SFP Cage Assemblies

1. INTRODUCTION

1.1. Purpose

Testing was performed on one and two-piece Small Form-factor Pluggable (SFP) cage assemblies to determine their conformance to the requirements of Product Specification 108-1950 Revision B.

1.2. Scope

This report covers the electrical and mechanical performance of the SFP cage assembly. Testing was performed on 2 piece cage assemblies at the Americas Regional Laboratory between 24Jul00 and 28Aug00. The test file number for this testing is CTL B019292-008. Additional testing was performed on 1 piece cage assemblies between19Apr02 and 16Aug02. The test file numbers for this additional testing are CTL B028492-003 and CTL A438-001. This documentation is on file at and available from the Americas Regional Laboratory.

1.3. Conclusion

The SFP 20 1 and 2 piece cage assemblies listed in paragraph 1.5., conformed to the electrical and mechanical performance requirements of Product Specification 108-1950 Revision B.

1.4. Product Description

The one and two-piece SFP cage assemblies are designed to enclose the SFP 20 position connector which is designed to interconnect SFP fiber optic or copper transceivers to printed circuit boards. The cage assembly offers a ground plane around the transceiver module and is designed to latch the transceiver to the printed circuit board.

1.5. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for test:

A. Two Piece Cage Assemblies

Test Group	Quantity	Part Number	Description
1,2,3	5 each	1367034-1	SFP lower cage
	5 each	1367035-1	SFP upper cage
	5 each	1367073-1	SFP connector

B. One Piece Cage Assemblies

Test Group	Quantity	Part Number	Description
1,3	5 each	1489669-1	One-piece press-fit cage, 11 pins
	5 each	1367073-1	SFP connector
2,4,5,6	5 each	1489669-1	One-piece press-fit cage, 11 pins
2	5	1489779-1	One-piece press-fit cage, 20 pins

* Trademark
I Indicates change

1.6. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

- Temperature: 15 to 35°C
- Relative Humidity: 20 to 80%

1.7. Qualification Test Sequence

A. Two Piece Cage Assemblies

Test or Examination	Test Group (a)		
	1	2	3
	Test Sequence (b)		
Initial examination of product	1	1	1
Dry circuit resistance			2,4
Solderability		2	
Cable pull	7		
Durability	4		3
Height of latch	2,6		
Insertion force	3		
Module retention	5		
Final examination of product	8	3	5

NOTE (a) *See paragraph 1.5.*
(b) *Numbers indicate sequence in which tests are performed.*

B. One Piece Cage Assemblies

Test or Examination	Test Group (a)					
	1	2	3	4	5	6
	Test Sequence (b)					
Initial examination of product	1	1	1	1	1	1
Dry circuit resistance			2,4			
Solderability		2				
Cable pull	6					
Durability	4		3			
Height of latch	2,5					
Insertion force	3					
Press-fit insertion force.				2	2	2
Press-fit extraction force.				3	4	4
Module retention	7					
Humidity-temperature cycling.					3	
Temperature life.						3
Final examination of product	8	3	5	4	5	5

NOTE (a) *See paragraph 1.5.*
(b) *Numbers indicate sequence in which tests are performed.*

2. SUMMARY OF TESTING

2.1. Two Piece Cage Assemblies - CTL Report B019292-008

A. Initial Examination of Product - All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by the Product Assurance Department. Where specified, specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

B. Termination Resistance - Test Groups 1, 2 and 3

All termination resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 35 milliohms.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
3	90	Initial	10.53	14.08	12.253
		After durability	10.40	14.26	12.139

NOTE *All values in milliohms.*

C. Solderability - Test Group 5

All contact leads had a minimum of 95% solder coverage.

D. Cable Pull - Test Group 1

There was no physical damage to, or failure of, the latch mechanism as a result of applying a 100 N [22.5 lb] static load to the cable and rotating it 360 degrees.

E. Durability - Test Groups 1 and 3

No physical damage was sustained by the cage assembly latch mechanism as a result of mating and unmating the specimens 100 times with the latch retention feature operational.

F. Height of Latch - Test Group 1

The height of the latch mechanism from the top of the cage assembly, when measured after testing, did not change more than 0.3 mm [.01 in] from the initial measurement.

G. Insertion Force - Test Group 1

The force required to insert the test module into the cage assembly to the fully latched position was less than 35 N [7.9 lb].

H. Module Retention - Test Group 1

The latches did not release when an axial load of 180 N [40.5 lb] was applied to the cage assembly.

I. Final Examination of Product - All Test Groups

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. One Piece Cage Assemblies - CTL Reports B028492-003 and A438-001

A. Initial Examination of Product - All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by the Product Assurance Department. Where specified, specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

B. Dry Circuit Resistance - Test Group 3

All termination resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 35 milliohms initially and had a change in resistance (ΔR) of less than 1.6 milliohms after testing.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
3 Action	5	Initial	0.390	0.455	0.427
		After mechanical (ΔR)	0.008	0.059	0.030
3 Crescent	5	Initial	1.064	1.320	1.183
		After mechanical (ΔR)	0.758	2.200	1.539

NOTE *All values in milliohms.*

C. Solderability - Test Group 2

All contact leads had a minimum of 95% solder coverage.

D. Cable Pull - Test Group 1

There was no physical damage to, or failure of, the latch mechanism as a result of applying a 100 N [22.5 lbf] static load to the cable and rotating it 45 degrees from the cable axis.

E. Durability - Test Groups 1 and 3

No physical damage was sustained by the cage assembly latch mechanism as a result of mating and unmating the specimens 200 times with the latch retention feature operational.

F. Height of Latch - Test Group 1

The height of the latch mechanism from the top of the cage assembly, when measured after testing, did not change more than 0.8 mm [.031 in] from the initial measurement.

G. Insertion Force - Test Group 1

The force required to insert the test module into the cage assembly to the fully latched position was less than 35 N [7.9 lbf].

H. Press-fit Insertion Force - Test Groups 4, 5 and 6

The force required to insert the cages into the printed circuit boards was less than 500 N [112.4 lbf].

I. Press-fit Extraction Force - Test Groups 4, 5 and 6

The force required to extract the cages from the printed circuit boards was greater than 80 N [18 lbf].

J. Module Retention - Test Group 1

The latches did not release when an axial load of 180 N [40.5 lbf] was applied to the cage assembly with the latch engaged.

K. Humidity-Temperature Cycling - Test Group 5

No evidence of physical damage was visible as a result of exposure to humidity-temperature cycling.

L. Temperature Life - Test Group 6

No evidence of physical damage was visible as a result of exposure to temperature life.

M. Final Examination of Product - All Test Groups

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3. TEST METHODS

3.1. Two Piece Cage Assemblies - CTL Report B019292-008

A. Initial Examination of Product

Where specified, specimens were visually examined for evidence of physical damage detrimental to product performance.

B. Termination Resistance

Termination resistance measurements at low level current were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

C. Solderability

Solder paste with a composition of 63 Sn/37 Pb RMA, visc/KCPS 1000 ± 10%, with a mesh of -325 +500 was placed on the areas of evaluation. The specimens were placed onto a 4.5 X 4.5 X .0395 inch ceramic substrate. Care was taken to ensure that the specimens were not contaminated in any way and were tested in the “as received” condition. The specimens and the ceramic substrate were placed in an oven. The temperature on the ceramic substrate, at a point close to the specimen, was monitored to enable temperature profiling. The specimens were exposed to temperatures starting at 180°C and increasing to 215°C over the first 2 minutes, and then increasing to 228°C at 5 minutes. After reflow was completed, the specimens were removed from the ceramic substrate and allowed to cool. Any flux residue was removed by immersing the specimens in an ultrasonic cleaner and alcohol for 5 minutes. Specimens were visually examined under 10X magnification.

D. Cable Pull

Modules mated to cage assemblies were mounted to fixtures and held at an approximate angle of 45 degrees. A solid piece of wire was inserted through a hole drilled in the module and a 100 N [22.5 lb] weight was applied to the free end of the wire. The modules and cage assemblies were then rotated 360 degrees.

E. Durability

Test modules were manually mated and unmated with the cage assembly and SPF connector 100 times with the latch retention feature operational.

F. Height of Latch

The height of the latch mechanism from the top of the cage assembly was measured using a dial caliper.

G. Insertion Force

The force required to mate test modules with cage assemblies and SFP connectors was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

H. Module Retention

After the test modules was inserted into the cage assembly and SFP connector, a hole was drilled into the end of the test module, a solid piece of wire was inserted through the hole, and a 180 N [40.5 lb] weight was applied to the free end of the wire. The load was applied long enough to verify that the cage assembly latches held the weight.

I. Final Examination of Product

Specimens were visually examined for evidence of physical damage detrimental to product performance.

3.2. One Piece Cage Assemblies - CTL Reports B028492-003 and A438-001

A. Initial Examination of Product

A Certificate of Conformance was issued stating that all specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts.

B. Dry Circuit Resistance

Dry circuit resistance measurements at low level current were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

C. Solderability

The areas of the specimens to be evaluated were immersed in type "R" flux (non-activated water white rosin) maintained at room temperature, for 5 to 10 seconds. After removal from the flux, the specimens were allowed to drain for 5 to 20 seconds. The specimens were then attached to a dipping machine. Any dross and oxidized flux were skimmed away before the specimens were immersed at a rate of approximately 1 inch per second into the solder bath filled with molten 60% tin and 40% lead maintained at 245 ± 5°C [473°F] and held for 4 to 5 seconds until the entire surface to be evaluated was coated. The specimens were then removed from the bath at a rate of approximately 1 inch per second and cleaned for 5 minutes using isopropyl alcohol. The specimens were then examined under 10X magnification.

D. Cable Pull

A module with cable was loaded into a cage soldered to a test board with an attached bezel. The specified load was applied to the cable and the cable rotated 45 degrees from the cable axis.

E. Durability

Specimens were mated and unmated 200 times at a maximum rate of 600 cycles per hour with latch retention feature operable.

F. Height of Latch

The height of the latch mechanism from the top of the cage assembly was measured using a toolmakers microscope.

G. Insertion Force

The force required to mate individual specimens with the latch engaged was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

H. Press-fit Insertion Force

The force required to mate individual specimens into a printed circuit board was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

I. Press-fit Extraction Force

The force required to extract individual specimens from a printed circuit board was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

J. Module Retention

The force required to unmate individual specimens with the latch engaged was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

K. Humidity-temperature Cycling

Mated specimens were subjected to 24, 3 hour cycles of humidity-temperature cycling between 25 ± 3°C at 80 ± 3% RH, and 65 ± 3°C at 50 ± 3% RH. Ramp times were .5 hour and dwell times were 1 hour at each extreme.

L. Temperature Life

Mated specimens were exposed to a temperature of 115°C for 432 hours.

M. Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.