



Industrial M12 X-code and RJ45 Plug Connector

1. INTRODUCTION

1.1 Purpose

Testing was performed on M12 X-code series to determine if it meets the requirements of design objective 108-137538.

1.2 Scope

This report covers the electrical, mechanical, environmental performance and electrical transmission requirements of the M12 X-code and RJ45 plug connector.

1.3 Product Description

P/N	Name
TAX3812XXX2-XXX	M12 X code, Male, Straight, Cable Assembly
TAX3822XXX2-XXX	M12 X code, Male, RA, Cable Assembly
TAX38X2XXX2-XXX	M12 X code male to M12 X code male cable assembly
TCX38X2XXX2-XXX	M12 X code male to RJ45 plug cable assembly

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

Item	PN	Description	Test Group			sample Total
			1	2	3	
			Sample Qty.			
1	TAX38121112-001	RPC-M12X-MS-8CON-PVC-0.5SH	2	1	1	4
2	TAX38221112-001	RPC-M12X-MR-8CON-PVC-0.5SH	2	1	1	4
3	TAX38125102-001	RPC-M12X-MS-8CON-PUR-0.5SH	1	1	1	3
4	TAX38225102-001	RPC-M12X-MR-8CON-PUR-0.5SH	1	1	1	3
5	TAX3812A202-001	RPC-M12X-MS-8CON-TPE-0.5SH	1	1	1	3
6	TAX3822A202-001	RPC-M12X-MR-8CON-TPE-0.5SH	1	1	1	3

## 1.3.2 Transmission test samples list

Item	PN	Description	Qty.
1	TCX38821112-002	RPC-M12X-8MR-1.0SH-RJ45-8MS-PVC	1
2	TCX38825102-002	RPC-M12X-8MR-1.0SH-RJ45-8MS-PUR	1
3	TCX3882A202-002	RPC-M12X-8MR-1.0SH-RJ45-8MS-TPE	1
4	TAX38721112-002	RPC-M12X-8MS-1.0SH-M12X-8MS-PVC	1
5	TCX38721112-002	RPC-M12X-8MS-1.0SH-RJ45-8MS-PVC	1
6	TAX38725102-002	RPC-M12X-8MS-1.0SH-M12X-8MS-PUR	1
7	TCX38725102-002	RPC-M12X-8MS-1.0SH-RJ45-8MS-PUR	1
8	TAX3872A202-002	RPC-M12X-8MS-1.0SH-M12X-8MS-TPE	1
9	TCX3872A202-002	RPC-M12X-8MS-1.0SH-RJ45-8MS-TPE	1

## 1.3.3 RJ45 Plug test samples list

Item	PN	Description	Qty.
1	2377624-1	RJ45 8P8CS CAT6A $\phi$ 1.06	5
2	2376548-1	RJ45 8P8CS CAT6A $\phi$ 1.15	5

## 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**

Test Examination	Test Group <sup>(a)</sup>			
	1	2	3	4
	Test Sequence <sup>(b)</sup>			
Examination of product	1,21	1,13	1,14	
Voltage proof (withstanding voltage)	4,11,19	4,12	4,8,13	
Insulation resistance	3,10,13,18	3,11	3,7,12	
LLCR	2,7,9,17	2,6,8,10	2,6,11	
Impacting water (IPX7)	20			
Durability 50cycles		5,9	9	
Sinusoidal vibration	5			
Mechanical shock	6			
Rapid change in temperature (30 minutes dwells at temperature extremes)	8			
Rapid change in temperature (60 minutes dwells at temperature extremes)			5	
Dry heat	12			
Damp heat, cyclic, first cycle	14			
Damp heat, cyclic, remaining cycles	16			
Cold	15			
Mixed flowing gas		7		
Electrical load and temperature			10	
Transmission requirement				1

Note: a) These test groups and sequences are defined per customer requirements according to product specification.  
 b) Numbers indicate sequence in which tests are performed.

3. TEST CONTENT

Group	Test Item	sample	Condition	Requirement	Test Condition And Result	Judgment
1	Initial examination of product	See 1.3.1	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.1	Initial	15mΩ Max.	<15mΩ	Meet Spec
	Insulation resistance	See 1.3.1	Initial	100MΩ Min.	>100MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.1	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Sinusoidal vibration	See 1.3.1	Final	No physical damage; No electrical discontinuity greater than 1μs	See 6.1 Fig.1	Meet Spec
	Mechanical shock	See 1.3.1	Final	No physical damage; No electrical discontinuity greater than 1μs	See 6.2 Fig.2	Meet Spec
	LLCR	See 1.3.1	Final	Δ15mΩ Max.	<15mΩ	Meet Spec
	Rapid change in temperature	See 1.3.1	Final	No physical damage	See 6.3 Fig.3	Meet Spec
	LLCR	See 1.3.1	Final	Δ15mΩ Max.	<15mΩ	Meet Spec
	Insulation resistance	See 1.3.1	Final	100MΩ Min.	>100MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.1	Final	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Dry heat	See 1.3.1	Final	No physical damage	See 6.4 Fig.4	Meet Spec
	Insulation resistance	See 1.3.1	Final	100MΩ Min.	>100MΩ	Meet Spec
	Damp heat, cyclic, first cycle	See 1.3.1	Final	No physical damage	See 6.5 Fig.5	Meet Spec
	Cold	See 1.3.1	Final	No physical damage	See 6.6 Fig.6	Meet Spec
	Damp heat, cyclic, remaining cycles	See 1.3.1	Final	No physical damage	See 6.7 Fig.7	Meet Spec
	LLCR	See 1.3.1	Final	Δ15mΩ Max.	<15mΩ	Meet Spec
	Insulation resistance	See 1.3.1	Final	100MΩ Min.	>100MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.1	Final	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	IPX7	See 1.3.1	Final	No water ingress	No water ingress	Meet Spec
Final examination of product	See 1.3.1	Final	No physical damage	Normal	Meet Spec	

2	Initial examination of product	See 1.3.1	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.1	Initial	15mΩ Max.	<15mΩ	Meet Spec
	Insulation resistance	See 1.3.1	Initial	100MΩ Min.	>100MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.1	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Durability 50cycles	See 1.3.1	Final	50 cycles for gold plating	Normal	Meet Spec
	LLCR	See 1.3.1	Final	Δ15mΩ Max.	<15mΩ	Meet Spec
	Mixed flowing gas	See 1.3.1	Final	No corrosion and defect	Normal	Meet Spec
	LLCR	See 1.3.1	Final	Δ15mΩ Max.	<15mΩ	Meet Spec
	Durability 50cycles	See 1.3.1	Final	50 cycles for gold plating	Normal	Meet Spec
	LLCR	See 1.3.1	Final	Δ15mΩ Max.	<15mΩ	Meet Spec
	Insulation resistance	See 1.3.1	Final	100MΩ Min.	>100MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.1	Final	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
Final examination of product	See 1.3.1	Final	No physical damage	Normal	Meet Spec	

3	Initial examination of product	See 1.3.1	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.1	Initial	15mΩ Max.	<15mΩ	Meet Spec
	Insulation resistance	See 1.3.1	Initial	100MΩ Min.	>100MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.1	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Rapid change in temperature	See 1.3.1	Final	No physical damage	Normal	Meet Spec
	LLCR	See 1.3.1	Final	15mΩ Max.	<15mΩ	Meet Spec
	Insulation resistance	See 1.3.1	Final	100MΩ Min.	>100MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.1	Final	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Durability 50cycles	See 1.3.1	Final	50 cycles for gold plating	Normal	Meet Spec
	Electrical load and temperature	See 1.3.1	Final	No physical damage	Normal	Meet Spec
	LLCR	See 1.3.1	Final	15mΩ Max.	<15mΩ	Meet Spec
	Insulation resistance	See 1.3.1	Final	100MΩ Min.	>100MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.1	Final	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Final examination of product	See 1.3.1	Final	No physical damage	Normal	Meet Spec

4	Insertion loss	See 1.3.2	Initial	0.35dB Max.	$\leq 0.45\text{dB}$	Meet Spec
	Return loss	See 1.3.2	Initial	See the curve.	$\geq 14\text{dB}$	Meet Spec
	NEXT	See 1.3.2	Initial	See the curve.	$\geq 37\text{dB}$	Meet Spec
	FEXT	See 1.3.2	Initial	See the curve.	$\geq 29\text{dB}$	Meet Spec
	CAT6A – Patch Cord Requirements	See 1.3.2	Initial	See the curve.	ISO/IEC 11801-1	Meet Spec

**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	1	1,5	1,5	1,4	1,4
2	Contact resistance	2	2,4		2,6	2,6	2,5	2,5
3	Insulation resistance	3			7	7	6	
4	Voltage proof	4			8	8	7	
5	Durability, jack-plug interface	5	3		9		8	
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	9	
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)

A	Initial examination of product	See 1.3.3	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.3	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Insulation resistance	See 1.3.3	Initial	1000MΩ Min.	>1000MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.3	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Durability, jack-plug interface.	See 1.3.3	Final	No physical damage, function of buckle normal	Normal	Meet Spec
B	Initial examination of product	See 1.3.3	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.3	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Durability, jack-plug interface.	See 1.3.3	Final	No physical damage, function of buckle normal	Normal	Meet Spec
	LLCR	See 1.3.3	Final	Δ10mΩ Max.	< 10mΩ	Meet Spec
	Final examination of product	See 1.3.3	Final	No physical damage	Normal	Meet Spec
C	Initial examination of product	See 1.3.3	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	Plug insertion force, jack-plug interface	See 1.3.3	Final	30N Max.	<30N	Meet Spec
	Plug withdrawal force, jack-plug interface	See 1.3.3	Final	30N Max.	<30N	Meet Spec
	Plug retention in jack, jack-plug interface.	See 1.3.3	Final	Plug shall not dislodge from jack	Normal	Meet Spec
D	Initial examination of product	See 1.3.3	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.3	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Thermal shock	See 1.3.3	Final	Δ10mΩ Max. No physical damage	< 10mΩ	Meet Spec
	Humidity, steady state	See 1.3.3	Final	No physical damage	Normal	Meet Spec
	Examination of product	See 1.3.3	Final	No physical damage	Normal	Meet Spec
	LLCR	See 1.3.3	Initial	Δ10mΩ Max.	<10mΩ	Meet Spec
	Insulation resistance	See 1.3.3	Initial	1000MΩ Min.	>1000MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.3	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Durability, jack-plug interface.	See 1.3.3	Final	No physical damage, function of buckle normal	Normal	Meet Spec
Final examination of product	See 1.3.3	Final	No physical damage	Normal	Meet Spec	

E	Initial examination of product	See 1.3.3	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.3	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Thermal shock	See 1.3.3	Final	Δ10mΩ Max. No physical damage	< 10mΩ	Meet Spec
	Humidity/temperature cycling	See 1.3.3	Final	No physical damage	Normal	Meet Spec
	Final examination of product	See 1.3.3	Final	No physical damage	Normal	Meet Spec
	LLCR	See 1.3.3	Initial	Δ10mΩ Max.	<10mΩ	Meet Spec
	Insulation resistance	See 1.3.3	Initial	1000MΩ Min.	>1000MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.3	Initial	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Plug retention in jack, jack-plug interface	See 1.3.3	Final	Plug shall not dislodge from jack	Normal	Meet Spec
	Final examination of product	See 1.3.3	Final	No physical damage	Normal	Meet Spec
F	Initial examination of product	See 1.3.3	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.3	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Stress relaxation	See 1.3.3	Final	No physical damage.	Normal	Meet Spec
	LLCR	See 1.3.3	Final	Δ10mΩ Max.	<10mΩ	Meet Spec
	Insulation resistance	See 1.3.3	Final	1000MΩ Min.	>1000MΩ	Meet Spec
	Voltage proof (withstanding voltage)	See 1.3.3	Final	No breakdown or flashover.	No breakdown or flashover.	Meet Spec
	Durability, jack-plug interface	See 1.3.3	Final	No physical damage, function of buckle normal	Normal	Meet Spec
	Plug retention in jack, jack-plug interface	See 1.3.3	Final	Plug shall not dislodge from jack	Normal	Meet Spec
	Final examination of product	See 1.3.3	Final	No physical damage	Normal	Meet Spec
G	Initial examination of product	See 1.3.3	Initial	Meets requirements of product drawing and Application Specification	No abnormalities	Meet Spec
	LLCR	See 1.3.3	Initial	20mΩ Max.	<20mΩ	Meet Spec
	Salt Spray Test	See 1.3.3	Final	No physical damage. Most one terminal is allowed A corrosion point, area of not more than 5%	Normal	Meet Spec
	LLCR	See 1.3.3	Final	Δ10mΩ Max.	<10mΩ	Meet Spec
	Final examination of product	See 1.3.3	Final	No physical damage	Normal	Meet Spec



## 6. Test Condition and results

### 6.1 Vibration test

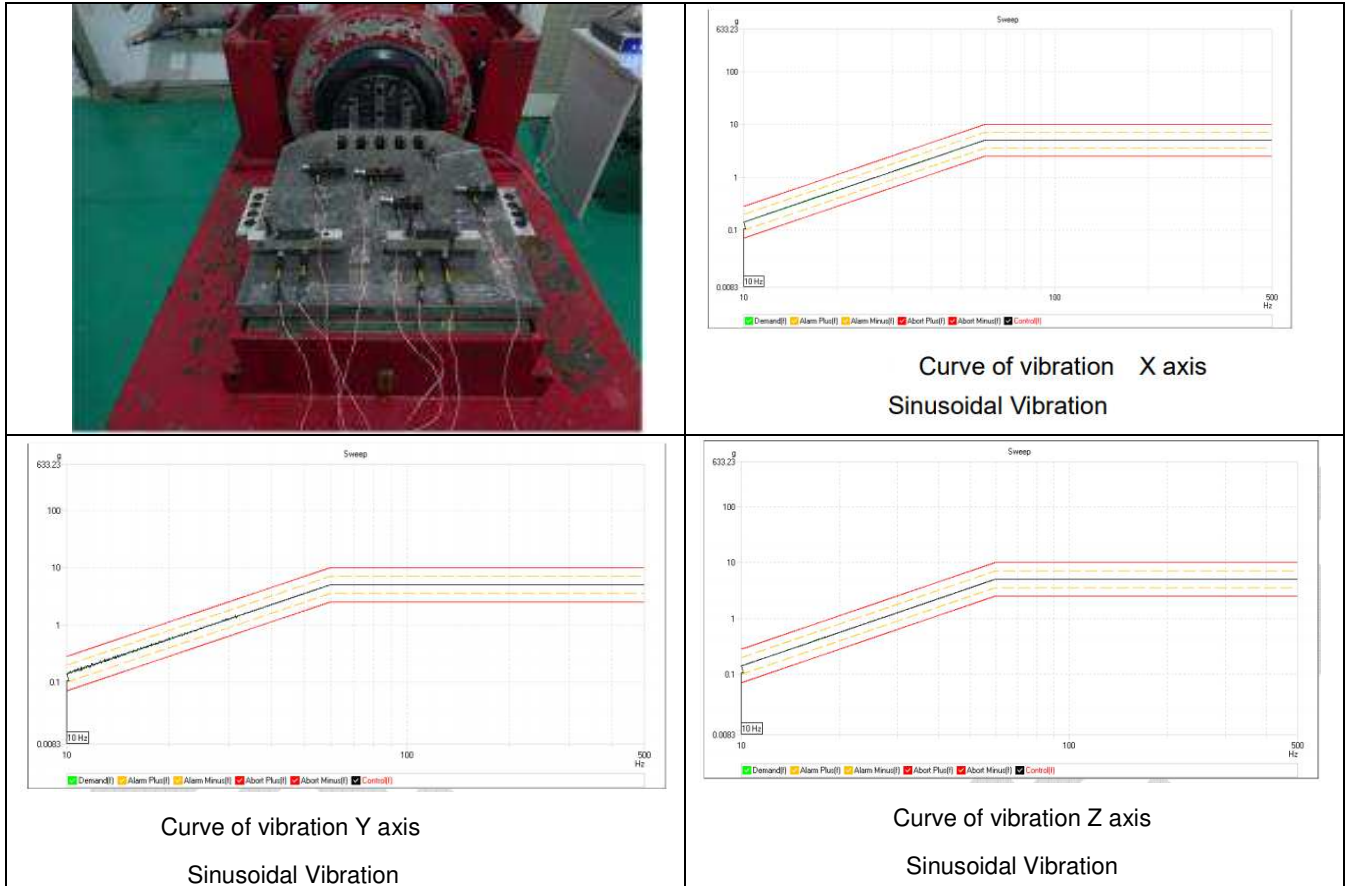
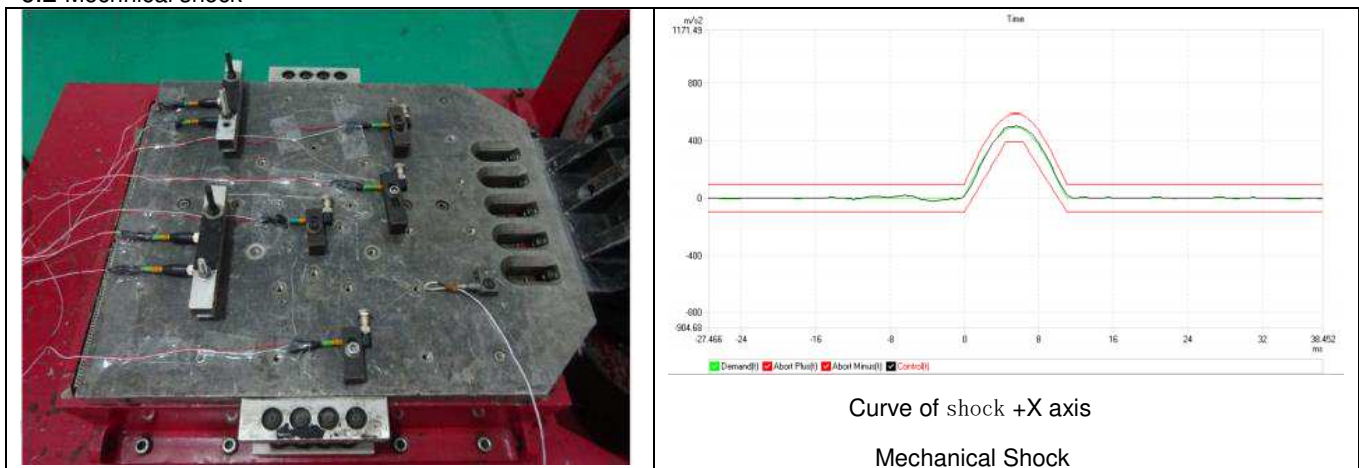


Fig.1

### 6.2 Mechanical shock



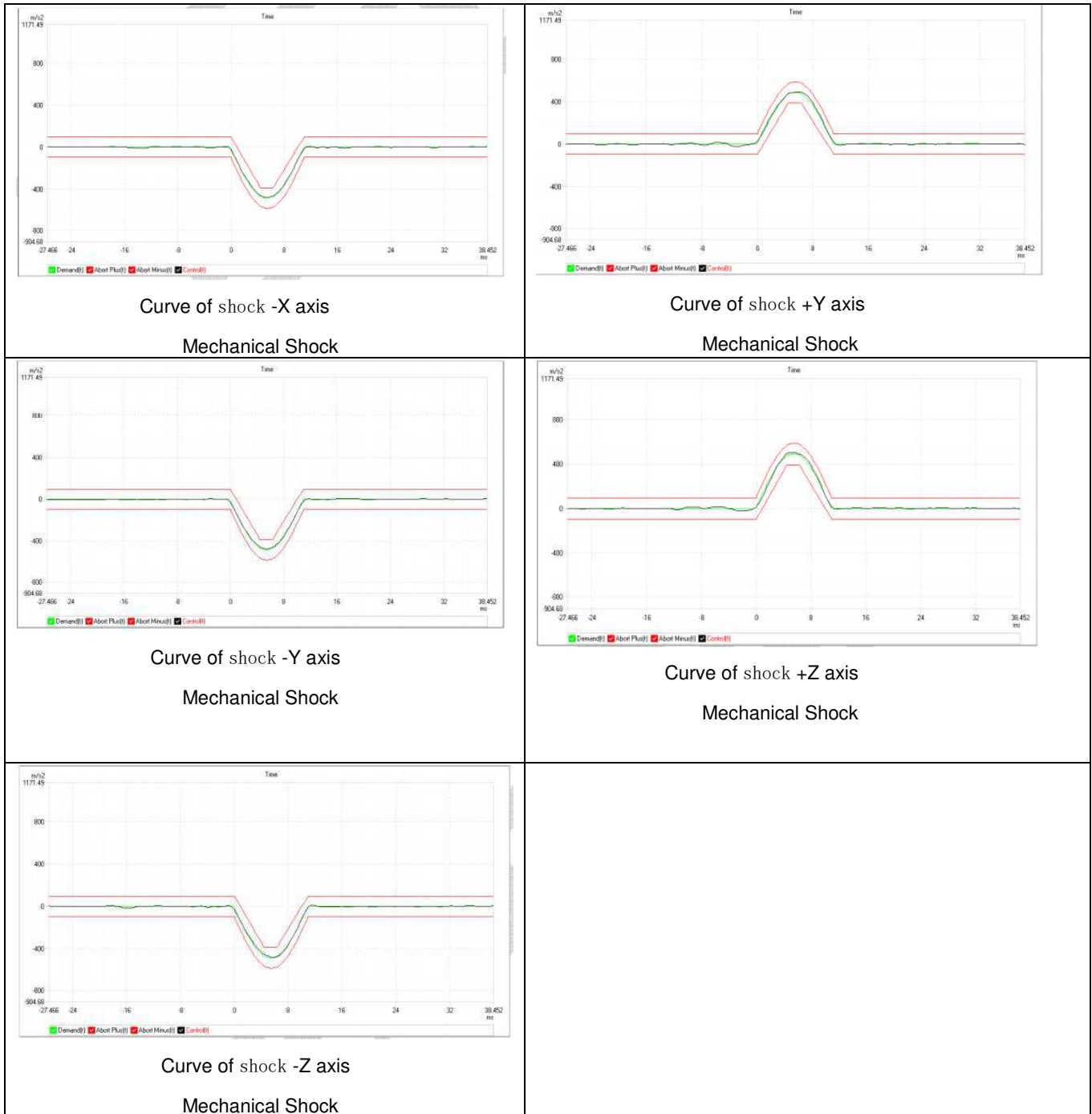


Fig.2

6.3 Rapid change in temperature

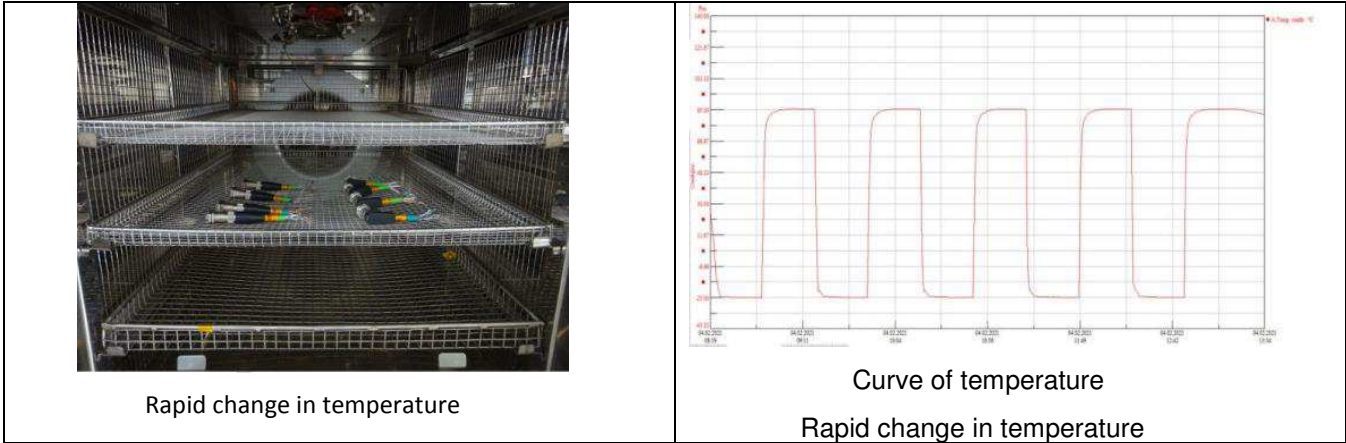


Fig.3

6.4 Dry heat



Fig.4

6.5 Damp heat, cycle, first cycle

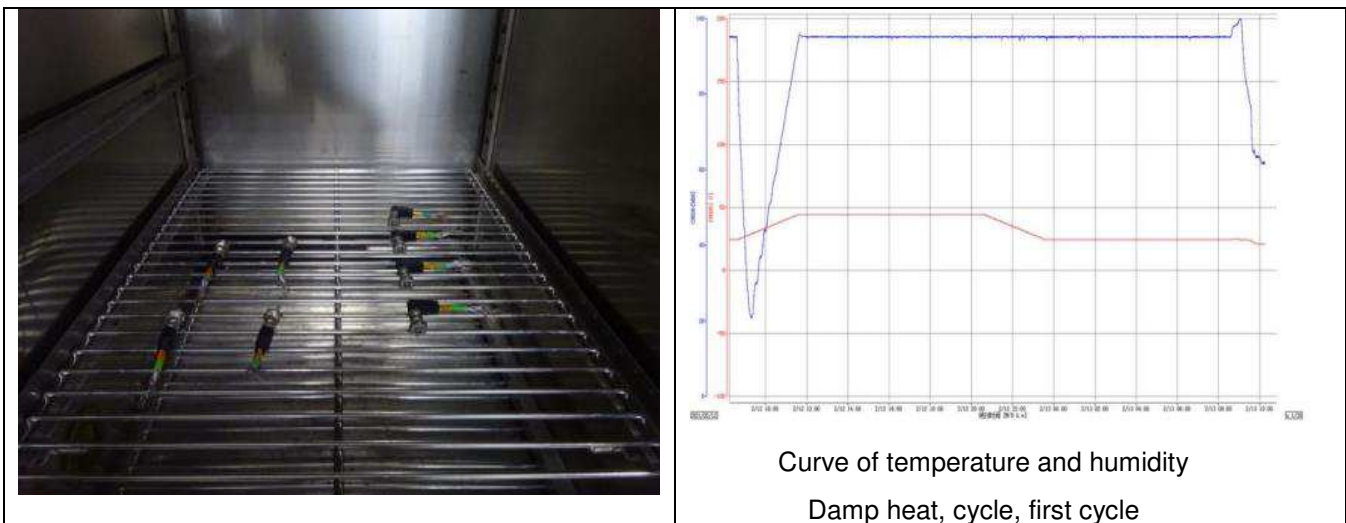


Fig.5

6.6 Cold



Fig.6

6.7 Damp heat, remaining cycle

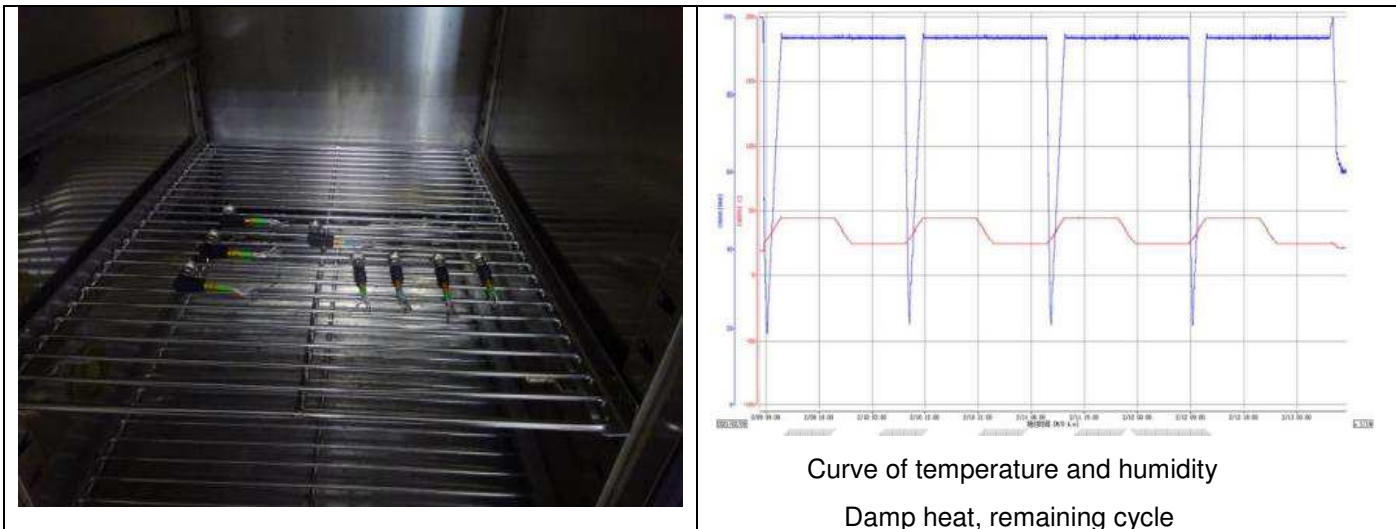
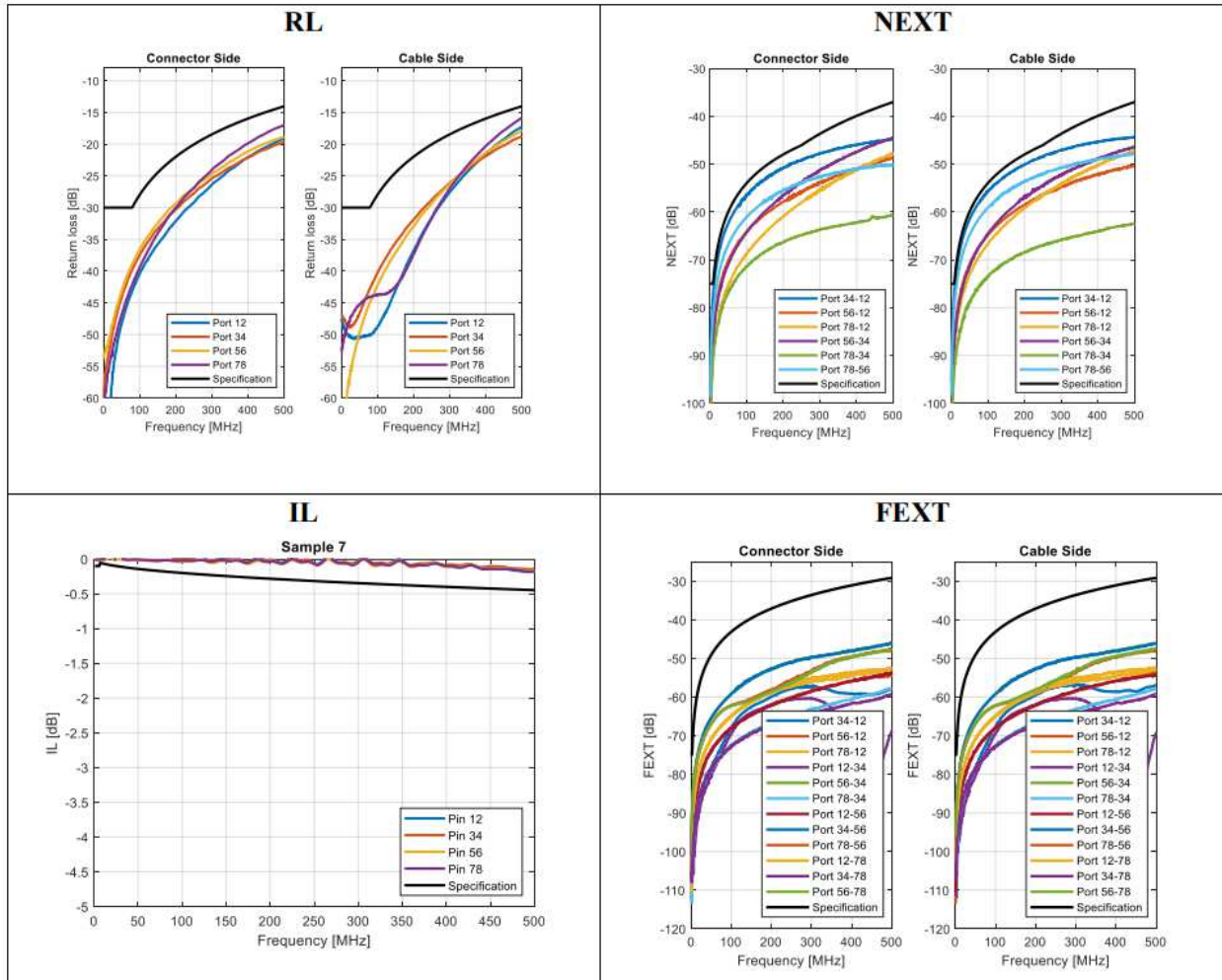


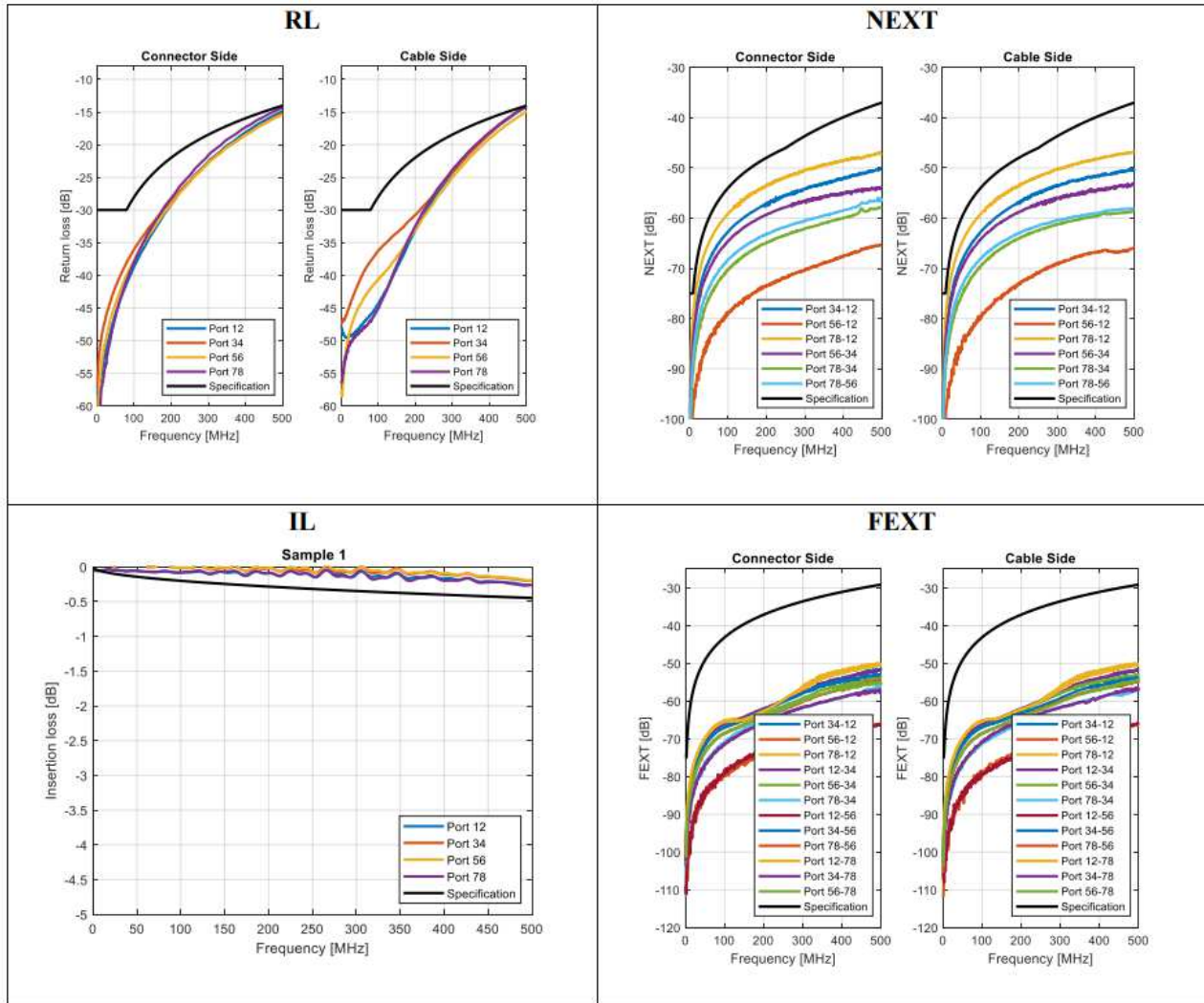
Fig.7

6.8 Mated Connector Test Results:

6.8.1 M12 X-code straight male:

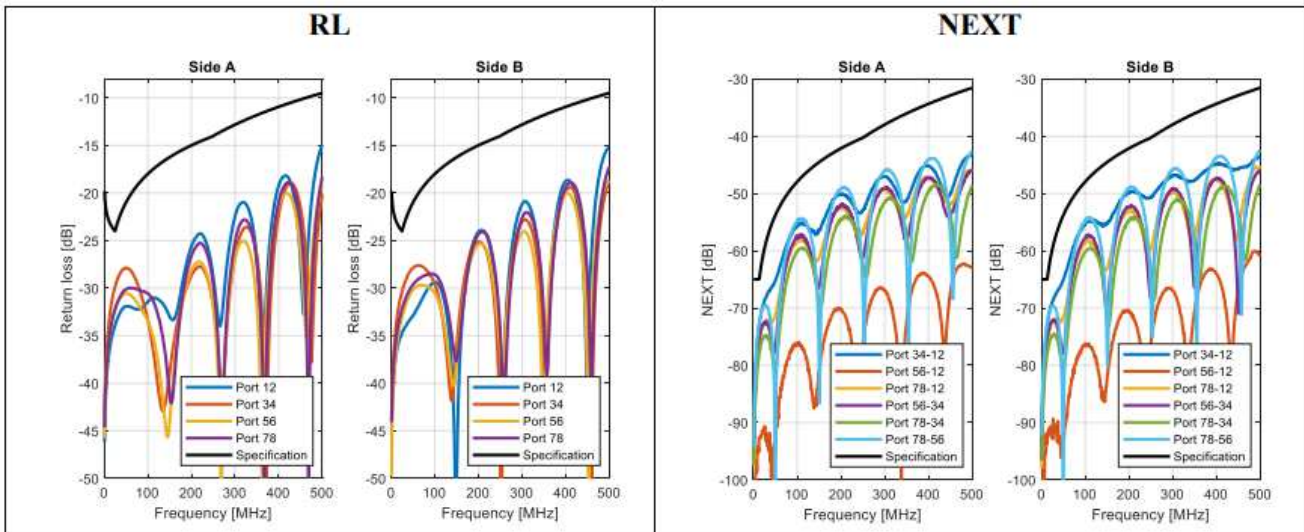


6.8.2 M12 X-code Right Angle, Male

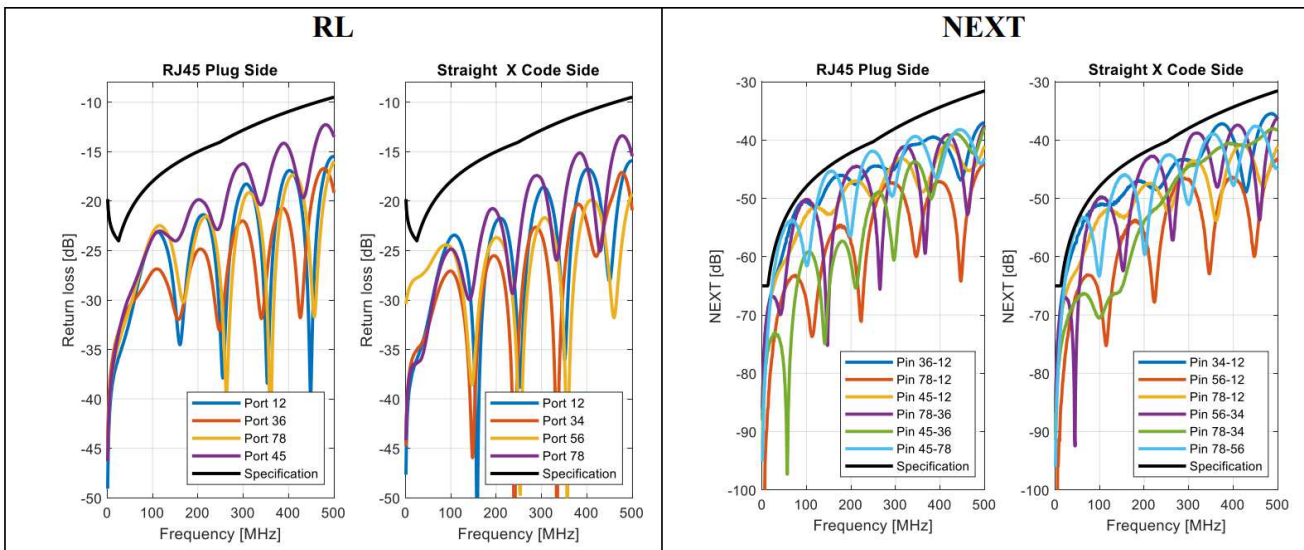


6.9 Patch Cord Test Results:

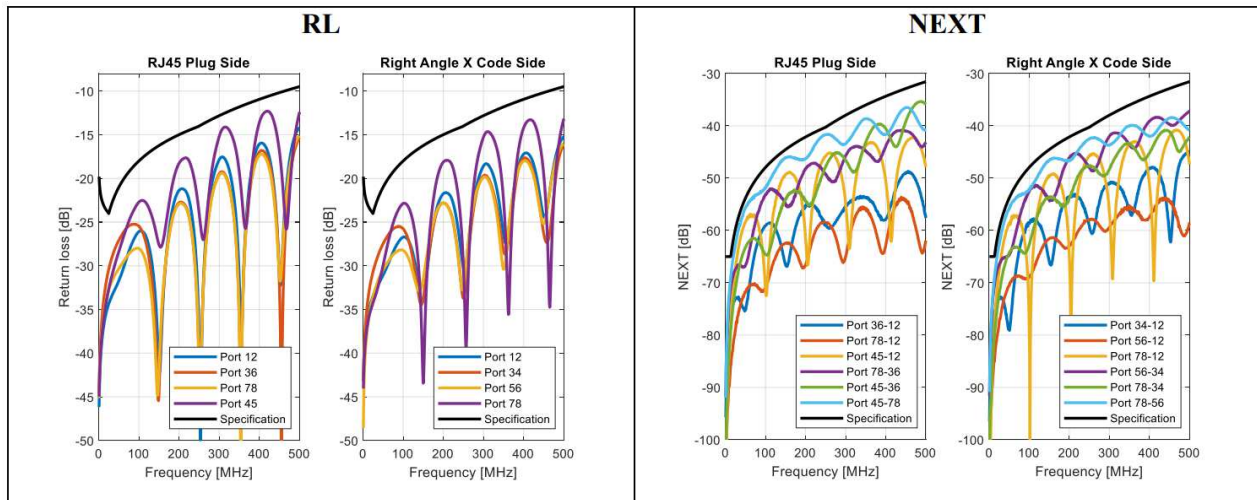
6.9.1 M12 X-code Male to M12 X-code male, Straight, PVC



6.9.2 M12 X-code Male to RJ45 male, Straight, TPE



6.9.3 M12 X-code Right Angle Male to RJ45 male, Straight, PVC



7. Conclusion

M12 X-code connector conforms to the electrical, mechanical, environmental performance and transmission requirements of Design Objective 108-137008.