

Customer: Various
Customer Specification: QSFP+
Customer Drawing: n/a
Reference Specification: PS-362
Cinch Catalog Part # 7170400000 7170400010 7170400040 7170400060
Cinch Assembly Part # Same as Catalog Part#

TITLE: Test Report for Quad Small Form-factor Pluggable (QSFP+)

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Date of Issue: 05/21/10

Approved By: Hecham Elkhatib

Revision	Date	Revised By	Approved By	Remarks
A	05/21/10		Hecham Elkhatib	Original Release
B	06/18/10	JD Scruggs	Hecham Elkhatib	Added Graphic Corrected title



1.0 SCOPE:

The purpose of this report is to summarize the results of the qualification testing performed on the Cinch QSFP+ cable assembly.

2.0 SUBJECT PARTS:

Cinch Part Number: **7170400000**
 7170400010
 7170400040
 7170400060

3.0 TEST CONDITIONS:

Unless otherwise specified, the general test conditions were:

Temperature: 20° C to 25° C (68° F to 77° F)
Relative Humidity: 45% to 75%
Barometric Pressure: 650 to 800 millimeters of mercury

4.0 REFERENCE DOCUMENTS:

- 4.1 Cinch drawing for the part listed in section 2.0
- 4.2 Cinch Product Specification PS-332.
- 4.3 QSFP+, Quad Small Form-factor Pluggable Transceiver Specification
SFF-8417
- 4.4 EIA-364 Test procedure for electrical connectors and sockets.
- 4.5 IEC 60512 Electromechanical Components for Electronic Equipment; Basic
Testing Procedures and Measuring Methods.



5.0 QUALIFICATION TEST PARAMETERS:

5.1 Mechanical

TEST DESCRIPTION	REQUIREMENT	APPLICABLE SPECIFICATIONS / PROCEDURE
5.1.1 Visual Examination	Shall meet the design requirement of the product drawings. There shall be no evidence of physical damage, swelling, blistering, distortion, etc. of the test sockets that prevents mechanical or electrical operation.	Inspect all unmated cable plugs per EIA-364-18
5.1.2 Durability	Precondition with 50 durability cycles. Shall meet differential Impedance requirements	EIA-364-09 <ul style="list-style-type: none"> • Plug cable end to test vehicle. • Unplug cable by pulling on lanyard.
5.1.3 Disturbance-Durability	Precondition with 3 durability cycles.	EIA-364-09 <ul style="list-style-type: none"> • Plug cable end to test vehicle. • Unplug cable by pulling on lanyard.
5.1.4 Cable Flex Test	Shall meet differential Impedance requirements	SFF-8417 Rev 4.0 Test Specimen 4.3 (cable assembly), 30 cycles total

5.2 Environmental

TEST DESCRIPTION	REQUIREMENT	APPLICABLE SPECIFICATIONS / PROCEDURE
5.2.1 Temperature Life	Cable shall meet Impedance requirements after being exposed to 500 hours at 90C stress relaxation/temperature life.	EIA-364-17, Method A. Per EIA-364-1000.01A for 65C field temperature for 5 years life.
5.2.2 Temperature Humidity-Cycling	Cable shall meet Impedance requirements after being subjected to 50 continuous cycles.	EIA-364-31 <ul style="list-style-type: none"> • 50 cycles • Ramp time=0.5 hours • Dwell time=1.0 hour, Dwell time begins when temp and humidity have stabilized within specified levels. Cycling temperature= 25 C +/-3C @ 80% R.H. +/-3% to 65 C +/-3 C @ 50% R.H. +/-3%
5.2.3 Thermal Shock	Socket shall withstand 10 cycles of -55°C to 85°C thermal shock without evidence of mechanical failure or Impedance failure	EIA-364-32, Test Condition I Cycle description: <ul style="list-style-type: none"> • Step 1=-55 (+0 -3)C Duration= 1 hour • Step 2=25 (+10 -5)C Duration= <= 1 minute. • Step 3=85 (+3 -0)C Duration= 1 hour • Step 4= 25 (+10 -5)C Duration= <= 1 minute. Number of cycles =10.
5.2.4 Accelerated Thermal Cycling (ATC).	Cable shall withstand 10 cycles of 15°C ± 3C to 85°C ± 3C thermal cycling without evidence of mechanical or Impedance failure.	EIA-364-32 <ul style="list-style-type: none"> • Hot extreme temperature is 85°C +/-3°C with a 15 minute dwell after stabilization. • Cold extreme temperature is 15°C +/-3°C with a minimum 5 minute dwell after stabilization. • Ramps should be a minimum of 2°C per minute. No current load applied.

5.3 Signal Integrity Requirements

TEST DESCRIPTION	REQUIREMENT		APPLICABLE SPECIFICATIONS / PROCEDURE
5.3.1 IBTA Differential Impedance	Cable shall meet a Differential Impedance rating of $100 \pm 10 \Omega$		EIA-364-108 Measurement to include connector plug/socket and cable. Mated cable and test card measured at 100 ps rise-time 20-80%
5.3.2 IBTA Time Domain NEXT	Maximum 4% sum of all contributing aggressors.		Mated cable and board connector, measured differentially with all adjacent neighbor pairs driven at 50 ps (20-80%) (DDR, QDR) transition time, per EIA 364-90 and Section 6.6.2.6 . A lower value will result in additional design margin.
5.3.3 IBTA Return Loss	Freq. (GHz)	SDD11 (max)	S-parameter measurement based on SFF 8414.
	0.1-1.0	-10	
	1.0-2.5	$-(12-2*\text{SQRT}(f))$	
	4.1-10	$-(6.3-13*\log_{10}(f/5.5))$	
5.3.4 IBTA Insertion Loss	TBD		TBD
5.3.5 IBTA Interoperability	Cables submitted to the IBTA Plugfest must pass compliance and interoperability tests.		Compliance targets and interoperability protocols are based on the most recent version of the IBTA CIWG documentation. Cable appearing on the IBTA integrators list valid.
5.3.6 IEEE Reference Impedance	100 Nominal		Measurement Differential Impedance Reference, no measurement required.
5.3.7 IEEE Cable Assembly Insertion Loss	IEEE 802.3ba Table 85-10 17.04 db @ 5.15625 GHz from TP1-TP4 and meeting fitted insertion loss coefficients listed.		Procedure based on IEEE 802.3ba Clause 85.10.2 using fitted insertion loss from 50MHz to 7500MHz w/ frequency spacing of 10MHz.
5.3.8 IEEE Cable Assembly Insertion Loss Deviation (ILD)	Limits based on IEEE 802.3ba Clause 85 Eq. 85-23 and 85-24.		Procedure based on IEEE 802.3ba Clause 85.10.3 Eq. 85-22. Determined by the difference in fitted insertion loss and measured insertion loss, 50MHz to 7500MHz.

5.3.9 IEEE Cable Assembly Return Loss	Freq. (GHz)	SDD11	Procedure Based on IEEE 802.3ba Clause 85.10.4 for s-parameter measurement frequencies 50MHz to 10GHz.
	$0.05 \leq f < 4.1$	$12 \cdot 2 \cdot \text{SQRT}(f)$	
	$4.1 \leq f \leq 10$	6.3- $12 \log_{10}(f/5.5)$	
5.3.10 IEEE Integrated Crosstalk Noise (ICN)	Limits for IEEE 802.3ba ICN referenced to Clause 85, Eq. 85-33 and Figure 85-12		Procedure is outlined in IEEE 802.3ba Clause 85.10.4 through 85.10.7. Including MDNEXT and MDFEXT calculations from S-parameter measurements made from 50MHz to 10GHz with frequency spacing of 10MHz.
5.3.11 SAS 2.1 Differential Return Loss	Limits set in SAS 2.1 Section 5.6.3 for SDD22 by equation and coefficient values in Table 25, depicted in Figure 83.		S-parameter measurements made in accordance with SAS 2.1 Section D9 using the frequency range described in Table 25 of 100MHz to 6GHz.
5.3.12 SAS 2.1 Differential to Common Mode Return Loss	Limits set in SAS 2.1 Section 5.6.3 for SCD22 by equation and coefficient values in Table 25, depicted in Figure 83.		S-parameter measurements made in accordance with SAS 2.1 Section D9 using the frequency range described in Table 25 of 100MHz to 6GHz.
5.3.13 SAS 2.1 Differential to Common Mode Conversion	Limits set in SAS 2.1 Section 5.6.3 for SCD21 by equation and coefficient values in Table 25, depicted in Figure 83.		S-parameter measurements made in accordance with SAS 2.1 Section D9 using the frequency range described in Table 25 of 100MHz to 6GHz.
5.3.14 SAS 2.1 Maximum Near-End Crosstalk (NEXT)	Limits set in SAS 2.1 Section 5.6.3 for NEXT in Table 25, depicted in Figure 83.		S-parameter measurements made in accordance with SAS 2.1 Section D9 using the frequency range described in Table 25 of 100MHz to 6GHz. Each near-end aggressor transfer function can be summed using equation located in Table 25 Note g. NEXT values will be expressed in negative db.
5.3.15 SAS 2.1 Simulated BER performance Level.	For trained 6Gbps signaling a BER that is less than 10^{-15} based on simulation results. SAS 2.1 Table 26 shows additional requirements for Minimum Voltage and Maximum TJ.		These simulations are performed using Agilent ADS channel simulation with requirements for reference transmitter (SAS 2.1 Section 5.8.4.6.5) and reference receiver (SAS 2.1 Section 5.8.5.7.3). No crosstalk sources will be included for the BER of 10^{-15} verification, this is expected to yield



6.0 Qualification Groups and Test Sequence

Group 1 Mechanical	Group 2 ENVIRONMENTAL	Group 3 ATC	Group 4 RF
Visual Examination per 5.1.1	Visual Examination per 5.1.1	Visual Examination per 5.1.1	Visual Examination per 5.1.1
Differential Impedance per 5.3.1	Differential Impedance per 5.3.1	Differential Impedance per 5.3.1	Disturbance Durability per 5.1.3
Durability per 5.1.2	Durability per 5.1.2	Durability per 5.1.2	IBTA Differential Impedance per 5.3.1
Differential Impedance per 5.3.1	Differential Impedance per 5.3.1	Differential Impedance per 5.3.1	IBTA Time Domain NEXT per 5.3.2
Cable Flex Test per 5.1.4	Thermal Shock per 5.2.3	Temperature Life per 5.2.1	IBTA Return Loss per 5.3.3
Differential Impedance per 5.3.1	Differential Impedance per 5.3.1	Differential Impedance per 5.3.1	IBTA Insertion Loss per 5.3.4
	Temp & humidity Cycling per 5.2.2	ATC per 5.2.4	IEEE Insertion Loss per 5.3.7
	Disturbance Durability per 5.1.3	Differential Impedance per 5.3.1	IEEE ILD per 5.3.8
	Differential Impedance per 5.3.1		IEEE Return Loss per 5.3.9
	Temperature Life per 5.2.1		IEEE ICN per 5.3.10
	Disturbance Durability per 5.1.3		SAS 2.1 SDD22 per 5.3.11
	Differential Impedance per 5.3.1		SAS 2.1 SCD22 per 5.3.12
			SAS 2.1 SCD21 per 5.3.13
			SAS 2.1 Differential NEXT per 5.3.14
			SAS 2.1 Simulated BER per 5.3.15

7.0 Test Results

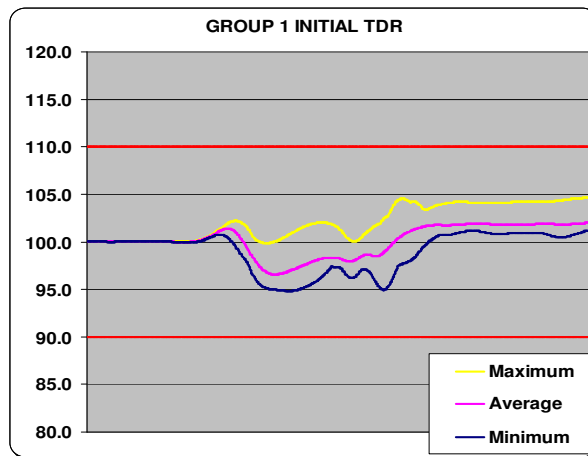
7.1 Group 1 Mechanical

Number of samples tested: 8
 Number of contact pairs per sample: 16
 Total number of pairs tested per this group: 128

7.1.1 Visual Examination

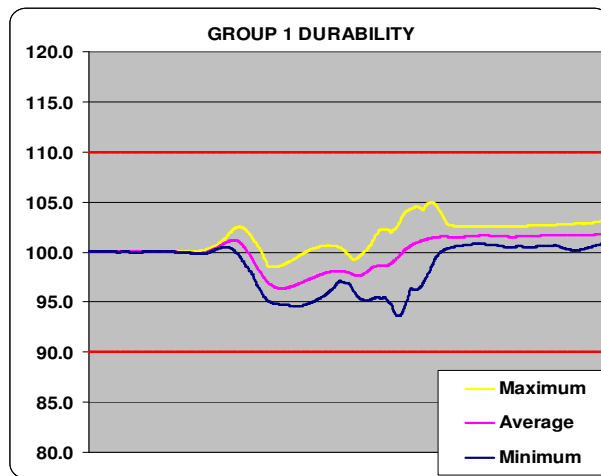
Product integrity remains unchanged i.e. no evidence of physical damage, swelling, blistering, distortion, etc. of the test sockets that prevents mechanical or electrical operation and meets design requirement of the product drawings

7.1.2 Initial TDR (100 ± 10 Ω):



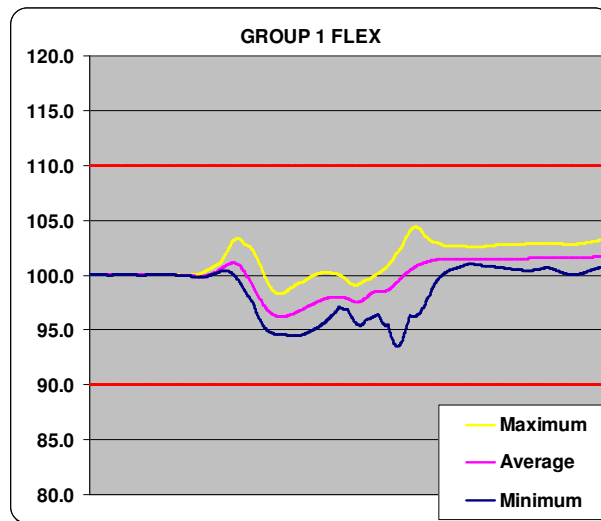
7.1.3 Durability (after 50 cycles):

Product differential impedance remains within requirements 100 ± 10 Ω



7.1.4 Cable Flex Test (after 30 cycles):

Product differential impedance remains within requirements $100 \pm 10 \Omega$



7.2 Group 2 Environmental

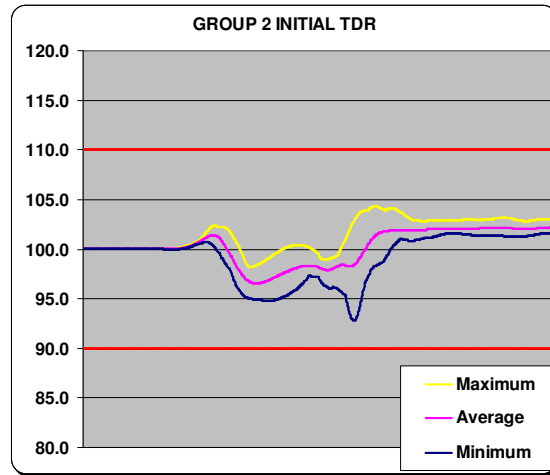
Number of samples tested:	8
Number of contact pairs per sample:	16
Total number of pairs tested:	128

7.2.1 Visual Examination

Product integrity remains unchanged i.e. no evidence of physical damage, swelling, blistering, distortion, etc. of the test sockets that prevents mechanical or electrical operation and meets design requirement of the product drawings

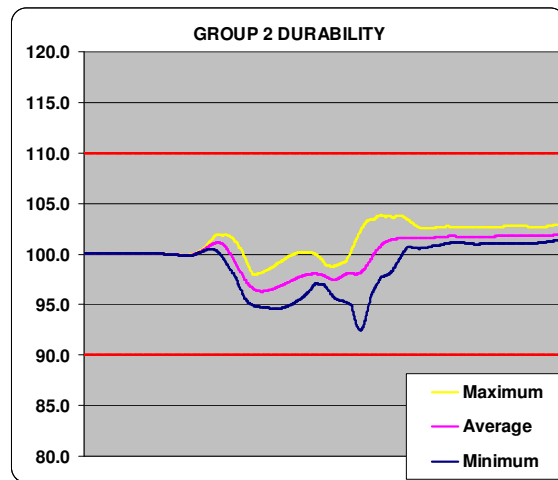
7.2.2 Differential Impedance ($100 \pm 10 \Omega$)

Product differential impedance remains within requirements $100 \pm 10 \Omega$



7.2.3 Durability (after 50 cycles):

Product differential impedance remains within requirements $100 \pm 10 \Omega$

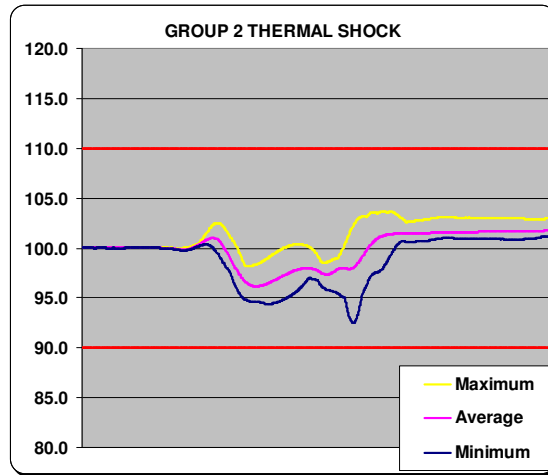


7.2.4 Differential Impedance ($100 \pm 10 \Omega$)

Product differential impedance remains within requirements $100 \pm 10 \Omega$

7.2.5 Thermal Shock

Socket withstood 10 cycles of thermal shock -55°C to 85°C without evidence of mechanical failure or Impedance failure

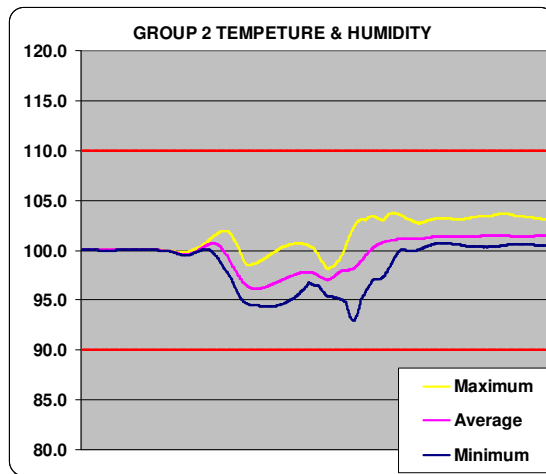


7.2.6 Differential Impedance

Product differential impedance remains within requirements $100 \pm 10 \Omega$

7.2.7 Temperature-Humidity Cycling:

Cable Impedance remains within spec after being subjected to 50 continuous cycles.



7.2.8 Disturbance-Durability:

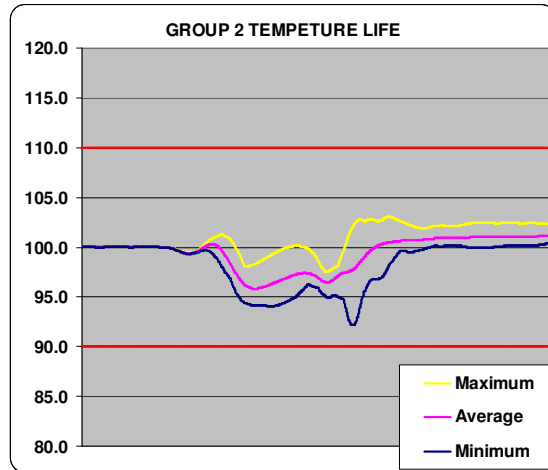
Passed 3 cycles: Plug cable end to test vehicle and unplug cable by pulling on lanyard.

7.2.9 Differential Impedance

Product differential impedance remains within requirements $100 \pm 10 \Omega$

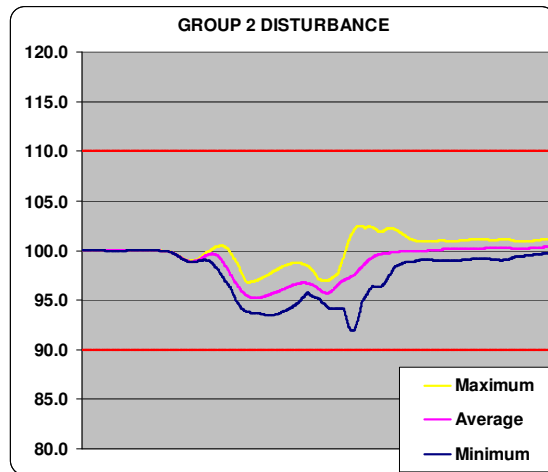
7.2.10 Temperature Life

Cable Impedance meets requirements after being exposed to 500 hours at 90C stress relaxation/temperature life.



7.2.11 Disturbance-Durability:

Product differential impedance remains within requirements 100 ± 10



7.2.12 Differential Impedance

Product differential impedance remains within requirements $100 \pm 10 \Omega$

7.3 Group 3 ATC

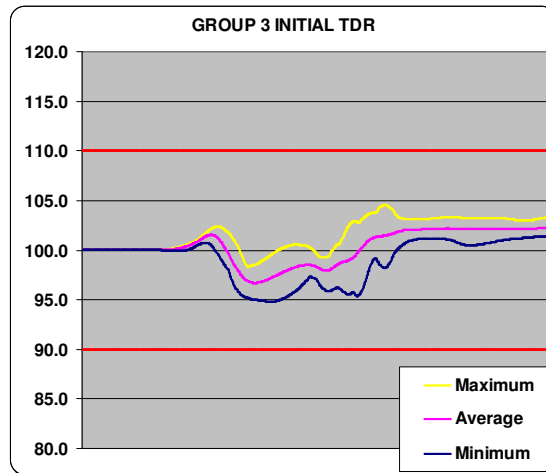
Number of samples tested:	8
Number of contact pairs per sample:	16
Total number of pairs tested:	128

7.3.1 Visual Examination

Product integrity remains unchanged i.e. no evidence of physical damage, swelling, blistering, distortion, etc. of the test sockets that prevents mechanical or electrical operation and meets design requirement of the product drawings

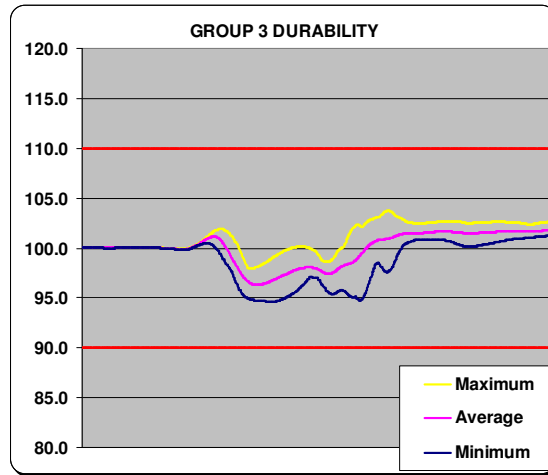
7.3.2 Differential Impedance

Product differential impedance remains within requirements $100 \pm 10 \Omega$



7.3.3 Durability (after 50 cycles)

Product differential impedance remains within requirements $100 \pm 10 \Omega$

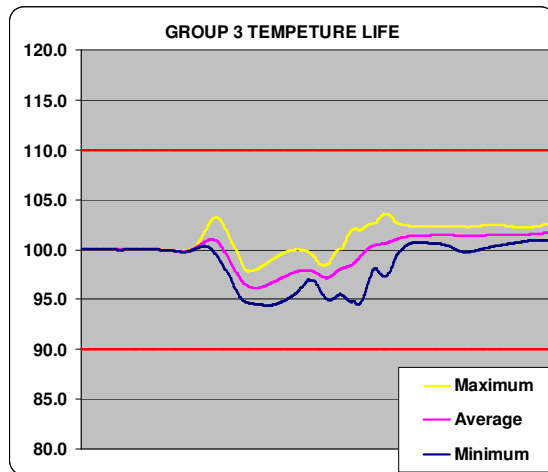


7.3.4 Differential Impedance

Product differential impedance remains within requirements $100 \pm 10 \Omega$

7.3.5 Temperature Life

Cable Impedance meets requirements after being exposed to 500 hours at 90C stress relaxation/temperature life.

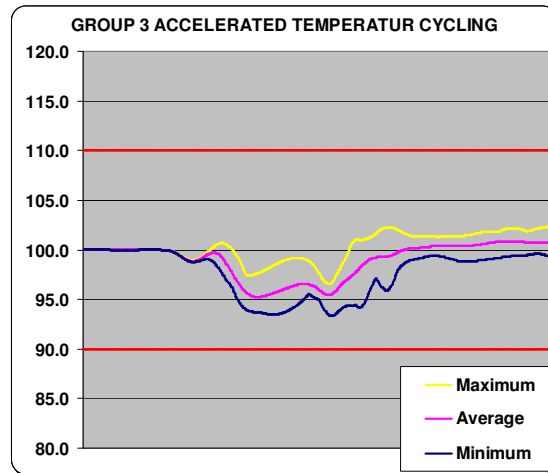


7.3.6 Differential Impedance

Product differential impedance remains within requirements $100 \pm 10 \Omega$

7.3.7 Accelerated Thermal Cycling (ATC)

Cable withstood 10 cycles of $15^{\circ}\text{C} \pm 3\text{C}$ to $85^{\circ}\text{C} \pm 3\text{C}$ thermal cycling without evidence of mechanical or Impedance failure.



7.3.8 Differential Impedance

Product differential impedance remains within required $100 \pm 10 \Omega$

7.4 Group 4 RF

Number of samples tested:	44
Number of contact pairs per sample:	8
Total number of pairs tested:	352

7.4.1 Visual Examination

Product integrity remains unchanged i.e. no evidence of physical damage, swelling, blistering, distortion, etc. of the test sockets that prevents mechanical or electrical operation and meets design requirement of the product drawings

7.4.2 Disturbance-Durability:

Product differential impedance remains within required $100 \pm 10 \Omega$

7.4.3 IBTA Differential Impedance

Product meets or exceeds IBTA test specifications. Reference IBTA published data for qualified integrators listing.

7.4.4 IBTA Time Domain NEXT

Maximum 4% sum of all contributing aggressors: Mated cable and board connector, measured differentially with all adjacent neighbor pairs driven at 50 ps (20-80%) (DDR, QDR) transition time.

Product meets or exceeds IBTA test specifications. Reference IBTA published data for qualified integrators listing.

7.4.5 IBTA Return Loss

S-parameter measurements:

Freq. (GHz)	SDD11 (max)
0.1-1.0	-10
1.0-2.5	-(12-2*SQRT(f))
2.5-4.1	-(12-2*SQRT(f))
4.1-10	-(6.3-13*log ₁₀ (f/5.5))

Product meets or exceeds IBTA test specifications. Reference IBTA published data for qualified integrators listing.

7.4.6 IBTA Insertion Loss

Product meets or exceeds IBTA test specifications. Reference IBTA published data for qualified integrators listing.

7.4.7 IEEE Insertion Loss

Meets procedure based on IEEE 802.3ba Table 85-10.2 17.04 db @ 5.15625 GHz from TP1-TP4 and insertion loss coefficients listed, Using fitted insertion loss from 50MHz to 7500MHz w/ frequency spacing of 10MHz.
 Meets requirements based on IEEE 802.3 ba D3.0

7.4.8 IEEE Insertion Loss Deviation

Meets limits based on IEEE 802.3ba Clause 85 Eq. 85-23 and 85-24. For procedure based on IEEE 802.3ba Clause 85.10.3 Eq. 85-22. Determined by the difference in fitted insertion loss and measured insertion loss, 50MHz to 7500MHz.
 Meets requirements based on IEEE 802.3 ba D3.0

7.4.9 IEEE Cable Assembly Return Loss

Meets requirements of IEEE procedure for S-parameter measurement frequencies 50 MHz to 10 GHz

Freq. (GHz)	SDD11
$0.05 \leq f < 4.1$	$12 - 2 * \text{SQRT}(f)$
$4.1 \leq f \leq 10$	$6.3 - 12 \log_{10}(f/5.5)$

Meets requirements based on IEEE 802.3 ba D3.0

7.4.10 IEEE Integrated Crosstalk Noise (ICN)

Meets the limits for IEEE 802.3ba ICN referenced to Clause 85, Eq. 85-33 and Figure 85-12 procedure outlined in IEEE 802.3ba Clause 85.10.4 through 85.10.7. Including MDNEXT and MDFEXT calculations from S-parameter measurements made from 50MHz to 10GHz with frequency spacing of 10MHz.

Meets requirements based on IEEE 802.3 ba D3.0

7.4.11 SAS 2.1 Differential Return Loss

Meets the limits set in SAS 2.1 Section 5.6.3 for SDD22 by equation and coefficient values in Table 25, depicted in Figure 83. S-parameter measurements were made in accordance with SAS 2.1 Section D9 using the frequency range described in Table 25 of 100MHz to 6GHz.

Meets required spec as set forth by SAS 2.1.

7.4.12 SAS 2.1 Differential to Common Mode Return Loss

Meets the limits set in SAS 2.1 Section 5.6.3 for SCD22 by equation and coefficient values in Table 25, depicted in Figure 83. S-parameter measurements were made in accordance with SAS 2.1 Section D9 using the frequency range described in Table 25 of 100MHz to 6GHz.

Meets required spec as set forth by SAS 2.1.

7.4.13 SAS 2.1 Differential to Common Mode Conversion

Meets the limits set in SAS 2.1 Section 5.6.3 for SCD21 by equation and coefficient values in Table 25, depicted in Figure 83. S-parameter measurements were made in accordance with SAS 2.1 Section D9 using the frequency range described in Table 25 of 100MHz to 6GHz.

Meets required spec as set forth by SAS 2.1.

7.4.14 SAS 2.1 Maximum Near-End Crosstalk (NEXT)

Meets the limits set in SAS 2.1 Section 5.6.3 for NEXT in Table 25, depicted in Figure 83.

S-parameter measurements were made in accordance with SAS 2.1 Section D9 using the frequency range described in Table 25 of 100MHz to 6GHz. Each near-end aggressor transfer function summed using equation located in Table 25 Note g. NEXT (in negative db).

Meets required spec as set forth by SAS 2.1.

7.4.15 SAS 2.1 Simulated BER performance

These simulations were performed using Agilent ADS channel simulation with requirements for reference transmitter (SAS 2.1 Section 5.8.4.6.5) and reference receiver (SAS 2.1 Section 5.8.5.7.3). No crosstalk sources were included for the BER of 10⁻¹⁵ verification, expected to yield.

For 6Gbps signaling a BER that is less than 10⁻¹⁵ based on simulation results. SAS 2.1.

Meets required spec as set forth by SAS 2.1.