MRJ 21 Connector System

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics MRJ 21 Connector System to determine its conformance to the requirements of Product Specification 108-2064 Revision C.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Mini RJ21 Connector System. Testing was performed at the Engineering Assurance Product Test Laboratory between 30Jan04 and 30Sep04. The test file numbers for this testing are EME B022740-003, ACL 20030213 and CTL G580-001 through G580-005. Additional testing was performed on MRJ 21 receptacles with a shortened front shell component on 19Jan07. The test file number for this additional testing is CTLG580-011. Additional testing was also performed on MRJ 21 cable assemblies with 27 AWG wire on 29Jun10. The test file number for this additional testing is 20100085ACL. This documentation is on file at and available from the EME Laboratory, the Product Reliability Center and the Engineering Assurance Product Test Laboratory respectively.

1.3. Conclusion

The MRJ 21 Connector System listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2064 Revision C.

1.4. Product Description

The MRJ 21 Connector System is comprised of a fully shielded board mounted receptacle and a shielded cable assembly, and is intended for use in networking applications where density and high performance is required. The receptacle is right angle, thru-hole soldered while the cable connector is designed to terminate to 24 and 27 AWG solid wire and includes a soldered termination. Product with 24 AWG wire is rated for Cat5e performance, product with 27 AWG wire is rated for Gigabit Ethernet Channel performance (Application 1000Base-T).

1.5. Test Specimens

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

Test Group	Quantity	Part Number	Description
1,2,3,4,5,6,7	5 each	1339362-1	48 position receptacle assembly
1,2,3,4,5,6,7	10 each	1339381-1	Receptacle screwlocks
1,2,3,4,5,6,7	5 each	1653347-2	48 position cable assembly
8	5	1888844-1	48 position receptacle assembly with shortened front shell component
4,9	5 each	1933960	180 position cable assembly with 27AWG wire

Figure 1

1.6. Environmental Conditions

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

- Temperature: 15 to 35°C
- Relative Humidity: 25 to 75%

* Trademark
| Indicates change

1.7. Qualification Test Sequence

Test or Examination	Test Group (a)								
	1	2	3	4	5	6	7	8	9
	Test Sequence (b)								
Initial examination of product	1	1	1	1	1	1	1	1	1
Low Level Contact Resistance (LLCR)	3,5,7,9	2,4,6							2,4,6
Insulation resistance				2,6					
Withstanding voltage				3,7(c)				2(c)	
Insertion loss					2				
Return loss					3				
NEXT					4				
PSNEXT					5				
ELFEXT					6				
PSELFEXT					7				
Solderability							2		
Vibration	6								3
Mechanical shock	8								5
Durability	4	3(d)							
Mating force	2								
Unmating force	10								
Screwlock torque						2			
Perpendicular loading						3			
Axial loading.						4			
Thermal shock				4					
Humidity/temperature cycling				5					
Temperature life		5							
Mixed flowing gas			2(e)						
Final examination of product	11	7	3	8	8	5	3	3	7

NOTE

(a) See paragraph 1.5.

(b) Numbers indicate sequence in which tests are performed.

(c) Specimens in test group 4 tested at 1000 volts contact to contact and 1500 volts contact to shield. Specimens in test group 8 tested at 2500 volts contact to shield.

(d) Precondition specimens with 12 durability cycles.

(e) Subject specimens to the following: 1) LLCR per EIA-364-23, mated. 2) Fifty durability cycles per EIA-364-9. 3) Temperature life at 105°C for 72 hours per EIA-364-17, mated. 4) LLCR per EIA-364-23, mated. 5) MFG, Option 2 per EIA-364-65, Class IIA. 6) LLCR per EIA-364-23, mated. 7) Ten cycles of thermal disturbance between 15 ± 3 and 85 ± 3°C; ramp time shall be a minimum of 2°C per minute with 10 minute dwell times at temperature extremes; humidity at laboratory ambient. 8) LLCR per EIA-364-23, mated. 9) Three cycles of durability. 10) LLCR per EIA-364-23, mated.

Figure 2

2. SUMMARY OF TESTING

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

2.2. LLCR

A. Test Groups 1 and 2 (24 AWG wire)

All LLCR measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage had a change in resistance (ΔR) of less than 10 milliohms after testing.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
1	240	Initial	51.57	62.72	58.24
		After durability	ΔR 1.67		
		After vibration	ΔR 1.81		
		After mechanical shock	ΔR 1.86		
2	240	Initial	71.75	81.13	76.85
		After durability	ΔR 0.72		
		After temperature life	ΔR 0.96		

NOTE *All values in milliohms.*

B. Test Group 9 (27 AWG wire)

Test Group	Specimen ID	Condition	Termination Resistance		
			Min	Max	Mean
9	3A	Initial	54.98	63.87	60.195
		After vibration	ΔR 1.99		
		After mechanical shock	ΔR -2.51		
	3B	Initial	55.75	64.67	60.612
		After vibration	ΔR -2.87		
		After mechanical shock	ΔR -2.89		
	3C	Initial	53.29	63.98	59.599
		After vibration	ΔR -1.28		
		After mechanical shock	ΔR -1.31		

NOTE *All values in milliohms.*

Figure 3

2.3. Insulation Resistance - Test Group 4

All insulation resistance measurements were greater than 1000 megohms initially, and 500 megohms after testing.

2.4. Withstanding Voltage - Test Group 4

No dielectric breakdown or flashover occurred.

2.5. Insertion Loss - Test Group 5

All insertion loss results were within the requirements of EIA/TIA-568-B.1.

2.6. Return Loss - Test Group 5

All return loss results were within the requirements of EIA/TIA-568-B.1.

2.7. Near-end Crosstalk (NEXT) - Test Group 5

All NEXT results were within the requirements of EIA/TIA-568-B.1.

2.8. Power Sum Near-End Crosstalk (PSNEXT) - Test Group 5

All PSNEXT results were within the requirements of EIA/TIA-568-B.1.

2.9. Equal Level Far-End Crosstalk (ELFEXT) - Test Group 5

All ELFEXT results were within the requirements of EIA/TIA-568-B.1.

2.10. Power Sum Equal Level Far-End Crosstalk (PSELFEXT) - Test Group 5

All PSELFEXT results were within the requirements of EIA/TIA-568-B.1.

2.11. Solderability - Test Group 7

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

| 2.12. Vibration - Test Groups 1 and 9

No discontinuities were detected during vibration testing. Following vibration testing, no cracks, breaks, or loose parts on the specimens were visible.

| 2.13. Mechanical Shock - Test Groups 1 and 9

No discontinuities were detected during mechanical shock testing. Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible.

2.14. Durability - Test Group 1

No physical damage occurred as a result of mating and unmating the specimens 500 times.

2.15. Mating Force - Test Group 1

All mating force measurements were less than 66.7 N [15 lbf].

2.16. Unmating Force - Test Group 1

All unmating force measurements were greater than 13.3 N [3 lbf].

2.17. Screwlock Torque - Test Group 6

All specimens met the requirement of 0.45 N•m [4 in-lb].

2.18. Perpendicular Loading - Test Group 6

All perpendicular loading measurements were greater than 2.26 N•m [20 in-lb].

2.19. Axial Loading - Test Group 6

All axial loading measurements were greater than 177.9 N [40 lbf].

2.20. Thermal Shock - Test Group 4

No evidence of physical damage was visible as a result of thermal shock testing.

2.21. Humidity/temperature Cycling - Test Group 4

No evidence of physical damage was visible as a result of humidity/temperature cycling.

2.22. Temperature Life - Test Group 2

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

2.23. Mixed Flowing Gas - Test Group 3

No evidence of physical damage was visible as a result of exposure to the pollutants of mixed flowing gas.

2.24. 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. 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.

3.2. LLCR

LLCR measurements 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.

3.3. Insulation Resistance

Insulation resistance was measured between adjacent contacts. A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

3.4. Withstanding Voltage

A test potential of 1000 volts AC was applied contact to contact for 1 minute and then returned to zero.
A test potential of 1500 volts AC was applied contact to shield for 1 minute and then returned to zero.
A test potential of 2500 volts DC was applied contact to shield for 1 minute and then returned to zero.

3.5. Insertion Loss

A full Two-Port Calibration was performed on a network analyzer and the insertion loss, S_{21}, of the specimen was measured.

3.6. Return Loss

A One-Port Calibration was performed on a network analyzer and the return loss, S_{11}, of the specimen was measured.

3.7. Near-end Crosstalk (NEXT)

Sinusoidal frequencies of 1 to 100 MHz were applied to 1 end of the "driven line". The "quiet line" was monitored with a network analyzer to measure any crosstalk signals.

3.8. Power Sum Near-End Crosstalk (PSNEXT).

Sinusoidal frequencies of 1 to 100 MHz were applied to 1 end of the "driven line". The "quiet line" was monitored with a network analyzer to measure any crosstalk signals.

3.9. Equal Level Far-End Crosstalk (ELFEXT).

Sinusoidal frequencies of 1 to 100 MHz were applied to 1 end of the "driven line". The "quiet line" was monitored with a network analyzer to measure any crosstalk signals.

3.10. Power Sum Equal Level Far-End Crosstalk (PSELFEXT).

Sinusoidal frequencies of 1 to 100 MHz were applied to 1 end of the "driven line". The "quiet line" was monitored with a network analyzer to measure any crosstalk signals.

3.11. Solderability

Specimen contact solder tails were subjected to a solderability test. The soldertails were immersed in Kester 182 flux for 5 to 10 seconds, allowed to drain for 10 to 60 seconds, then held over molten solder without contact for 2 seconds. The solder tails were then immersed in the molten solder at a rate of approximately 1 inch per second, held for 3 to 5 seconds, then withdrawn. After cleaning in isopropyl alcohol, the specimens were visually examined for solder coverage. The solder used for testing was 60/40 tin lead composition and was maintained at a temperature of 245 ± 5°C.

3.12. Vibration, Random

Mated specimens were subjected to a random vibration test, specified by a random vibration spectrum, with excitation frequency bounds of 20 and 500 Hz. The power spectral density at 5 Hz was 0.000312 G^2/Hz. The spectrum sloped up at 6 dB per octave to a PSD of 0.02 G^2/Hz at 14 Hz. The spectrum was flat at 0.02 G^2/Hz from 14 to 500 Hz. The root-mean square amplitude of the excitation was 3.10 GRMS. This was performed for 15 minutes in each of 3 mutually perpendicular planes for a total vibration time of 45 minutes. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.13. Mechanical Shock, Half-sine

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 30 gravity units (g peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 18 shocks. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.14. Durability

Specimens were mated and unmated 500 times at a maximum rate of 500 cycles per hour.

3.15. Mating Force

The force required to mate individual specimens 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.

3.16. Unmating Force

The force required to unmate individual specimens 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.

3.17. Screwlock Torque

Screwlocks of the specimens were torqued to 0.45 N•m [4 in-lb] and then released.

3.18. Perpendicular Loading

A perpendicular load was applied to the specimens and held for 5 seconds.

3.19. Axial Loading

An axial load of was applied to the specimens and held for 5 seconds.

3.20. Thermal Shock

Specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 85°C. The transition between temperatures was less than 1 minute.

3.21. Humidity/temperature Cycling

Specimens were exposed to 10 cycles of humidity/temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 and 65°C twice while maintaining high humidity.

3.22. Temperature Life

Mated specimens were exposed to a temperature of 85°C for 500 hours. Specimens were preconditioned with 12 cycles of durability.

3.23. Mixed Flowing Gas

Specimens were exposed per the requirements of Option 2, Test Group 4 of EIA-364-1000.01 as follows: 1) LLCR per EIA-364-23, mated. 2) Fifty durability cycles per EIA-364-9. 3) Temperature life at 105°C for 72 hours per EIA-364-17, mated. 4) LLCR per EIA-364-23, mated. 5) MFG, Option 2 per EIA-364-65, Class IIA. 6) LLCR per EIA-364-23, mated. 7) Ten cycles of thermal disturbance between 15 ± 3 and 85 ± 3°C; ramp time shall be a minimum of 2°C per minute with 10 minute dwell times at temperature extremes; humidity at laboratory ambient. 8) LLCR per EIA-364-23, mated. 9) Three cycles of durability. 10) LLCR per EIA-364-23, mated.

3.24. Final Examination of Product

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