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TESTING
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# 江苏省计量科学研究院

## JIANGSU INSTITUTE OF METROLOGY

# 检 测 报 告

## Test Report

报 告 编 号：T2020-40184
Report No.

| | |
|---|---|
| 委 托 单 位<br>Customer | 江苏安科瑞电器制造有限公司<br>Jiangsu Acrel Electrical Manufacturing. Co., Ltd. |
| 委托单位地址<br>Customer Add. | 江苏省江阴市南闸街道东盟路 5 号<br>No.5, Dongmeng Road, Nanzha Street, Jiangyin City, Jiangsu Province |
| 样 品 名 称<br>Name of Instrument | 三相四线电子式电能表（导轨式）<br>Three Phase Four Wire Static Energy Meter(DIN-rail mounted） |
| 制 造 单 位<br>Manufacturer | 江苏安科瑞电器制造有限公司<br>Jiangsu Acrel Electrical Manufacturing. Co., Ltd. |


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样品信息
Description of samples

| | | | |
|---|---|---|---|
| 名称<br>Name | 三相四线电子式电能表(导轨式)<br>Three Phase Four Wire Static Energy Meter(DIN-rail mounted) | 型号/规格<br>Type/specification | ADW300<br>3×220/380V 3×1(6)A |
| 编号<br>Serial No. | 71912032800061 | 测量范围<br>Measuring Range | - |
| 委托日期<br>Accepting date | 2020-03-25 | 准确度等级/最大允许误差<br>Class of Accuracy/Maximum Permissible Errors | 有功电能 0.5S 级<br>Active energy class 0.5S |
| 到样日期<br>Date of samples received | 2020-03-25 | 受样方式<br>Accepting way of samples | 来样<br>Incoming sample |
| 备注<br>Remarks | 此类架装式仪表未进行防尘防水试验，使用时应安装于不低于 IP51 或 IP54 防护等级的封闭外罩内。<br>This kind of rack mounted meters were not done the dustproof and waterproof test.The meters should be installed in a closed enclosure not less than IP51 or IP54 protection level when they used. | | |

本次检测的依据：
Reference documents for the test

| 序号 | 文件代号及名称 |
|---|---|
| 1 | IEC 62052-11:2003 *Electricity metering equipment (a.c.) – General requirements, tests and test conditions - Part 11: Metering equipment* |
| 2 | IEC 62053-22:2003 *Electricity metering equipment (a.c.) – Particular requirements – Part 22:Static meters for active energy(classes 0.2S and 0.5S)* |
| | |

检测结论：
Results of test

依据用户委托，对样品进行了检测，所检项目符合 IEC 62052-11:2003 *Electricity metering equipment (a.c.) – General requirements, tests and test conditions - Part 11: Metering equipment* 和 IEC 62053-22:2003 *Electricity metering equipment (a.c.) – Particular requirements – Part 22:Static meters for active energy(classes 0.2S and 0.5S)*的要求。

We tested the samples according to the items of test standard. The test results meet the requirements of the following documents: IEC 62052-11:2003 *Electricity metering equipment(a.c.) – General requirements, tests and test conditions - Part 11: Metering equipment* and IEC 62053-22:2003 *Electricity metering equipment(a.c.) – Particular requirements – Part 22:Static meters for active energy(classes 0.2S and 0.5S)*.

注：本报告提供的结果仅对本次被测样品有效。
The results in the report are only valid for the tested sample(s).

批准人 Approved by 邓凌翔

审核人 Checked by 李博

检测人 Tested by 韩沁

（检测专用章） Stamp

签发日期 Date of Issue 2020 年 Year 06 月 Month 30 日 Day



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检测用主要仪器设备一览表：
Main instruments used in this test:

| 仪器设备名称 Name | 型号/规格 Type/specification | 编号 Number | 证书编号/有效期至 Certificate No./ Valid to |
|---|---|---|---|
| 程控耐压测试仪 Program control high votage testing equipment | YD9811 | 063 | E2019-0056801 /2020-07-01 |
| 三相电能表检验装置 3-Phase Watt-hour Meter Calibration System | SJJ-1 | 1431003 | E2019-0103075 /2020-11-12 |
| 冲击碰撞试验台 Striking and hitting test-bed | CP-100 | 920913 | E2019-0103074 /2020-11-13 |
| 电磁干扰接收机 EMI receiver | ESU26 | 100159 | E2019-0108395 /2020-12-03 |
| 射频传导抗扰度测试系统 Immunity to conducted disturbances induced by radio frequency fields | CIT-10-75 | 126A1462/2017 | E2019-0090701 /2020-10-09 |
| 射频电磁场辐射抗扰度测试系统 RF Immunity Test System | SML03 | 103221 | E2019-0103071 /2020-11-17 |
| 静电放电发生器 ESD Simulator | ESD-30G | EC0281210 | E2020-0000171 /2021-01-07 |
| 高温试验箱 High temperature test chamber | SEG-101H | 1061111190 | H2019-0115498 /2020-12-17 |
| 灼热丝试验仪 Hot wire testing equipment | ZRS-2 | 127-12 | H2020-0016354 /2021-03-15 |
| 电动振动试验系统 Electric vibration testing system | DC-1000-13 | 080206 | E2020-0000157 /2021-01-02 |
| 组合式传导抗扰度模拟器 Combined conduction immunity simulator | NSG3060 | 1333 | E2020-0010155 /2021-02-27 |

检测日期、检测地点、环境条件：
Location and environmental conditions for the test:

检测时间：从 2020 年 04 月 07 日 到 2020 年 06 月 04 日
Date of testing from 2020.04.07 to 2020.06.04

地点：南京市文澜路 95 号 4412、3121、4105、4306、4302、4406 室
Location: Room 4412,3121,4105,4306,4302,4406,No.95, WenLan Road,Nanjing

温度：(18.0～23.0)℃
Temperature:

相对湿度：(45～60)%
R. Humidity:



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## 检测结果一览表

List of test items

| 序号<br>No. | 检测项目<br>Test item | 检测依据序号/条款号<br>Reference documents | 结果<br>Results |
|---|---|---|---|
| 1 | 外观、标志及结构<br>Appearance signs and structure | 1/5 | P |
| 2 | 间隙和爬电距离<br>Clearance and Creepage distance | 1/5.6 | P |
| 3 | 脉冲电压试验<br>Impulse voltage tests | 1/7.3.2 | P |
| 4 | 交流电压试验<br>AC voltage tests | 1/7.3.3 | P |
| 5 | 仪表的初始起动<br>Initial start-up of the meter | 2/8.3 | P |
| 6 | 电流变化引起的误差极限<br>Limits of error due to variation of the current | 2/8.1 | P |
| 7 | 仪表常数<br>Meter constant | 2/8.4 | P |
| 8 | 起动试验<br>Starting | 2/8.3 | P |
| 9 | 潜动试验<br>Test of no-load condition | 2/8.3 | P |
| 10 | 环境温度改变<br>Ambient temperature variation | 2/8.2 | P |
| 11 | 电压改变<br>Voltage variation | 2/8.2 | P |
| 12 | 频率改变<br>Frequency variation | 2/8.2 | P |
| 13 | 谐波改变<br>Influence of harmonics | 2/8.2 | P |
| 14 | 外部恒定磁感应<br>Continuous magnetic induction of external origin | 2/8.2 | P |
| 15 | 外磁感应强度<br>Magnetic induction of external origin 0.5mT | 2/8.2 | P |
| 16 | 功率消耗<br>Power consumption | 2/7.1 | P |
| 17 | 自热影响<br>Influence of self-heating | 2/7.3 | P |
| 18 | 温升<br>Heating | 1/7.2 | P |
| 19 | 短时过电流影响<br>Influence of short-time overcurrents | 2/7.2 | P |
| 20 | 电压暂降和短时中断<br>Voltage dips and short interruptions | 1/7.1.2, 2/8.1 | P |
| 21 | 无线电干扰抑制<br>Radio interference suppression | 1/7.5.8 | P |
| 22 | 快速瞬变脉冲群抗扰度<br>Fast transient burst test | 1/7.5.4,2/8.2 | P |
| 23 | 衰减振荡波抗扰度<br>Damped oscillatory waves immunity test | 1/7.5.7,2/8.2 | P |
| 24 | 射频电磁场抗扰度<br>Test of immunity to electromagnetic RF fields | 1/7.5.3,2/8.2 | P |
| 25 | 射频场感应的传导骚扰抗扰度<br>Test of immunity to conducted disturbances, induced by radio-frequency fields | 1/7.5.5,2/8.2 | P |
| 26 | 静电放电抗扰度<br>Test of immunity to electrostatic discharges | 1/7.5.2 | P |



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| | | | |
|---|---|---|---|
| 27 | 浪涌抗扰度<br>Surge immunity test | 1/7.5.6 | P |
| 28 | 高温试验<br>Dry heat test | 1/6.3.1,2/8.1 | P |
| 29 | 低温试验<br>Cold test | 1/6.3.2,2/8.1 | P |
| 30 | 交变湿热试验<br>Damp heat cyclic test | 1/6.3.3,2/8.1 | P |
| 31 | 振动试验<br>Vibration test | 1/5.2.2.3,2/8.1 | P |
| 32 | 冲击试验<br>Shock test | 1/5.2.2.2,2/8.1 | P |
| 33 | 弹簧锤试验<br>Spring hammer test | 1/5.2.2.1 | P |
| 34 | 耐热和阻燃<br>Resistance to heat and fire | 1/5.8 | P |
| 35 | 逆相序<br>Reversed phase sequence | 2/8.2 | P |
| 36 | 电压不平衡<br>Voltage unbalance | 2/8.2 | P |
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“结果”一栏中，P——合格、F——不合格、N/A——不适用。

In “Results” column , P- pass; F- fail; N/A- not applicable.



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# 检测结果/说明

Results of test and additional explanation (continued page)

| 序号 No. | 检测项目 Test Item | 技术要求 Technical Standard Requirement | 检测结果 Test Result 71912032800061 | 结论 Conclusion | 备注 Remark |
|---|---|---|---|---|---|
| 1 | 外观、标志及结构 Appearance signs and structure | 表壳、窗口、端子-端子座-保护接地端子、端子盖、间隙和爬电距离、绝缘防护等级、测量值的显示、输出装置等应符合规定的电能表机械要求；铭牌应具有相应可应用信息、接线图和端子标志应永久地标示接入的线路。<br>Case ,window ,terminals-terminal block(s)-Protective earth terminal ,terminal covers, insulating encased meter of protective class Ⅱ,resistance to heat and fire ,protection against penetration of dust and water ,display of measured values ,output device, marking of meter shall meet item 5(mechanical requirements and tests) of IEC62052-11. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| 2 | 间隙和爬电距离 Clearance and Creepage distance | 最小间隙不小于 5.5mm<br>Minimum clearance ≥ 5.5 mm | 7.39mm | 合格<br>pass | |
| | | 最小爬电距离不小于 6.3mm<br>Minimum creepage distance ≥ 6.3mm | 10.27mm | 合格<br>pass | |
| 3 | 脉冲电压试验 Impulse voltage tests | 脉冲电压峰值:6kV，波形 1.2μs/50μs 脉冲，脉冲之间最小间隔时间 3s，正、负极性各 10 次，应无电弧放电或击穿现象。<br>Impulse waveform: 1.2/50 impulse specified in IEC60060-1; test voltage: 6kV.The EUT should be tested according to Item 7.3.2 of IEC62052-11.During this test no flashover, disruptive discharge or puncture shall occur. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| 4 | 交流电压试验 AC voltage tests | 所有电路对地之间施加交流电压 4kV，保持 1min，应无击穿或飞弧。<br>Between, on the one hand, all the current and voltage circuits as well as the auxiliary circuits whose reference voltage is over 40V, connected together, and, on the other hand, earth.<br>Test voltage:4kV;<br>test time:1min.<br>During this test no flashover, disruptive discharge or puncture shall occur. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| | | 在工作中不连接的各线路之间施加交流电压 2kV，保持 1min，应无击穿或飞弧现象。<br>Between circuits not intended to be connected together in service.<br>Test voltage:2kV;<br>test time:1min.<br>During this test no flashover, disruptive discharge or puncture shall occur. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| 5 | 仪表的初始起动 Initial start-up of the meter | 参比电压加到仪表接线端后，5s 内仪表应达到全部工作状态。<br>The meter shall be functional within 5s after the reference voltage is applied to the meter terminals. | 符合要求<br>All requirements are met. | 合格<br>pass | |



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| 序号 No. | 检测项目 Test Item | 技术要求 Technical Standard Requirement | 检测结果 Test Result | 结论 Conclusion | 备注 Remark |
|---|---|---|---|---|---|
| | | | 71912032800061 | | |
| 6 | 电流变化引起的误差极限(有功电能) Limits of error due to variation of the current (active energy) | 平衡负载<br>balanced loads<br>$0.01I_n \leqslant I < 0.05I_n$（cosφ=1.0）<br>$0.02I_n \leqslant I < 0.1I_n$（cosφ=0.5L、0.8C）<br>-1.0%≤Percentage error(PE)≤+1.0% | +0.28% | 合格 pass | |
| | | 平衡负载<br>balanced loads<br>$0.05I_n \leqslant I \leqslant I_{max}$（cosφ=1.0）<br>$0.1I_n \leqslant I \leqslant I_{max}$（cosφ=0.5L、0.8C）<br>-0.5%≤Percentage error(PE)≤+0.5% | +0.29% | 合格 pass | |
| | | 不平衡负载<br>unbalanced loads<br>$0.05I_n \leqslant I \leqslant I_{max}$（cosφ=1.0）<br>-0.6%≤Percentage error(PE)≤+0.6% | +0.57% | 合格 pass | |
| | | 不平衡负载<br>unbalanced loads<br>$0.1I_n \leqslant I \leqslant I_{max}$（cosφ=0.5L）<br>-1.0%≤Percentage error(PE)≤+1.0% | +0.81% | 合格 pass | |
| | | 单相负载与三相平衡负载误差之差≤1.0%<br>The difference between the percentage error when the meter is carrying a single-phase load and a balanced polyphase load shall not exceed 1.0%. | 0.03% | 合格 pass | |
| 7 | 仪表常数 Meter constant | 测试输出与显示器指示之间的关系应与铭牌标志一致。<br>The relation between the test output and the indication in the display shall comply with the marking on the name-plate. | 符合要求<br>All requirements are met. | 合格 pass | |



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|---|---|---|---|---|---|
| 8 | 起动试验 Starting | 在规定电流条件下，仪表应能起动并连续记录。<br>The meter shall start and continue to register. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| 9 | 潜动试验 Test of no-load condition | 仪表加 115%$U_n$ 电流回路中没有电流，其测试输出端不应产生多于一个的脉冲。<br>When the voltage is applied with no current flowing in the current circuit, the test output of the meter shall not produce more than one pulse. For this test the current circuit shall be open-circuit and a voltage of 115% of the reference voltage shall be applied to the voltage circuits. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| 10 | 环境温度改变 Ambient temperature variation | 变差≤0.03%/℃（cosφ=1.0）<br>Variation in PE≤0.03%/℃（cosφ=1.0） | 0.005%/℃ | 合格<br>pass | |
| | | 变差≤0.05%/℃（cosφ=0.5L）<br>Variation in PE≤0.05%/℃（cosφ=0.5L） | 0.004%/℃ | 合格<br>pass | |
| 11 | 电压改变 Voltage variation | 1.1$U_n$ 和 0.9$U_n$ 时：变差≤0.4%<br>±10%$U_n$: Variation in PE≤0.4% | 0.04% | 合格<br>pass | |
| | | 极限的工作范围为(0.0～1.15)$U_n$，试验后仪表应无损坏或信息改变。<br>Limit range of operation(0.0～1.15)$U_n$, After test, the meter shall show no damage or change of the information. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| | | 1.15$U_n$ 和 0.8$U_n$ 时：变差≤1.2%<br>1.15$U_n$ and 0.8$U_n$: Variation in PE≤1.2% | 0.05% | 合格<br>pass | |
| 12 | 频率改变 Frequency variation | 变差≤0.2%<br>Variation in PE≤0.2% | 0.05% | 合格<br>pass | |



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|---|---|---|---|---|---|
| 13 | 谐波改变 Influence of harmonics | | | | |
| (1) | 电流和电压线路谐波分量影响 Harmonic components in the current and Voltage circuits | 变差≤0.5% Variation in PE≤0.5% | 0.08% | 合格 pass | |
| (2) | 交流线路中次谐波的影响 Sub-harmonics in the a.c. current circuit | 变差≤1.5% Variation in PE≤1.5% | 0.91% | 合格 pass | |
| 14 | 外部恒定磁感应 Continuous magnetic induction of external origin | 变差≤2.0% Variation in PE≤2.0% | 0.02% | 合格 pass | |
| 15 | 外磁感应强度 Magnetic induction of external origin 0.5mT | 变差≤1.0% Variation in PE≤1.0% | 0.02% | 合格 pass | |
| 16 | 功率消耗 Power consumption | | | | |
| (1) | 电压线路视在功率消耗 Voltage circuit(VA) | ≤0.5VA | 0.08VA | 合格 pass | |
| (2) | 电流线路视在功率消耗 Current circuit(VA) | ≤1.0VA | 0.01VA | 合格 pass | |
| (3) | 辅助电源线路视在功率消耗 Auxiliary power supply(VA) | ≤10VA | 2.9VA | 合格 pass | |
| 17 | 自热影响 Influence of self-heating | 变差≤0.2%（cosφ=1.0） Variation in PE≤0.2%（cosφ=1.0） | 0.02% | 合格 pass | |
| | | 变差≤0.2%（cosφ=0.5L） Variation in PE≤0.2%（cosφ=0.5L） | 0.03% | 合格 pass | |
| 18 | 温升 Heating | 电能表在 40℃条件下，电流线路通以额定最大电流，电压线路包括辅助电源线路加 115%的参比电压，2h 后立即测量仪表表面温度，表壳的外表面温升不应超过 25K。 The temperature rise of the external surface shall not exceed 25K, with an ambient temperature of 40℃. | 8.2K | 合格 pass | |
| | | 试验后表壳不应损坏，工作正常，绝缘性能符合要求。 After the test, the meter shall show no damage and shall comply with the dielectric strength tests. | 符合要求 All requirements are met. | 合格 pass | |



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|---|---|---|---|---|---|
| 19 | 短时过电流影响 Influence of short-time overcurrents | 短时过电流不应损坏仪表。当恢复至初始条件时，仪表应能正常工作。<br>Short-time overcurrents shall not damage the meter. The meter shall perform correctly when back to its initial working condition. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| | | 变差≤0.05%<br>Variation in PE≤0.05% | 0.02% | 合格<br>pass | |
| 20 | 电压暂降和短时中断 Voltage dips and short interruptions | 试验按下列条件进行：<br>—电压线路和辅助线路通以参比电压；<br>—电流线路无电流。<br>a) 电压中断，△U=100%<br>—中断时间：1s；<br>—中断次数：3 次；<br>—中断间隔时间：50ms。<br>b) 电压中断，△U=100%<br>—中断时间：参比频率的一个周期；<br>—中断次数： 1 次。<br>c) 电压暂降，△U=50%<br>—暂降时间：1min；<br>—暂降次数：1 次。<br>电压暂降和短时中断应不使计度器产生大于 0.00396kWh 计量单位的改变以及测试输出不应产生大于等同 0.00396kWh 计量单位的信号量。<br>The test shall be carried out under the following conditions:<br>-voltage and auxiliary circuits energized with reference voltage;<br>-without any current in the current circuits.<br>a)voltage interruptions of △U=100%<br>-interruption time:1s;<br>-number of interruptions:3;<br>-restoring time between interruptions: 50ms.<br>b)voltage interruptions of △U=100%<br>-interruption time: one cycle at rated frequency;<br>-number of interruptions:1;<br>c)voltage dips of △U=50%<br>-dip time:1min;<br>-number of dips:1.<br>Voltage dips and short interruptions shall not produce a change in the register of more than 0.00396kWh and the test output shall not produce a signal equivalent of more than 0.00396kWh. | 符合要求<br>All requirements are met. | 合格<br>（详见附录 2）<br>pass<br>(refer to appendix 2) | |
| | | 电压恢复后仪表计量特性<br>When the voltage is restored, the meter shall not have suffered degradation of its metrological characteristics.<br>-0.5%≤Percentage error(PE)≤+0.5% | +0.06% | 合格<br>pass | |



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|---|---|---|---|---|---|
| | | | 71912032800061 | | |
| 21 | 无线电干扰抑制 Radio interference suppression | | | | |
| (1) | 电源端子传导骚扰 Conducted emission test | 试验应按 CISPR 22，在下列条件下进行：<br>—作为 B 级设备；<br>—作为台式设备试验；<br>—对电压线路与每个连接器的连接，应使用长度为 1m 的无屏蔽电缆；<br>—仪表在工作状态；<br>—电压线路和辅助线路通以参比电压；<br>—电流在 $0.1I_b(I_n)$与 $0.2I_b(I_n)$之间。(由线性负荷引出并以 1m 长的无屏蔽电缆连接)。<br>The test shall be carried out according to CISPR 22,under the following conditions:<br>•for class B equipment;<br>•tested as table-top equipment;<br>•for connection to the voltage circuits, an unshielded cable length of 1 m to each connector shall be used;<br>•meter in operating condition:<br>- voltage and auxiliary circuits energized with reference voltage;<br>- with a current between 0,1 $I_b$ and 0,2 $I_b$ resp. 0,1 $I_n$ and 0,2 $I_n$(drawn by linear load and connected by unshielded cable length of 1 m)<br>(0.15～≤0.50)MHz QP≤ (66～56)dBμV<br>(0.50～≤5.0)MHz QP≤ 56dBμV<br>(5.0～≤30)MHz QP≤ 60dBμV<br>(0.15～≤0.50)MHz AV≤ (56～46)dBμV<br>(0.50～≤5.0)MHz AV≤ 46dBμV<br>(5.0～≤30)MHz AV≤ 50dBμV | 符合要求<br>All requirements are met. | 合格（详见附录 3）<br>pass (refer to appendix 3) | |



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|---|---|---|---|---|---|
| (2) | 辐射骚扰 Radiated emission test | 试验应按 CISPR 22，在下列条件下进行：<br>—作为 B 级设备；<br>—作为台式设备试验；<br>—电压线路与每个连接器的连接，应使用长度为 1m 的无屏蔽电缆；<br>仪表在工作状态：<br>—电压线路和辅助线路通以参比电压；<br>—电流在 0.1$I_b$($I_n$)与 0.2$I_b$($I_n$)之间。(由线性负荷引出并以 1m 长的无屏蔽电缆连接)。<br>测试距离：10m<br>天线升降范围：(1～4)m<br>天线极化方向：垂直、水平<br>转台角度范围：0～360°<br>The test shall be carried out according to CISPR 22,under the following conditions:<br>•for class B equipment;<br>•tested as table-top equipment;<br>•for connection to the voltage circuits, an unshielded cable length of 1 m to each connector shall be used;<br>•meter in operating condition:<br>- voltage and auxiliary circuits energized with reference voltage;<br>- with a current between 0,1 $I_b$ and 0,2 $I_b$ resp. 0,1 $I_n$ and 0,2 $I_n$(drawn by linear load and connected by unshielded cable length of 1 m).<br>measuring distance:10 m;<br>antenna elevation range(1～4)m;<br>antenna polarization direction: vertical ,horizontal ;<br>turntable angle range:0～360°.<br>(30～≤230)MHz QP≤30dBμV/m<br>(230～1000)MHz QP≤37dBμV/m | 符合要求<br>All requirements are met. | 合格（详见附录 4）<br>pass (refer to appendix 4) | |



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|---|---|---|---|---|---|
| | | | 71912032800061 | | |
| 22 | 快速瞬变脉冲群抗扰度 Fast transient burst test | 试验在下列条件下进行：<br>—作为台式设备试验；<br>—仪表在工作状态：<br>● 电压线路和辅助线路通以参比电压；<br>● 基本电流 $I_b$(相应的额定电流 $I_n$)和 cosφ(相应的 sinφ)按相应标准规定的数值；<br>—在耦合设备与仪表之间的电缆长度：1m；<br>—试验电压以共模方式（线对地）作用于：<br>● 电压线路；<br>● 电流线路，如果在正常使用时与电压线路是隔离的；<br>● 辅助线路，如果在正常使用时与电压线路是隔离的；<br>—在电流线路和电压线路上的试验电压：4kV；<br>—在参比电压超过 40V 的辅助线路上的试验电压：2kV；<br>—试验时间：每一极性 60s。<br>在试验中，功能或性能有短暂的降低或失去是允许的。误差的改变应小于 4.0%。<br>The test shall be carried out according to IEC 61000-4-4,under the following conditions:<br>•tested as table-top equipment;<br>•meter in operating condition:<br>- voltage and auxiliary circuits energized with reference voltage;<br>- with basic current $I_b$ resp. rated current $I_n$ ,and cosφ resp. sinφ according to the value given in the relevant standard.<br>•cable length between coupling device and EUT:1m;<br>•the test voltage shall be applied in common mode(line to earth)to:<br>- the voltage circuits;<br>- the current circuits, if separated from the voltage circuits in normal operation;<br>- the auxiliary circuits, if separated from the voltage circuits in normal operation;<br>•test voltage on the current and voltage circuit: 4kV;<br>•test voltage on the auxiliary circuits with a reference voltage over 40V: 2kV;<br>•duration of the test: 60s at each polarity.<br>During the test, a temporary degradation or loss of function or performance is acceptable, nevertheless the variation of the error shall be less than 4.0%. | 0.13% | 合格（详见附录 5）pass (refer to appendix 5) | |



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|---|---|---|---|---|---|
| | | | 71912032800061 | | |
| 23 | 衰减振荡波抗扰度 Damped oscillatory waves immunity test | 试验在下列条件下进行：<br>—仅对经互感器工作的仪表；<br>—作为台式设备试验；<br>—仪表在工作状态：<br>● 电压线路和辅助线路通以参比电压；<br>● 额定电流 $I_n$ 和 cosφ(相应的 sinφ) 按相应标准规定的数值；<br>—在电压线路和参比电压超过 40V 的辅助线路上的试验电压：<br>● 共模方式：2.5kV；<br>● 差模方式：1.0kV；<br>—试验频率：<br>● 100kHz,重复速率：40Hz；<br>● 1MHz，重复速率：400Hz；<br>—试验时间：60s（对每种试验频率以 2s 开、2s 关，进行 15 个周期）。<br>在试验时应不使设备的状况紊乱且误差的改变应小于 2.0%。<br>The test shall be carried out according to IEC 61000-4-12,under the following conditions:<br>•only for transformer operated meters;<br>•tested as table top equipment;<br>•meter in operating condition:<br>-voltage and auxiliary circuits energized with reference voltage;<br>-with rated current $I_n$ and cosφ resp. sinφ according to the value given in the relevant standard;<br>•test voltage on voltage circuits and auxiliary circuits with a reference voltage >40V:<br>-common mode:2.5kV;<br>-differential mode:1.0kV;<br>•test frequencies:<br>-100kHz,repetition rate:40Hz;<br>-1MHz,repetition rate:400Hz;<br>•test duration:60s(15 cycles with 2s on,2s off for each frequency)<br>During the test the behavior of the equipment shall not be perturbed and the variation in error shall be less than 2.0%. | 0.22% | 合格（详见附录 6）<br>pass (refer to appendix 6) | |



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| | | | 71912032800061 | | |
| 24 | 射频电磁场抗扰度 Test of immunity to electromagnetic RF fields | 试验按下列条件下进行：<br>—作为台式设备试验；<br>—暴露于电磁场中的电缆长度：1m；<br>—频率范围：80MHz～2000MHz；<br>—在 1kHz 正弦波上以 80%调幅载波调制；<br>—仪表在工作状态：<br>● 电压线路和辅助线路通以参比电压；<br>● 基本电流 $I_b$(相应的额定电流 $I_n$)和 cos$\varphi$(相应的 sin$\varphi$) 按相应标准规定的数值；<br>—未调制的试验场强：10V/m。<br>在试验时应不使设备的状况紊乱且误差的改变应小于 2.0%。<br>The test shall be carried out according to IEC 61000-4-3,under the following conditions:<br>•tested as table-top equipment;<br>•cable length, exposed to the field: 1m;<br>•frequency band:80MHz～2000MHz;<br>•carrier modulated with 80% AM at 1kHz sine wave;<br>Test with current<br>•meter in operating condition:<br>- voltage and auxiliary circuits energized with reference voltage;<br>- basic current $I_b$ resp. rated current $I_n$, and cosφ resp. sinφ according to the value given in the relevant standard.<br>•unmodulated test field strength: 10V/m.<br>During the test, the behaviour of the equipment shall not be perturbed and the variation of error shall be less than 2.0%. | 0.06% | 合格（详见附录 7）pass (refer to appendix 7) | |



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|---|---|---|---|---|---|
| | 射频电磁场抗扰度 Test of immunity to electromagnetic RF fields | 试验按下列条件下进行：<br>—作为台式设备试验；<br>—暴露于电磁场中的电缆长度：1m；<br>—频率范围：80MHz～2000MHz；<br>—在 1kHz 正弦波上以 80%调幅载波调制；<br>—仪表在工作状态：<br>● 电压线路和辅助线路通以参比电压；<br>● 电流线路无电流且电流端开路；<br>—未调制的试验场强：30V/m。<br>高频电磁场的作用不应使计度器产生大于 0.00396kWh 计量单位的改变以及测试输出不应产生大于等同 0.00396kWh 计量单位的信号量。<br>在试验中，功能或性能有短暂的降低或失去是允许的。<br>The test shall be carried out according to IEC 61000-4-3,under the following conditions:<br>•tested as table-top equipment;<br>•cable length, exposed to the field: 1m;<br>•frequency band:80MHz～2000MHz;<br>•carrier modulated with 80% AM at 1kHz sine wave;<br>Test without any current<br>•meter in operating condition:<br>- voltage and auxiliary circuits energized with reference voltage;<br>- without any current in the current circuits and the current terminals shall be open circuit.<br>•unmodulated test field strength: 30V/m.<br>The application of the RF field shall not produce a change in the register of more than 0.00396kWh and the test output shall not produce a signal equivalent to more than 0.00396kWh.<br>During the test,a temporary degradation or loss of function or performance is acceptable. | 符合要求<br>All requirements are met. | 合格（详见附录 7）<br>pass (refer to appendix 7) | |



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| | | | 71912032800061 | | |
| 25 | 射频场感应的传导骚扰抗扰度 Test of immunity to conducted disturbances, induced by radio-frequency fields | 试验在下列条件下进行：<br>—作为台式设备试验；<br>—仪表在工作状态：<br>● 电压线路和辅助线路通以参比电压；<br>● 基本电流 $I_b$(相应的额定电流 $I_n$)和 cosφ(相应的 sinφ)按相应标准规定的数值；<br>—频率范围：150kHz～80MHz；<br>—电压水平：10V。<br>在试验时应不使设备的状况紊乱且误差的改变应小于 2.0%。<br>The test shall be carried out according to IEC 61000-4-6,under the following conditions:<br>•tested as table-top equipment;<br>•meter in operating condition;<br>- voltage and auxiliary circuits energized with reference voltage;<br>- with basic current $I_b$ resp. rated current $I_n$, and cosφ resp. sinφ according to the value given in the relevant standard;<br>•frequency range:150kHz to 80MHz;<br>•voltage level: 10V.<br>During the test, the behaviour of the equipment shall not be perturbed and variation of the error shall be less than 2.0%. | 0.04% | 合格（详见附录 8）<br>pass (refer to appendix 8) | |



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| 26 | 静电放电抗扰度 Test of immunity to electrostatic discharges | 试验在下列条件下进行：<br>—作为台式设备试验；<br>—仪表在工作状态：<br>● 电压线路和辅助线路通以参比电压；<br>● 电流线路无电流（开路）；<br>—接触放电；<br>—试验电压：8kV；<br>—放电次数：10（以最敏感的极性）；<br>—因无外露金属部件而不能接触放电，则以15kV 试验电压作空气放电。<br>静电放电作用应不使计度器产生大于0.00396kWh 计量单位的改变以及测试输出不应产生大于等同 0.00396kWh 计量单位的信号量。<br>在试验中，功能或性能有短暂的降低或失去是容许的。<br>The test shall be carried out according to IEC61000-4-2,under the following conditions:<br>•tested as table-top equipment;<br>•meter in operating condition;<br>- voltage and auxiliary circuits energized with reference voltage;<br>- without any current in the current circuits(open circuit);<br>•contact discharge;<br>•test voltage: 8kV;<br>• number of discharges: 10(in the most sensitive polarity).<br>If contact discharge is not applicable because no metallic parts are outside, then apply air discharge with a 15 kV test voltage.<br>The application of the electrostatic discharge shall not produce a change in the register of more than 0.00396kWh and the test output shall not produce a signal equivalent to more than 0.00396kWh.<br>During the test, a temporary degradation or loss of function or performance is acceptable. | 符合要求<br>All requirements are met. | 合格（详见附录 9）<br>pass (refer to appendix 9) | |



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| 27 | 浪涌抗扰度 Surge immunity test | 试验在下列条件下进行：<br>—仪表在工作状态：<br>● 电压线路和辅助线路通以参比电压；<br>● 电流线路无电流且电流端应开路；<br>—浪涌发生器与仪表之间的电缆长度：1m；<br>—以差模方式（线对线）试验；<br>—相位角：在相对于交流电源零位的 60°和 240°施加脉冲；<br>—在电流线路和电压线路（干线）上的试验电压：4kV，发生器电源阻抗：2Ω；<br>—在参比电压超过 40V 的辅助线路上的试验电压：1kV；发生器电源阻抗：42Ω；<br>—试验次数：正极性 5 次负极性 5 次；<br>—重复率：最大 1/min。<br>浪涌抗扰度试验电压的作用应不使计度器产生大于 0.00396kWh 计量单位的改变以及测试输出不应产生大于等同 0.00396kWh 计量单位的信号量。<br>在试验中，功能或性能有短暂的降低或失去是容许的。<br>The test shall be carried out according to IEC61000-4-5,under the following conditions:<br>•meter in operating condition:<br>- voltage and auxiliary circuits energized with reference voltage;<br>- without any current in the current circuits and the current terminals shall be open circuit;<br>•cable length between surge generator and meter: 1m;<br>•tested in differential mode(line to line);<br>•Phase angle: pulses to be applied at 60° and 240° relative to zero crossing of AC supply;<br>•test voltage on the current and voltage circuit(mains lines): 4kV.<br>•number of tests: 5 positive and 5 negative;<br>•repetition rate: 1/min.<br>The application of the surge immunity test voltage shall not produce a change in the register of more than 0.00396kWh and the test output shall not produce a signal equivalent to more than 0.00396kWh.<br>During the test, a temporary degradation or loss of function or performance is acceptable. | 符合要求<br>All requirements are met. | 合格（详见附录 10）<br>pass (refer to appendix 10) | |



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| 28 | 高温试验 Dry heat test | 高温贮存：+70℃±2℃，72h ；仪表为非工作状态。<br>-meter in non-operating condition;<br>-temperature: +70℃±2℃;<br>-duration of the test:72h. | | | |
| | | 试验后仪表应无损坏或信息改变。<br>After the test,the meter shall show no damage or change of information and shall operate correctly. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| | | -0.5%≤Percentage error(PE)≤+0.5% | +0.13% | 合格<br>pass | |
| 29 | 低温试验 Cold test | 低温贮存：-25℃±3℃，72h ；仪表为非工作状态。<br>-meter in non-operating condition;<br>-temperature: -25℃±3℃;<br>-duration of the test:72h. | | | |
| | | 试验后仪表应无损坏或信息改变。<br>After the test, the meter shall show no damage or change of information and shall operate correctly. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| | | -0.5%≤Percentage error(PE)≤+0.5% | -0.07% | 合格<br>pass | |
| 30 | 交变湿热试验 Damp heat cyclic test | 交变湿热：电能表所有电压线路加参比电压，电流线路无电流；试验温度（25～40）℃，相对湿度为：93%±3%。试验 6 个周期，每个周期 24h。<br>-voltage and auxiliary circuits energized with reference voltage;<br>-without any current in the current circuits;<br>-temperature: (25～40)℃;<br>-humidity: 93%±3%RH;<br>-duration of the test:6 cycles, 24 hours each cycle; | | | |
| | | 试验后，仪表应无损坏或信息改变并能正确地工作，不应出现可能影响仪表功能特性的腐蚀痕迹。并满足规定的脉冲电压试验和交流电压试验要求。<br>After the test, the meter shall show no damage or change of information and shall operate correctly.<br>24h after the end of this test, the meter shall comply with the dielectric strength tests.<br>No trace of corrosion likely to affect the functional properties of the meter shall be apparent. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| | | -0.5%≤Percentage error(PE)≤+0.5% | -0.04% | 合格<br>pass | |
| 31 | 振动试验 Vibration test | 频率 f=(10～60)Hz，振幅 Am=0.075mm；频率 f=(60～150)Hz，加速度 a=9.8m/s$^2$,每一轴向扫频 10 次。<br>-meter in non-operation condition, without the packing;<br>-Frequency range:10Hz to 150Hz;<br>-Transition frequency:60Hz;<br>-$f$<60Hz,constant amplitude of movement 0.075mm;<br>-$f$>60Hz,constant acceleration 9.8m/s$^2$;<br>-Single point control;<br>-Number of sweep cycles per axis:10. | | | |
| | | 试验后仪表应无损坏或信息改变。<br>After the test, the meter shall show no damage or change of information and shall operate correctly. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| | | -0.5%≤Percentage error(PE)≤+0.5% | -0.01% | 合格<br>pass | |



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| 序号 No. | 检测项目 Test Item | 技术要求 Technical Standard Requirement | 检测结果 Test Result<br>71912032800061 | 结论 Conclusion | 备注 Remark |
|---|---|---|---|---|---|
| 32 | 冲击试验 Shock test | 峰值加速度:a=300m/s²；冲击时间：T=18ms；每个面 3 次，6 个面共 18 次。<br>-meter in non-operation condition, without the packing;<br>-half-sine pulse;<br>-peak acceleration: a=300m/s² ;<br>-duration of the pulse: 18ms. | | | |
| | | 试验后仪表应无损坏或信息改变。<br>After the test, the meter shall show no damage or change of information and shall operate correctly. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| | | -0.5%≤Percentage error(PE)≤+0.5% | +0.03% | 合格<br>pass | |
| 33 | 弹簧锤试验 Spring hammer test | (0.2±0.02)J 的动能作用于表壳(包括窗口) 和端盖的外表面上，不应出现影响仪表功能及可触及带电部件的损伤。<br>The spring hammer shall act on the outer surfaces of the meter cover(including windows) and on the terminal cover with a kinetic energy of 0.2J±0.02J.<br>The meter case and terminal cover do not sustain damage which could affect the function of the meter and it is not possible to touch live parts. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| 34 | 耐热和阻燃 Resistance to heat and fire | 接线端座: (960±10)℃<br>接线端盖和表壳:(650±10)℃；<br>作用时间: (30±1)s；<br>仪表不应燃烧。<br>如发生燃烧，则应在移开灼热丝之后的 30s 内熄灭，且铺底层的绢纸不应起燃。<br>-terminal block: (960±10)℃<br>-terminal cover and meter case: （650±10)℃;<br>-duration of application: (30±1)s.<br>The terminal block ,the terminal cover and the meter case shall ensure reasonable safety against spread of fire .They should not be ignited by thermal overload of live parts in contact with them. | 符合要求<br>All requirements are met. | 合格<br>pass | |
| 35 | 逆相序 Reversed phase sequence | 变差≤0.1%<br>Variation in PE≤0.1% | 0.03% | 合格<br>pass | |
| 36 | 电压不平衡 Voltage unbalance | 变差≤1.0%<br>Variation in PE≤1.0% | 0.02% | 合格<br>pass | |



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附录 1
Appendix 1

样品照片 Sample picture

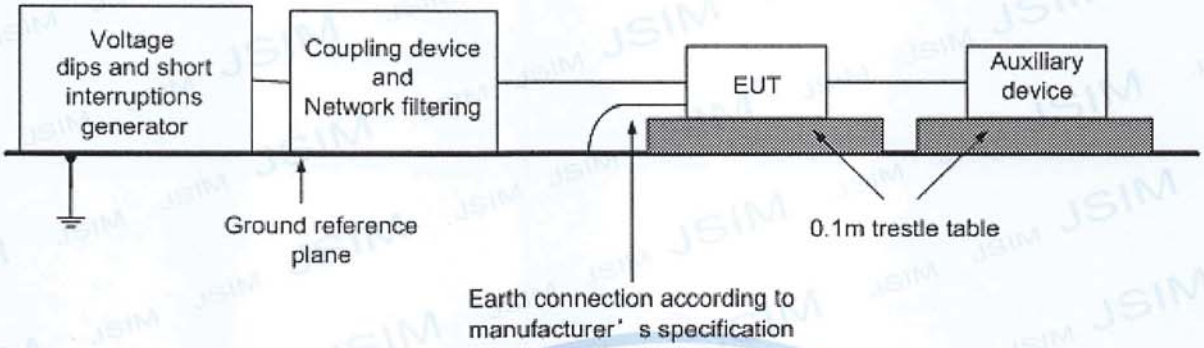





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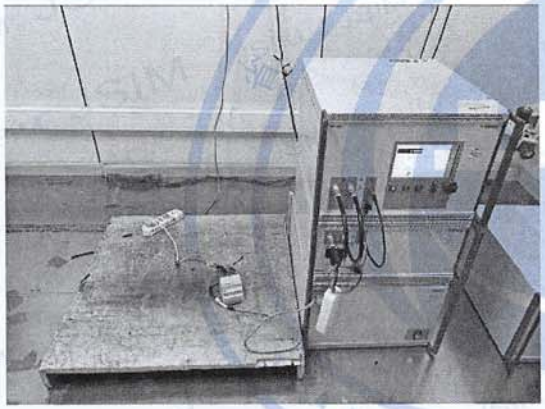
附录 2
Appendix 2

1. 电压暂降和短时中断试验布置图
Setup pic of voltage dips and short interruptions test

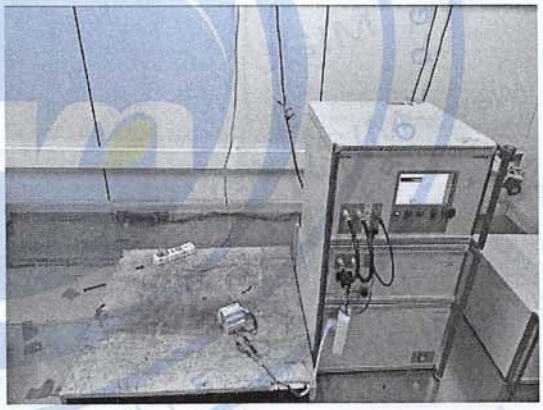



2. 电压暂降和短时中断试验布置照片
Test pic of voltage dips and short interruptions test

① 辅助电源线路 auxiliary circuits



② 电压线路 voltage circuits

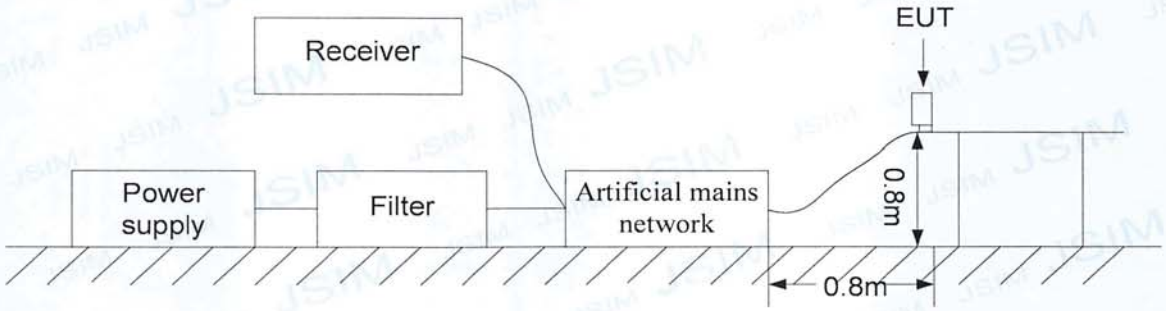




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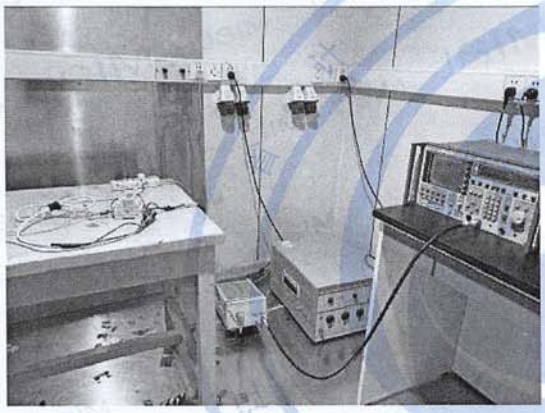
附录 3
Appendix 3

1. 电源端子传导骚扰试验布置图
Setup pic of conducted emission test

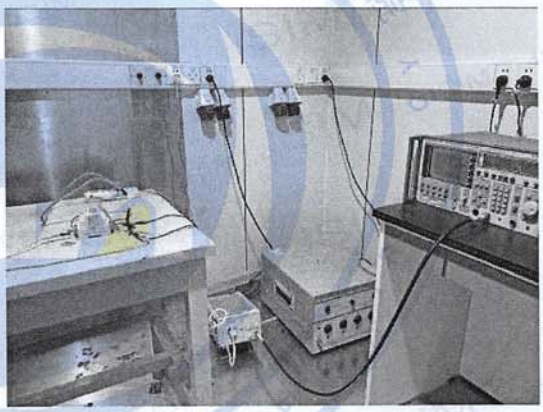



2. 电源端子传导骚扰试验布置照片
Test pic of conducted emission test

① 辅助电源线路 auxiliary circuits



② 电压电流线路 voltage and current circuits

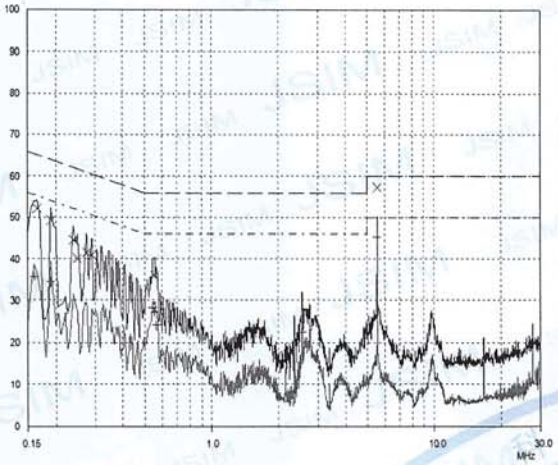




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# 3．电源端子传导骚扰试验测试曲线及结果
# Curve and Results of Conducted Emission Test

## ① 辅助电源线路 auxiliary circuits

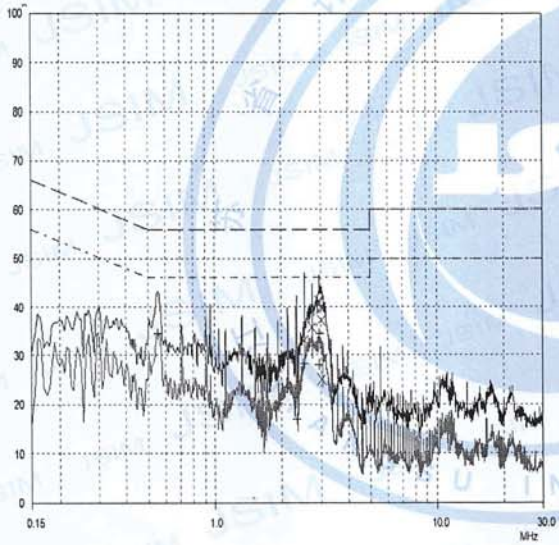



Final Measurement Results

| Frequency MHz | QP Level dBµV | QP Limit dBµV | QP Delta dB | Phase - | PE - |
|---|---|---|---|---|---|
| 0.165 | 52.12 | 65.21 | 13.09 | L1 | gnd |
| 0.19 | 49.22 | 64.04 | 14.82 | L1 | gnd |
| 0.24 | 44.53 | 62.10 | 17.57 | L1 | gnd |
| 0.25 | 40.06 | 61.76 | 21.70 | L1 | gnd |
| 0.275 | 41.58 | 60.97 | 19.39 | L1 | gnd |
| 0.29 | 40.79 | 60.52 | 19.73 | L1 | gnd |
| 0.556 | 35.91 | 56.00 | 20.09 | L1 | gnd |
| 5.53 | 57.28 | 60.00 | 2.72 | N | gnd |

| Frequency MHz | AV Level dBµV | AV Limit dBµV | AV Delta dB | Phase - | PE - |
|---|---|---|---|---|---|
| 0.16 | 35.74 | 55.46 | 19.72 | N | gnd |
| 0.19 | 34.39 | 54.04 | 19.65 | N | gnd |
| 0.545 | 28.30 | 46.00 | 17.70 | L1 | gnd |
| 0.555 | 27.21 | 46.00 | 18.79 | L1 | gnd |
| 0.565 | 24.02 | 46.00 | 21.98 | L1 | gnd |
| 2.545 | 22.42 | 46.00 | 23.58 | N | gnd |
| 5.535 | 45.18 | 50.00 | 4.82 | N | gnd |

## ② 电压电流线路 voltage and current circuits




Final Measurement Results

| Frequency MHz | QP Level dBµV | QP Limit dBµV | QP Delta dB | Phase - | PE - |
|---|---|---|---|---|---|
| 2.53 | 32.99 | 56.00 | 23.01 | L1 | gnd |
| 2.735 | 35.75 | 56.00 | 20.25 | L1 | gnd |
| 2.94 | 41.06 | 56.00 | 14.94 | L1 | gnd |
| 2.96 | 40.88 | 56.00 | 15.12 | L1 | gnd |
| 2.995 | 39.71 | 56.00 | 16.29 | L1 | gnd |
| 3.005 | 37.19 | 56.00 | 18.81 | L1 | gnd |
| 3.025 | 24.93 | 56.00 | 31.07 | L1 | gnd |
| 3.035 | 39.69 | 56.00 | 16.31 | L1 | gnd |

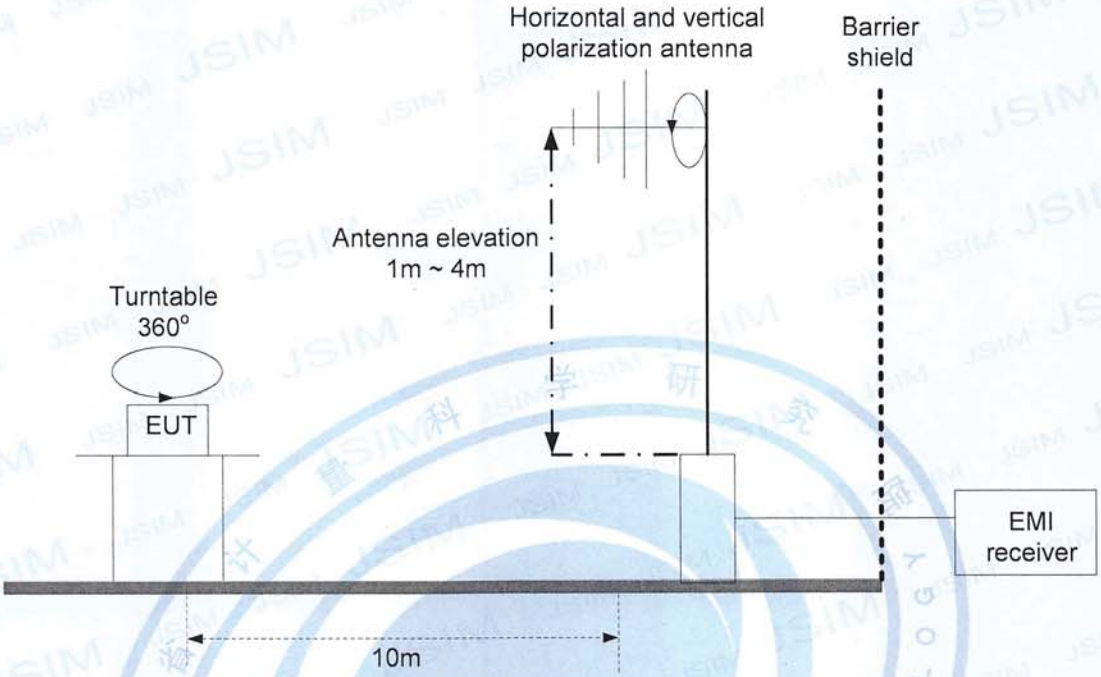
| Frequency MHz | AV Level dBµV | AV Limit dBµV | AV Delta dB | Phase - | PE - |
|---|---|---|---|---|---|
| 0.555 | 34.46 | 46.00 | 11.54 | L1 | gnd |
| 1.925 | 20.15 | 46.00 | 25.85 | L1 | gnd |
| 2.125 | 23.38 | 46.00 | 22.62 | L1 | gnd |
| 2.33 | 17.04 | 46.00 | 28.96 | L1 | gnd |
| 2.53 | 28.23 | 46.00 | 17.77 | L1 | gnd |
| 2.735 | 31.96 | 46.00 | 14.04 | L1 | gnd |
| 2.94 | 28.01 | 46.00 | 17.99 | N | gnd |
| 2.96 | 34.35 | 46.00 | 11.65 | L1 | gnd |



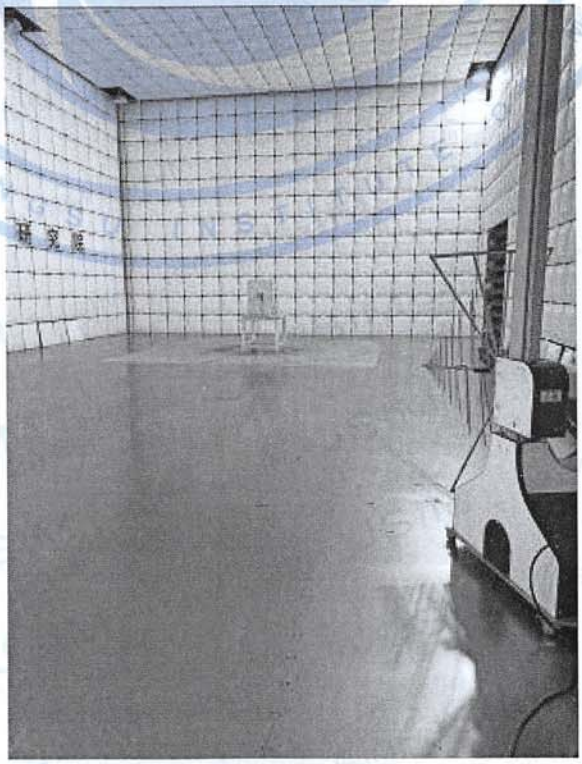
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附录 4
Appendix 4

1. 辐射骚扰试验布置图
Setup pic of radiated emission test



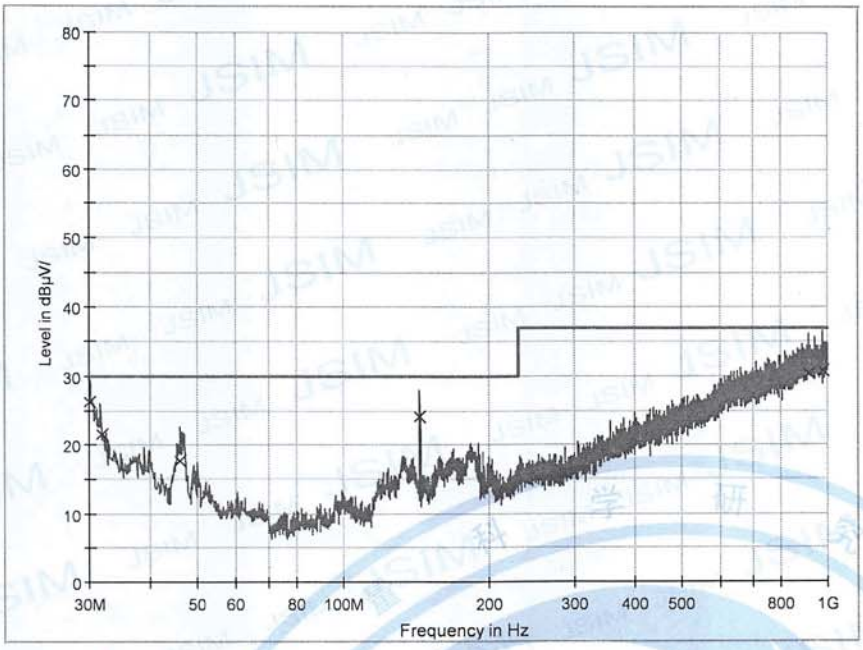

2. 辐射骚扰试验布置照片
Test pic of radiated emission test





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## 3．辐射骚扰试验测试曲线及结果
## Curve and Results of Radiation Emission Test




## Result Table_Single

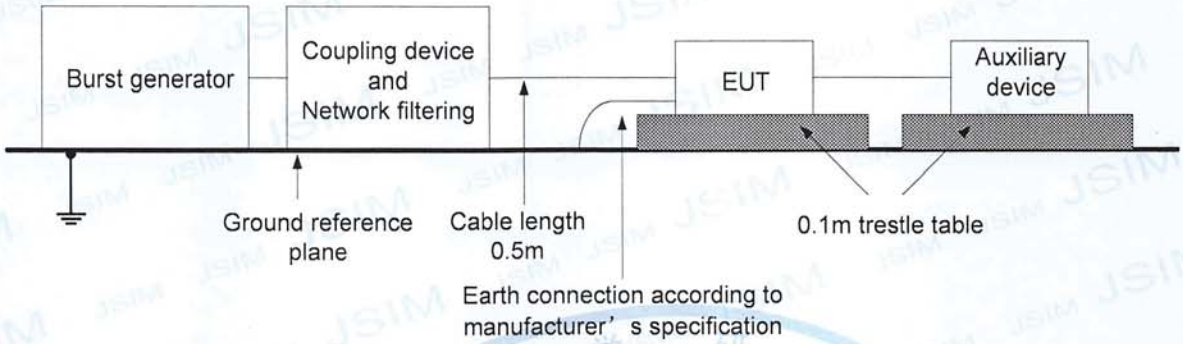
| Frequency (MHz) | QuasiPeak (dB µ V/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB) | Comment |
|---|---|---|---|---|---|---|---|---|
| 30.000000 | 26.2 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 18.7 | |
| 31.710000 | 21.6 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 17.6 | |
| 46.000000 | 17.6 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 10.9 | |
| 143.970000 | 24.2 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 10.1 | |
| 912.340000 | 30.2 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 29.2 | |
| 977.080000 | 30.7 | 1000.0 | 120.000 | 100.0 | V | 0.0 | 29.8 | |



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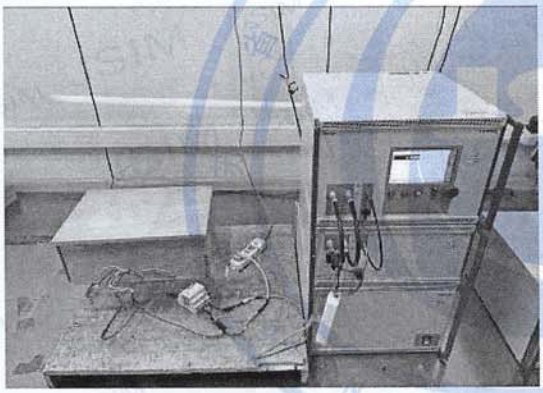
附录 5
Appendix 5

1. 快速瞬变脉冲群抗扰度试验布置图
Setup pic of fast transient burst test

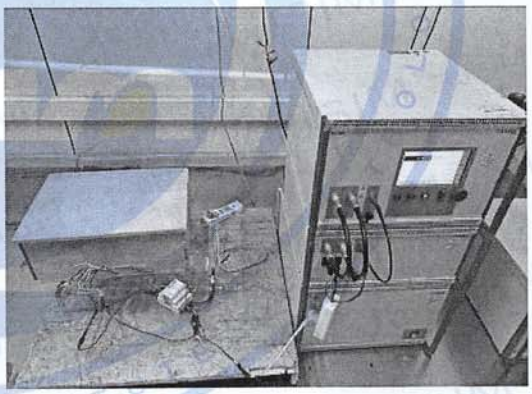



2. 快速瞬变脉冲群抗扰度试验布置照片
Test pic of fast transient burst test

① 辅助电源线路 auxiliary circuits



② 电压电流线路 voltage and current circuits

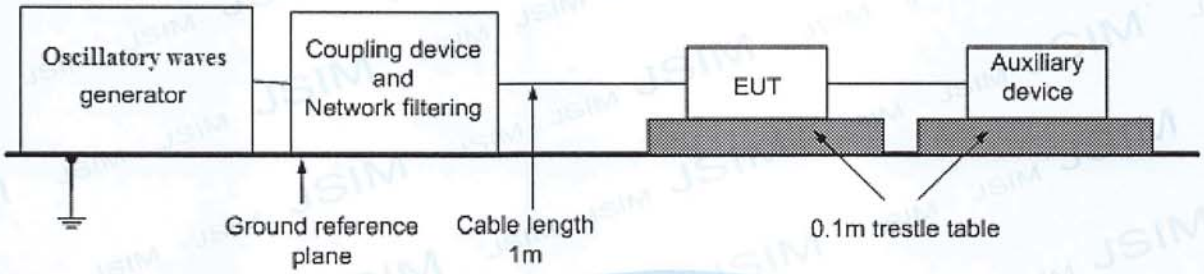




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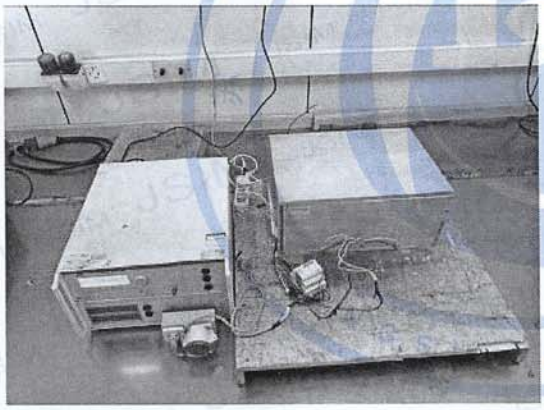
附录 6
Appendix 6

1. 衰减振荡波抗扰度试验布置图
Setup pic of damped oscillatory waves immunity test

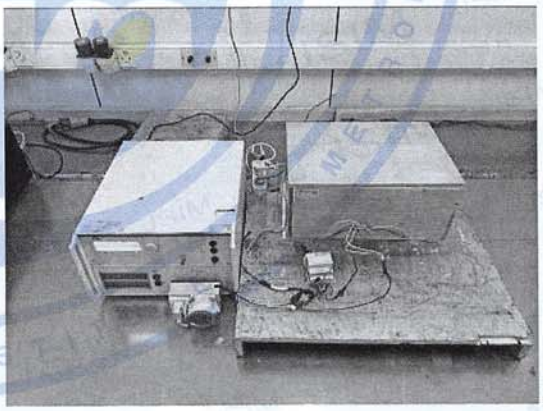



2. 衰减振荡波抗扰度试验布置照片
Test pic of damped oscillatory waves immunity test

① 辅助电源线路 auxiliary circuits



② 电压电流线路 voltage and current circuits

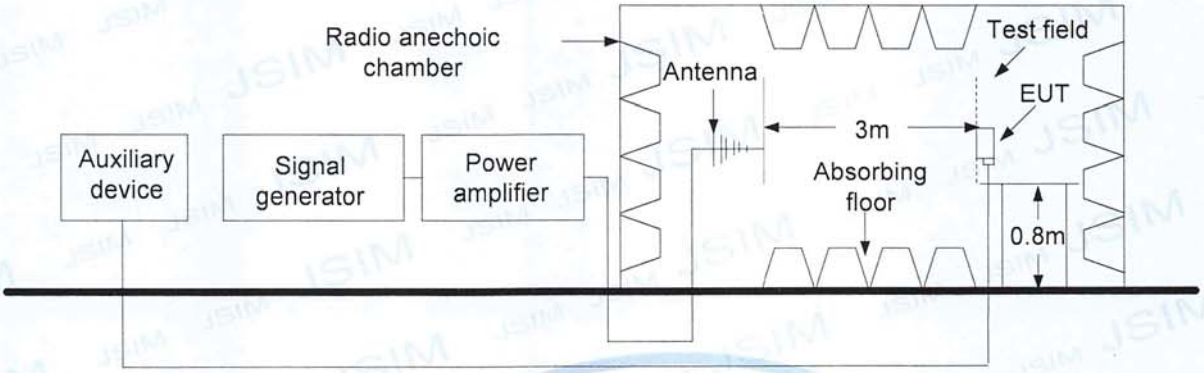




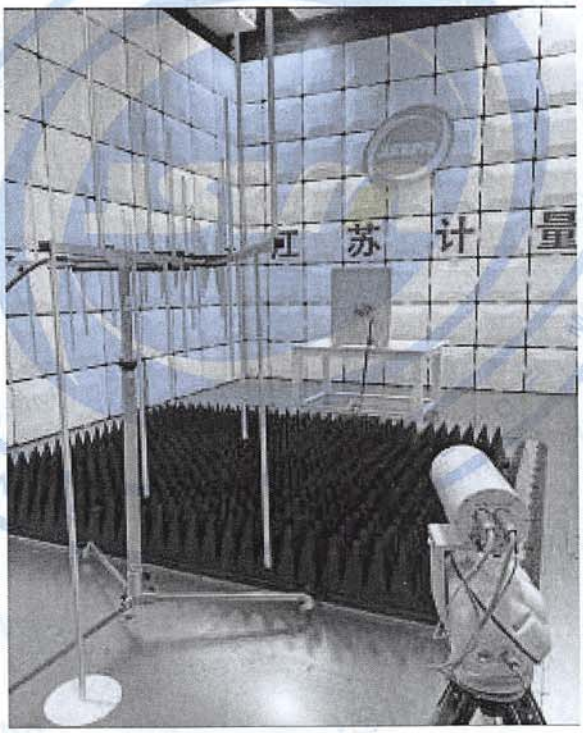
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附录 7
Appendix 7

1. 射频电磁场抗扰度试验布置图
Setup pic of Test of immunity to electromagnetic RF fields




2. 射频电磁场抗扰度试验布置照片
Test pic of Test of immunity to electromagnetic RF fields

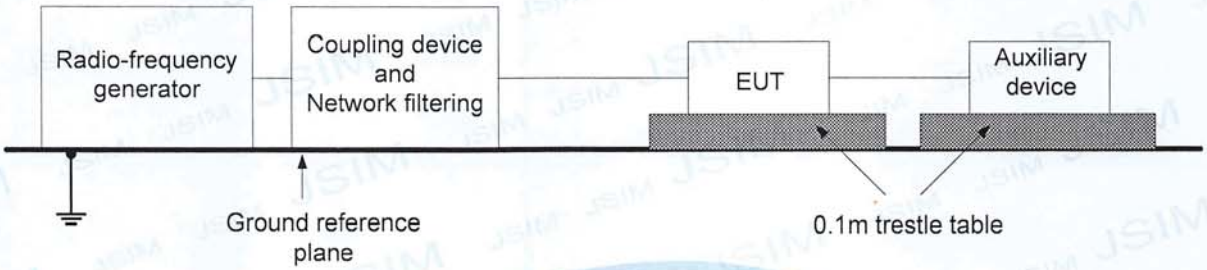




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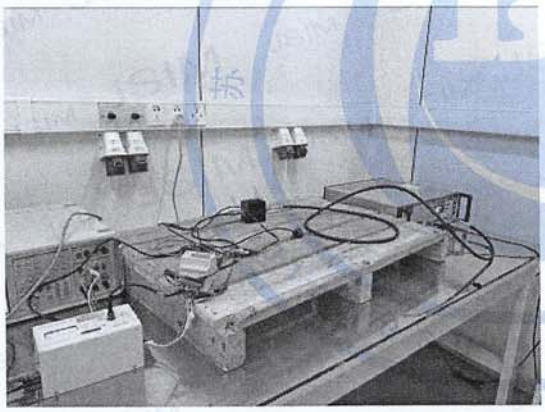
附录 8
Appendix 8

1. 射频场感应的传导骚扰抗扰度试验布置图
Setup pic of Test of immunity to conducted disturbances, induced by radio-frequency fields




2. 射频场感应的传导骚扰抗扰度试验布置照片
Test pic of Test of immunity to conducted disturbances, induced by radio-frequency fields

① 辅助电源线路 auxiliary circuits



② 电压电流线路 voltage and current circuits



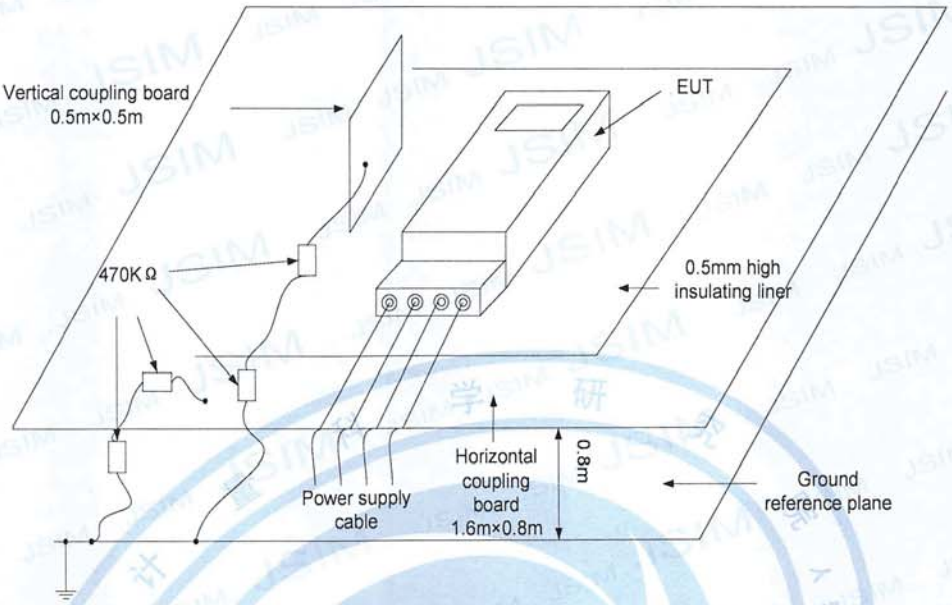


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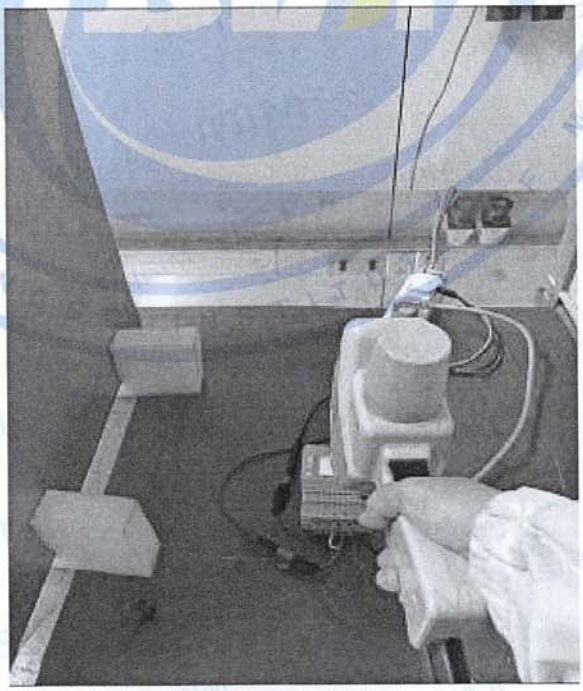
附录 9

Appendix 9

1. 静电放电抗扰度试验布置图
Setup pic of test of immunity to electrostatic discharges




2. 静电放电抗扰度试验布置照片
Test pic of test of immunity to electrostatic discharges

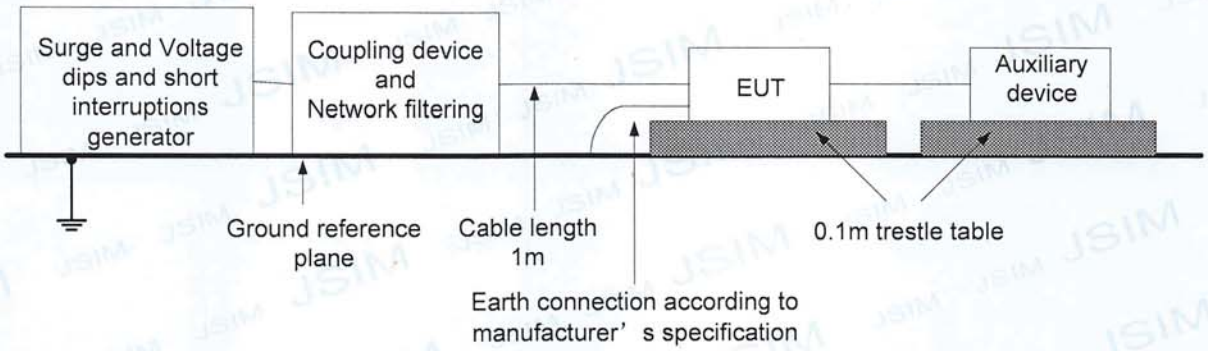




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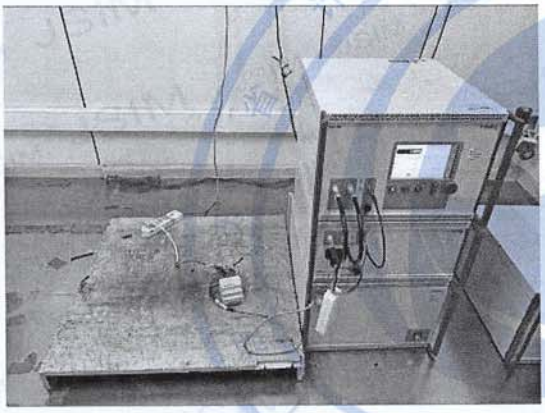
附录 10
Appendix 10

1. 浪涌抗扰度试验布置图
Setup pic of surge immunity test

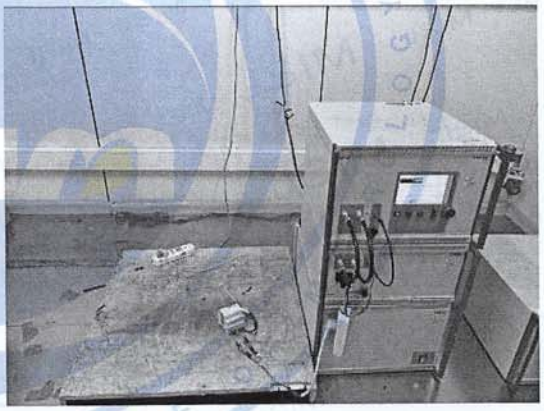



2. 浪涌抗扰度试验布置照片
Test pic of surge immunity test

① 辅助电源线路 auxiliary circuits



② 电压线路 voltage circuits



以下空白

End of Report



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# 注 意 事 项

## *Attention*

一、本检测报告未加盖本机构“检测专用章”或有数据涂改的均无效。

The report is invalid without an official stamp of Jiangsu Institute of Metrology (JSIM) or if tampered.

二、复制检测报告未重新加盖“检测专用章”的均为无效。

The report can not be copied in any form without JSIM's authorization.

三、对检测结果有异议者，请在收到本检测报告之日起十五日内向本机构提出。

Please make an objection to the test result within 15 days from you receipt the report.

四、委托检测，按照《检测业务委托合同》执行，其检测结果仅对检测样品负责。

This test is in accordance with the contract. The test result is valid only for the samples.

五、请在收到本报告时取回送样样品，逾期三个月不领且未提出处理意见的，将按本机构有关规定处理。

The samples will be returned at the same time you receipt the report. If the sample not be taken back more than three months without any handling opinions, JSMI will deal with the sample according to related regulations.

六、本检测报告无主检、审核、批准人签字无效。

The report is invalid without signatures of the tester, checker and approver.

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