

车载高速连接方案及关键技术能力要求

Connect solution in intelligent vehicle and key ability

童桂林



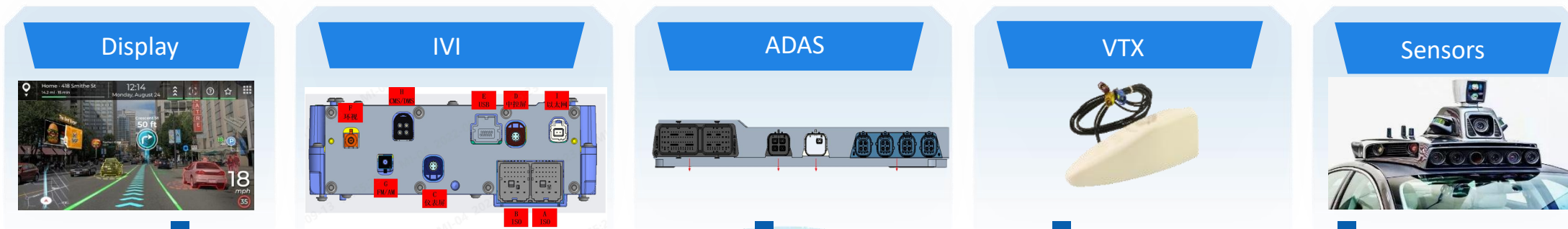
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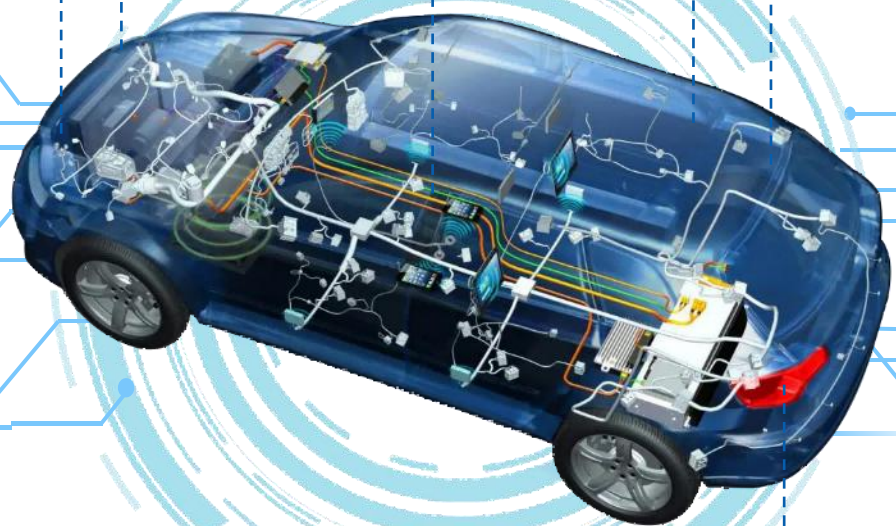
1 / 车载高速连接应用

2 / 车载高速产品及性能

3 / 关键能力要求

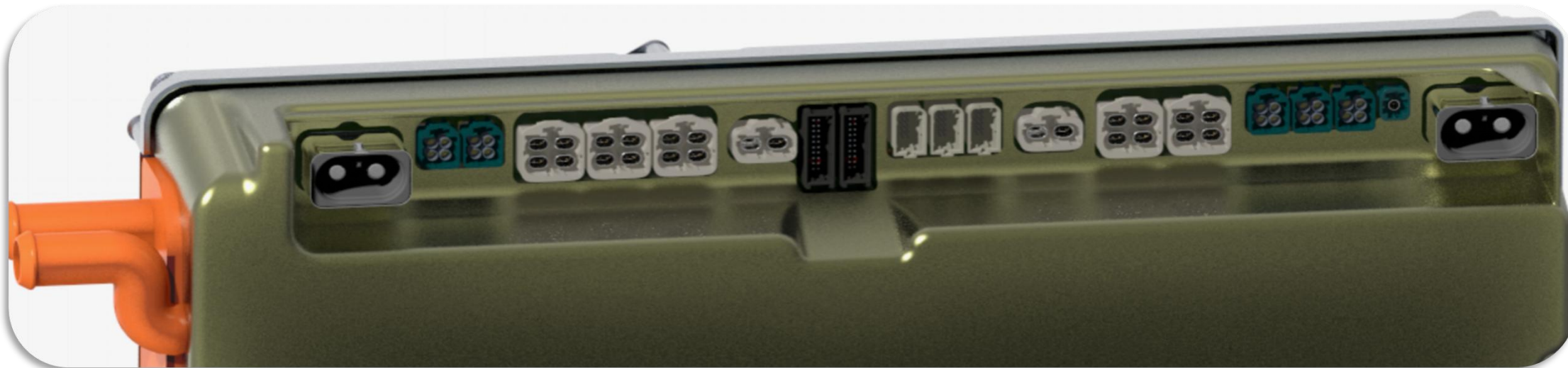


FAKRA
MINI FAKRA
ETHERNET
HSD



HD CAMERA
RADAR ADAPTER
USB
OTHER RF







02



WHAT ARE WE DOING



AUTO PRODUCT

- Fakra系列
- MINI Fakra系列
- HSD系列
- HD系列
- 激光雷达系列
- 以太网系列
- USB系列
- 其他系列

Fakra系列



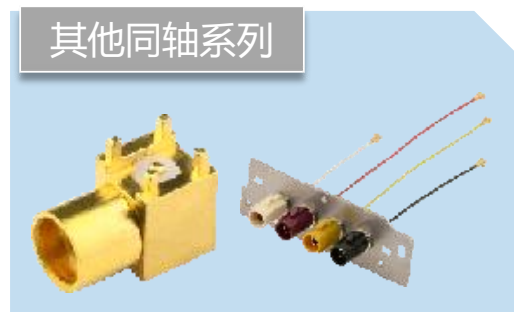
MINI FAKRA系列



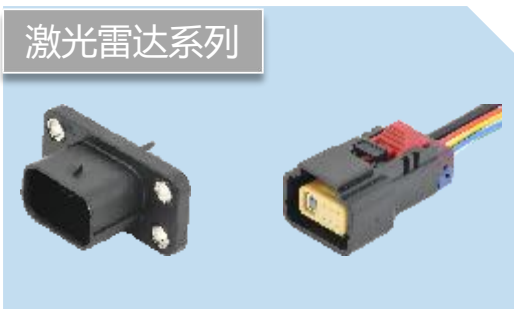
HD系列



其他同轴系列



激光雷达系列



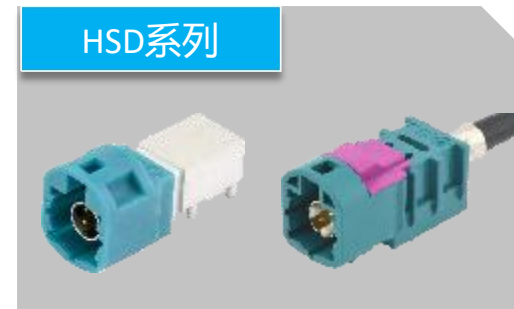
以太网系列



USB系列



HSD系列



- 汽车类产品满足行业国际规范，产品规格种类齐全，已在国内多家主流车厂开始量产导入，性价比高。
- 车载娱乐系统LVDS，USB，ANTENNA和360高清应用连接器全覆盖，能够给客户id提供整套新方案选型和替换方案。

MINI Fakra PCB 板端



MINI Fakra Cable Plug 线端公头



MINI Fakra Cable Jack 线端母头



- MINI FAKRA系列包括板端、线端公头、线端母头。MINI FAKRA具备高度集成的优势，支持高达20GBPS的数据传输，减少了高达70%~80%的安装空间需求。
- 应用于360°环绕视图相机、汽车计算模块、自主车辆、高级驾驶辅助系统(ADAS)、以及GPS导航。

Table 7 - Return loss requirement

| Frequency, GHz | Return Loss Requirement, Max. |
|-------------------|--|
| $0.01 < f \leq 1$ | ≤ -23 dB |
| $1 < f \leq 9$ | $\leq 10 \frac{\log f(\text{GHz})}{\log 9} - 23$ |

Table 8 - Crosstalk configurations


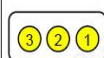

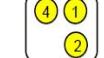


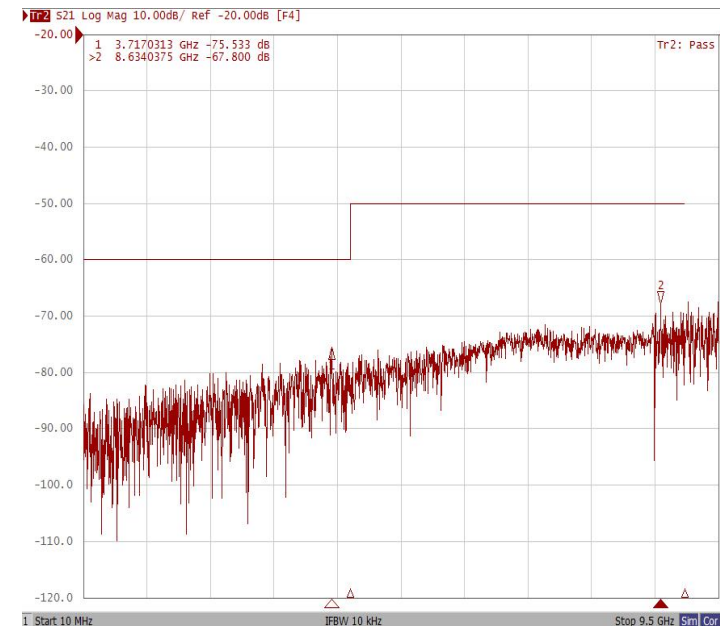
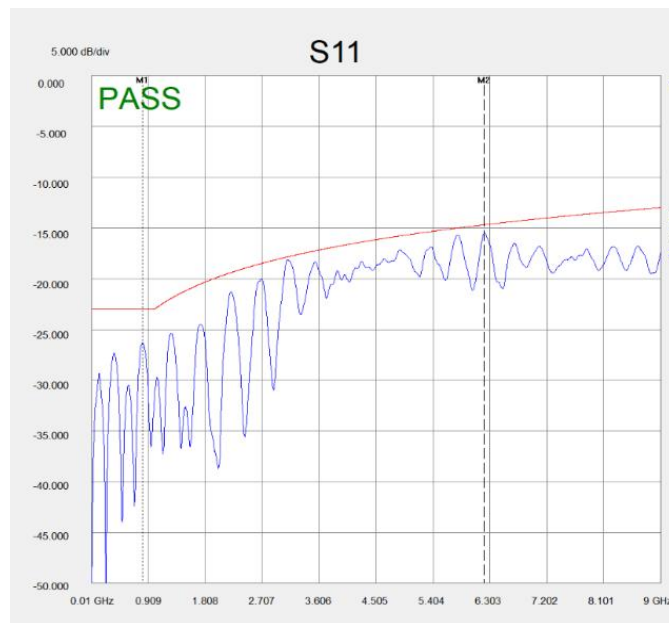
| Assembled channels of the Socket Connector |  |  |  |  |  |  |
|--|---|---|---|---|---|---|
| Measurement(s) required between channels | 1 - 2 | 1 - 2 | 1 - 2 1 - 3 1 - 4 | 1 - 2 1 - 4 2 - 4 | 1 - 2 | 1 - 2 1 - 3 2 - 3 |

Table 9 - Crosstalk performance requirements for mini coax with foil shielded wire

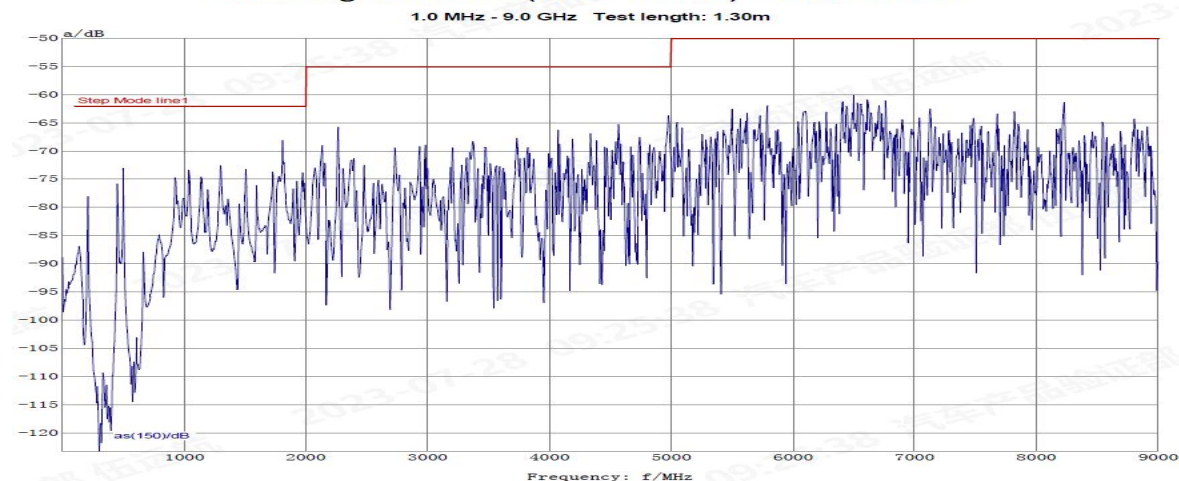
| Frequency | NEXT Limit |
|---|------------|
| $0.01 \text{ GHz} < f \leq 4 \text{ GHz}$ | 60 dB |
| $4 \text{ GHz} < f \leq 9 \text{ GHz}$ | 50 dB |

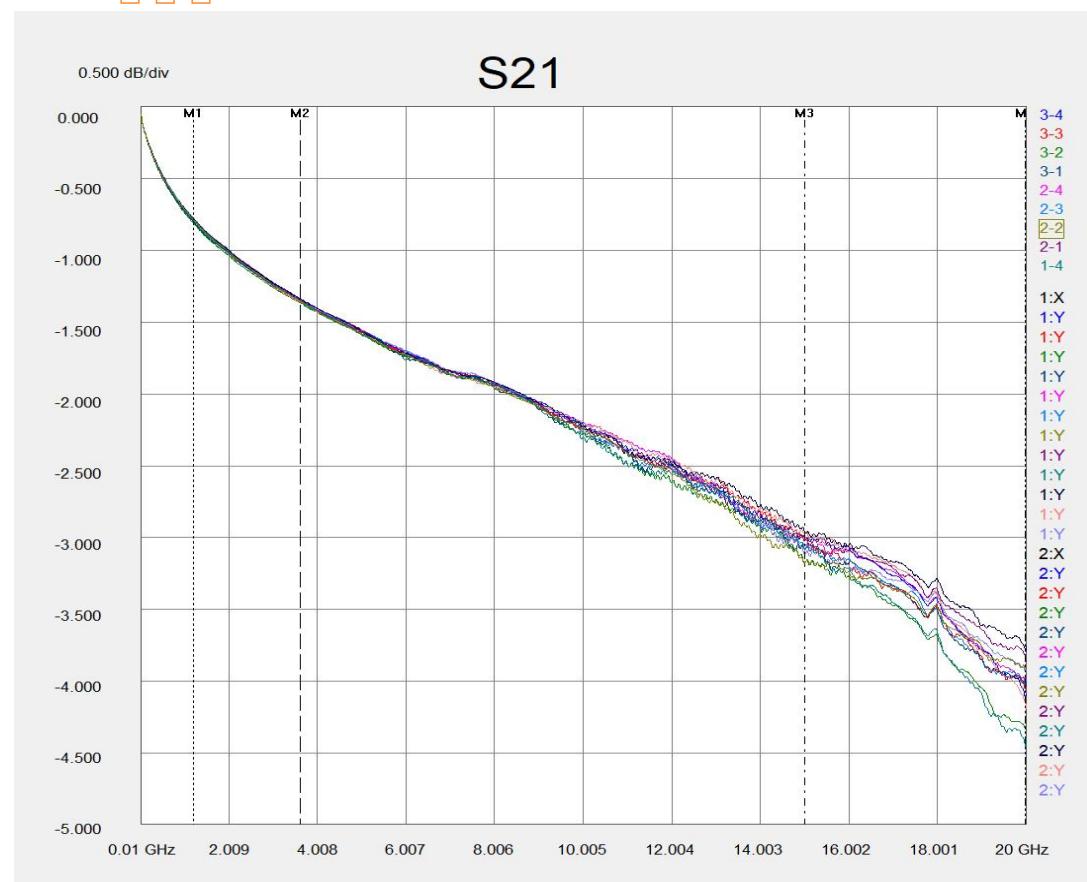
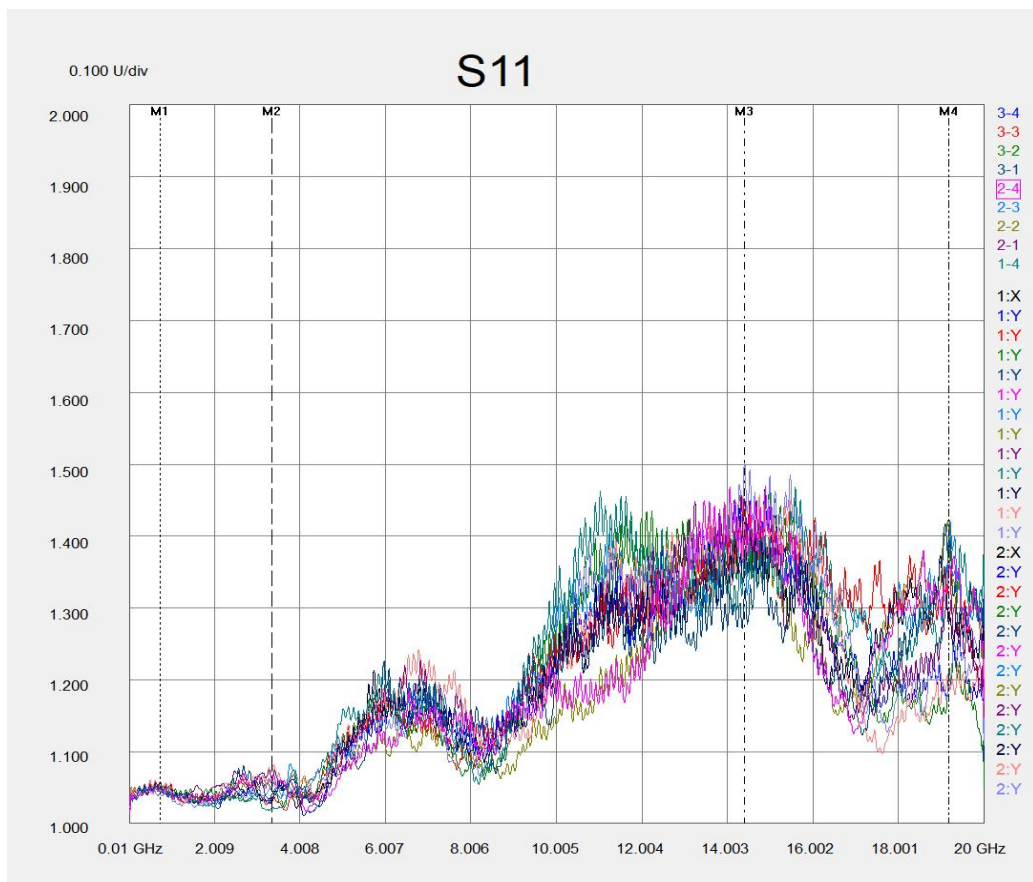
Table 10 - Shielding attenuation performance limits

| Frequency (MHz) | Shielding Attenuation (dB) |
|-----------------|----------------------------|
| 100 - 2000 | -62 |
| 2000 - 5000 | -55 |
| 5000 - 9000 | -50 |

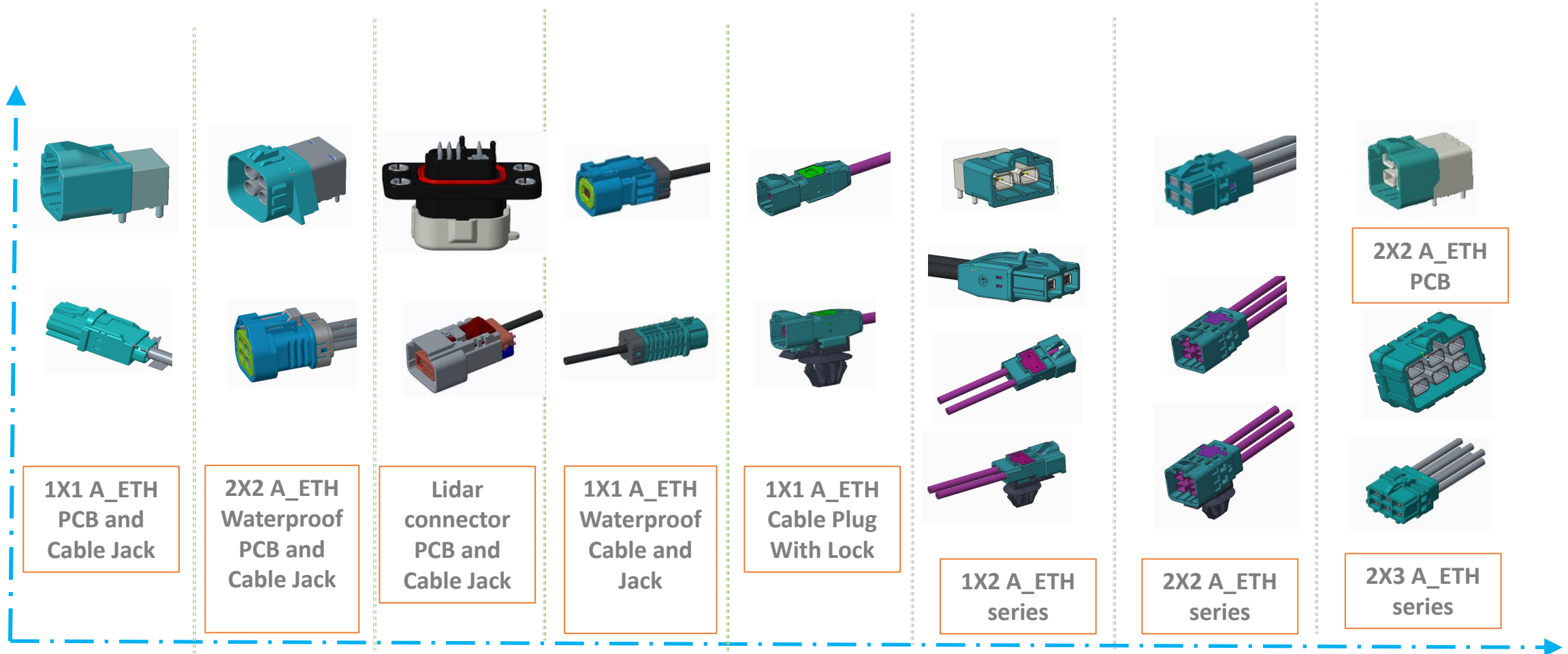


Screening Attenuation (62153-4-4 Ed.2) Coaxial Cable





| 测试项目 | VSWR | | | | | | | | 插入损耗 (单位: dB) | | | | | | | | |
|------|-----------------------|----------------|----------------|----------------|----------------|----------------|---------------|--------------|------------------|----------------|----------------|----------------|----------------|----------------|---------------|--------------|------|
| | 0~1.0 GHz | 1.0~2.0 GHz | 2.0~5.5 GHz | 5.5~6.0 GHz | 6.0~8.0 GHz | 8.0~9.0 GHz | 9.0~15 GHz | 15~20 GHz | 0~1.0 GHz | 1.0~2.0 GHz | 2.0~5.5 GHz | 5.5~6.0 GHz | 6.0~8.0 GHz | 8.0~9.0 GHz | 9.0~15 GHz | 15~20 GHz | |
| 测试样品 | 044-MINIFAKRA 总长1M | 1.07 | 1.06 | 1.18 | 1.22 | 1.24 | 1.2 | 1.49 | 1.48 | 0.75 | 1.12 | 1.67 | 1.74 | 1.86 | 2.18 | 3.17 | 4.44 |



□ 连接器SCC测试

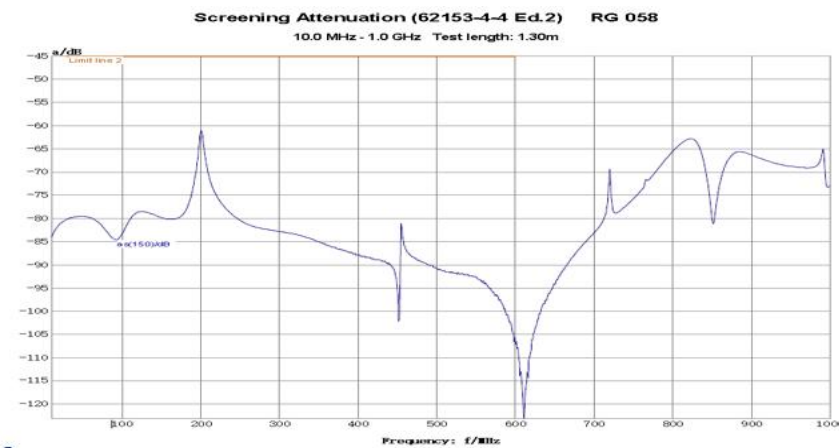
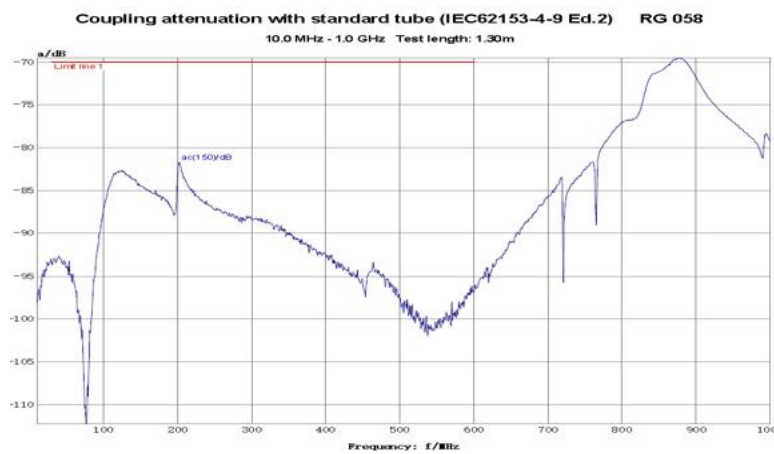
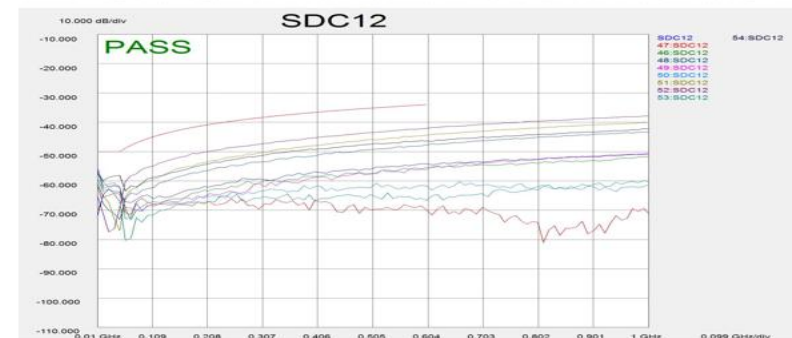
□ 线缆SCC测试

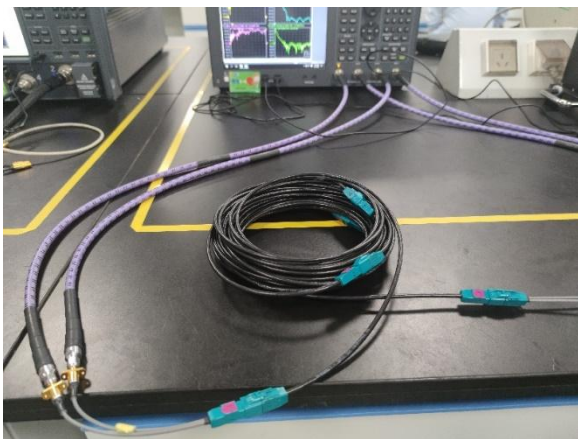
□ WCC SCC测试

□ 连接器ES测试

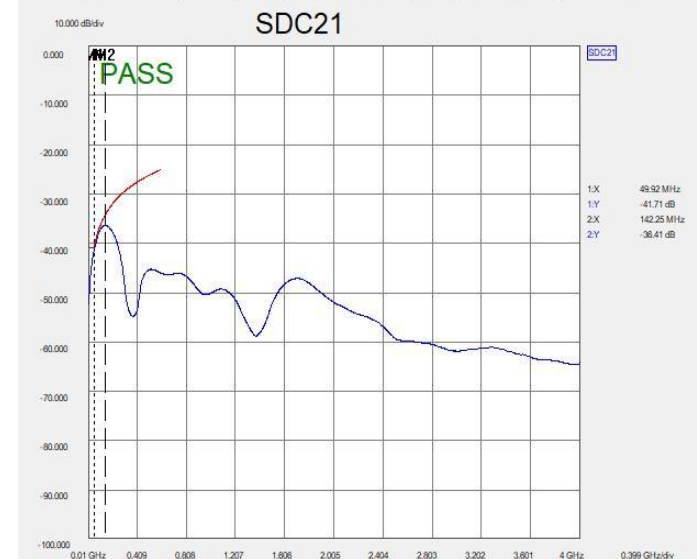
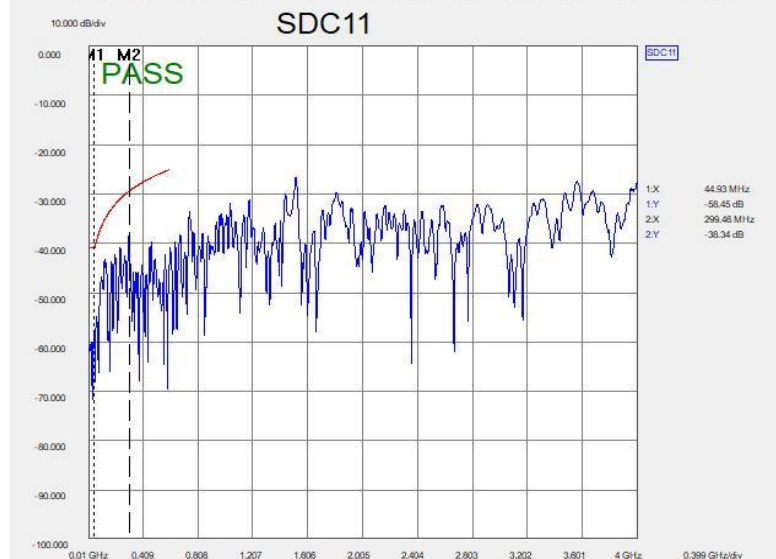
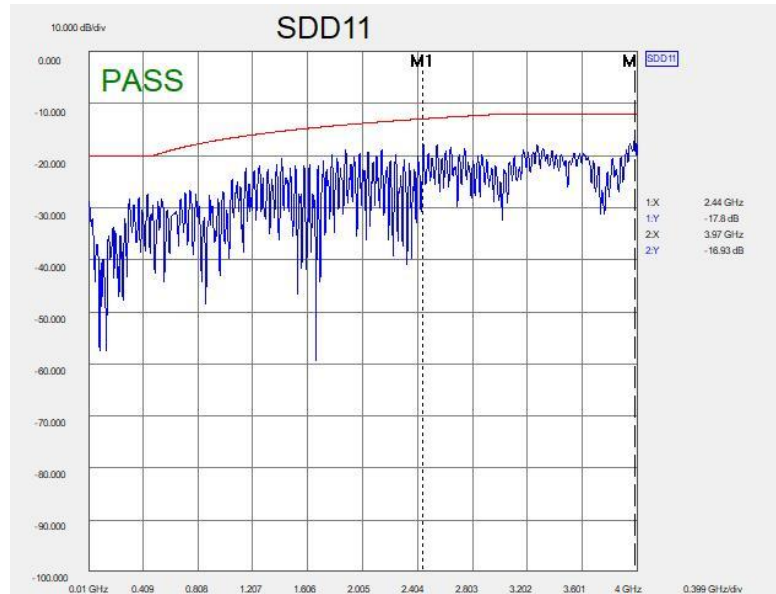
□ 线缆 ES测试

□ WCC ES测试



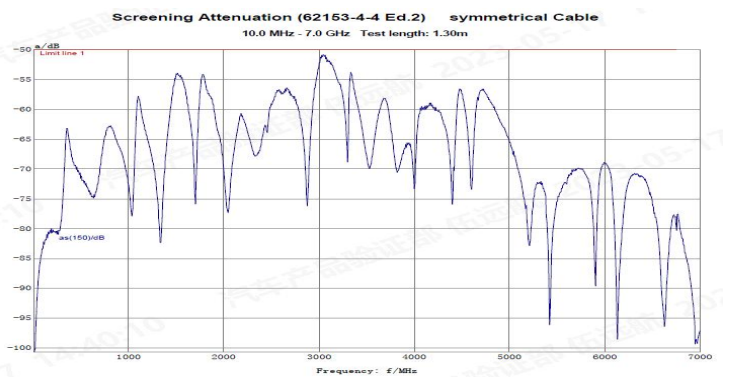
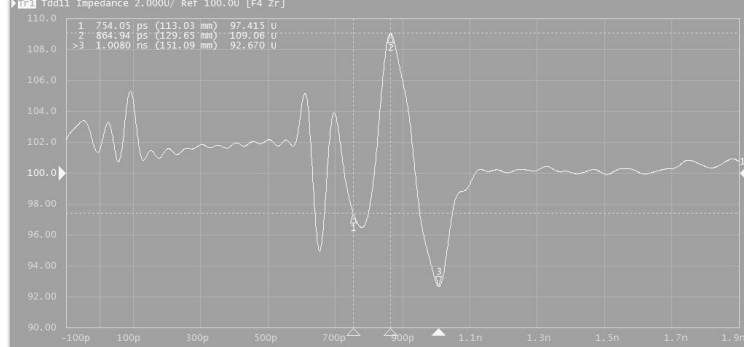
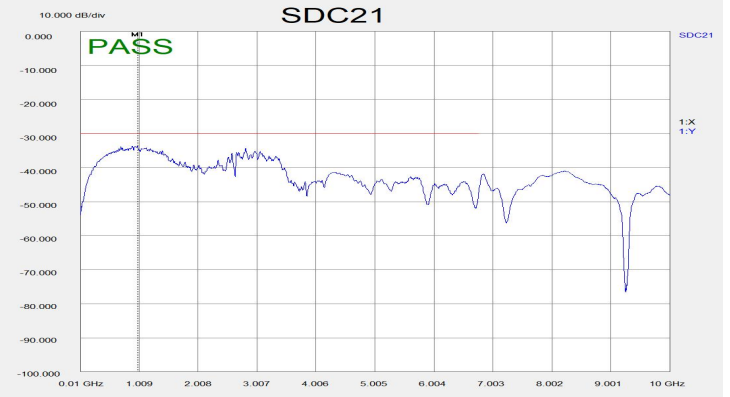
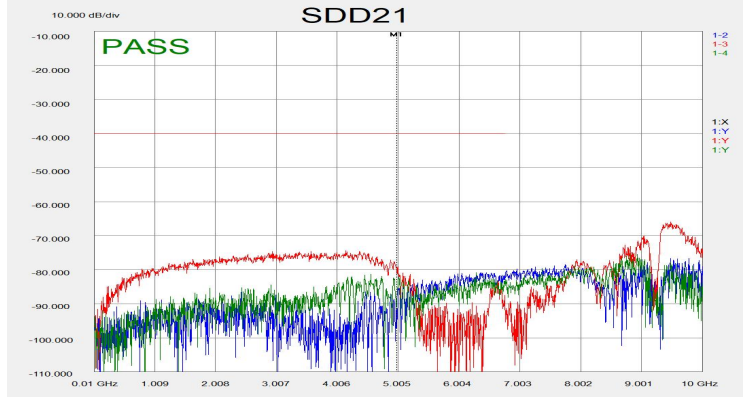
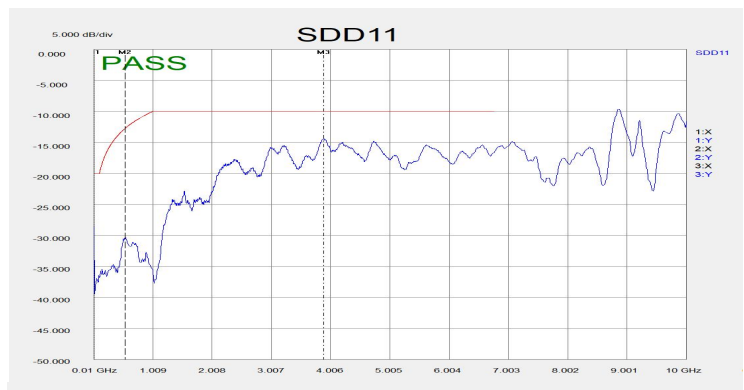


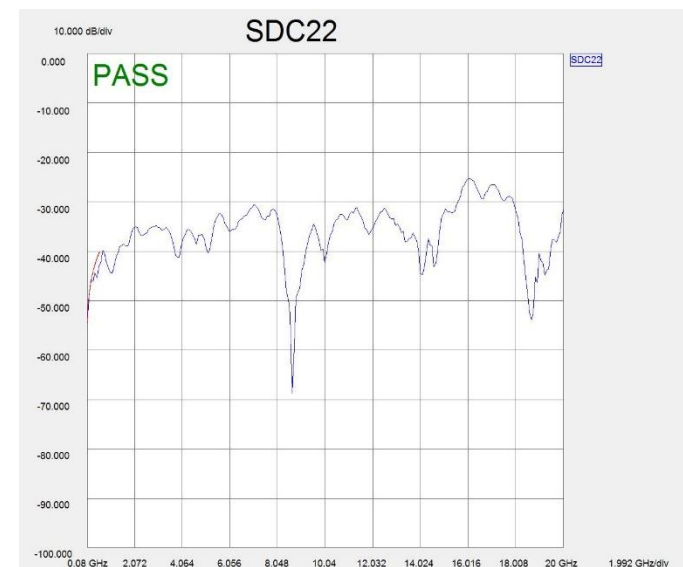
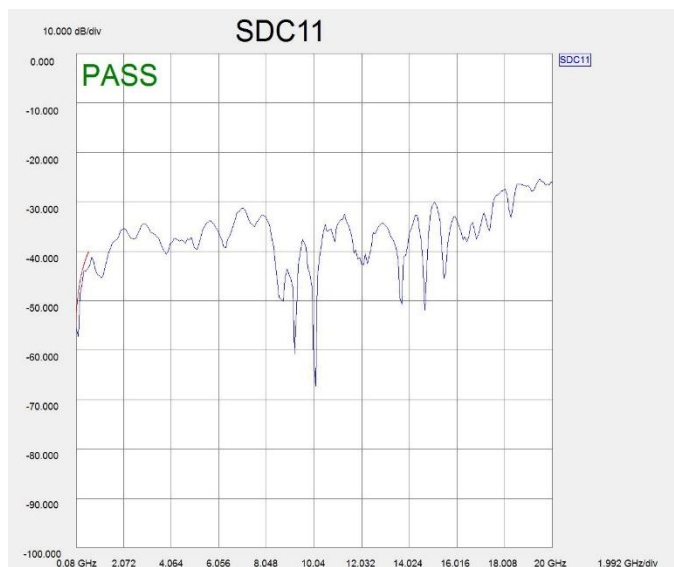
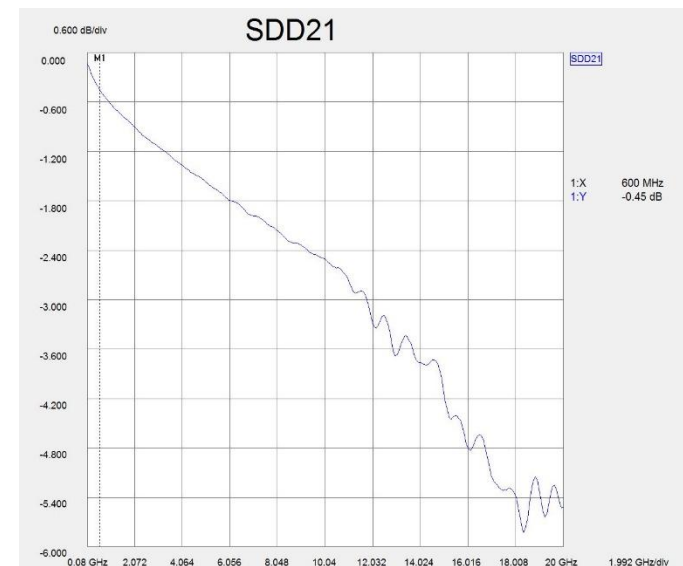
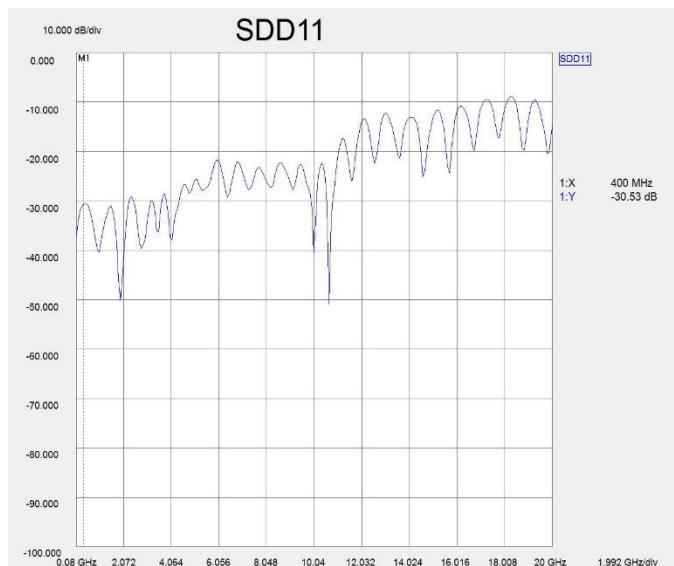
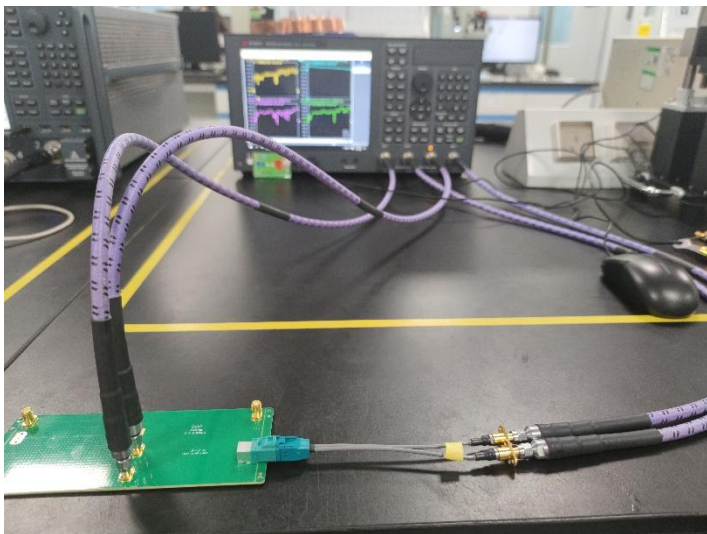
| 测试项目 | 实测值 |
|------------------------------|-------------------------------------|
| 回波损耗 (Sdd11) 单位: dB | 17.80@0~2.8G 16.93@2.8G~4.0G |
| 插入损耗 (Sdd21) 单位: dB | 27.82@0~2.8G 35.31@2.8G~4.0G |
| 共模转差模回损 (Sdc11) 单位: dB | 58.45@0~50MHz 38.34@50MHz~600MHz |
| 共模转差模插损 (Sdc21) 单位: dB | 41.71@0~50MHz 36.41@50MHz~600MHz |



Applies to DS90UH983-984

| Parameter | C _{dc} (±10%) | Frequency | Table 3A - Recommendations | | | Table 3 - Requirements | | | Table 3B - Recommendations | | |
|------------------------------|--|----------------------|----------------------------|---|---|---------------------------|------|--|----------------------------|--|--|
| | | | PCB Budget | Total Channel Requirement | Cable assembly - Budget | After Aging & Temperature | UNIT | | | | |
| Return loss, SDD11 | 0.1 µF | f<1 - 100 MHz | -24 | -18.5 | -20 | dB | | | | | |
| | 0.1 µF | f<0.1 - 1 GHz | -16+4.4*log(f/fmax) | -2+9*log(f/fmax) | -10+10*log(f) | dB | | | | | |
| fmax = 6.75 GHz | 0.1 µF | f<1 - 6.75 GHz | -16+4.4*log(f/fmax) | -9+0.6*log(f/fmax) | -10 | dB | | | | | |
| Insertion Loss, SDD21 | 0.1 µF | f<1 MHz - 6.75 GHz | -0.53/(GHz) - 0.12 | | | | | | | | |
| | | f<1 MHz | -0.121 | | | dB | | | | | |
| | | f<5 MHz | -0.123 | | | dB | | | | | |
| | | f<10 MHz | -0.125 | | | dB | | | | | |
| | | f<50 MHz | -0.147 | | | dB | | | | | |
| | | f<78.3 MHz | -0.161 | | | dB | | | | | |
| | | f<84.38 MHz | -0.165 | | | dB | | | | | |
| | | f<100 MHz | -0.173 | | | dB | | | | | |
| | | f<500 MHz | -0.385 | | | dB | | | | | |
| | | f<1.0 GHz | -0.650 | | | dB | | | | | |
| | | f<1.6875 GHz | -1.014 | [3.375 Gbps limit] | [3.375 Gbps limit] | dB | | | | | |
| | | f<1.8375 GHz | -1.094 | | | dB | | | | | |
| | | f<3.375 GHz | -1.909 | [6.75 Gbps limit] | [6.75 Gbps limit] | dB | | | | | |
| | | f<5.4 GHz | -2.982 | [10.8 Gbps limit] | [10.8 Gbps limit] | dB | | | | | |
| | | f<6.26 GHz | -3.438 | [12.528 Gbps limit] | [12.528 Gbps limit] | dB | | | | | |
| | | f<6.75 GHz | -3.698 | [13.5 Gbps limit] | [13.5 Gbps limit] | dB | | | | | |
| 3.375 Gbps limit | 0.1 µF | f<1 MHz - 1.6875 GHz | -0.53/(GHz) - 0.12 | -3.939/(GHz) - 4.395/(GHz) ² - 2.428 | -2.879/(GHz) - 4.395/(GHz) ² - 2.188 | dB | | | | | |
| Insertion Loss, SDD21 | | f<84.38 MHz | -0.165 | -2.750 | -1.606 | dB | | | | | |
| | | f<1.6875 GHz | -1.014 | -18.069 | -16.040 | dB | | | | | |
| 6.75 Gbps limit | 0.1 µF | f<1 MHz - 3.375 GHz | -0.53/(GHz) - 0.12 | -1.06/(GHz) - 10.28/(GHz) ² - 1.12 | -10.28/(GHz) ² - 0.88 | dB | | | | | |
| Insertion Loss, SDD21 | | f<84.38 MHz | -0.16 | -2.750 | -1.606 | dB | | | | | |
| | | f<3.375 GHz | -1.909 | -26.137 | -22.319 | dB | | | | | |
| 10.8 Gbps limit | 0.1 µF | f<1 MHz - 5.4 GHz | -0.53/(GHz) - 0.12 | -2.418/(GHz) - 5.922/(GHz) ² - 1.46 | -1.358/(GHz) - 5.922/(GHz) ² - 1.22 | dB | | | | | |
| Insertion Loss, SDD21 | | f<84.38 MHz | -0.165 | -3.38 | -3.055 | dB | | | | | |
| | | f<5.4 GHz | -2.982 | -28.28 | -22.315 | dB | | | | | |
| 12.528 Gbps limit | 0.1 µF | f<1 MHz - 6.26 GHz | -0.53/(GHz) - 0.12 | -2.216/(GHz) - 3.9/(GHz) ² - 1.22 | -1.156/(GHz) - 3.9/(GHz) ² - 0.98 | dB | | | | | |
| Insertion Loss, SDD21 | | f<78.3 MHz | -0.161 | -2.308 | -1.985 | dB | | | | | |
| | | f<6.26 GHz | -3.438 | -23.400 | -16.524 | dB | | | | | |
| 13.5 Gbps limit | 0.1 µF | f<1 MHz - 6.75 GHz | -0.53/(GHz) - 0.12 | -2.255/(GHz) - 3.084/(GHz) ² - 1.35 | -1.195/(GHz) - 3.084/(GHz) ² - 1.11 | dB | | | | | |
| Insertion Loss, SDD21 | | f<84.38 MHz | -0.165 | -2.436 | -2.11 | dB | | | | | |
| | | f<6.75 GHz | -3.698 | -24.584 | -17.189 | dB | | | | | |
| Near end crosstalk [NEXT] | | f<200MHz | | -35 | | dB | | | | | |
| Far end crosstalk [FEXT] | | f<6.75 GHz | | -40 | | dB | | | | | |
| Differential to Common [SCD] | | f<6.75 GHz | | -30 | | dB | | | | | |
| Common to Differential [SDC] | | f<6.75 GHz | | -30 | | dB | | | | | |
| | | | MIN | NOM | MAX | | | | | | |
| Impedance | PCB trace | | 90 | 100 | 110 | Ω | | | | | |
| TDR edge rate of 35 ps | landing pad and component cable connector region | | 85 | 100 | 115 | Ω | | | | | |
| Shielding effectiveness | Cable assembly | f<6.75 GHz | | | ≥50 | dB | | | | | |
| In-line connectors | | | | | Typ: s1 | | | | | | |
| Cable reach | Test with Dacar 686-3 | | | | Typ: 8 | m | | | | | |
| | | 3.375 Gbps | | | Typ: 8 | m | | | | | |
| | | 6.75 Gbps | | | Typ: 6 | m | | | | | |
| | | 10.8 Gbps | | | Typ: 3.5 | m | | | | | |
| | | 12.528 Gbps | | | Typ: 3.5 | m | | | | | |
| | | 13.5 Gbps | | | Typ: 3.5 | m | | | | | |







03

What's ability
you need



能力要求

—  ADVANTAGES

- Design
- Manufacture
- Verification
- Beyond Connector

仿真设计能力

① SI设计及仿真

连接器的SI仿真设计

测试治具及SI板的仿真设计

板端连接器封装的仿真分析

② 模流设计及仿真

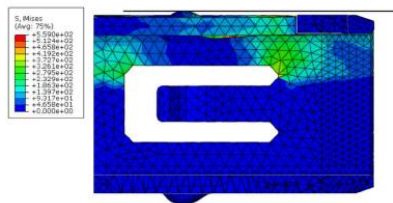
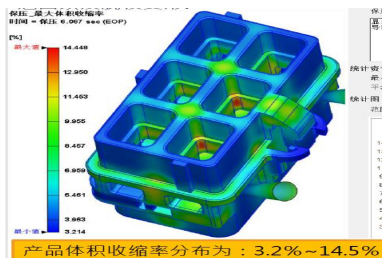
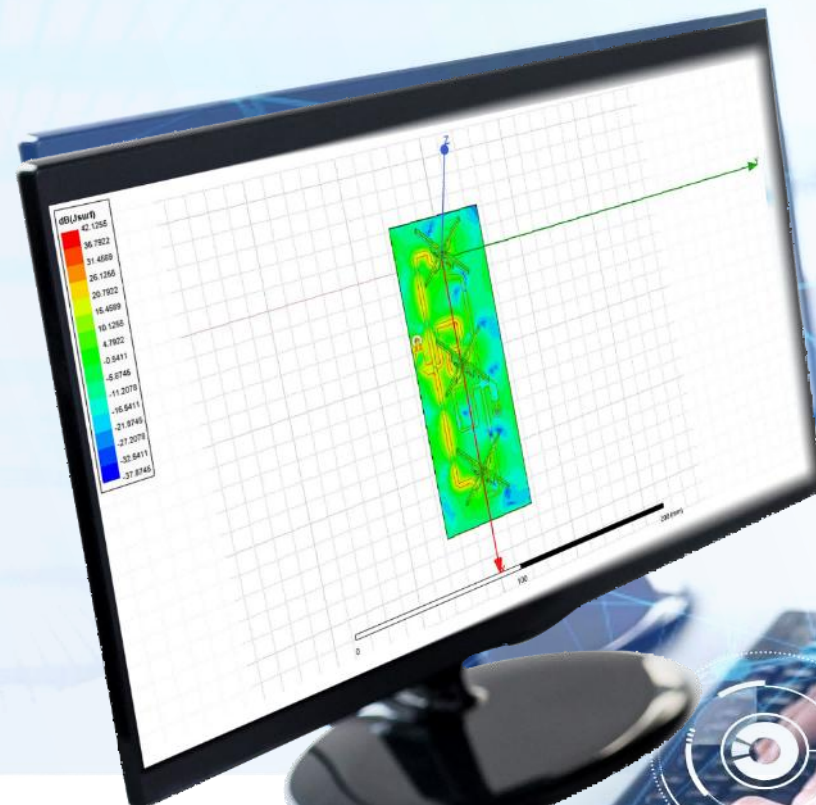
• 三维模拟分析

• 设计/仿真塑胶产品设计与制造

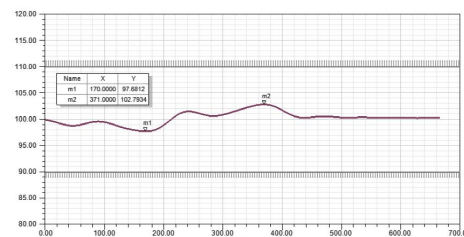
③ 机械结构设计及仿真

• 连接器/线束设计和分析

• 接触类弹片设计和仿真



TDR Impedance @50ps(10%~90%)

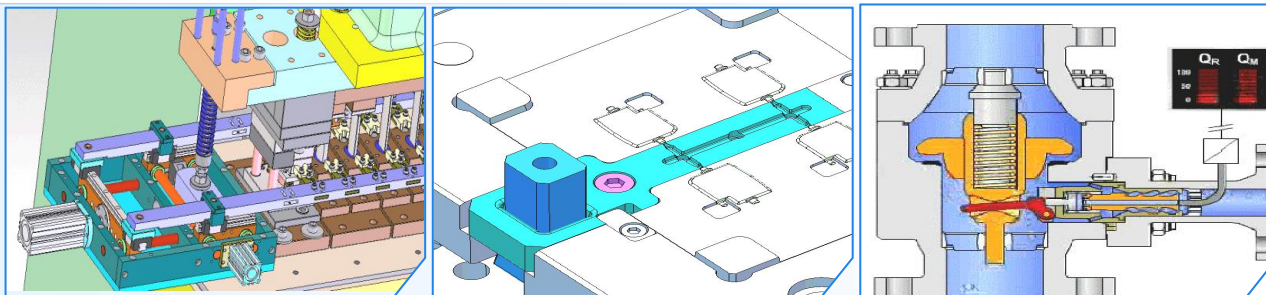


拥有

- 具备全自动化机械制造解决方案和设备制作能力。
- 自动化设备都由电连技术自动化团队独立设计和生产。
- 截止目前汽车事业部已经拥有FAKRA自动组装机(KOMAX), FAKRA二代连接器自动组装机、FAKRA三代连接器自动组装机、HSD全自动化组装机、SMB自动组装机等。

优势

- 自动检测、信息处理、分析判断,从而实现预期目标。
- 改善劳动条件, 缩减生产占地面积。
- 降低生产成本, 缩短生产周期, 稳定和提高产品质量。



FAKRA自动组装机 (KOMAX)



FAKRA二代连接器自动组装机



FAKRA三代连接器自动组装机



HSD全自动化组装机



SMB自动组装机

1. 实验室通过CNAS认证, 所有汽车连接器常规机械、电气、射频、环境的测试要求, 除部分化学材料之外, 其他都可以在电连完成测试验证。
2. 测试参考标准, 如ISO20860-1, USCAR-2, USCAR17, LV214, GB/T1067.1-2017, GB/T29106, GB/T28046, TC9中机械性能试验, 电气性能试验, 耐气候试验, 射频性能试验等; 同时结合了国内主机厂音视频连接器的标准, 如长安, 吉利, 北汽, 上汽, 广汽, 江淮, 奇瑞, 长城等。

外观与尺寸检测



- 放大镜
- 显微镜
- CCD电子显微镜
- 扫描电子显微镜
- 光学数码显微镜
- 图像尺寸测量仪
- 影像测量仪
- 全自动影像测量仪

材质成分分析



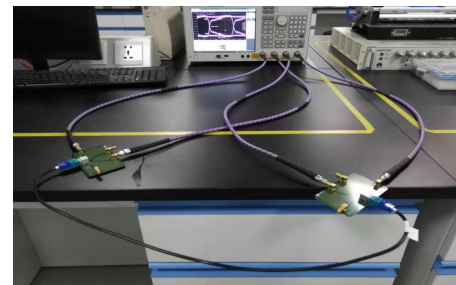
- X-射线透射仪 (工业CT)
- 膜厚测试仪
- ROHS测试仪
- 成分与异物分析仪

机械性能测试



- 摇摆测试仪
- 插拔力实验机
- 自动荷重试验机
- 三综合振动试验机
- 机械冲击试验机
- 包装跌落试验机
- 研磨抛光机
- 载带剥离测试机
- 推拉力计

电气性能测试

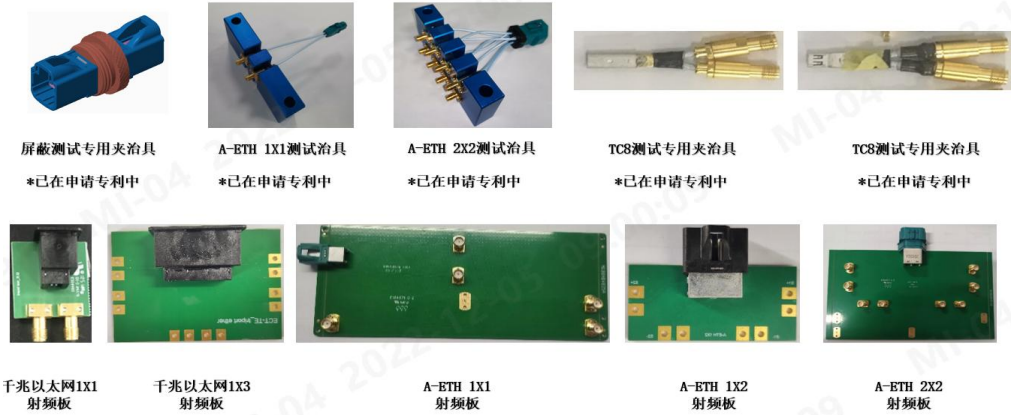


- 矢量网络分析仪
- 电阻测试仪
- 瞬断检测仪
- 线材测试仪
- 绝缘耐压测试仪
- 直流可调稳压恒流源
- 三同轴屏蔽测试系统

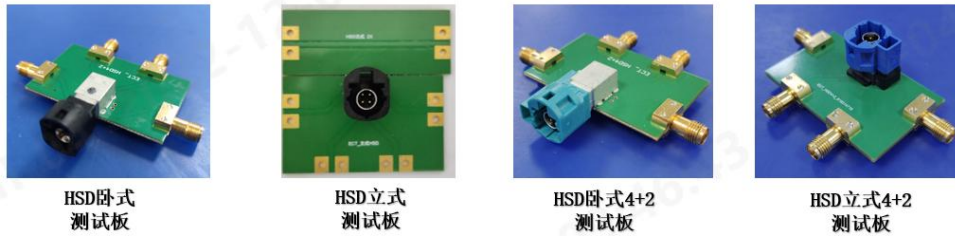
环境模拟测试



- 盐雾实验箱
- 高温箱
- 恒温恒湿试验箱
- 冷热冲击箱
- 无铅回流焊
- 强喷水实验箱
- 压力浸水试验机
- 混合气体试验箱
- 粉尘实验箱



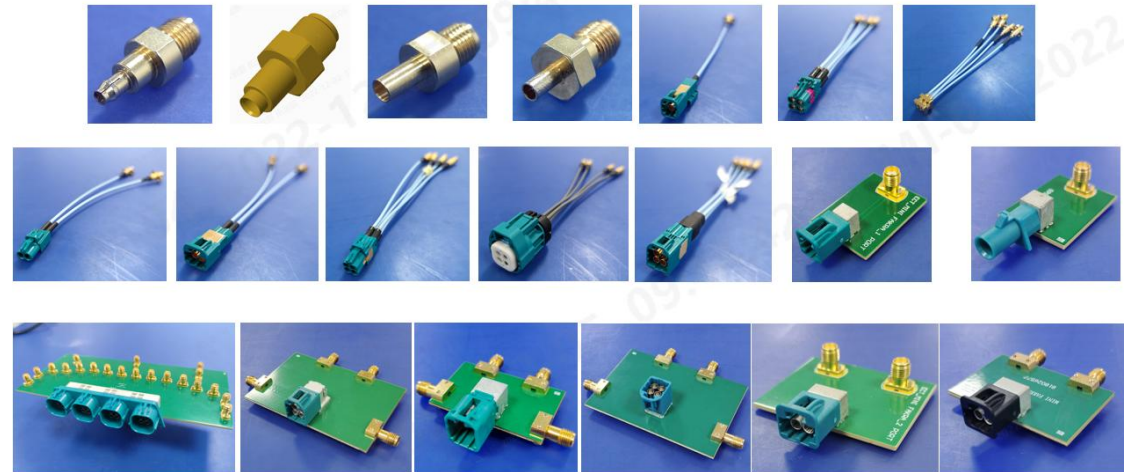
以太网系列



HSD系列

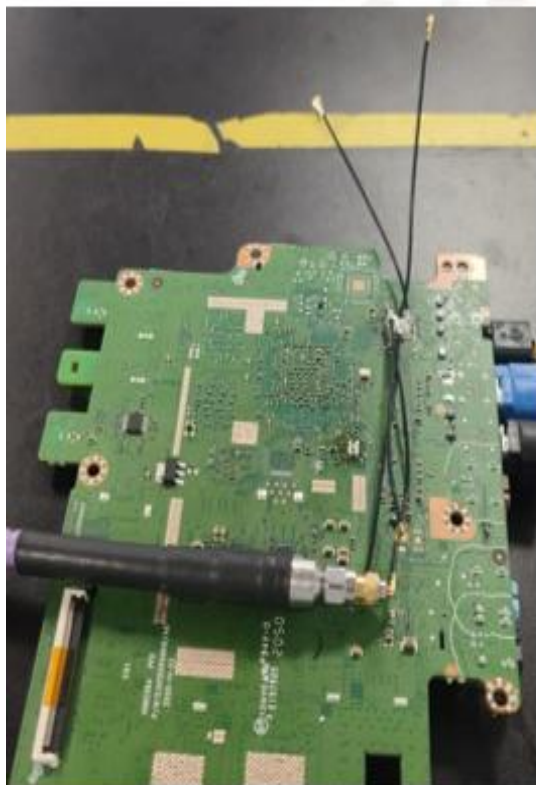


FAKRA系列



Mini FAKRA系列

结合美信GMSL、TI FPD LINK 等应用芯片要求, pin to pin 完整链路测试分析能力



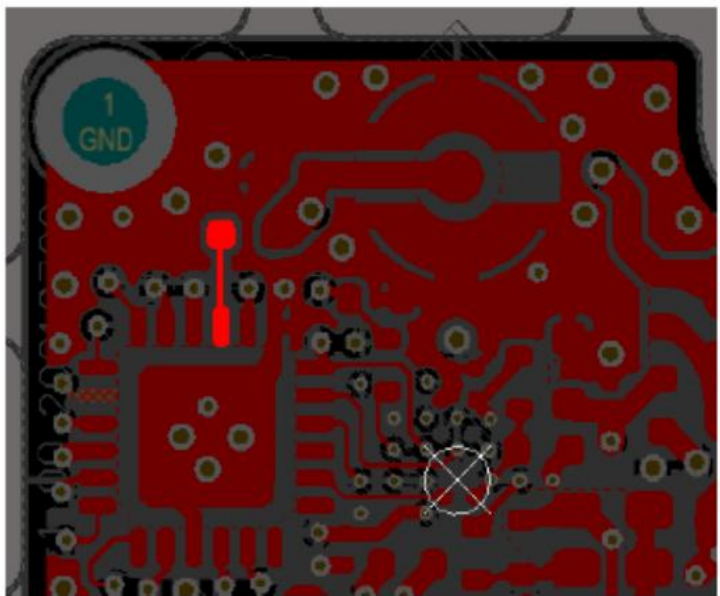
主机板端



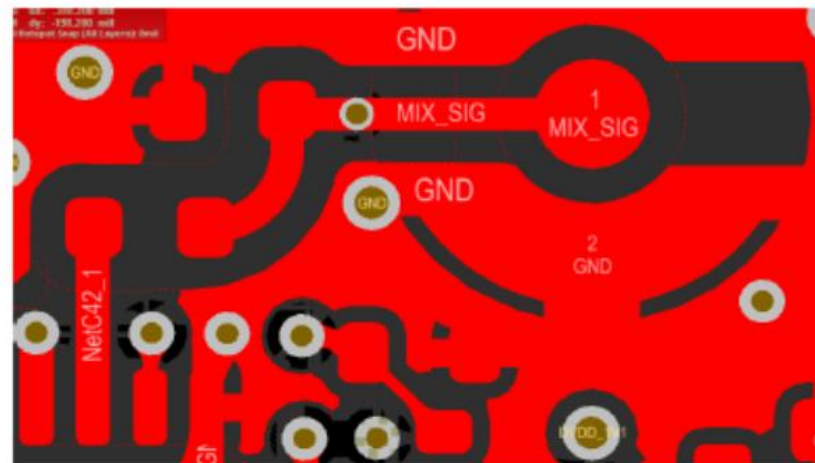
MINIFAKRA/FAKRA线束

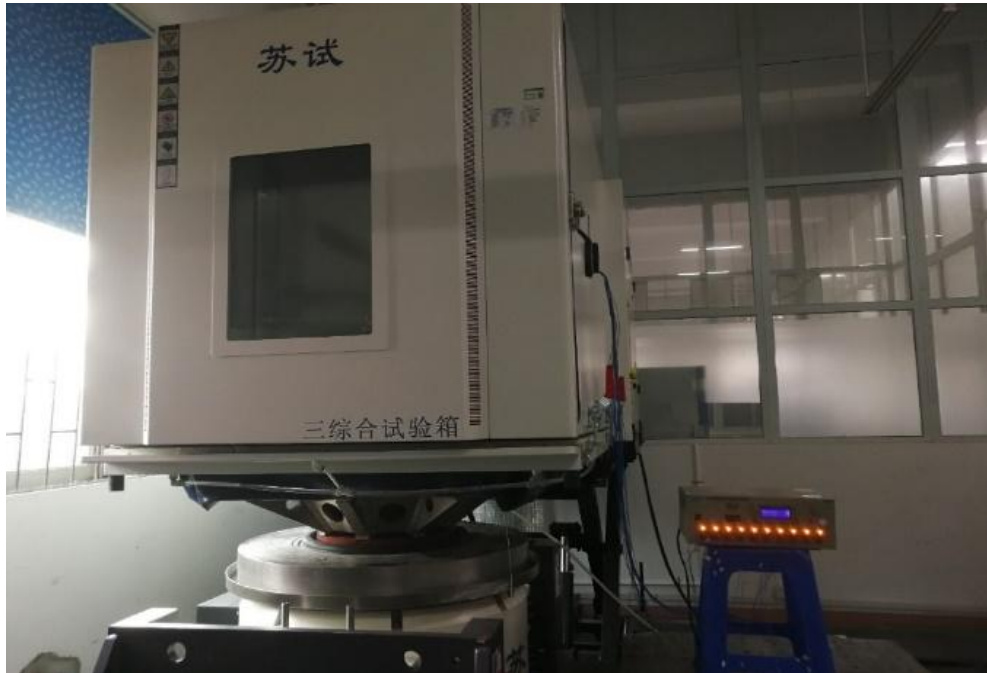


摄像头端



阻抗优化





整机复合振动环境链路研究验证



实车现场网分测试分析



专业汽车射频连接器制造商

PROFESSIONAL TOP ELECTRONIC CONNECTIVITY PRODUCTS MANUFACTURER

电连技术 × 感谢观看

