

**[Magnetic Modjack]****1. INTRODUCTION****1.1. Purpose**

Testing was performed on the TE Connectivity (TE) RJ45 Connector with 1G/2.5G/5G/10G Base-T Transformer (Based on TE part#, see Table1) to determine its conformance to the requirements of Product Specification 108-161860 Revision .

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of RJ45 Connector with 1G/2.5G/5G/10G Base-T Transformer (Based on TE part#, see Table1). Testing was performed at TE The test file number for this testing is 501-161908. This documentation available on TE.com.

1.3. Conclusion

All part numbers listed in table1 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-161860 .

1.4. Product Description

The RJ45 Connector with 1G/2.5G/5G/10G Base-T Transformer (Based on TE part#, see Table1) are mainly used in Wi-Fi 6, network communication devices and servers, etc. The product complies with FCC and IEEE specifications.

1.5. Test Specimens

The test specimens were representative of normal production lots, and the following part numbers were used for testing (see Table1).

Test Group	Quantity	TE Part#	Description	Data Rate	T. Rise Rated Current	POE / non POE
1-11	33	2497289-1	RJ45 W/MAGNET 1X2 1G LED	1G BASE-T	0.6A	POE
1-11	33	2497290-1	RJ45 W/MAGNET 1X2 2.5G LED	2.5G BASE-T	0.6A	POE
1-11	33	2497291-1	RJ45 W/MAGNET 1X2 5G LED	5G BASE-T	0.6A	POE
1-11	33	2497292-1	RJ45 W/MAGNET 1x2 10G LED	10G BASE-T	0.6A	POE
1-11	33	2497288-X	RJ45 W/MAGNET 1x2 10G LED	10G BASE-T	0.1A	POE

Table 1: TE Part# list and Description

TRANSMISSION PERFORMANCE

Items	Performance Requirement
LCR	Part# 2497289-1 OCL: 350uH MIN@100KHZ/0.1v 8mA DC bias TR: 1:1±3% @ 100kHZ/0.1V CP: 1000PF @ 1kHz/1V OPEN/SHORT DCR: PHY: 1.5 Ω max

	CABLE: 1.0Ωmax
Insertion Loss	-1.0 dB MAX from 0.3 MHz to 100 MHz
Return Loss	-18dB MIN from 1 MHz to 30 MHz -16dB MIN from 30 MHz to 60 MHz -12dB MIN from 60 MHz to 80 MHz -10dB MIN from 80 MHz to 100 MHz
Near-End Cross-Talk (NEXT)	-30dB MIN from 1 MHz to 100 MHz
Common- to- Common Mode Attenuation	-30dB MIN from 1 MHz to 100 MHz

Table 2 Part# 2497289-1(1X2 1G) TRANSMISSION PERFORMANCE

Items	Performance Requirement
LCR	Part# 2497290-1 OCL:180uH MIN@100KHZ/0.1v 8mA DC bias TR: 1:1±3% @ 100kHz/0.1V CP: 1000PF @ 1kHz/1V OPEN/SHORT DCR:PHY:1.2 Ω max CABLE: 1.0Ωmax
Insertion Loss	-1.0dB MAX@1MHz-50MHz -1.5dB MAX@50MHz-125MHz
Return Loss	-18dB MIN@1MHz-40MHz; -18+15LOG (f/40MHz)dB MIN@40MHz-250MHz
Near-End Cross-Talk (NEXT)	-30dB MIN@1MHz-40MHz; -30+15LOG (f/40MHz)dB MIN@40MHz-125MHz
Common Mode Rejection	-30dB MIN@1 MHz-200 MHz

Table 3: Part# 2497290-1 (1X2 2.5G)TRANSMISSION PERFORMANCE

Items	Performance Requirement
LCR	Part# 2497291-1 OCL:180uH MIN@100KHZ/0.1v 8mA DC bias TR: 1:1±3% @ 100kHz/0.1V CP: 1000PF @ 1kHz/1V OPEN/SHORT DCR:PHY:1.2 Ω max CABLE: 1.0Ωmax
Insertion Loss	-0.5dB MAX@1MHz-50MHz -1.0dB MAX@50MHz-125MHz -2.0dB MAX@125MHz-200MHz -2.5dB MAX@200MHz-250MHz
Return Loss	-20dB MIN@1MHz-50MHz; -20+15LOG (f/40MHz)dB MIN@50MHz-250MHz
Near-End Cross-Talk (NEXT)	-23dB MIN@1MHz-125MHz;

	-20dB MIN@125MHz-250MHz
Common Mode Rejection	-23dB MIN@1MHz-250MHz

Table 4: Part# 2497291-1 (1X2 5G) TRANSMISSION PERFORMANCE

Items	Performance Requirement
	Part# 2497288-1 / 2497292-1 OCL:160uH MIN@100KHZ/0.1v TR: 1:1±3% @ 100kHZ/0.1V CP: 1000PF @ 1kHz/1V OPEN/SHORT DCR:PHY:1.2 Ω max CABLE: 1.0Ωmax
Insertion Loss	-3.0dB Max from 1MHz to 500 MHz
Return Loss	-22dB MIN@1MHz-100MHz; -22+20.75LOG(f/100)dB MIN@100MHz-500MHz
Near-End Cross-Talk (NEXT)	-28 dB MIN from 1 MHz to 100 MHz -16 dB MIN from 100 MHz to 500 MHz
Common Mode Rejection	-30dB MIN from 1 MHz to 100 MHz -18dB MIN from 100 MHz to 500 MHz

Table 5: Part# 2497288-1 / 2497292-1 (1X2 10G) TRANSMISSION PERFORMANCE

1.6. Qualification Test Sequence

Test Items	Test Groups (a)										
	A	B	C	D	E	F	G	H	I	J	K
	Test Sequence (b)										
Examination of product	1,5	1,5	1,5	1,6	1,7	1,6	1,4	1,5	1,4	1,3	1,10
Dielectric withstanding Voltage											2
Insulation Resistance											3
Contact Resistance						2,5		2,4			
LCR	2,4	2,4	2,4	2,5	2,6						4
IL											5
RL											6
CT											7
CMR											8
Temperature Rise					5						
Mechanical Vibration				3							
Mechanical shock				4							

Ring test					4					
Durability						4				
ConnectorMating,Unmatig Force						3				
Normal force									2	
Plug Retention Force							2			
Jack Retention to PCB							3			
Plug Typs					3					
Thermal shock			3							
Salt Spray								3		
Humidity/temperature cycling	3									
Temperature life		3								
Solderability									2	
Resistance to soldering heat									3	
Sample Quantity(pcs)	Single port Connector 5pcs/Test Group; Multi port connector 3pcs/Test Group									

Table 6: Test Items & Groups



NOTE

- (a) See Paragraph 0.
- (b) Numbers indicate sequence which tests were performed.

1.7. Environmental Conditions

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

Temperature: 15°C to 35°C

Relative Humidity: 20% to 80%

2. SUMMARY OF TESTING

2.1. TEST RESULTS:

Group A										
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3			RESULTS	
A.01	Examination of Product	--	Meet the drawing requirements	Normal						PASS
A.02	LCR	--	Meet specification requirements	OK	OK	OK			PASS	
A.03	Humidity-Temperature Cycle	--	No damage	OK	OK	OK			PASS	
A.04	LCR	--	Meet specification requirements	OK	OK	OK			PASS	
A.05	Examination of Product	--	Meet the drawing requirements	Normal						PASS

Group B										
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3				RESULTS
B.01	Examination of Product	--	Meet the drawing requirements	Normal						PASS
B.02	LCR	--	Meet specification requirements	OK	OK	OK				PASS
B.03	Temperature life	--	No damage	OK	OK	OK				PASS
B.04	LCR	--	Meet specification requirements	OK	OK	OK				PASS
B.05	Examination of Product	--	Meet the drawing requirements	Normal						PASS

Group C										
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3				RESULTS
C.01	Examination of Product	--	Meet the drawing requirements	Normal						PASS
C.02	LCR	--	Meet specification requirements	OK	OK	OK				PASS
C.03	Thermal shock	--	No damage	OK	OK	OK				PASS
C.04	LCR	--	Meet specification requirements	OK	OK	OK				PASS
C.05	Examination of Product	--	Meet the drawing requirements	Normal						PASS

Group D										
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3				RESULTS
D.01	Examination of Product	--	Meet the drawing requirements	Normal						PASS
D.02	LCR	--	Meet specification requirements	OK	OK	OK				PASS
D.03	Mechanical Vibration	--	Discontinuity less than 1 μ s; No damage	OK	OK	OK				PASS
D.04	Mechanical shock	--	Discontinuity less than 1 μ s; No damage	OK	OK	OK				PASS
D.05	LCR	--	Meet specification requirements	OK	OK	OK				PASS
D.06	Examination of Product	--	Meet the drawing requirements	Normal						PASS

Group E										
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3				RESULTS
E.01	Examination of Product	--	Meet the drawing requirements	Normal						PASS
E.02	LCR	--	Meet specification requirements	OK	OK	OK				PASS

E.03	Plug Typs		No damage	OK	OK	OK			PASS
E.04	Ring test	--	Discontinuity less than 1 μ s; No damage	OK	OK	OK			PASS
E.05	Temperature Rise	$^{\circ}$ C	30 $^{\circ}$ C Max	OK	OK	OK			PASS
E.06	LCR	--	Meet specification requirements	OK	OK	OK			PASS
E.07	Examination of Product	--	Meet the drawing requirements	Normal					PASS

Group F									
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3			RESULTS
F.01	Examination of Product	--	Meet the drawing requirements	Normal					PASS
F.03	Contact Resistance	m Ω	20 m Ω Max	8.35	7.62	8.66			PASS
F.04	Mating force	N	30N Max	10.21	9.98	9.86			PASS
	Unmating force			4.32	4.27	5.04			PASS
F.05	Durability	--	No damage	OK	OK	OK			PASS
F.06	Contact Resistance	m Ω	40 m Ω Max	11.64	10.23	11.45			PASS
F.07	Examination of Product	--	Meet the drawing requirements	Normal					PASS

Group G									
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3			RESULTS
G.01	Examination of Product	--	Meet the drawing requirements	Normal					PASS
G.02	Plug Retention Force	--	5kgf Min	OK	OK	OK			PASS
G.03	Jack Retention to PCB	--	5kgf Min	OK	OK	OK			PASS
G.04	Examination of Product	--	Meet the drawing requirements	Normal					PASS

Group H									
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3			RESULTS
H.01	Examination of Product	--	Meet the drawing requirements	Normal					PASS
H.02	Contact Resistance	m Ω	20 m Ω Max	9.68	9.37	10.05			PASS
H.03	Salt spray	--	No damage	OK	OK	OK			PASS
H.04	Examination of Product	--	Meet the drawing requirements	Normal					PASS
H.05	Contact Resistance	m Ω	40 m Ω Max	13.12	12.64	12.63			PASS

Group I										
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3				RESULTS
I.01	Examination of Product	--	Meet the drawing requirements	Normal						PASS
I.02	Solderability	--	95% of immersed area must show no voids, pin holes	OK	OK	OK				PASS
I.03	Resistance to Soldering heat	--	No damage	OK	OK	OK				PASS
I.04	Examination of Product	--	Meet the drawing requirements	OK	OK	OK				PASS

Group J										
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3				RESULTS
J.01	Examination of Product	--	Meet the drawing requirements	Normal						PASS
J.02	Normal force	g	50gf/pin minimum	85.43	79.47	82.54				PASS
J.03	Examination of Product	--	Meet the drawing requirements	Normal						PASS

Group K										
Sep.	TEST ITEM	Unit	REQUIREMENTS	Sample#1	Sample#2	Sample#3	Sample#4	Sample#5	RESULTS	
J.01	Examination of Product	--	Meet the drawing requirements	Normal						PASS
J.02	Dielectric withstanding Voltage	--	No discharge or breakdown	OK	OK	OK	OK	OK	PASS	
J.03	Insulation Resistance	--	500MΩmin	OK	OK	OK	OK	OK	PASS	
J.04	LCR	--	Meet specification requirements	OK	OK	OK	OK	OK	PASS	
J.05	IL	--	Meet specification requirements	OK	OK	OK	OK	OK	PASS	
J.06	RL	--	Meet specification requirements	OK	OK	OK	OK	OK	PASS	
J.07	NEXT	--	Meet specification requirements	OK	OK	OK	OK	OK	PASS	
J.08	CMR	--	Meet specification requirements	OK	OK	OK	OK	OK	PASS	
J.09	CM to DM	--	Meet specification requirements	OK	OK	OK	OK	OK	PASS	
J.10	Examination of Product	--	Meet the drawing requirements	Normal						PASS

Table 7: Test Result

3. TEST METHODS

3.1 Examination of Product

Per EIA-364-18, Visual inspection of samples

Test condition: Meet requirements of product drawing.

3.2 Dielectric withstanding Voltage

Specimens were subjected to Dielectric withstanding Voltage test in accordance with EIA-364-20.

Test condition: Apply a voltage between transformer primary and secondary. Voltage: 2250 VDC, Duration: 1 minute; between shield and contacts. Voltage: 2250 VDC, Duration: 1 minute.

Requirement: No discharge or breakdown.

3.3 Insulation Resistance

Specimens were subjected to Insulation Resistance test in accordance with EIA-364-21.

Test condition: Apply a voltage between transformer primary and secondary. Voltage: 500 VDC, Duration: 2 minutes; between shield and contacts. Voltage: 500 VDC, Duration: 2 minutes.

Requirement: 500MΩmin

3.4 Contact Resistance

Specimens were subjected to Contact Resistance test in accordance with EIA-364-23.

Test condition: 20mV Maximum, 100mA apply to measure contact resistance by dry circuit.

Requirement: Initial is 20 milliohm Max. After test is 40 milliohm Max

3.5 LCR comprehensive performance test

Test condition: Test with the LCR tester ZX2789

Performance Requirement: See Table 2 to Table 6

3.6 Insertion Loss

Specimens were subjected to Insertion Loss test in accordance with EIA-568-A

Test condition: Use a four port E5071C network analyzer to test the IL parameters of each channel

Performance Requirement: See Table 2 to Table 6

3.7 Return Loss

Specimens were subjected to Return Loss test in accordance with EIA-568-A

Test condition: Use a four port E5071C network analyzer to test the RL parameters of each channel

Performance Requirement: See Table 2 to Table 6

3.8 Cross Talk

Specimens were subjected to Cross Talk test in accordance with EIA-568-A

Test condition: Use a four port E5071C network analyzer to test the NEXT CTK between channels 1 and 2, 2 and 3, and 3 and 4, as well as the CTK of each adjacent 2 port channel

Performance Requirement: See Table 2 to Table 6

3.9 Common Mode Rejection Ratio

Specimens were subjected to Common Mode Rejection Ratio test in accordance with EIA-568-A

Test condition: Use a four port E5071C network analyzer to test the CMRR parameters of each channel

Performance Requirement: See Table 2 to Table 6

3.10 Temperature Rise

Specimens were subjected to Temperature Rise test in accordance with EIA-364-70 Method I

Test condition: Ambient Conditions Still air at 25°C. Stabilize at a single current level until 3 readings at 5 minute intervals are within 1°C; 4 pairs of differential lines connected in series with a rated current (current value refer to Table 1) for internal temperature rise testing

Requirement: 30°C maximum temperature rise.

3.11 Mechanical Vibration

Specimens were subjected to Vibration test in accordance with EIA-364-28.

Test condition: Solder each of plug and receptacle connector to the P.C. Board, then mate them together. Place the mated connector firmly on the vibrator and apply the following condition shall be done, passing DC 100mA current during the test.

Frequency: Change 20Hz - 500Hz within one minute

Amplitude: 1.52mm

Acceleration: 3.10G' S

Direction: along three perpendicular directions

Time: 15 minutes in each direction, 45minutes in total

Requirement: Discontinuity less than 1 μ s, No damage.

3.12 Mechanical Shock

Specimens were subjected to Mechanical Shock test in accordance with EIA-364-28.

Test condition: Accelerate Velocity: 490m/s² (50G); Waveform: Half-sine shock plus

Pulse width: 11milli-second.

Number of impacts: 3 drops each to normal and reversed directions of X,Y and Z axes, totally 18 drops

Requirement: Discontinuity less than 1 μ s, No damage.

3.13 Ring Test

Rotating instantaneous breaking test on the sample according to the figure

Test condition: Mating connectors at weight: 2lbs.

cable and vertical centerline angle: 45°

Plug height: 6.02mm.

Rotate counterclockwise and clockwise 3 cycles/direction

Speed: 4 RPM

Requirement: Discontinuity less than 1 μ s, No damage.

3.14 Durability

Specimens were subjected to Durability test in accordance with EIA-364-9.

Test condition: cycle rate: 10-20cycles per minute, Testing cycles: 750cycles.

Requirement: No damage after testing,

3.15 Connector mating unmating Force

Specimens were subjected to Connector mating unmating Force test in accordance with EIA-364-13

Test condition: at a maximum rate of 25 ± 3 mm per minute, Mating & Unmating force

Requirement: 30N Max

3.16 Normal force

Specimens were subjected to Normal force test in accordance with EIA-364-04

Test condition: Terminal at maximum rate 25 ± 3 mm Per minute and measure the normal force.

Requirement: 50gf/pin minimum

3.17 Plug Retention Force

Specimens were subjected to Plug Retention Force test in accordance with EIA-364-98.

Test condition: Put the connector and plug in a vertical position, hang a 5Kgf object at the bottom of the plug for 60s ± 5 s

Requirement: The samples were not damaged after testing.

3.18 Jack Retention to PCB

Specimens were subjected to Jack Retention to PCB test in accordance with EIA-364-29

Test condition: Put the connector and plug in a vertical e position, hang a 5kgf object at the bottom of the plug for 60s ± 5 s

Requirement: 5kg Min, Connector shall not Come apart from PCB

3.19 Plug Types

Specimens were subjected to Plug types test in accordance with product specification.

Test condition: use 1 types of plug

Requirement: Meet Standard RJ45 Jack Height:5.89-6.15mm

3.20 Thermal Shock

Specimens were subjected to Thermal Shock test in accordance with EIA-364-32

Test condition: Duration: 10 cycles. Temperature: -40°C(30 min.), +85°C(30 min.).

Test other items when placed at room temperature for 1-2h after the test.

Requirement: No physical damage.

3.21 Humidity-Temperature Cycle

Specimens were subjected to Humidity-Temperature Cycle test in accordance with EIA-364-31B, Method IV.

Test condition: Per EIA-364-31, Subject samples to 10 cycles (10 days) between 25 °C and 65 °C with 90% to 95% RH.

Test other items when placed at room temperature for 1-2h after the test.

Requirement: No physical damage.

3.22 Salt Spray

Specimens were subjected to Salt Spray test in accordance with EIA-364-26B

Test condition: Temperature $35 \pm 2^\circ\text{C}$, Salt - solution (5 ± 1) %, Humidity (95~98) %(R.H.), PH value: 6.5-7.2.

Duration: 48H.

Requirement: 48 hour salt spray test, no corrosion found in the thick gold area of the gold needle terminal

3.23 Temperature life

Specimens were subjected to Temperature life test in accordance with EIA-364-17

Test condition: Subject mated samples to 85°C for 250 hours.

Test other items when placed at room temperature for 1-2h after the test

Requirement: Meet visual requirements, No evidence physical damage;

3.24 Solderability

Specimens were subjected to Solderability test in accordance with EIA-364-52

Test condition: Test temperature: $245^\circ\text{C} \pm 5^\circ\text{C}$.

Test time: 5 ± 0.5 seconds.

Requirement: 95% of immersed area must show no voids or pin holes.

3.25 Resistance to Soldering heat

Specimens were subjected to Resistance to Soldering heat test in accordance with EIA-364-56

Test condition: PIP: 260°C 30S number of time: 2 times

4. APPENDIX

4.1. Table List

Table 1: TE Part# list and Description.....	1
Table 2 Part# 2497289-1(1X2 1G) TRANSMISSION PERFORMANCE	2
Table 3: Part# 2497290-1 (1X2 2.5G)TRANSMISSION PERFORMANCE	2
Table 4: Part# 2497291-1 (1X2 5G) TRANSMISSION PERFORMANCE	3
Table 5: Part# 2497288-1 / 2497292-1 (1X2 10G) TRANSMISSION PERFORMANCE	3
Table 6: Test Items&Groups	4
Table 7: Test Result	7