

Amphenol

The Product Specification For
NetBridge+ Series Products
高速以太网产品系列规格书

Product Spec. #
S-NTH-001

Date :
8/28'23

Rev. A

ECN #
HK12055

Page: 1 / 22

Revision History修订履历

Rev. 版本	Updated Description 更新描述	Updated Date 更新日期	Updated by 更新人
A	First Release	Aug 28, 2023	Helen

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1 OBJECTIVE 目的

This specification defines the performance, test, quality and reliability requirements of Amphenol NetBridge+ series products.

本规格书定义了高速以太网汽车连接器产品的性能、测试、质量以及可靠性要求。

2 SCOPE 范围

This Specification includes the Materials/Finishing, Mechanical Characteristics, Electrical Characteristics and Environmental requirements of Amphenol NetBridge+ series products.

本规范包括高速以太网汽车连接器产品的材料/表面处理、机械特性、电气特性和环境要求。

3 APPLICABLE DOCUMENTS 应用文件

3.1 Application应用

3.1.1 Engineering drawings 工程图纸

3.2 Reference Standards参考标准

3.2.1 SAE/USCAR-2: Performance Specification for Automotive Electrical Connector Systems
SAE/USCAR-2 汽车电气连接器系统性能规范

3.2.2 OPEN ALLIANCE TC9 For 1000BASE-T1 Link Segment Type A 1000 兆高频测试规范

3.2.3 IEEE 1000MBASE-T1 Definitions for Communication Channel 1000 兆高频测试规范

3.2.4 IEEE P802.3ch 10GBASE-T1 10 Gbps 高频测试规范

3.2.5 MIL-STD-202F: Test Methods for Electronic Components Parts 电子元件的测试方法

3.2.6 MIL-STS-1344A : Test Methods for Electrical Connectors 电气连接器的测试方法

3.2.7 MIL-C-45662 : Equipment Calibration 设备校准

3.3 Other Standards and Specifications 其他标准和规范

3.4.1 EIA 364: Electrical Connector/Socket Test Procedures Including Environmental Classifications 电气连接器测试程序包括环境分类。

3.4.2 Safety Requirements 安全要求:

Plastic material flammability class for board connector: UL94 V-0.

板端连接器胶料防火等级: UL94 V-0

Plastic material flammability class for cable connector: UL94 HB.

线束端连接器胶料防火等级: UL94 HB

4 REQUIREMENTS 要求

4.1 Lab conditions 实验室条件

Connectors furnished under this specification shall be capable of meeting the qualification test requirements specified herein. Unless otherwise specified, all measurements shall be performed within the following lab conditions: 根据本规范连接器提供应以满足指定的资格测试需求, 除非另有规定, 所有测试应当执行以下的实验条件:

Temperature 温度 : 15 to 35°C

Relative Humidity 相对湿度 : 20% to 80%

Atmospheric Pressure 大气压力: 650mm to 800mm of Hg (86 ~106Kpa)

4.2 Material 材料

Material for each part shall be specified herein, or equivalent. Substitute material shall meet the performance requirements of this specification. 每个零件的材料应在此指定, 或同等替代材料应符合本规范的性能要求。

Netbridge for automotive connector 以太网汽车连接器

For the basic material, refer to the latest engineering drawing. 基本材料参见最新工程图纸。

4.3 Finish 表面处理

Plated finished for qualification components shall be as specified herein or equivalent.

合格部件的表面处理应依此规格书或同等条件下指定。

Plating: please refer to the latest engineering drawing.

电镀:请参照最新工程图纸。

4.4 Mating 配插

The connectors shall be capable of mating and un-mating manually without the use of special tools. 连接器应能够在不使用特殊工具的情况下手动进行插拔。

4.5 Workmanship 工艺

Connectors shall be uniform in quality and shall be free from burrs, scratches, cracks, voids, chips, blisters, pin holes, sharp edges, and other (specific reference value range AICC Net Bridge appearance standard) defects that will adversely affect product's life or serviceability.

连接器在品质上应一致, 无毛刺、划痕、裂纹、孔洞、碎屑、气泡、针孔、锐边和其他(特定的参考值范围依 AICC 以太网外观标准)会对产品寿命及适应性产生不利影响的缺陷。

4.6 Board Connector Shelf-life 板端连接器存储期限

The packaged board connectors shall be stored at a temperature lower than 30 ° C and a humidity of 70%RH for less than one year. The connectors shall be used within 4 weeks after the packaging is opened.

包装好的板端连接器应存储在低于 30 摄氏度温度和 70%RH 湿度环境下, 且存放时间不得超过 1 年。在包装打开后, 连接器应在 4 周之内使用完。

5 Classification 等级

5.1 Temperature Class 温度等级

Class	Ambient Operating Temperature	Typical Installation Position
T2	-40 °C to +105 °C	In passenger compartment

5.2 Vibration Class 振动等级

Class	Typical Installation Position
V1	on sprung portions of vehicle not coupled to engine

5.3 Seal Class (For sealed version) 密封等级 (针对防水版)

Class	Ambient Operating Temperature	Typical Installation Position
S3	High Pressure Spray Protected	Exposed Areas where High Pressure Spray is Expected

6 CHARACTERISTICS 特点

6.1 ELECTRICAL CHARACTERISTICS 电器特性

6.1.1 Current Cycling 电流循环

Reference: USCAR-2, 5.3.4 参考 USCAR-2, 5.3.4

a) Current rating: 3.0 A Max. for STP and 22AWG power wire, 5A Max. for 20 AWG power wire.

额定电流：以太网线和 22AWG 电源 pin 3.0 安培最大，20AWG 电源 pin 5A 最大。

b) Acceptance criteria:

The temperature of any terminal interface must not exceed a 55°C rise over ambient at any time during the test.

在试验期间，任何接触位置的温度不得超过环境温度 55°C。

The total connection resistance or maximum voltage drop of any terminal interface reading shall not exceed the Acceptance Criteria listed of this specification.

任何接触位置的总接触阻抗和最大电压降值不得超过本规范定义之验收标准。

6.1.2 Contact Resistance 接触阻抗

Mated with applicable connector, the low level contact resistance is 20m ohm maximum initial when measured in accordance with SAE/USCAR-2 5.3.1, the contact resistance of after environmental exposure shall not exceed 20m ohm maximum angle from initial. (For contact resistance of male and female connectors only, excluding cable) Cable Resistance depends on the length of cable (125 Ω /KM Max for conductor cross section area: 0.13~0.14MM², 55.5 Ω /KM Max for conductor cross section area; 0.35MM², 36.7 Ω /KM Max for conductor cross section area)

与适用的连接器匹配，根据 SAE/USCAR-2 5.3.1 测量，接触电阻为 20m 欧姆最大初始值。（仅针对公母头连接器对插接触电阻，不包含线材），线材电阻取决于电缆的长度（导体截面积为 0.13~0.14 MM² 的线材 125 Ω /KM 最大，导体截面积为 0.35 mm² 的线材 55.5mhm/KM 最大，0.5mm² 的线材 36.7 ohm/KM 最大）。

The following details shall apply 应满足如下要求:

- a) Test Voltage 测试电压: 15mV DC maximum at open circuit. 15 毫伏直流最大在开路下测试.
- b) Test Current 测试电流: not to exceed 100mA. 不超过 100 毫安培。

6.1.3 Voltage drop 电压降

Reference: USCAR-2, 5.3.2

参考: USCAR-2, 5.3.2 进行测试

Acceptance criteria in accordance with USCAR-2, 5.3.2.4 maximum voltage drop: 50 mV

允收标准依照 USCAR-2, 5.3.2.4 最大电压降: 50 mV

6.1.4 Insulation Resistance 绝缘阻抗

Reference: USCAR-2, 5.5.1

参考 USCAR-2, 5.5.1 规范

The following details shall apply: 应满足如下要求:

- a) Test Voltage: 500V DC 测试电压: 500 伏直流电
- b) Acceptance criteria: the resistance between every combination of two adjacent terminals in the connection must exceed 100 MΩ at 500 VDC.
验收标准: 在 500 V 直流电下，连接中两个相邻端子的每一个组合之间的电阻必须超过 100MΩ。
- c) Electrification Time 带电时间 : 1 minute. 1 分钟
- d) Point of Measurement 测试点: Between adjacent contacts. 相邻近的端子

6.1.5 Dielectric Withstanding Voltage 绝缘耐压

There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (0.5mA max) when the mated connectors are tested in accordance with Customer. The following details shall apply: 与配插端配插进行测试时, 没有任何证据表明有电弧、绝缘损坏或过度泄漏电流 (0.5 毫安培最大), 应满足如下要求:

- a) Test Voltage: 500V AC 测试电压: 500 伏交流电
- b) Test Duration: 1 minute. 测试持续时间: 1 分钟
- c) Points of measurement: Between adjacent contacts. 测试点: 相邻的端子
- d) Per EIA-364-20C 依 EIA-364-20C 电子连接器耐电压测试方法

6.1.6 Circuit continuity monitoring 电路连续性检测

- a) Reference: USCAR-2, 5.1.9 参考 USCAR-2 规范, 5.1.9
- b) Acceptance criteria in accordance with USCAR-2, 5.1.9, there must be no loss of electrical continuity, for more than 1 μ s.
验收标准按照 USCAR-2, 5.1.9, 不允许有超过 1 μ s 的瞬断。

6.2 MECHANICAL CHARACTERISTICS 机械特性

6.2.1 Connector-Connector Mating/Un-mating/Retention 连接器与连接器的插拔力/保持力

The following details shall apply: 应满足如下要求:

- a) Reference: USCAR-2 5.4.2 参考 USCAR-2 5.4.2
- b) Insert and withdraw connectors at the speed rate of 50 \pm 10mm/minute.
以 50 \pm 10 mm/分钟的速度插入和拔出连接器。
- c) Mating force 插入力:
 - \leq 75 N (1~6port, Gold plated terminal); 1~6port 连接器(镀金端子)插入力小于等于 75N.
 - \leq 75 N (1~4port, Tin plated terminal); 1~4port 连接器(镀锡端子)插入力小于等于 75N.
 - \leq 85 N (6port, Tin plated terminal); 6port 连接器(镀锡端子)插入力小于等于 85N.
- d) Newton with the connector lock fully engaged.
锁扣破坏力需大于或等于 110N.
- e) Un-mating force (Lock fully disengaged or disabled) 拔出力(无锁扣状态):
 - \leq 75 N (1~6port, Gold plated terminal); 1~6port 连接器(镀金端子)拔出力小于等于 75N.
 - \leq 75 N (1~4port, Tin plated terminal); 1~4port 连接器(镀锡端子)拔出力小于等于 75N.
 - \leq 85 N (6port, Tin plated terminal); 6port 连接器(镀锡端子)拔出力小于等于 85N.
- f) The force to completely disengage the primary connector lock must be >2N and \leq 51N
连接器解锁力应 2N~51N.

6.2.2 Connector or Terminal Cycle 连接器或端子循环

Completely mate and un-mate each connector or terminal pair 25 times.

完成每一对端子或连接器 25 次插拔。

a) Reference: SAE/USCAR-2 5.1.7 参考 SAE/USCAR-2 5.1.7

b) Number of Cycles: 25 cycles. 插拔次数: 25 次

c) Acceptance criteria: No physical damage.

验收标准: 无物理性损伤

6.2.3 Vibration/ Mechanical Shock 振动/机械冲击

Per SAE/USCAR-2 5.4.6 依照 SAE/USCAR-2 5.4.6

Direction: each of 3 orthogonal axis 方向: X,Y,Z 三个互相垂直的轴向

a. Mechanical Shock 机械冲击

Test Condition: 测试条件

Vibration Class	Shocks per Axis	Wave Shape	Direction (+/-)	Duration (ms)	Acceleration (g)
V1	10	Half Sine Wave	Positive	5 ~ 10	35

b. Vibration 振动

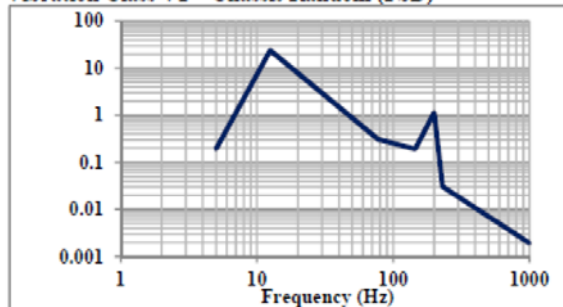
Test Condition: Random duration 8H/Axis by class V1

测试条件: 振动等级V1, 随机振动8小时/轴.

V1 - Random

F (Hz)	PSD ¹	PSD g ² /Hz
5.0	0.192	0.00200
12.5	23.8	0.24800
77.5	0.307	0.00320
145.0	0.192	0.00200
200.0	1.13	0.01180
230.0	0.031	0.00032
1000.0	0.002	0.00002
g_{rms}	17.74	1.81 g

Vibration Class V1 - Chassis Random (PSD)



Thermal Cycling shall be performed during the vibration schedules with below

Temperatures condition :

振动期间进行热循环, 温度条件如下:

-Temperature Range is -40 ° C to 105 ° C 温度范围-40 ° C to 105 ° C

- Dwell time for -40 ° C equals 2 hours. 停留时间-40 ° C下2小时
 - Dwell time for 105 ° C equals 2 hours. 停留时间105 ° C下2小时
 - Temperature Transistion rate shall range between 3 to 5 ° C /minute.
温度转换速度应在每分钟3~5 ° C
 - One thermal cycle is approx. 360 minutes. 一个热循环大约是360分钟
- c. Acceptance criteria :no loss of electrical continuity for more than 1 μs, No damage allowed
验收标准：瞬断不得大于1微秒，无物理性损伤

6.2.4 Cable Crimping Retention force 电线压接保持力

- a) Shield Crimping Retention force (Axial): 110N Min. for STP, 80N Min. for UTP
屏蔽壳压接保持力（轴向）： STP 电缆最小 110N； UTP 电缆最小 80N。
- b) Terminal crimping retention force(Axial): 20N Min for 26AWG, 50N for 22AWG and 70N for 20AWG
端子压接保持力（轴向）： 26 AWG 线 20N 最小， 22AWG 50N 最小， 20AWG 线 70N 最小

6.2.5 Connector drop test 连接器跌落试验

- a) Reference: USCAR-2, 5.4.8 参考 USCAR-2, 5.4.8 进行测试.
- b) Acceptance criteria according to USCAR-2, 5.4.8.4
需符合 USCAR-2, 5.4.8.4 的验收标准.

6.2.6 Header pin retention 板端连接器 PIN 保持力

Using the force tester, apply a ramping pressure to the terminal pin. Note and record the maximum force required to displace the pin a maximum of 0.2mm, within the plastic housing or board attachment. Repeat for each pin location.

使用测力仪，应用一个倾斜的压力作用端子插针，注意并记录 塑料外壳内销最大位移 0.2 mm 所需的最大力，对每个端子位置重复此步骤。

- a) Per SAE/USCAR-2 5.7.1 依据 SAE/USCAR-2 5.7.1
- b) Contact Retention force: 15N Min. 端子保持力 15N /支最小
- c) Shield cassette retention force: 15N Min for VT,30N min for RA. 屏蔽暗盒保持力 直立式 15N 最小,卧式 30N 最小

6.2.7 Terminal-Connector insertion Retention Force 端子至连接器的插拔力

- a) USCAR-2, 5.4.1 参考 USCAR-2, 5.4.1
- b) Contact carrier Insertion force : 30N Max 端子载体插入力 30 牛顿最大.
- c) Insert to break the stopper force: >=50N. 止挡位置的破坏力需大于或等于 50 牛.
- d) Contact carrier retention force(primary lock only): NTH Contact carrier : 60N Min,
power contact :30N Min. 一次锁保持力：以太网端子载体: 60 牛最小，电源端子： 30 牛最小.
- e) Contact retention force(secondary lock, After moisture conditioning): NTH contact carrier: 100N

min, power contact :60Nmin

保持力(二次锁和潮湿处理后): 以太网端子载体 100 牛最小, 电源端子 60 牛最小。

- f) Terminal retention force (primary lock +secondary lock , After Temp/Humidity and HTE) :NTH
Contact carrier :70N Min, power contact :50N Min 端子保持力(一次锁+二次锁, 温湿度循环和高温暴露后): 以太网端子载体 70 牛最小, 电源端子 50 牛最小
- g) The contact carrier is the shield after crimping:端子载体组件为压接后的屏蔽壳。

6.2.8 Terminal to Terminal engage/Disengage Force 端子至端子的结合力与分离力

- a) USCAR-2, 5.2.1 参考 USCAR-2, 5.2.1
- b) Record the first engage force and 25th disengage force
记录第一次的插入力和第 25 次的拔出力
- c) Complete the Visual Examination, No base material should be exposed.
完成外观检查, 不可以露基材。

6.2.9 Terminal Bend Resistance 端子抗弯力

- a) USCAR-2, 5.2.2.3 参考 USCAR-2, 5.2.2.3
- b) Applied force: 3.0N for NTH pin,4N for power pin:施加力量以太网端子 3N min,电源 pin 4N min.
- c) No tear or crack. 没有撕裂或裂纹。

6.2.10 Connector to connector Audible Click 连接器至连接器可听见的卡塔响。

- a) USCAR-2, 5.4.7 参考 USCAR-2, 5.4.7
- b) Acceptance criteria according to USCAR-2, 5.4.7.4
需符合 USCAR-2, 5.4.7.4 的验收标准。

6.2.11 Polarization Feature Effectiveness 极化特殊效果。

- a) USCAR-2, 5.4.4 参考 USCAR-2, 5.4.4
- b) Mating in incorrect orientations and different coding.
错误的方向或不同扣位之间互配。
- c) Requirement: 60 N minimum. 要求: 60 牛最小。
- d) Insert the female connector to the position when male and female terminal are connected at least
将线端连接器至少插入到公母端子接触的位置。
- e) No damage to the connector and no electrical contact shall be made between the male/female terminals. 连接器不被损坏, 并且公母端子没有电气连接。

6.2.12 Terminal/Cavity Polarization Test 端子, 型腔极性测试。

- a) USCAR-2, 5.4.10 参考 USCAR-2, 5.4.10
- b) Insert the contact carrier in the incorrect orientations, apply a force equaling 1.5 times the maximum force recorded, (At latest 15N)

在错误的方向插端子载体，施加正常插入力的 1.5 倍(不低于 15N)

Acceptance criteria according to USCAR-2, 5.4.10.4.

- c) The contact carrier should not insert into a connector
端子载体不能安装到连接器。
- d) There shall be no visible damage to either the terminal or connector
端子和连接器不能被损坏。

6.2.13 Connector Mounting Feature Mechanical Strength(If applicable) 连接器安装机械强度(如适用)

- a) USCAR-2, 5.4.11 参考 USCAR-2, 5.4.11
- b) Apply a force with a probe to the non-mounted mating connector in direction F1~F6 until breakage of the mounting feature or until the force specified in the Acceptance Criteria of section 5.4.11.4 is reached.
沿 F1~F6 方向施加力直到安装特征断裂或达到验收标准规定的力
- c) Acceptance criteria: F1~F4, F6 \geq 50N; F5 \geq 110N
验收标准: F1~F4 和 F6 力需大于等于 50N; F5 方向力需大于等于 110N

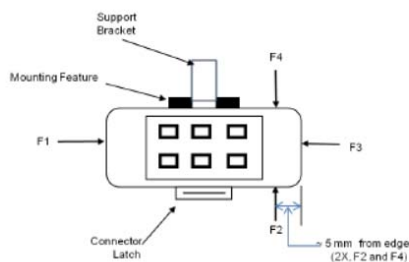


FIGURE 5.4.11.3B: TEST SET-UP (END VIEW)

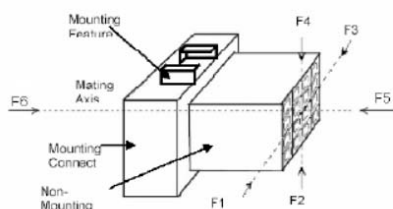


FIGURE 5.4.11.3C: TEST SET-UP (3D VIEW)

6.2.14 Connector Seal Retention(Mated) 连接器密封保持 (配对)

- a) USCAR-2, 5.4.14 参考 USCAR-2, 5.4.14
- b) Connector shall be fully separated within one second.
连接器在 1 秒内快速分开。
- c) Seal is not displaced. 密封圈没有发生位移。

6.2.15 CPA Engage/Disengage Force CPA 的插入力和拔出力

- a) USCAR-2, 5.4.5 参考 USCAR-2, 5.4.5

- b) CPA engage force (pre-set to lock): 60N min (un-matting) / 22N MAX (matting)
CPA (预插状态到锁定状态) 插入力: 60N 最小(未配插状态) 22N 最大(配插状态)
CPA disengage force (lock to pre-set) : 10-30N
CPA (锁定状态到预插状态) 拔出力: 10-30N.
CPA disengage force (removing) : 30N Min
CPA 完全拔出力 30 牛最小.
- c) CCPA engage force(Pre-set to Lock): 60N Max.
CCPA (预插状态到锁定状态) 插入力: 60N 最大
CCPA disengage force (Lock to Pre-set): 30N Max.
CCPA (锁定状态到预插状态) 退出力: 30N 最大
CCPA disengage force (removing): 10N Min.
CCPA 完全拔出力 10N 最小

6.3 ENVIRONMENTAL CHARACTERISTICS 环境特性

After exposure to the following environmental conditions in accordance with the specified test procedures and/or details, the product shall show no physical damage and shall meet the electrical and mechanical requirements per paragraphs 5.0 and 6.0 as specified in Table 1 test sequence. Product subjected to these environmental tests must be applied to printed circuit boards. Unless otherwise specified, the assemblies shall be mated during exposure.

根据规定的试验程序或细节, 在暴露于以下环境条件中后, 产品应无物理损伤, 并应符合表 1 试验顺序中的电气和机械要求。接受这些环境试验的产品必须应用于印刷电路板。除非另有规定, 否则组件应在暴露期间匹配。

6.3.1 Thermal Shock 冷热冲击

- a) Per SAE/USCAR-2 5.6.1 参照 SAE/USCAR-2 5.6.1
b) Temperature Class -40 ° C to +105 ° C. 温度等级为-40 ° C to +105 ° C.
c) Remain 30min.;保持 30 分钟
transition in less than 30 seconds 转换时间 30 秒
d) Repeat 99 more times. 重复九十九次以上。
e) No loss of electrical continuity for more than 1 μs.
瞬断不得大于1微秒。
f) conditioning process only.
群组测试过程条件。

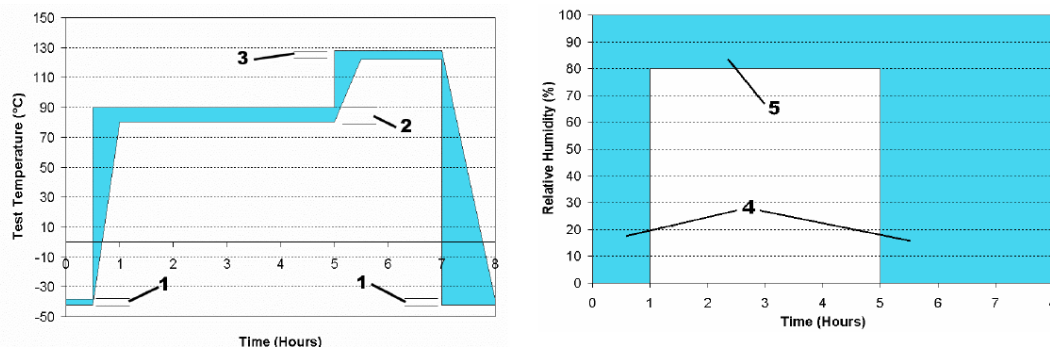
6.3.2 Temperature/Humidity Cycling 温湿度循环

- a) Per SAE/USCAR-2 5.6.2 参照 SAE/USCAR-2 5.6.2
b) Cycle the test samples 40 times using the cycling schedule shown in Figure 5.6.2.3. The cycle begins with the sample at -40 ° C to +105 ° C, 0%-95%RH. Completion of the schedule shown in Figure 5.6.2.3 will constitute one cycle. Use +105 ° C for hours 5 through 7.

使用图 5.6.2.3 所示的循环时间表循环试验样品 40 次, 循环从-40°C到+105°C, 0%-95%相对湿度, 完成图 5.6.2.3 所示的计划构成一个周期。使用最大环境温度+105°C第 5 至第 7 小时。

c) conditioning process only.

群组测试过程条件



Key: 1 (-40)°C 2 (80 – 90)°C 3 Test temperature per Table 5.1.4.1 (Class 3 shown for illustration only)
4 Relative Humidity, uncontrolled. Do not vent chamber at hour 5. 5 (80 – 100)% Relative Humidity

6.3.3 High Temperature Exposure 高温暴露

a) Per SAE/USCAR-2 5.6.3 参照 SAE/USCAR-2 5.6.3

b) Place the samples in the chamber, set to the maximum ambient temperature +105 ° C, so that there is no substantial obstruction to air flow across and around the samples, and the samples are not touching each other. Leave the samples in the chamber for 1008 hours.
将样品放入室内,设置好最高周围温度+105 ° C,以便样品与样品周围空气流动没有实质性阻碍,样品也没有相互接触,样品留下在室内 1008 小时。

6.3.4 Submersion 水浸

a) Per SAE/USCAR-2 5.6.5 参照 SAE/USCAR-2 5.6.5

b) Prepare enough salt water solution to completely submerge the samples. Use tap water and 12-16 grams of table salt and 10ml of liquid dish washing soap per liter and mix well. It is recommended that an appropriate ultraviolet dye be added to assist in visual inspection for any ingress of solution into the test samples. Cool the solution to 0°C.

准备足够的盐水溶液使样品完全浸没,每升自来水中加 15-16 克食盐和 10 毫升洗洁精并充分混合,建议添加适当的紫外线染料,以帮助目视检查溶液是否进入样品。将溶液冷却至 0°C

c) Determine the Temperature Class for the intended application of the connector system from table 5.1.4.1. with Class T2. Set to the Maximum Ambient Temperature. Heat Soak the samples at the elevated temperature of the chamber.

选择连接器系统表 5.1.4.1 预期应用温度等级为等级 T2,设置到最高温度,直到产品在试验箱中完全均热。

d) Within 30 seconds, submerge them in the 0°C solution to a depth of 30-40cm for 30 minutes. 在 30 秒内将其浸入 30-40 厘米深的 0°C 的盐水溶液中,保持 30 分钟。

e) After drying the sample surface, immediately perform the Insulation Resistance test.擦干样品表面,并对其进行绝缘电阻测试。

6.3.5 Pressure/Vacuum Source 压力/真空泄漏

- a) Per SAE/USCAR-2 5.6.6 参照 SAE/USCAR-2 5.6.6
- b) Prepare enough salt water solution to completely submerge the samples. Use tap water and 15-16 grams of table salt and 10 ml of liquid dish washing soap per liter then mix well. It is recommended that an appropriate ultraviolet dye be added to assist in visual inspection for any ingress of solution into the test samples.
准备足够的盐水溶液使样品完全浸没，每升自来水中加 15-16 克食盐和 10 毫升洗洁精并充分混合，建议添加适当的紫外线染料，以帮助目视检查溶液是否进入实验样品。
- c) Increase the air pressure to 48kPa(7psig). Observe samples for a minimum of 15 seconds and verify that there are no air bubbles.
调节气压至 48 千帕（7 磅/平方英尺），观察样品至少 15 秒确认无气泡产生。
- d) Switch the pressure to vacuum, Decrease the air pressure to 48kPa(7psig). Observe samples for a minimum of 15 seconds and verify that there are no air bubbles.
切换到真空压力，调节气压至 48 千帕（7 磅/平方英尺），观察样品至少 15 秒确认无气泡。
- e) After drying the sample surface, immediately perform the Insulation Resistance test.
擦干样品表面，并立即对其进行绝缘电阻测试。
- f) Determine the Temperature Class for the intended application of the connector system from table 5.1.4.1. with Class T2. Set to the Maximum Ambient Temperature. Heat Soak the samples for 70 hours, then cool to Room Temperature.
选择连接器系统表 5.1.4.1 预期应用温度等级为等级 T2，设置到最高温度，将样品热浸 70 小时，然后冷却至室温。
- g) Repeat Steps c to e, except the limit pressure to 28kPa(4 psig).
重复 c 至 e，除了气压的限制需下调至 28 千帕（4 磅/平方英尺）。
- NOTE: step F), G) are performed only when vacuum pressure leaks are tested separately and skipped if the vacuum pressure leak is tested after the environmental test.
注意：步骤 f)、g) 只有在单独测试真空压力泄露时才进行，如果是测环境测试之后的真空压力泄露则跳过这两个步骤。

6.3.6 High Pressure Spray 高压喷射

- a) Per SAE/USCAR-2 5.6.7 参照 SAE/USCAR-2 5.6.7
- b) Testing conditions 测试条件

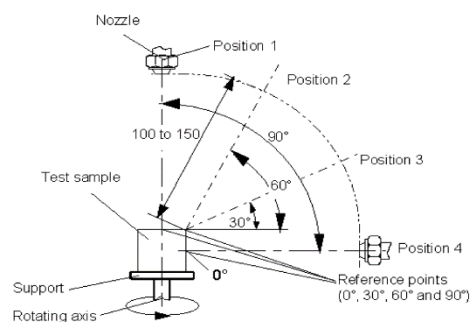
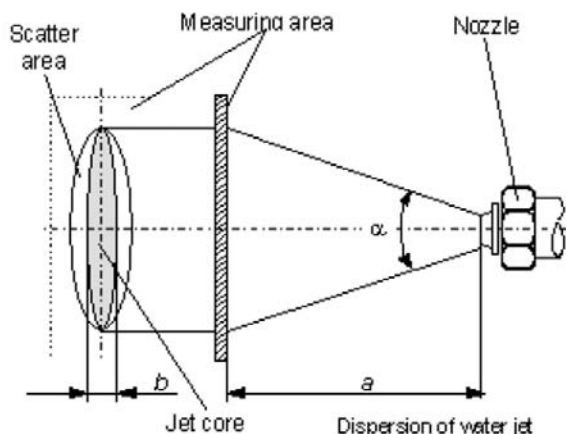


FIGURE 5.6.7.3-1: SPRAY NOZZLE AND TABLE ARRANGEMENT

Equipment	Spray Requirements	Water Flow	Water Pressure	Water temperature	Exposure Time
Fan jet nozzle $\alpha=30^\circ\pm 10^\circ$	Turntable Speed = 5 ± 1 rpm, Position Angle of ($0^\circ, 30^\circ, 60^\circ, 90^\circ$) $\pm 5^\circ$, Distance of (100 to 150) mm	14 to 16 L/min	Approx. 8,000 to 10,000 KPa	$80\pm 5^\circ\text{C}$	30sec / position of spray angle

TABLE 5.6.7.3-1 SPECIFICATION FOR HIGH PRESSURE SPRAY TESTING



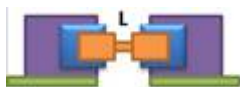
A	a	b
30 ± 5	100	8 ± 2
30 ± 5	150	10 ± 2

FIGURE 5.6.7.3-2 AND TABLE 5.6.7.3-2: NOZZLE AND JET DIMENSIONS (MM)

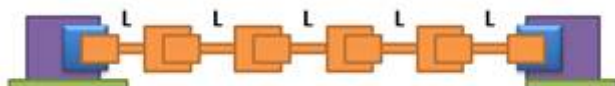
- c) After drying the sample surface, immediately perform the Insulation Resistance test.
擦干样品表面，并立即对其进行绝缘电阻测试。

7 SI TEST 高频测试

7.1 Link definition1 (接线方式1)



7.2 Link definition2 (接线方式2)

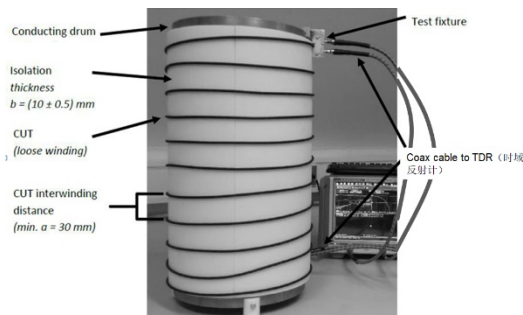
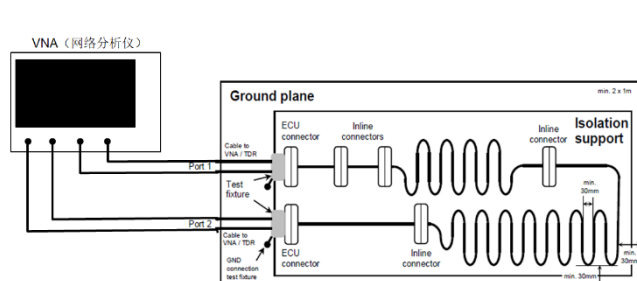


7.3 SI Data (100Mbps cable assembly, 针对100Mbps线缆组件)

All parts of evaluated configuration should be placed as below figure, for small configurations the cables should be route in a straight way. For large configurations the cable segments should be arranged as a meander between the connectors to avoid parasitic couplings at test setup. And the parameters and limits are required according to below table.

线缆组件测试如下图所示，当线缆组件长度较短时，线缆组件只要直线放置测试；当线缆组件长度较长时，连接器之间的线缆必须蛇形走线用以规避寄生效应影响测试结果，测试

参数要求如下图所示。



类别	试验参数	要求
Standalone Communication Channel(单通道)	CIDM(Characteristic Impedance Differential Mode) 差分阻抗	100 Ω +/- 10%, valid for 700 ps rise time
	IL(Insertion Loss)插入损耗	1MHz: 1.0dB 10MHz: 2.6dB 33MHz: 4.9dB 66MHz: 7.2dB
	RL(Return Loss)回波损耗	1MHz: 18.0dB 20MHz: 18.0dB 66MHz: 12.8dB
	LCL/LCTL(Longitudinal Conversion Loss/Longitudinal Conversion Transmission Loss) 模式转换	1MHz: 43.0dB 33MHz: 43.0dB 50MHz: 39.4dB 200MHz: 27.3dB
Multi- Communication Channel (多通道)	PSANEXT(Power Sum Alien Near End Crosstalk Loss)近端串扰衰减和	1MHz: 51.5dB 100MHz: 31.5dB
	PSAACRF(Power Sum Attenuation to Alien Crosstalk Ration Far End)定量远端串扰功率衰减和	1MHz: 56.5dB 100MHz: 16.5dB
	ANEXTDC/AFEXTDC(Crosstalk Mode Conversion) 近端/远端串扰模式转换	1MHz: 43.0dB 33MHz: 43.0dB 50MHz: 39.4dB 200MHz: 27.3dB

7.4 SI Data (1Gbps cable assembly, 针对1Gbps线缆组件)

All parts of evaluated configuration should be placed as below figure, for small configurations the cables should be route in a straight way. For large configurations the cable segments should be arranged as a meander between the connectors to avoid parasitic couplings at test setup. And the parameters and limits are required according to below table.

线缆组件测试如下图所示，当线缆组件长度较短时，线缆组件只要直线放置测试；当线缆

组件长度较长时，连接器之间的线缆必须蛇形走线用以规避寄生效应影响测试结果，测试参数要求如下图所示。

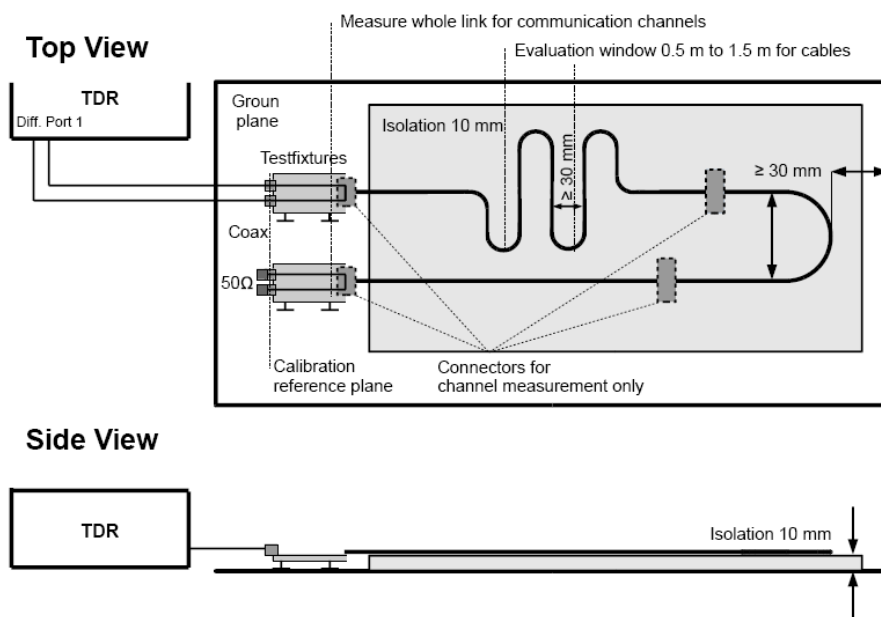
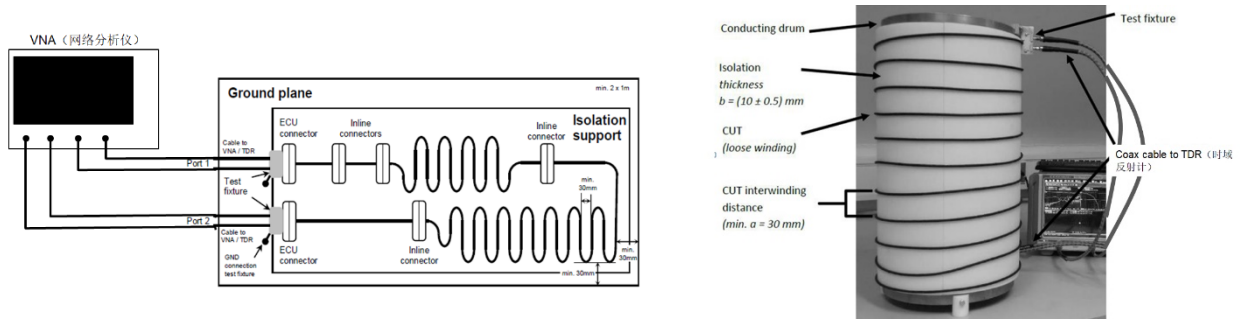


Figure 5.2.1-3: TDR measurement setup using conducting ground plane

Test Parameter		Requirement
CIDM	Z _{RF}	Informative parameter only (not required) 100 Ω ± 10 % (at 500 ps rise time)
Propagation Delay	t _d	≤ 94 ns 2 ≤ f ≤ 600, frequency f in MHz Port reference impedances: 100 Ω (DM), 200 Ω (CM)
IL	S _{dd21}	≤ $\left(0.0023f + 0.5907\sqrt{f} + 0.0639/\sqrt{f} \right) dB$ 1 ≤ f ≤ 600, frequency f in MHz Port reference impedances: 100 Ω (DM), 200 Ω (CM)
RL	S _{dd11} , S _{dd22}	$\geq \begin{pmatrix} 19 & 1 \leq f < 10 \\ 24 - 5\log f & 10 \leq f < 40 \\ 16 & 40 \leq f < 130 \\ 37 - 10\log f & 130 \leq f < 400 \\ 11 & 400 \leq f \leq 600 \end{pmatrix} dB$ 1 ≤ f ≤ 600, frequency f in MHz Port reference impedances: 100 Ω (DM), 200 Ω (CM)
LCL LCTL	S _{dc11} , S _{dc22} S _{dc21} , S _{dc12}	$\geq \begin{pmatrix} 50 & 10 \leq f \leq 80 \\ 72 - 11.51\log(f) & 80 < f \leq 600 \end{pmatrix} dB$ 10 ≤ f ≤ 600, frequency f in MHz Port reference impedances: 100 Ω (DM), 200 Ω (CM)

Table 6.1.3-1: Electrical limits for Whole Communication Channel (SCC context)

Test Parameter		Requirement
PSANEXT LOSS	S _{dd31} , S _{ddyx}	$\geq \begin{pmatrix} 54 - 10\log\left(\frac{f}{100}\right) & 1 \leq f \leq 100 \\ 54 - 15\log\left(\frac{f}{100}\right) - 6\left(\frac{f-100}{400}\right) & 100 < f \leq 600 \end{pmatrix} dB$ 1 ≤ f ≤ 600, frequency f in MHz Port reference impedances: 100 Ω (DM), 200 Ω (CM)
PSAACRF	S _{dd41} , S _{ddyx}	$\geq \left(43.67 - 20\log\left(\frac{f}{100}\right) \right) dB^3$ 1 ≤ f ≤ 600, frequency f in MHz Port reference impedances: 100 Ω (DM), 200 Ω (CM)
AFEXTDC LOSS AFEXTDS LOSS	S _{dc41} , S _{dcyx} S _{ds45} , S _{dsyx}	$\geq \begin{pmatrix} 50 & 10 \leq f \leq 80 \\ 72 - 11.51\log(f) & 80 < f \leq 600 \end{pmatrix} dB$ 10 ≤ f ≤ 600, frequency f in MHz Port reference impedances: 100 Ω (DM), 200 Ω (CM)

Table 6.2.3-1: Electrical limits for WCC (ES context)

8 QUALITY ASSURANCE PROVISIONS 质量保证条款

8.1 Equipment Calibration. 设备校准

All test equipment and inspection facilities used in the performance of any test shall be maintained in a calibration system in accordance with MIL-C-45662 and ISO 9000.

所有测试设备和检验设施用于测试时的性能应符合 MIL- C - 45662 和 ISO 9000 的校准系统的规定。

8.2 Visual Examination 外观检验

Visual Examination: Per SAE/USCAR-2 5.1.8 外观检查：依照 SAE/USCAR-2 5.1.8 章

8.3 Inspection Condition. 检验条件

Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions: 除非另有说明,所有的检查应在下列环境条件下进行:

- a) Temperature 温度 : $25 \pm 5^{\circ}\text{C}$
- b) Relative Humidity 相对湿度 : 30% ~ 60%
- c) Barometric Pressure 气压: Local ambient 当地的环境

8.4 Sample Quantity and Description 样本数量和描述

The numbers of samples to be tested in each group shown in Qualification Testing Sequences are defined as follows: Groups A through T:

5 samples in each group: All samples must be free of defects that would impair normal connector operation. All samples must meet dimensional requirements of connector.

样品的数量在每组测试资格如下所示: A 组到 T 组,每组 5 个样品,所有的样品必须是无缺陷的,所有样品必须符合尺寸要求。

8.5 Acceptance 验收:

6.4.1 Electrical and mechanical requirements placed on test samples as indicated in Paragraphs

5.2 and 5.3 shall be established from test data using appropriate statistical techniques or shall otherwise be customer specified, and all samples tested in accordance with this product specification shall meet the stated requirements.

测试样本应符合在段落 5.2 和 5.3 的机械与电气要求,测试数据使用适当的统计技术或按客户指定的规定,所有样品测试符合本产品规范所规定的要求。

6.4.2 Failures attributed to equipment, test setup, or operator error shall not disqualify the product. If product failure occurs, corrective actions shall not disqualify the product. If product failure occurs, corrective action shall be taken and samples resubmitted for qualification.

测试失败归因于设备、测试设置或操作错误的原因不得取消产品认证。如果产品测试因以上原因,应采取纠正措施和再次提交样品认证。

8.6 Qualification Testing. 资格测试

Qualification testing shall be performed on sample units produced with equipment and procedures normally used in production. The test sequence shall be as shown in Qualification Testing Sequences.

进行资格应测试样本应与通过正常生产设备和制程的产品一致。所示的测试序列应当体现在资格测试序列中。

8.7 Re-qualification Testing. 重新资格测试

If any of the following conditions occur, the responsible product engineer shall initiate re-qualification testing consisting of all applicable parts of the qualification test matrix Table 1.

如果出现下列情形之一的,产品工程师应启动重测表 1 中所有的测试。

- a) A significant design change is made to the existing product which impacts the product form, fit or function. Examples of significant changes shall include, but not be limited to, changes in the plating material composition or thickness, normal force, contact surface geometry, insulator design, contact base material, or contact lubrication requirements.
重大的设计变更影响现有产品形状或功能.明显的变化的例子包括但不限于改变电镀材料成分或厚度、正向力、接触表面形状,绝缘体、端子底材或接触润滑要求发生改变。
- b) A significant change is made to the manufacturing process, which impacts the product form, fit or function.
生产过程的显著变化,影响产品形状,安装或功能的变化。
- c) A significant event occurs during production or end use requiring corrective action to be taken relative to the product design or manufacturing process.
在生产过程中有重大事件发生或最终使用要求纠正产品设计或制造过程。

9 Soldering process:焊接工艺

Lead free reflow soldering in reference to JEDEC J-STD-020.

参照 JEDEC J-STD-020 无铅回流焊。

10 Qualification Testing Sequences 测试实验顺序

TEST OR EXAMINATION 测试或检验		TEST GROUP 测试群组												
Sequence ID 序列号		A	B	C	D	E	F	G	H	I	J	K	L	M
Visual Examination	8.2	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3	1,3
Current cycling	6.1.1													
Contact Resistance	6.1.2													
Insulation Resistance	6.1.4													
Voltage Drop	6.1.3													
Dielectric Withstanding Voltage	6.1.5													
Circuit continuity monitoring	6.1.6													
Connector-Connector Mating/Unmating/Retention	6.2.1					2								
Connector or Terminal Cycle	6.2.2													
Vibration/ Mechanical Shock	6.2.3													
Cable Crimping Retention	6.2.4				2									
Connector Drop Test	6.2.5									2				
Header pin retention force	6.2.6													2
Terminal-Connector Insertion Retention Force	6.2.7			2										
Terminal-Terminal engage/Disengage Force	6.2.8	2												
Terminal Bend Resistance	6.2.9		2											
Connector to connector Audible Click	6.2.10								2					
Polarization Feature Effectiveness	6.2.11						2							
Terminal/Cavity Polarization Test	6.2.12										2			
Connector Mounting Feature Mechanical Strength	6.2.13											2		
Connector Seal Retention	6.2.14												2	
CPA& CCPA Engage/Disengage Force	6.2.15							2						
Thermal Shock	6.3.1													
Temperature/Humidity Cycling	6.3.2													
High Temperature Exposure	6.3.3													
Submersion	6.3.4													
Pressure/Vacuum Leak	6.3.5													
High Pressure Spray	6.3.6													

TEST OR EXAMINATION 测试或检验		TEST GROUP 测试群组								
Sequence ID 序列号		N	O	P	Q	R	S ^(3*)	T ^(3*)		
Visual Examination	8.2	1,4	1,7	1,7	1,8	1,7	1,13	1,14		
Current cycling	6.1.1	3								
Contact Resistance	6.1.2		3,5	3,5	3,5	3,5				
Insulation Resistance	6.1.4				7		3,6,8,10,12	3,7,9,11,13		
Voltage Drop	6.1.3		6	6	6	6				
Dielectric Withstanding Voltage	6.1.5							6		
Circuit continuity monitoring	6.1.6									
Connector-Connector Mating/Unmating/Retention	6.2.1									
Connector or Terminal Cycle	6.2.2	2	2	2	2	2	2	2		
Vibration/ Mechanical Shock	6.2.3		4							
Cable Crimping Retention	6.2.4									
Connector Drop Test	6.2.5									
Header pin retention force	6.2.6									
Terminal-Connector Insertion Retention Force	6.2.7				9	8				
Terminal-Terminal engage/Disengage Force	6.2.8									
Terminal Bend Resistance	6.2.9									
Connector to connector Audible Click	6.2.10									
Polarization Feature Effectiveness	6.2.11									
Terminal/Cavity Polarization Test	6.2.12									
Connector Mounting Feature Mechanical Strength	6.2.13									
Connector Seal Retention	6.2.14									
CPA& CCPA Engage/Disengage Force	6.2.15									
Thermal Shock	6.3.1			4						
Temperature/Humidity Cycling	6.3.2				4			5		
High Temperature Exposure	6.3.3					4	5			
Submersion	6.3.4						9	10		
Pressure/Vacuum Leak	6.3.5						4,7	4,8		
High Pressure Spray	6.3.6						11	12		

Remarks 备注:

- 5pcs samples in each group: 每组 5 个样品。
- SI testing shall be performed and recorded in another separate report. 高频测试应该记录单独的报告。
- 3*.Group S/T are performed only when the connector is sealed 只有防水性连接器才测试 S/T 组。