

Industrial M12 D-code To RJ45 Plug cordsets

1. INTRODUCTION

1.1 Purpose

Testing was performed on M12 D-code male straight 4P to RJ45 cordsets to determine if it meets the requirements of design objective 108-137541.

1.2 Scope

This report covers the electrical, mechanical, environmental performance and electrical transmission requirements of the M12 D-code male straight 4P connector and RJ45 plug connector.

1.3 Product Description

P/N	Name
TCD14745101-XXX	M12 D code, 4P, Male Straight to RJ45 plug cordset with shielded PUR cable
TCD14741111-XXX	M12 D code, 4P, Male Straight to RJ45 plug cordset with shielded PVC cable
TCD1473A201-XXX	M12 D code, 4P, Male Straight to RJ45 plug cordset with shielded TPE cable
TCD2473A201-XXX	M12 D code, 4P, Male Straight to RJ45 plug cordset with unshielded TPE cable

1.3.1 Take minimum samples as below for testing to cover the whole family due to platform design

Item	PN	Description
1	TCD14745101-001	M12D4-MS-RJ-PUR-22SH-TYPE C GREEN-0.5M
2	TCD14741111-001	M12D4-MS-RJ-PVC-22SH-TYPE B GREEN-0.5M
3	TCD1473A201-001	M12D4-MS-RJ-TPE-24SH-TEAL-0.5M
4	TCD2473A201-001	M12D4-MS-RJ-TPE-24UNSH-TEAL-0.5M

1.3.2 RJ45 Plug test samples list

Item	PN	Description
1	2378164-1	RJ45 PLUG,4PIN,8P4CS
2	2378166-1	RJ45 PLUG,4PIN,8P4CS
3	2378167-1	RJ45 PLUG,4PIN,8P4CS

PRELIMINARY

1.4 Test condition



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

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

2. Qualification Test Sequence for M12 D code side

Test or Examination	Test Group					
	A(a)	B	C	D	E(f)	F(g)
	Test Sequence					
Examination of product	1	3,6,11,20,26	8	9	1	
Voltage proof	4	10,19,25	4,7	4,8		
Insulation resistance	3	9,13,18,24	3,6	3,7		
LLCR	2	2,5,8,17,23	2	2	2,6	
Temperature Rising				5(e)		
Impacting water		21	5	6		
Dust(IP6X)		22(b)				
Durability					4	
Mating and Un-mating Force					3,5	
Sinusoidal vibration		1				
Mechanical shock		4				
Rapid change in temperature		7		1		
Dry heat		12				
Damp heat, cyclic		14(c),16(d)				
Cold		15				
Mixed flowing gas			1			
Transmission requirement						1

- (a) When the initial test group A has been completed, the specimens are divided in the 3 groups B, C, D. All connectors in each group shall undergo the tests specified for the relevant group numbers indicate sequence in which tests are performed.
- (b) It's allowed to perform with an additional specimen, extending the total number of specimen by 1.
- (c) First cycle
- (d) Remaining cycles
- (e) Test with additional specimen for over-molding type cable assembly
- (f) This test group should be tested without the screw nut

*** Notes:**

Numbers indicate the sequence in which the tests are performed.

3. TEST CONTENT for M12 D code connector side

3.1 Test Group
 3.1.1 Group A+B

Group	Test Item	Sample	Requirement	Test Condition and Result	Conclusion
A	LLCR	See 1.3.1	10 m Ω Max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.3.1	No breakdown or flashover	No breakdown and flashover	meet spec.
B	Sinusoidal vibration	See 1.3.1	No physical damage; No electrical discontinuity greater than 1μs	No abnormalities	meet spec.
	LLCR	See 1.3.1	Δ15mΩ max.	<15 mΩ	meet spec.
	Examination of product	See 1.3.1	No defect would impair normal operation	Normal	meet spec.
	Mechanical shock	See 1.3.1	No physical damage; No electrical discontinuity greater than 1μs	No abnormalities	meet spec.
	LLCR	See 1.3.1	Δ15mΩ max.	<15 mΩ	meet spec.
	Examination of product	See 1.3.1	No defect would impair normal operation	Normal	meet spec.
	Rapid change in temperature	See 1.3.1	No physical damage	No abnormalities	meet spec.
	LLCR	See 1.3.1	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage proof(withstanding voltage)	See 1.3.1	No breakdown or flashover	No breakdown and flashover	meet spec.
	Examination of product	See 1.3.1	No defect would impair normal operation	Normal	meet spec.
	Dry heat	See 1.3.1	No physical damage	Normal	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Damp heat, cyclic	See 1.3.1	No physical damage	No abnormalities	meet spec.
	Cold	See 1.3.1	No physical damage	Normal	meet spec.
	Damp heat, cyclic	See 1.3.1	No physical damage	No abnormalities	meet spec.
	LLCR	See 1.3.1	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage proof(withstanding voltage)	See 1.3.1	No breakdown or flashover	No breakdown or flashover	meet spec.
	Examination of product	See 1.3.1	No defect would impair normal operation	Normal	meet spec.
Impacting water	See 1.3.1	No water ingress	No water ingress	meet spec.	
LLCR	See 1.3.1	Δ15mΩ max.	<15 mΩ	meet spec.	

	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage proof(withstanding voltage)	See 1.3.1	No breakdown or flashover	No breakdown or flashover	meet spec.
	Examination of product	See 1.3.1	No physical damage	Normal	meet spec.

3.1.2 Group A+C

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
A	LLCR	See 1.3.1	10 m Ω Max.	<10 m Ω	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.3.1	No breakdown or flashover	No breakdown and flashover	meet spec.
C	Mixed Flowing Gas	See 1.3.1	No corrosion and defect	No abnormalities	meet spec.
	LLCR	See 1.3.1	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage proof(withstanding voltage)	See 1.3.1	No breakdown or flashover	No breakdown and flashover	meet spec.
	Impacting water	See 1.3.1	No water ingress	No water ingress	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage proof(withstanding voltage)	See 1.3.1	No breakdown or flashover	No breakdown and flashover	meet spec.
	Examination of product	See 1.3.1	No defect would impair normal operation	Normal	meet spec.

3.1.3 Group A+D

Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
A	LLCR	See 1.3.1	10 m Ω Max.	<10 m Ω	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage Proof	See 1.3.1	No breakdown or flashover	No breakdown and flashover	meet spec.
D	Rapid change in temperature	See 1.3.1	No physical damage	No abnormalities	meet spec.
	LLCR	See 1.3.1	Δ15mΩ max.	<15 mΩ	meet spec.
	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage proof(withstanding voltage)	See 1.3.1	No breakdown or flashover	No breakdown and flashover	meet spec.
	Temperature Rising	See 1.3.1	ΔT 30° C Max.	No abnormalities	meet spec.
	Impacting water	See 1.3.1	No water ingress	No water ingress	meet spec.

	Insulation resistance	See 1.3.1	100MΩ Min	>100MΩ	meet spec.
	Voltage proof (withstanding voltage)	See 1.3.1	No breakdown or flashover	No breakdown and flashover	meet spec.
	Examination of product	See 1.3.1	No defect would impair normal operation	Normal	meet spec.

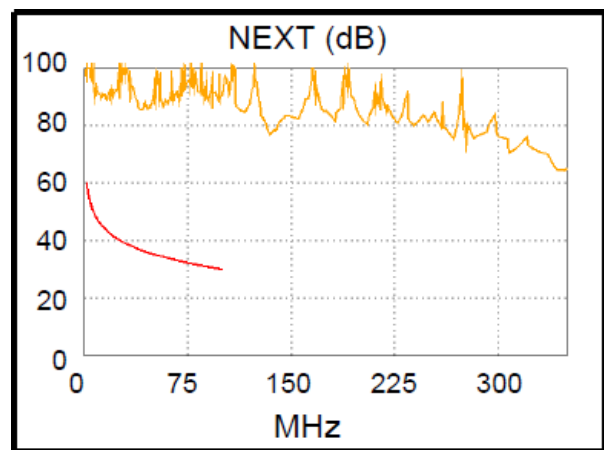
3.1.4 Group E

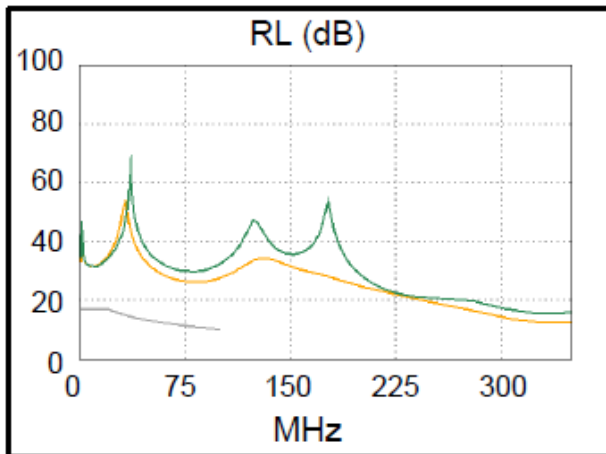
Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
E	Examination of product	See 1.3.1	No defect would impair normal operation	No abnormalities	meet spec.
	LLCR	See 1.3.1	10 m Ω Max.	<10 m Ω	meet spec.
	Mating and Un-mating Force	See 1.3.1	15N Max.	<15N	meet spec.
	Durability	See 1.3.1	100 cycles for gold plating	No abnormalities	meet spec.
	Mating and Un-mating Force	See 1.3.1	15N Max.	<15N	meet spec.
	LLCR	See 1.3.1	Δ15mΩ max.	<15 m Ω	meet spec.

3.1.5 Group F (Electrical transmission for M12 D code to RJ45 plug cordsets)

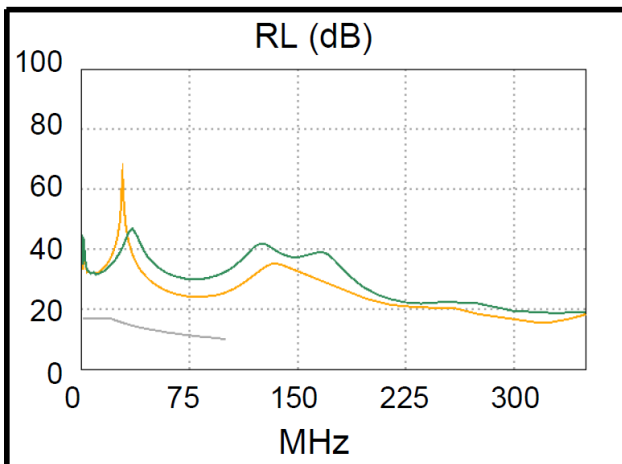
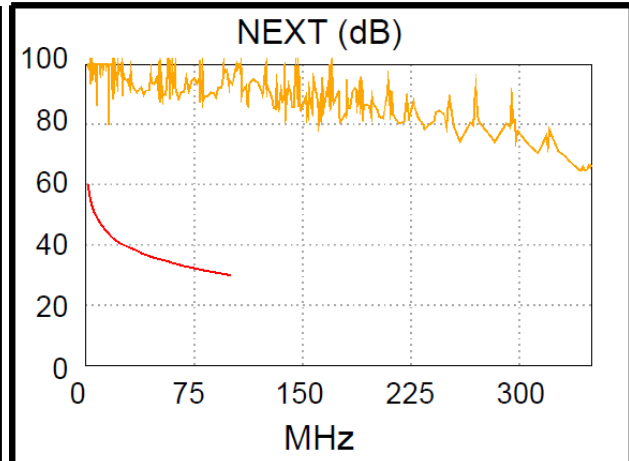
Group	Test Item	Sample Number	Requirement	Test Condition and Result	Conclusion
F	Insertion loss	See 1.3.1	≥4dB at 1 MHz, ≥24dB at 100MHz	See the curve	Meet Spec
	Return loss	See 1.3.1	≥17dB at 1 MHz, ≥10dB at 100MHz	See the curve	Meet Spec
	NEXT	See 1.3.1	≥ 63.3 dB at 1 MHz, ≥ 30.1 dB at 100 MHz	See the curve	Meet Spec

3.1.5.1 Electrical transmission curve for TCD14745101-001

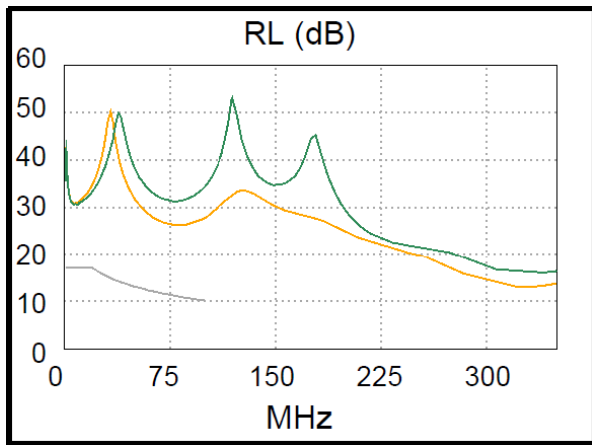
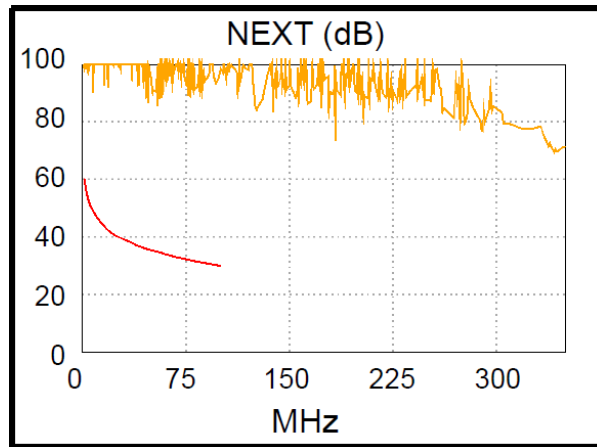




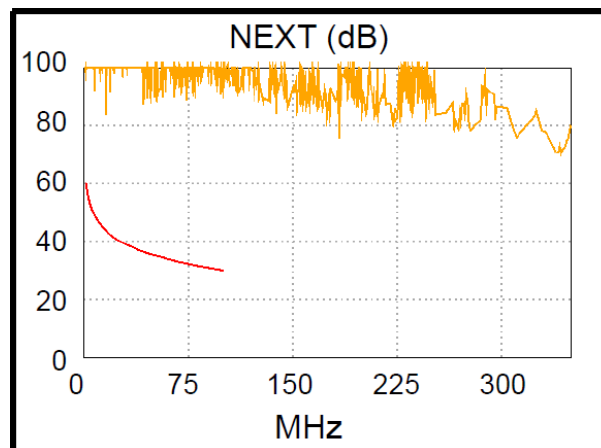
3.1.5.2 Electrical transmission curve for TCD14741111-001

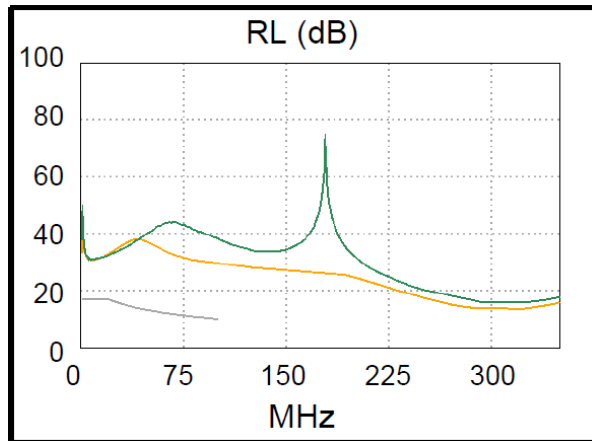


3.1.5.3 Electrical transmission curve for TCD1473A201-001



3.1.5.4 Electrical transmission curve for TCD2473A201-001





4.RJ45 Plug Test Sequence

No.	Test or Examination	Test Group						
		A	B	C	D	E	F	G
		Test Sequence						
1	Examination of product	1	1,5	1	1,5,10	1,5,10	1,9	1,5
2	Contact resistance	2	2,4		2,6	2,6	2,4	2,4
3	Insulation resistance	3			7	7	5	
4	Voltage proof	4			8	8	6	
5	Durability, jack-plug interface	5	3		9		7	
6	Plug insertion force, jack-plug interface			2				
7	Plug withdrawal force, jack-plug interface			3				
8	Plug retention in jack, jack-plug interface			4		9	8	
9	Thermal shock				3	3		
10	Humidity/temperature cycling					4		
11	Humidity, steady state				4			
12	Salt Spray Test							3
13	Stress relaxation						3	

5. TEST CONTENT (RJ45 PLUG)

Group	Test Items	Sample Number	status	Requirement	Test Condition and Result	Conclusion
A	Initial examination of product	See 1.3.2	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.2	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Insulation resistance	See 1.3.2	Initial	1000MΩ Min.	>1000MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.2	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Durability, jack-plug interface.	See 1.3.2	Final	No physical damage, function of buckle normal	Normal	Meet Spec
B	Initial examination of product	See 1.3.2	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.2	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Durability, jack-plug interface.	See 1.3.2	Final	No physical damage, function of buckle normal	Normal	Meet Spec
	LLCR	See 1.3.2	Final	Δ10mΩ Max.	< 10mΩ	Meet Spec
	Final examination of product	See 1.3.2	Final	No physical damage	Normal	Meet Spec
C	Initial examination of product	See 1.3.2	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	Plug insertion force, jack-plug interface	See 1.3.2	Final	30N Max.	<30N	Meet Spec
	Plug withdrawal force, jack-plug interface	See 1.3.2	Final	30N Max.	<30N	Meet Spec
	Plug retention in jack, jack-plug interface.	See 1.3.2	Final	Plug shall not dislodge from jack	Normal	Meet Spec
D	Initial examination of product	See 1.3.2	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.2	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Thermal shock	See 1.3.2	Final	Δ10mΩ Max. No physical damage	< 10mΩ	Meet Spec
	Humidity, steady state	See 1.3.2	Final	No physical damage	Normal	Meet Spec
	Examination of product	See 1.3.2	Final	No physical damage	Normal	Meet Spec
	LLCR	See 1.3.2	Initial	Δ10mΩ Max.	<10mΩ	Meet Spec
	Insulation resistance	See 1.3.2	Initial	1000MΩ Min.	>1000MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.2	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Durability, jack-plug interface.	See 1.3.2	Final	No physical damage, function of buckle normal	Normal	Meet Spec
Final examination of product	See 1.3.2	Final	No physical damage	Normal	Meet Spec	

E	Initial examination of product	See 1.3.2	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.2	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Thermal shock	See 1.3.2	Final	Δ10mΩ Max. No physical damage	< 10mΩ	Meet Spec
	Humidity/temperature cycling	See 1.3.2	Final	No physical damage	Normal	Meet Spec
	Final examination of product	See 1.3.2	Final	No physical damage	Normal	Meet Spec
	LLCR	See 1.3.2	Initial	Δ10mΩ Max.	<10mΩ	Meet Spec
	Insulation resistance	See 1.3.2	Initial	1000MΩ Min.	>1000MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.2	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Plug retention in jack, jack-plug interface	See 1.3.2	Final	Plug shall not dislodge from jack	Normal	Meet Spec
	Final examination of product	See 1.3.2	Final	No physical damage	Normal	Meet Spec
F	Initial examination of product	See 1.3.2	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.2	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Stress relaxation	See 1.3.2	Final	No physical damage.	Normal	Meet Spec
	LLCR	See 1.3.2	Final	Δ10mΩ Max.	<10mΩ	Meet Spec
	Insulation resistance	See 1.3.2	Final	1000MΩ Min.	>1000MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.2	Final	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Durability, jack-plug interface	See 1.3.2	Final	No physical damage, function of buckle normal	Normal	Meet Spec
	Plug retention in jack, jack-plug interface	See 1.3.2	Final	Plug shall not dislodge from jack	Normal	Meet Spec
	Final examination of product	See 1.3.2	Final	No physical damage	Normal	Meet Spec
G	Initial examination of product	See 1.3.2	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.2	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Salt Spray Test	See 1.3.2	Final	No physical damage. Most one terminal is allowed A corrosion point, area of not more than 5%	Normal	Meet Spec
	LLCR	See 1.3.2	Final	Δ10mΩ Max.	<10mΩ	Meet Spec
	Final examination of product	See 1.3.2	Final	No physical damage	Normal	Meet Spec



6. Conclusion

M12 D-code male straight to RJ45 plug cordsets meet all the electrical, mechanical, environmental performance and transmission requirements of product specification 108-137541.