MT-RJ Patch Panel and Outlet Jacks (Standard, XG, SECURE and SECURE XG)

1. INTRODUCTION

1.1. Purpose

Testing was performed on Tyco Electronics MT-RJ Jack, 39 mm, multimode, Standard, XG compatible and MT-RJ SECURE fiber optic connectors to determine their conformance to the requirements of Product Specification 108-1832, Revision D, which meets the Optical Fiber Cabling Components Standard TIA/EIA-568-B.3

1.2. Scope

This report covers the optical, environmental, and mechanical performance of MT-RJ Jack, 39 mm, multimode fiber optic connectors, in the following configurations: Standard, XG and MT-RJ SECURE. All connectors were manufactured by Tyco Electronics, Fiber Optic Business Unit. Testing was performed between 21Oct02 and 01Mar05. The test file numbers for this testing are B034072-006 B041976-004, A285-005 and B059794-002.

1.3. Conclusion

The MT-RJ Jack, 39 mm, multimode Standard fiber optic connectors, listed in paragraph 1.5, (Test Groups 1-4), meet the optical, environmental, and mechanical performance requirements of Product Specification 108-1832, Revision D and the Optical Fiber Cabling Components Standard TIA/EIA-568-B.3.

The MT-RJ Jack, 39 mm, multimode, Standard fiber optic connectors terminated to 250 µm coated fiber, listed in paragraph 1.5 (Test Group 5), meet the optical and mechanical performance requirements of Product Specification 108-1832, Revision D and the Optical Fiber Cabling Components Standard TIA/EIA-568-B.3. Environmental performance is assumed to be qualified by similarity to the standard product terminated to 900 µm tight buffered fiber.

The MT-RJ Jack, 39 mm, multimode, XG compatible fiber optic connectors, listed in paragraph 1.5 (Test Group 6), meet the optical performance requirements of Product Specification 108-1832, Revision D and the Optical Fiber Cabling Components Standard TIA/EIA-568-B.3. Environmental and mechanical performance are assumed to be qualified by similarity to the standard product line.

The MT-RJ Jack, 39 mm, multimode, secure fiber optic connectors, listed in paragraph 1.5 (Test Group 7), were subjected to optical tests and a subset of the mechanical tests from Product Specification 108-1832, Revision D and the Optical Fiber Cabling Components Standard TIA/EIA-568-B.3. Product meets performance requirements for those tests performed. Performance from the environmental tests and remaining mechanical tests is assumed to be qualified by similarity to the standard product line. The following additional keying configurations/colors are assumed to be qualified by similarity to the parts tested.

MT-RJ SECURE Jacks	
1588493-2 (Yellow)	1588493-6 (Aqua)
1588493-3 (Green)	1588493-8 (Violet)
1588493-4 (Blue)	1588493-9 (Orange)
1588493-5 (Rose)	1-1588493-0 (Slate)

MT-RJ SECURE Plugs	
1918356-2 (Yellow)	1918356-6 (Aqua)
1918356-3 (Green)	1918356-8 (Violet)
1918356-4 (Blue)	1918356-9 (Orange)
1918356-5 (Rose)	1-1918356-0 (Slate)

* Trademark
| Indicates change

1.4. Product Description

The Tyco Electronics MT-RJ Jack, 39 mm fiber optic connectors are field installable multimode 2-fiber connectors that are used in data communication and telecommunications networks and equipment.

The MT-RJ SECURE product line is available in ten keys and ten colors - four standard colors and six additional colors. MT-RJ SECURE product provides assured safety and protection against unwanted intrusion. The chance of improper interconnections between networks can be minimized when multiple networks in a common area are segregated by colors. Only plugs and jacks of the same color will mate, and none of the MT-RJ SECURE products will mate with the standard versions.

1.5. Test Specimens

Test specimens were manufactured using normal production means. Specimens consisted of the jack assemblies and the following supplies outlined below.

Test Group	1	2	3	4	5	6	7
Fiber size: (µm/µm)	50/125			62.5/125	50/125	50/125	50-125
Cable type for jack termination (receive end)	900 µm Tight Buffer			900 µm Tight Buffer	250 µm Coated Fiber	250 µm Coated Fiber	900 µm Tight Buffer
MT-RJ Plug Cable Assembly PN	1-1278128-0			1-1278032-0	1278128-3		1-1278873-0 1-1828264-0
MT-RJ Jack Module Assembly PN	1588495-2			1588495-1	1-1374395-1	1-1374395-3 (XG)	1588493-1 (red) 1588493-7 (brown) MT-RJ SECURE jack
MT-RJ Connector Kit PN see Note (a)	6278750-1						1918356-1 (red) 1918356-7 (brown) MT-RJ SECURE plug
Test specimens required	8	8	8	8	8	15	8 see Note (b)
Control cable required	1	0	0	1	0	0	0

NOTE

(a) MT-RJ connector kit part numbers were used in the manufacture of plug cable assemblies listed above.

(b) Two colors were tested to represent the MT-RJ SECURE product line. The test group quantity of 8 specimens consisted of 4 each from the part numbers shown. An MT-RJ SECURE plug and an MT-RJ SECURE jack were mated to form 8 connector pairs.

1.6. Qualification Test Sequence

Test or Examination	Test Groups (a)						
	1	2	3	4	5	6	7
	Test Sequence (b)						
Visual and mechanical inspection	1	1	1	1	1	1	1
Attenuation (insertion loss)	2	2	2	2	2	2	2
Return loss	3	3	3	3	3	3	3
Low temperature	4			4			
Humidity, steady state	5			5			
Temperature life	6			6			
Strength of coupling mechanism		4					4
Cable retention, 0 degrees		5			4		
Cable retention, 90 degrees		6			5		
Durability		7					6
Cable flexing			4		6		
Twist			5		7		
Impact			6		8		5

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

2. SUMMARY OF TESTING

2.1. Visual and Mechanical Inspection - All Test Groups

All specimens submitted for testing were manufactured by Tyco Electronics, and were inspected and accepted by the Product Assurance Department of the Fiber Optics Business Unit.

Specimens are assumed to be compliant with FOCIS dimensions per Tyco Electronics First Article approval, which includes verification of product drawings per the dimensions specified in TIA/EIA-604-12. For MT-RJ SECURE product, areas not impacted by keying geometries are assumed to comply, based on First Article.

2.2. Initial Optical Performance - All Test Groups

All attenuation and return loss measurements met the specification requirements. Attenuation and return loss were measured at 850 and 1300 nm for all test groups, both 50/125 and 62.5/125 micron fiber size.

Performance requirements	Multimode Test Groups (1-7)	
	850 nm	1300 nm
Maximum allowed attenuation for any individual specimen	0.75	0.75
Minimum allowed return loss for any individual specimen	20	20

Attenuation (Insertion Loss) and Return Loss - Requirements for New Product (dB)

Test Group	Fiber Type	Maximum Attenuation		Minimum Return Loss	
		850 nm	1300 nm	850 nm	1300 nm
1	Multimode	0.64	0.56	30.9	32.7
2	Multimode	0.60	0.49	34.8	34.9
3	Multimode	0.62	0.58	32.4	32.8
4	Multimode	0.64	0.59	34.0	31.9
5	Multimode	0.48	0.42	33.7	36.1
6	Multimode	0.63	0.47	32.7	34.2
7	Multimode	0.35	0.32	36.4	39.0

Attenuation (Insertion Loss) and Return Loss - Actual for New Product (dB)

2.3. Attenuation, Change in Attenuation, Attenuation Increase and Return Loss – All Test Groups

All attenuation, change in attenuation, attenuation increase and return loss measurements met the specification requirements. All measurements were recorded at 850 and 1300 nm for 50/125 µm and 62.5/125 µm fiber sizes. Values shown in the table below represent maximum attenuation, maximum change in attenuation, maximum attenuation increase and minimum return loss.

Test Group	Condition	Requirements (850 and 1300 nm)			Actual (850 nm)			Actual (1300 nm)		
		Before	During	After	Before	During	After	Before	During	After
		IL	ΔIL	IL,RL,IL↑	IL	ΔIL	IL,RL,IL↑	IL	ΔIL	IL,RL,IL↑
	Low temperature		0.3		0.59	0.08	0.59(IL) 31.0(RL)	0.55	0.07	0.53(IL) 31.6(RL)
1	Humidity, steady state	0.75	0.4	0.75(IL) 20(RL)	0.61	0.13	0.64(IL) 30.6(RL)	0.54	0.07	0.55(IL) 32.3(RL)
	Temperature life		NA		0.65	NA	0.64(IL) 30.9(RL)	0.55	NA	0.59(IL) 32.4(RL)
	Strength of coupling mechanism			0.75(IL) 20(RL)	0.58		0.59(IL) 34.7(RL)	0.45		0.46(IL) 34.7(RL)
2	Cable retention	0.75	NA	0.75(IL) 20(RL) 0.5(IL↑)	0.61	NA	0.61(IL) 34.7(RL) 0.06(IL↑)	0.49	NA	0.49(IL) 34.7(RL) 0.06(IL↑)
	Side pull				0.60		0.65(IL) 34.7(RL) 0.07(IL↑)	0.56		0.57(IL) 34.8(RL) 0.09(IL↑)
	Durability			0.75(IL) 20(RL)	0.56		0.60(IL) 26.7(RL)	0.45		0.50(IL) 25.1(RL)
	Cable flexing				0.67		0.73(IL) 32.5(RL)	0.64		0.63(IL) 33.3(RL)
3	Twist	0.75	NA	0.75(IL) 20(RL)	0.67	NA	0.70(IL) 32.6(RL)	0.61	NA	0.64(IL) 33.3(RL)
	Impact				0.62		0.66(IL) 32.7(RL)	0.59		0.58(IL) 33.2(RL)
	Low temperature		0.3		0.59	0.06	0.59(IL) 34.1(RL)	0.59	0.05	0.59(IL) 32.2(RL)
4	Humidity, steady state	0.75	0.4	0.75(IL) 20(RL)	0.63	0.15	0.60(IL) 33.9(RL)	0.59	0.10	0.57(IL) 33.3(RL)
	Temperature life		NA		0.60	NA	0.60(IL) 33.7(RL)	0.58	NA	0.59(IL) 33.2(RL)

Change in Attenuation, Attenuation Increase and Return Loss Results (dB)
(continued)

Test Group	Condition	Requirements (850 and 1300 nm)			Actual (850 nm)			Actual (1300 nm)		
		Before	During	After	Before	During	After	Before	During	After
		IL	ΔIL	IL,RL,IL↑	IL	ΔIL	IL,RL,IL↑	IL	ΔIL	IL,RL,IL↑
5	Cable retention, 0 degrees	0.75	NA	0.75(IL) 20(RL) 0.5(IL↑)	0.44	NA	0.59(IL) 33.8(RL) 0.23(IL↑)	0.52	NA	0.51(IL) 35.9(RL) 0.23(IL↑)
	Cable retention, 90 degrees				0.40		0.52(IL) 33.7(RL) 0.14(IL↑)	0.41		0.54(IL) 36.1(RL) 0.15(IL↑)
	Cable flexing			0.75(IL) 20(RL)	0.52		0.61(IL) 33.4(RL)	0.45		0.72(IL) 34.2(RL)
	Twist				0.60		0.41(IL) 33.5(RL)	0.71		0.52(IL) 33.3(RL)
	Impact				0.41		0.42(IL) 33.4(RL)	0.51		0.47(IL) 33.8(RL)
6	Insertion loss and return loss only (see paragraph 2.2. for results)	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Strength of coupling mechanism	0.75	NA	0.75(IL) 20(RL)	0.38	NA	0.39(IL) 36.6(RL)	0.35	NA	0.35(IL) 39.2(RL)
	Impact				0.40		0.31(IL) 36.5(RL)	0.35		0.27(IL) 38.5(RL)
	Durability				0.34		0.42(IL) 26.4(RL)	0.32		0.35(IL) 28.1(RL)

Attenuation, Change in Attenuation, Attenuation Increase and Return Loss (dB) (end)

NOTE *IL - Insertion Loss (Attenuation)*
ΔIL - Change in Insertion Loss (Attenuation)
IL↑ - Insertion Loss (Attenuation) Increase
RL - Return Loss

2.4. Low Temperature – Test Groups 1 and 4

There was no evidence of physical damage to the jack connector or terminated fiber and no change in optical performance beyond the specified limit during low temperature exposure. All attenuation and return loss measurements met requirements before and after test. Optical performance was measured at 850 and 1300 nm.

2.5. Humidity, Steady State - Test Groups 1 and 4

There was no evidence of physical damage to the jack connector or terminated fiber and no change in optical performance beyond the specified limits during steady state humidity. All attenuation and return loss measurements met requirements before and after test. Optical performance was measured at 850 and 1300 nm.

2.6. Temperature Life - Test Groups 1 and 4

There was no evidence of physical damage to the jack connector or terminated fiber after temperature life. All attenuation and return loss measurements met specified limits before and after test. Optical performance was measured at 850 and 1300 nm.

2.7. Strength of Coupling Mechanism - Test Groups 2 and 7

There was no evidence of physical damage to the jack connector or terminated fiber. Attenuation and return loss measurements met the specified limits before and after strength of coupling mechanism test. Optical performance was measured at 850 and 1300 nm.

| 2.8. Cable Retention, 0 Degrees - Test Groups 2 and 5

There was no evidence of fiber pullout, or other damage to the jack connector or terminated fiber and no change in optical performance beyond the specified limits after cable retention test. Optical performance was measured at 850 and 1300 nm.

| 2.9. Cable Retention, 90 Degrees - Test Groups 2 and 5

There was no evidence of fiber pullout, or other damage to the jack connector or terminated fiber and no change in optical performance beyond the specified limits after side pull test. Optical performance was measured at 850 and 1300 nm.

| 2.10. Durability - Test Groups 2 and 7

There was no evidence of physical damage to the jack connector or mating plug connector. Attenuation and return loss measurements met the specified limits before and after durability test. Optical performance was measured at 850 and 1300 nm.

2.11. Cable Flexing - Test Groups 3 and 5

There was no evidence of physical damage to the jack connector or terminated fiber. Attenuation and return loss measurements met the specified limits before and after flex test. Optical performance was measured at 850 and 1300 nm.

2.12. Twist - Test Groups 3 and 5

There was no evidence of physical damage to the jack connector or terminated fiber. Attenuation and return loss measurements met the specified limits before and after twist test. Optical performance was measured at 850 and 1300 nm.

| 2.13. Impact - Test Groups 3, 5 and 7

There was no evidence of physical damage to the jack connector. Attenuation and return loss measurements met the specified limits before and after impact test. Optical performance was measured at 850 and 1300 nm.

3. TEST METHODS

The multimode environmental facility is an automated, FOTP-20 compliant test system with initial specimen installation performed according to FOTP-171 procedures. Following the installation of the specimens, the sequential testing was performed.

3.1. Visual and Mechanical Inspection

Product drawings and inspection plans were used to examine the specimens. They were examined visually and functionally.

3.2. Attenuation (Insertion Loss)

All multimode attenuation was measured in accordance with FOTP-171, method D1 processes, except that the launch was part of the specimen under test and was not reference quality. The initial optical power through each launch (plug) connector fiber paths was measured. The plug-to-jack connector assembly was then mated and optical power measured from the receive side field fiber. Attenuation was calculated by taking the difference between these two measurements. The field fiber was then spliced to a receive lead attached to the optical test equipment. Optical power was recorded as a reference to calculate change in attenuation during/after subsequent tests. Optical power readings were compensated by changes in a source monitor cable. In cases where a control cable was also used and exceeded limits stated in the specification, the change in the control cable was also factored into the loss.

3.3. Return Loss

Return loss was measured in accordance with FOTP-8 or similar method. A single measurement was recorded for return loss. Return loss was measured initially and after each test evaluation.

3.4. Change in Attenuation (Insertion Loss)

The initial optical power (dBm) through the specimens was recorded before the test using an optical source and detector. Relative optical power (dB) through the fiber was measured during and after each test as applicable. Change in attenuation was calculated by taking the difference between the initial measurement and the during/after measurements and recording the maximum range of all values for a specimen. Optical power readings were compensated by changes in the source monitor cable. In cases where a control cable was also used and exceeded limits stated in the specification, the change in the control cable was also factored into the loss.

3.5. Attenuation Increase

Increase in attenuation was calculated by taking the difference between the initial measurement and the measurement after each applicable test. Attenuation increase represents a change in attenuation that results from a decrease in optical power (degraded performance).

3.6. Low Temperature

Mated specimens were subjected to 0 ± 3˚C for a period of 96 hours (4 days). Optical performance for each specimen was recorded before and after exposure with the specimens in place in the test chamber and at 4-hour intervals throughout the exposure. Final optical performance was recorded after specimens returned to ambient conditions.

3.7. Humidity, Steady State

Mated specimens were subjected to 40 ± 2˚C at 90 to 95% RH for a period of 96 hours (4 days). Optical performance for each specimen was recorded before and after exposure with the specimens in place in the test chamber and at 4-hour intervals throughout the exposure. Final optical performance was recorded after specimens returned to ambient conditions.

3.8. Temperature Life

Mated specimens were subjected to 60 ± 2˚C for a period of 96 hours (4 days). Optical performance for each specimen was recorded before and after exposure with the specimens in place in the test chamber. Final optical performance was recorded after specimens returned to ambient conditions.

3.9. Strength of Coupling Mechanism

The jack module assembly was mated to a plug connector. A 33 N [7.4 lbf] tensile load was applied to the plug housing at a rate of 25.4 mm [1 in] per minute. The load was sustained for a minimum of 5 seconds. Optical performance was measured before and after test with the load removed.

3.10. Cable Retention, 0 Degrees

Specimens were subjected to a sustained load of 2.2 N [0.5 lbf] for a minimum of 5 seconds. The jack connector was secured to the test fixture. The tensile load was applied by wrapping the buffered or coated fiber around a 7.5 cm [3 in] diameter mandrel at a point 23 cm [9 in] from behind the back end of the module assembly. Load was applied at a rate of 25.4 mm [1 in] per minute. Optical performance was measured before and after test with the load removed.

3.11. Cable Retention, 90 Degrees

Specimens were subjected to a sustained load of 2.2 N [0.5 lbf] for a minimum of 5 seconds. The jack connector was secured to the test fixture. The load was applied at a 90 degree pull angle by wrapping the buffered or coated fiber around a 7.5 cm [3 in] diameter mandrel at a point 23 cm [9 in] from behind the back end of the module assembly. Load was applied at a rate of 25.4 mm [1 in] per minute. Optical performance was measured before and after test with the load removed.

3.12. Durability

The plug-to-jack connection of each mated specimen was subjected to 500 cycles of durability. Specimens were manually cycled at a rate not in excess of 300 cycles per hour. Jack and plug connectors were cleaned as specified every 25 cycles. Optical performance was measured before testing and after every 50th cycle. Specimens were unmated, cleaned, inspected, and re-mated before each measurement.

3.13. Cable Flexing

Specimens were subjected to 100 cycles of fiber flexing. Specimens were tested at a rate of 15 cycles per minute. A 7.5 cm [3 in] mandrel was used to apply a tensile load of 224 g [0.5 lbf] to buffered or coated fiber at a point 20 cm [8 in] from the rear of a mated jack module. The flex arc was ± 90 degrees from a vertical position. Optical performance was measured before and after test with the load removed.

3.14. Twist

Specimens were subjected to 10 cycles of twist. Specimens were tested at a rate less than 30 cycles per minute. A 7.5 cm [3 in] diameter mandrel was used to apply a tensile load of 2.2 N [0.5 lbf] to buffered or coated fiber at a point 23 cm [9 in] from the rear of a mated jack module. The twist motion for each cycle was ± 2.5 revolutions about the axis of the fiber. Optical performance was measured before and after test with the load removed.

3.15. Impact

An unmated jack module assembly was dropped from a height of 1.8 m [70.9 in] onto a concrete slab. The impact exposure was repeated 8 times. Initial optical performance was recorded before the specimen was unmated and exposed to testing. After completion of the 8 impacts, each jack was opened and re-terminated according to guidelines in 408-8718. (Note that re-termination included repositioning of the fiber only, and fibers were not re-cleaved.) Final optical performance was recorded after all specimens were tested, re-terminated, inspected, cleaned and re-mated to a plug connector.

For Test Group 7 (MT-RJ SECURE), the plug was also tested in addition to the jack. Both plug and jack were individually dropped 8 times each. After cleaning the plug and re-terminating the jack, parts were mated back together to record final attenuation and return loss.