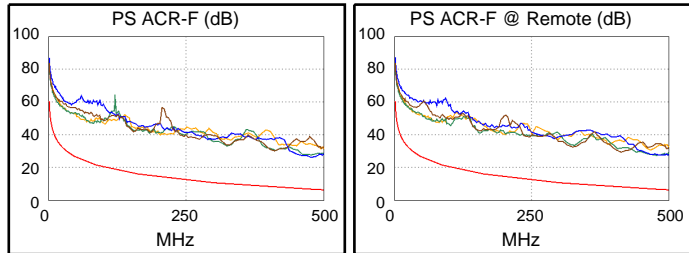


Worst Case Margin Worst Case Value

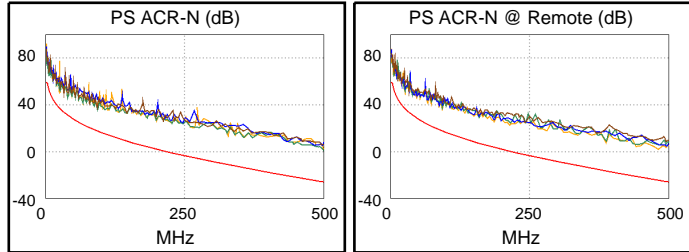
PASS	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
NEXT (dB)	8.1	8.5	11.0	8.8
Freq. (MHz)	39.8	387.0	500.0	442.0
Limit (dB)	46.7	29.1	26.1	27.6
Worst Pair	36	36	36	36
PS NEXT (dB)	9.5	10.1	11.8	11.1
Freq. (MHz)	6.4	6.3	500.0	442.0
Limit (dB)	57.2	57.4	23.2	24.6



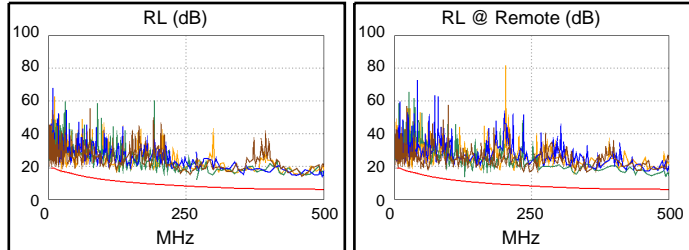
PASS	MAIN	SR	MAIN	SR
Worst Pair	36-45	36-45	36-45	36-45
ACR-F (dB)	17.4	17.3	17.5	17.3
Freq. (MHz)	477.0	480.0	484.0	480.0
Limit (dB)	9.7	9.6	9.6	9.6
Worst Pair	45	45	45	45
PS ACR-F (dB)	19.4	19.9	19.5	19.9
Freq. (MHz)	464.0	480.0	477.0	480.0
Limit (dB)	6.9	6.6	6.7	6.6



N/A	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
ACR-N (dB)	10.4	10.9	25.9	25.8
Freq. (MHz)	6.4	6.4	500.0	481.0
Limit (dB)	54.6	54.6	-23.2	-21.7
Worst Pair	36	36	36	12
PS ACR-N (dB)	11.3	11.9	26.7	26.5
Freq. (MHz)	6.4	6.3	500.0	482.0
Limit (dB)	52.0	52.2	-26.1	-24.7



PASS	MAIN	SR	MAIN	SR
Worst Pair	12	78	78	36
RL (dB)	2.6	2.7	7.5	7.5
Freq. (MHz)	23.0	25.5	461.0	467.0
Limit (dB)	17.2	17.0	6.0	6.0



Compliant Network Standards:

10BASE-T	100BASE-TX	100BASE-T4
1000BASE-T	10GBASE-T	ATM-25
ATM-51	ATM-155	100VG-AnyLan
TR-4	TR-16 Active	TR-16 Passive



Cable ID: COMPLIANCE_49M

Date / Time: 01/12/2017 01:29:18 PM

Headroom 7.8 dB (NEXT 12-36)

Test Limit: TIA Cat 6A Channel

Cable Type: Cat 6 F/UTP

NVP: 70.0%

Operator: Bryan

Software Version: V3.0 Build 6

Limits Version: V3.0

Test Summary: PASS

Model: DSX-5000

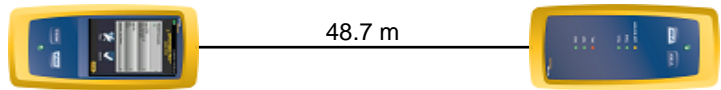
Main S/N: 2766352

Remote S/N: 2766289

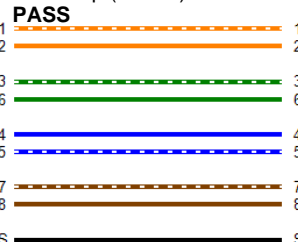
Main Adapter: DSX-CHA004

Remote Adapter: DSX-CHA004

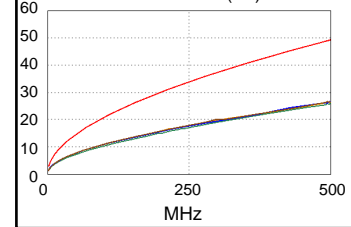
Length (m), Limit 100.0	[Pair 45]	48.7
Prop. Delay (ns), Limit 555	[Pair 78]	243
Delay Skew (ns), Limit 50	[Pair 78]	11
Resistance (ohms)	[Pair 78]	8.2
Insertion Loss Margin (dB)	[Pair 45]	22.6
Frequency (MHz)	[Pair 45]	498.0
Limit (dB)	[Pair 45]	49.2



Wire Map (T568B)

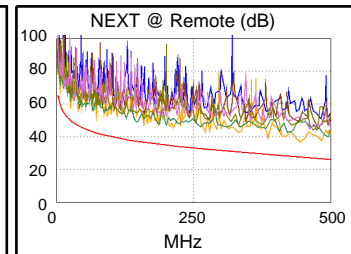
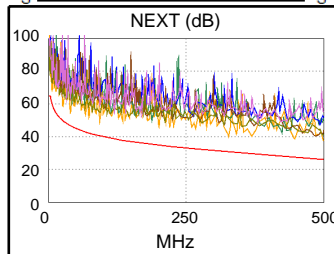


Insertion Loss (dB)

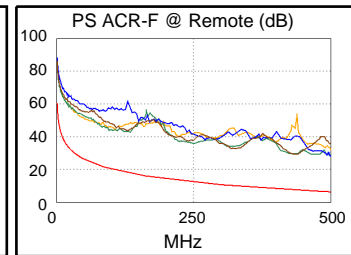
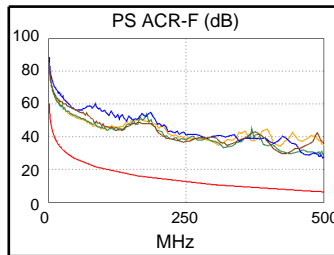


Worst Case Margin Worst Case Value

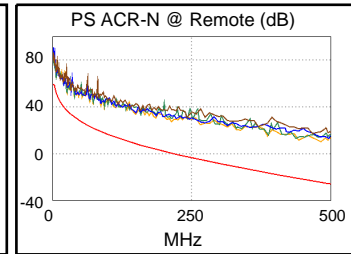
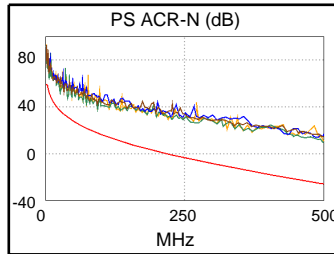
PASS	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
NEXT (dB)	7.8	8.0	11.5	8.5
Freq. (MHz)	39.5	25.8	500.0	442.0
Limit (dB)	46.7	49.8	26.1	27.6
Worst Pair	36	12	36	36
PS NEXT (dB)	9.3	9.6	12.0	10.8
Freq. (MHz)	6.3	25.6	499.0	442.0
Limit (dB)	57.4	47.2	23.3	24.6



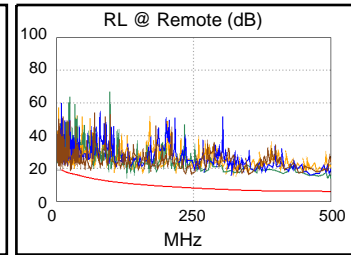
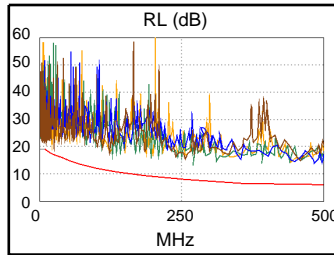
PASS	MAIN	SR	MAIN	SR
Worst Pair	36-78	36-78	36-45	36-45
ACR-F (dB)	18.7	19.0	18.8	19.7
Freq. (MHz)	422.0	439.0	498.0	499.0
Limit (dB)	10.8	10.4	9.3	9.3
Worst Pair	45	36	45	45
PS ACR-F (dB)	20.7	21.0	20.7	22.0
Freq. (MHz)	498.0	421.0	498.0	499.0
Limit (dB)	6.3	7.8	6.3	6.3



N/A	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
ACR-N (dB)	10.6	10.8	34.7	33.4
Freq. (MHz)	6.4	6.4	500.0	481.0
Limit (dB)	54.6	54.6	-23.2	-21.7
Worst Pair	36	36	36	12
PS ACR-N (dB)	11.9	12.2	35.4	34.6
Freq. (MHz)	6.3	6.3	500.0	481.0
Limit (dB)	52.2	52.2	-26.1	-24.6



PASS	MAIN	SR	MAIN	SR
Worst Pair	78	78	78	36
RL (dB)	3.1	2.0	7.6	7.4
Freq. (MHz)	25.5	25.5	461.0	481.0
Limit (dB)	17.0	17.0	6.0	6.0



Compliant Network Standards:

10BASE-T	100BASE-TX	100BASE-T4
1000BASE-T	10GBASE-T	ATM-25
ATM-51	ATM-155	100VG-AnyLan
TR-4	TR-16 Active	TR-16 Passive



Cable ID: COMPLIANCE_33M

Date / Time: 01/12/2017 01:32:05 PM

Headroom 8.2 dB (NEXT 12-36)

Test Limit: TIA Cat 6A Channel

Cable Type: Cat 6 F/UTP

NVP: 70.0%

Operator: Bryan

Software Version: V3.0 Build 6

Limits Version: V3.0

Test Summary: PASS

Model: DSX-5000

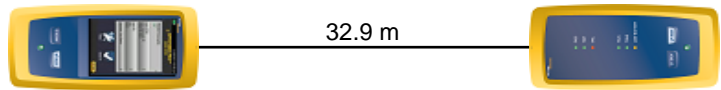
Main S/N: 2766352

Remote S/N: 2766289

Main Adapter: DSX-CHA004

Remote Adapter: DSX-CHA004

Length (m), Limit 100.0	[Pair 45]	32.9
Prop. Delay (ns), Limit 555	[Pair 78]	165
Delay Skew (ns), Limit 50	[Pair 78]	8
Resistance (ohms)	[Pair 78]	5.6
Insertion Loss Margin (dB)	[Pair 78]	30.9
Frequency (MHz)	[Pair 78]	494.0
Limit (dB)	[Pair 78]	49.0

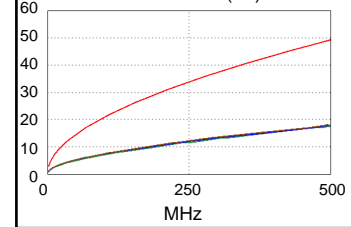


Wire Map (T568B)

PASS

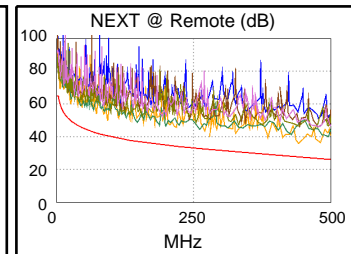
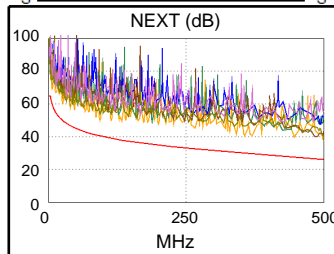


Insertion Loss (dB)

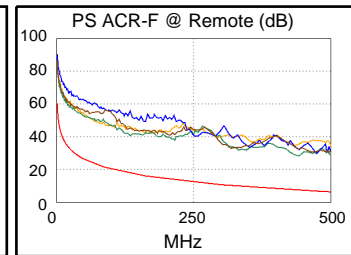
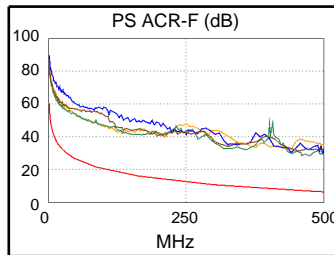


Worst Case Margin Worst Case Value

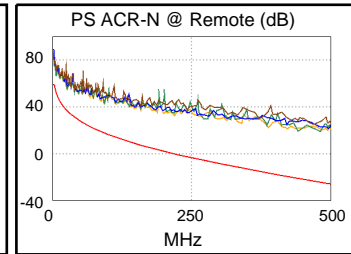
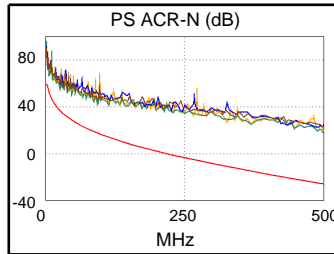
PASS	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
NEXT (dB)	8.9	8.2	11.6	8.4
Freq. (MHz)	327.0	387.0	500.0	441.0
Limit (dB)	31.1	29.1	26.1	27.6
Worst Pair	36	36	36	12
PS NEXT (dB)	10.5	10.5	12.1	11.4
Freq. (MHz)	6.3	6.3	499.0	481.0
Limit (dB)	57.4	57.4	23.3	23.7



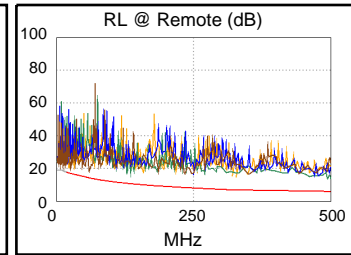
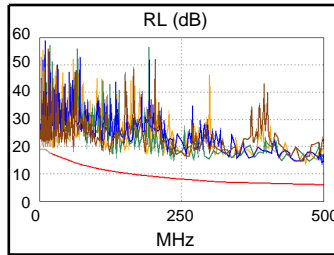
PASS	MAIN	SR	MAIN	SR
Worst Pair	36-45	36-78	45-36	36-45
ACR-F (dB)	19.9	20.0	20.3	20.2
Freq. (MHz)	428.0	318.0	474.0	474.0
Limit (dB)	10.6	13.2	9.7	9.7
Worst Pair	36	36	36	36
PS ACR-F (dB)	21.5	20.1	21.5	20.1
Freq. (MHz)	474.0	441.0	474.0	441.0
Limit (dB)	6.7	7.4	6.7	7.4



N/A	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
ACR-N (dB)	12.5	12.5	43.2	40.8
Freq. (MHz)	6.3	6.1	500.0	481.0
Limit (dB)	54.8	55.0	-23.2	-21.7
Worst Pair	36	36	36	12
PS ACR-N (dB)	13.9	13.9	43.9	42.2
Freq. (MHz)	6.1	6.1	500.0	481.0
Limit (dB)	52.4	52.4	-26.1	-24.6



PASS	MAIN	SR	MAIN	SR
Worst Pair	12	78	45	36
RL (dB)	2.3	2.4	7.6	7.2
Freq. (MHz)	23.0	25.6	484.0	467.0
Limit (dB)	17.2	17.0	6.0	6.0



Compliant Network Standards:

10BASE-T	100BASE-TX	100BASE-T4
1000BASE-T	10GBASE-T	ATM-25
ATM-51	ATM-155	100VG-AnyLan
TR-4	TR-16 Active	TR-16 Passive



Cable ID: COMPLIANCE_17M

Date / Time: 01/12/2017 01:35:54 PM

Headroom 6.2 dB (NEXT 12-36)

Test Limit: TIA Cat 6A Channel

Cable Type: Cat 6 F/UTP

NVP: 70.0%

Operator: Bryan

Software Version: V3.0 Build 6

Limits Version: V3.0

Test Summary: PASS

Model: DSX-5000

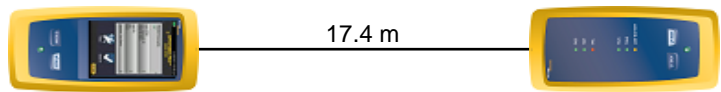
Main S/N: 2766352

Remote S/N: 2766289

Main Adapter: DSX-CHA004

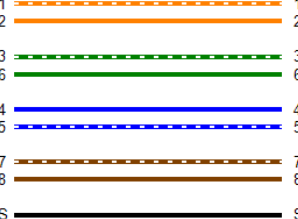
Remote Adapter: DSX-CHA004

Length (m), Limit 100.0	[Pair 45]	17.4
Prop. Delay (ns), Limit 555	[Pair 78]	87
Delay Skew (ns), Limit 50	[Pair 78]	4
Resistance (ohms)	[Pair 78]	2.9
Insertion Loss Margin (dB)	[Pair 78]	39.2
Frequency (MHz)	[Pair 78]	493.0
Limit (dB)	[Pair 78]	48.9

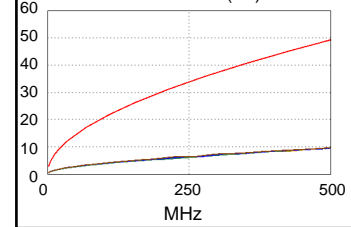


Wire Map (T568B)

PASS

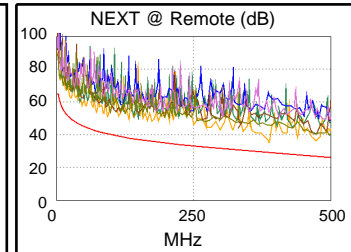
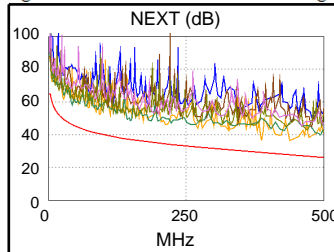


Insertion Loss (dB)

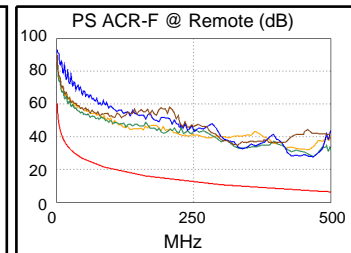
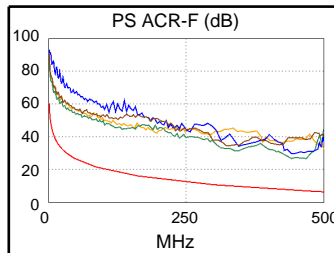


Worst Case Margin Worst Case Value

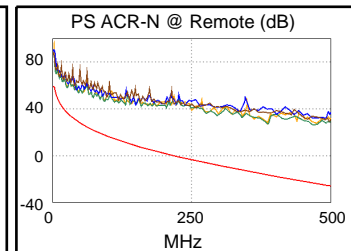
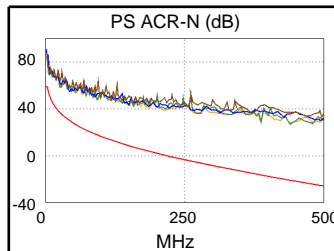
PASS	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
NEXT (dB)	7.7	6.2	8.3	6.2
Freq. (MHz)	387.0	387.0	439.0	387.0
Limit (dB)	29.1	29.1	27.6	29.1
Worst Pair	12	36	36	36
PS NEXT (dB)	10.4	8.6	10.7	9.6
Freq. (MHz)	387.0	387.0	439.0	472.0
Limit (dB)	26.2	26.2	24.7	23.9



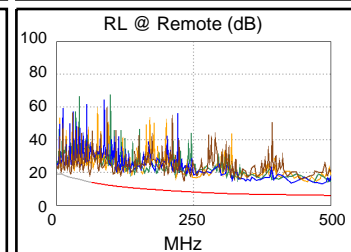
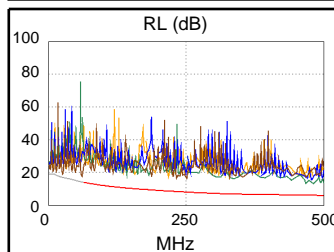
PASS	MAIN	SR	MAIN	SR
Worst Pair	45-36	36-45	45-36	36-45
ACR-F (dB)	17.3	17.3	17.6	17.4
Freq. (MHz)	441.0	441.0	467.0	442.0
Limit (dB)	10.4	10.4	9.9	10.3
Worst Pair	36	45	36	45
PS ACR-F (dB)	19.3	20.1	19.6	20.2
Freq. (MHz)	442.0	441.0	467.0	442.0
Limit (dB)	7.3	7.4	6.9	7.3



N/A	MAIN	SR	MAIN	SR
Worst Pair	12-36	12-36	12-36	12-36
ACR-N (dB)	16.7	17.4	45.6	47.9
Freq. (MHz)	6.1	5.5	439.0	472.0
Limit (dB)	55.0	56.0	-18.3	-21.0
Worst Pair	36	36	12	36
PS ACR-N (dB)	16.5	17.3	51.1	48.4
Freq. (MHz)	5.8	5.8	481.0	472.0
Limit (dB)	53.0	53.0	-24.6	-23.9



PASS	MAIN	SR	MAIN	SR
Worst Pair	78	78	36	45
RL (dB)	3.3	4.3	7.1	6.3
Freq. (MHz)	60.3	60.8	481.0	472.0
Limit (dB)	14.2	14.2	6.0	6.0



Compliant Network Standards:

10BASE-T	100BASE-TX	100BASE-T4
1000BASE-T	10GBASE-T	ATM-25
ATM-51	ATM-155	100VG-AnyLan
TR-4	TR-16 Active	TR-16 Passive