

电磁兼容测试方案五：灯具类设备



图一：灯具类设备的磁场辐射发射测试

1. 概述

灯具类产品的电磁兼容测试。测试项目包括磁场辐射，电场辐射，电源线和控制线的骚扰电压。

受试设备举例：

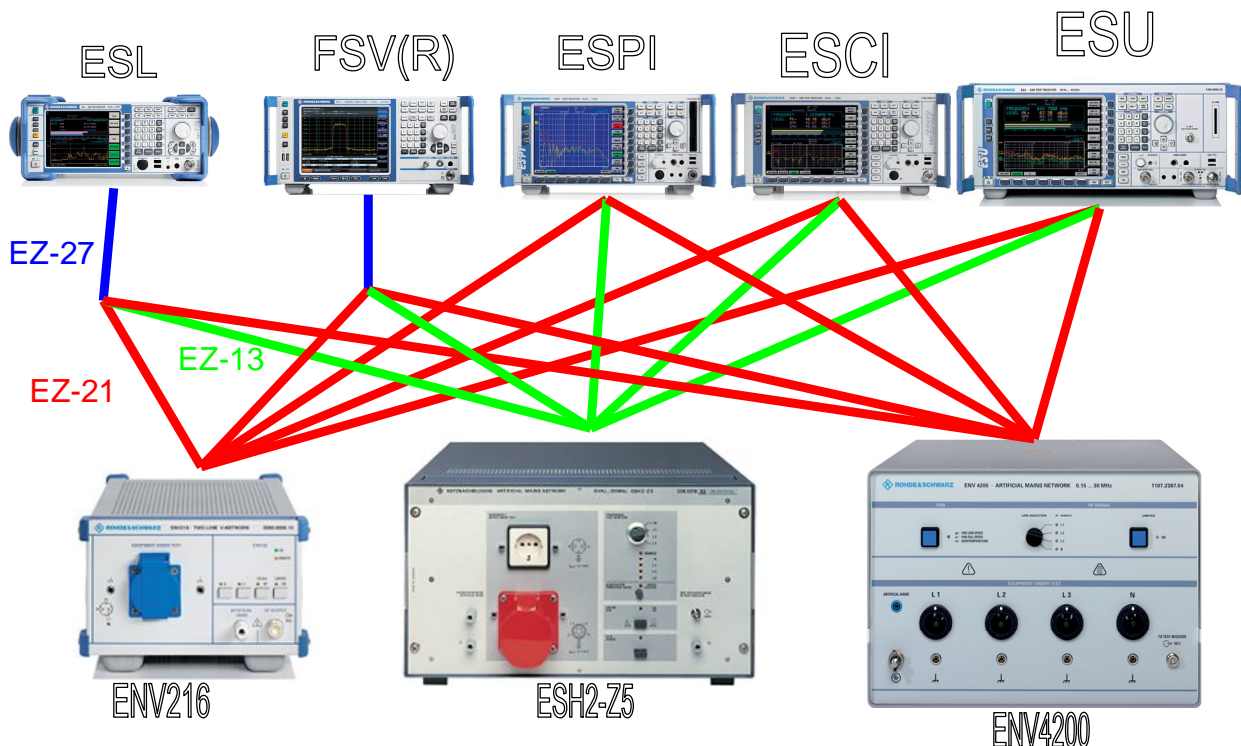
光源控制装置、电子镇流器、电子变压器、电子节能灯、无极灯，微波硫灯和新型的气体放电灯等。

2. 适用标准

GB 17743, CISPR15, EN55015

测试一般在暗室，开阔场或现场进行。而且标准提出也可以采用 CDN 的替代方法，节省了暗室的高成本。

- 磁场天线：如 R&S HM020。在 9kHz---30MHz 对受试设备进行磁场发射测试，X,Y,Z 三环可通过 R&S BG020 进行切换。
- 人工电源网络：R&S ESH2-Z5，R&S ENY216。其中 R&S ESH2-Z5 额定电流 $4 \times 25A$ ，R&S ENY216 额定电流 $2 \times 16A$ 。
- 电压探头：R&S ESH2-Z3，若受试设备有控制线，可采用此探头进行测试；此外，对大电流的电源线测试，若没有相应的 LISN，也可用此探头进行替代测试。
- 诊断测试近场探头：R&S HZ-14 或 R&S HZ-15，16。
- 测试电缆和连接器：射频电缆：50 欧姆的射频同轴电缆。接收机对人工电源网络的控制线缆：EZ-21，EZ-13，EZ-27。不同的接收机和人工电源网络的组合所需的自动切换控制线会有差异，见下图所示：



图三：传导骚扰自动控制连线配置

4. 成功案例:

- 天祥 (ITS) 上海
- 上海计量院 上海
- 浙江医疗 杭州
- 江苏医疗 杭州
- 时代之光 上海
- 常州质检所 常州
- 飞利浦 上海
- 阳光照明 厦门
- 东星电子 慈溪
- 立达信 厦门
- 富桦电子 上海
- 厦门质检 厦门

5. 详细方案配置:

接收机配置选项: 可选择 ESU, FSV(R) 或 ESCI, ESPI, ESL

Typ Type	Material	Designation
R&S® ESU26	1302.6005.26	EMI Test Receiver 20 Hz to 26.5 GHz -155 dBm to +30 dBm, RBW 1 Hz to 10 MHz, for certification to commercial and military standards, compliant to CISPR 16-1-1
R&S® ESU26-DKD	1302.6511.02	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ESU26 (order only with device)
R&S® ESU40	1302.6005.40	EMI Test Receiver 20 Hz to 40 GHz, -155 dBm to +30 dBm, RBW 1 Hz to 10 MHz, for certification to commercial and military standards, compliant to CISPR 16-1-1
R&S® ESU40-DKD	1302.6528.02	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ESU40 (order only with device)

R&S® ESU8	1302.6005.08	EMI Test Receiver 20 Hz to 8 GHz, -155 dBm to +30 dBm, RBW 1 Hz to 10 MHz, for certification to commercial and military standards, compliant to CISPR 16-1-1
R&S® ESU8-DKD	1302.6505.02	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ESU8 (order only with device)
R&S® FSU-B12	1142.9349.02	Option: Output attenuator for tracking generator for FSU, FSQ
R&S® FSU-B9	1142.8994.02	Option: Tracking generator for FSU and FSQ, 100 kHz - 3.6 GHz
R&S® ESU-B18	1303.0400.06	Option: Removable Hard Disk(Flash Card), operating system WinXP (Factory installation only)
R&S® ESU-B19	1303.0600.06	Option: 2nd hard disk (Flash Card) for ESU-B18 incl. ESU firmware Operating system WinXP
R&S® ESU-B24	1157.2100.08	Option: Internal preamplifier 100kHz to 8GHz; gain 30dB nominal (For EMI Test Receiver R&S® ESU8; retrofitting requires re-calibration)
	1157.2100.26	Option: Internal preamplifier 100kHz to 26.5GHz; gain 30dB nominal (For EMI Test Receiver R&S® ESU26; retrofitting requires re-calibration)
	1157.2100.40	Option: Internal preamplifier 100kHz to 40GHz; gain 30dB nominal (For EMI Test Receiver R&S® ESU40; retrofitting requires re-calibration)
R&S® ESU-DCV	T000.0002.96	Documentation of calibration values ESU Please order: DCV-2 /Mat.No.: 0240.2193.09
R&S® ESU-K53	1305.8509.02	Option: Time Domain Scan FFT based scan for very fast overview measurements
R&S® ESCI	1166.5950.03	EMI Test Receiver for certification to commercial

		standards, 9 kHz to 3 GHz, CISPR 16-1-1 compliant
R&S® ESCI7	1166.5950.07	EMI test receiver, 9kHz to 7GHz, for certification measurements to commercial standards, compliant to basic standard CISPR 16-1-1
R&S® FSP-B9	1129.6991.02	Tracking generator for FSP 9 kHz - 3 GHz, I/Q modulator
R&S® FSP-B16	1129.8042.03	LAN interface 10/100 base T for FSP 1164.4391.XX and ESPI 1164.6407.XX
R&S® ESCI7DKD	1161.2646.07	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ESCI7 (order only with device)
R&S® ESCI-B20	1155.1606.14	Extended environment specification for ESCI/ESCI7 (Random Vibration 1.9G RMS; temperature 0 to 55°C), no retrofitting, only for instruments with FMR7
R&S® ESCI-DCV	T000.0002.80	Documentation of calibration values ESCI/ESCI7 Please order: DCV-2 /Mat.No.: 0240.2193.09
R&S® FSP-B30	1155.1158.02	DC power supply 12 - 28 V for FSP spectrum analyzer and ESPI test receiver
R&S® FSP-B31	1155.1258.02	NiMH battery pack + charger for FSP and ESPI requires FSP-B1 and FSP-B30
R&S® FSP-B32	1155.1506.02	Spare battery pack (NiMH) for FSP spectrum analyzer and ESPI test receiver
R&S® ESCI-DKD	1161.2646.02	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ESCI (order only with device)
R&S® ESPI3	1164.6407.03	EMI Test Receiver 9 kHz to 3 GHz, for precertification to commercial standards
R&S® ESPI3DKD	1161.2546.02	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000,

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Department: Product Support

Document type: Internal document

Ref: PSD-DD-1205

By: Ding Ding

		for R&S®ESPI3 (order only with device)
R&S® ESPI7	1164.6407.07	EMI Test Receiver 9 kHz to 7 GHz, for precertification to commercial standards
R&S® ESPI7DKD	1161.2552.02	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ESPI7 (order only with device)
R&S® ESPI-B2	1129.7498.03	Option: Preselector and preamplifier for R&S®ESPI3, R&S®ESPI7; factory installation
R&S® FSP-B16	1129.8042.03	LAN interface 10/100 base T for FSP 1164.4391.XX and ESPI 1164.6407.XX
R&S® ESPI-B20	1155.1606.13	Extended environment specification (Random Vibration 1.9G RMS; temperature 0 to 55°C), no retrofitting (for ESPI3, ESPI7)
R&S® FSP-B30	1155.1158.02	DC power supply 12 - 28 V for FSP spectrum analyzer and ESPI test receiver
R&S® FSP-B31	1155.1258.02	NiMH battery pack + charger for FSP and ESPI requires FSP-B1 and FSP-B30
R&S® FSP-B32	1155.1506.02	Spare battery pack (NiMH) for FSP spectrum analyzer and ESPI test receiver
R&S® ESPI-DCV	T000.0002.54	Documentation of calibration values ESPI3/7 Please order: DCV-2 /Mat.No.: 0240.2193.09
R&S® ESL3	1300.5001.03	EMI Test Receiver 9 kHz to 3 GHz, for precompliance measurements
	1300.5001.13	EMI Test Receiver 9 kHz to 3 GHz, for precompliance measurements, with built-in tracking generator up to 3 GHz
R&S® ESL3-DKD	1303.6044.33	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ESL3, spectrum analysis only (order only with device)
R&S® ESL6	1300.5001.06	EMI Test Receiver 9 kHz to 6 GHz,

		for precompliance measurements
	1300.5001.16	EMI Test Receiver 9 kHz to 6 GHz, for precompliance measurements, with built-in tracking generator up to 6 GHz
R&S® ESL6-DKD	1303.6044.36	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ESL6, spectrum analysis only (order only with device)
R&S® FSL-B10	1300.6208.02	GPIO interface
R&S® FSL-B22	1300.5953.02	RF preamplifier, gain 20 dB (software license)
R&S® FSL-B30	1300.6308.02	DC power supply 12 - 28 V
R&S® FSL-B31	1300.6408.02	NiMH battery pack
R&S® FSL-B5	1300.6108.02	Additional interfaces video/IF-output, power meter 28 V - DC for noise source
R&S® ESL-DCV	T000.0003.34	Documentation of calibration values ESL Please order: DCV-1 / Mat.No.: 0240.2187.09
R&S® FSV13	1307.9002.13	Signal Analyzer 10Hz to 13,6 GHz, -154 dBm to 30 dBm, resolutionbandwidth 1 Hz to 10 MHz, Touchscreen
R&S® FSV13-DKD	1303.6038.13	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®FSV13 (order only with device)
R&S® FSV3	1307.9002.03	Signal analyzer 10Hz to 3.6GHz, -154dBm to 30dBm, Resolutionbandwidth 1Hz to 10MHz, Touchscreen
R&S® FSV30	1307.9002.30	Signal and Spectrum Analyzer 10Hz to 30GHz, -154dBm to 30dBm, resolutionbandwidth 1Hz to 10MHz, Touchscreen
R&S® FSV30-DKD	1303.6038.30	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®FSV30 (order only with device)
R&S® FSV3-DKD	1303.6038.03	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®FSV3

		(order only with device)
R&S® FSV40	1307.9002.39	Signal and spectrum analyzer, 10Hz to 40GHz, -154dBm to +30dBm, resolution bandwidth 1Hz bis 10MHz, touchscreen
	1307.9002.40	Signal and spectrum analyzer, 10Hz to 40GHz, -154dBm to +30dBm, resolution bandwidth 1Hz to 28(40)MHz, touchscreen
R&S® FSV40-DKD	1303.6038.40	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®FSV40 (order only with device)
R&S® FSV7	1307.9002.07	Signal analyzer 10Hz to 7GHz, -154dBm to 30dBm, Resolutionbandwidth 1Hz to 10MHz, Touchscreen
R&S® FSV7-DKD	1303.6038.07	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®FSV7 (order only with device)
R&S® FSV-B10	1310.9551.02	External generator control
R&S® FSV-B21	1310.9597.02	LO/IF connections for external mixers (FSV30 / FSV40)
R&S® FSV-B22	1310.9600.02	RF Preamplifier 20 dB, 9 kHz to 7 GHz
R&S® FSV-B24	1310.9616.13	RF preamplifier 9kHz to 13GHz (for R&S® FSV13 only) not installable post factory
	1310.9616.30	RF preamplifier 9kHz to 30GHz (for R&S® FSV30 only) not installable post factory
	1310.9616.40	RF preamplifier 9kHz to 40GHz (for R&S® FSV40 only) not installable post factory
R&S® FSV-B25	1310.9622.02	Electronic attenuator, 1 dB steps
R&S® FSV-B29	1310.9639.02	Frequency extension to 20Hz (retrofitable in service center only)
R&S® FSV-B3	1310.9516.02	Option: AM/FM demodulator for listening; includes loudspeaker, plug for headphone and volume control
R&S® FSV-B4	1310.9522.02	Option: OCXO, precision frequency reference Aging per year: 0.1 ppm

		Temp. drift: 0.1 ppm (5 to 45 °C)
	1310.9522.03	Option: OCXO, precision frequency reference, aging per year: 0.1 ppm improved specification of temp. drift: 0.01ppm (5 to 40°C)
R&S® FSV-B5	1310.9539.02	Option: Additional interfaces. IF/Video/AM-FM-demod. output, AUX port, trigger output, 2 additional USB(A) connectors
R&S® FSV-B9	1310.9545.02	Tracking generator. 100 kHz - 7 GHz (R&S®FSV7/13/30/40); 100 kHz - 3.6 GHz (R&S®FSV3)
R&S® FSV-K14	1310.8255.02	Spectrogram measurement application
R&S® FSV-K54	1310.0425.02	EMI application for diagnostic of RF interference with spectrum analyzers R&S®FSV and real-time spectrum analyzers R&S®FSVR, R&S®ES-SCAN recommended (software license)
R&S® FSVR13	1311.0006.13	Real-Time spectrum analyzer, 10 Hz to 13GHz, 40MHz bandwidth, signal and spectrum analyzer, 10 Hz to 13GHz
R&S® FSVR13DKD	1303.6050.13	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®FSVR13 (order only with device)
R&S® FSVR30	1311.0006.30	Real-Time spectrum analyzer, 10 Hz to 30GHz, 40MHz bandwidth, signal and spectrum analyzer, 10 Hz to 30GHz
R&S® FSVR30DKD	1303.6050.30	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®FSVR30 (order only with device)
R&S® FSVR40	1311.0006.40	Real-Time spectrum analyzer, 10 Hz to 40GHz, 40MHz bandwidth, signal and spectrum analyzer, 10 Hz to 40GHz
R&S® FSVR40DKD	1303.6050.40	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000,

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Department: Product Support

Document type: Internal document

Ref: PSD-DD-1205

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		for R&S®FSVR40 (order only with device)
R&S® FSVR7	1311.0006.07	Real-Time spectrum analyzer, 10 Hz to 7GHz, 40MHz bandwidth, signal and spectrum analyzer, 10 Hz to 7GHz
R&S® FSVR7-DKD	1303.6050.07	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®FSVR7 (order only with device)

附件及软件配置选项:

Typ Type	Material	Designation
R&S® BG020	4024.1002.02	Control Unit to HM020 Antenna needed, if a measurement receiver without user port is applied
R&S® EMC32-EB	1300.7010.02	EMI measurement software; basic version for commercial and military standards; hardlock protection. Operating system: Win7 or Vista (32/64 bit), XP SP3; english versions (software license)
R&S® EMC32-K10	1117.6840.02	Option EMI Auto Test for EMC32-EB
R&S® ENV216	3560.6550.12	2-Line V-Network, 9kHz to 30 MHz, 16A continuous current, for disturb. voltage measurements, Mains connectors for Germany, incl. calibration certificate and report
	3560.6550.13	2-Line V-Network, 9kHz to 30 MHz, 13A continuous current, for disturb. voltage measurements, Mains connectors for United Kingdom, incl. calibration certificate and report
	3560.6550.14	2-Line V-Network, 9kHz to 30 MHz, 16A continuous current, for disturb. voltage measurements, Mains connectors for France, incl. calibration certificate and report
	3560.6550.15	2-Line V-Network, 9kHz to 30 MHz, 10A continuous current, for disturb. voltage measurements, Mains connectors for China/Australia, incl. calibration certificate and report
	3560.6550.16	2-Line V-Network, 9kHz to 30 MHz, 15A continuous current, for disturb. voltage measurements, Mains connectors for USA, incl. calibration certificate and report

R&S® ENV216DKD	1161.2623.02	DAkks(formerly DKD) calibration according to ISO 17025 and ISO 9000, for R&S®ENV216 (order only with device)
R&S® ENV4200	1107.2387.04	4 line V-network, continuous current 200 A; 0.15 to 30 MHz; remote controllable (TTL); incl. calibration certificate and test report
R&S® ESH2-Z2	0299.7210.52	Accessory: Active voltage probe 9 kHz to 30 MHz, voltage division factor 10 dB incl. calibration certificate and report
R&S® ESH2-Z3	0299.7810.56	Accessory : Passive voltage probe 9 kHz to 30 MHz, voltage division factor 30dB, incl. calibration certificate and report
R&S® ESH2Z31	0827.6513.06	Attenuator for R&S®ESH2-Z3 for determination of RFI source impedance in accordance with CISPR16-2-1. (Accessory, replaces model 02)
R&S® ESH2-Z5	0338.5219.53	4 line V-network, 9 kHz to 30 MHz, continuous current 25 A, remote control (TTL) incl. calibration certificate and report
R&S® ESH3-Z2	0357.8810.54	Pulse limiter 0 - 30 MHz N-type connector incl. calibration certificate and report
R&S® ES-SCAN	1308.9270.02	EMI Software for EMI Test Receivers R&S®ESL, R&S®ESPI, R&S®ESCI and Analyzers R&S®FSL, R&S®FSP, R&S®FSV; incl. VISA software interface from National Instruments
R&S® EZ-13	1026.5293.02	Accessory: Control cable 2 m length; from ESCS/ESIB/ESPI/ESCI/ESU/ESL to ESH2-Z5; fits with EZ-5/EZ-6; ESL additionally requires adapter EZ-27 and option FSL-B5
R&S® EZ-21	1107.2087.03	Accessory: Control cable 3 m length; from ESxS/ESIB/ESPI/ESCI/ESU/ESL to ENV216/ENV4200; ESL additionally requires adapter EZ-27

		and option FSL-B5
	1107.2087.10	Accessory: Control cable 10 m length; from ESxS/ESIB/ESPI/ESCI/ESU/ESL to ENV216/ENV4200; ESL additionally requires adapter EZ-27 and option FSL-B5
R&S® EZ-26	1142.8320.02	Test-/Calibration adapter for ENV4200
R&S® EZ-27	1142.8271.02	Adapter for control cable R&S®EZ-21/EZ-13 for remote control of R&S V-networks(LISNs) by R&S EMI Test Receiver R&S®ESL
R&S® EZ-5	0816.0625.03	Accessory: Control cable 10 m from ESxI/ESIB/ESPI/ESCI/ESU to ESH2-Z5 (in shielded room)
R&S® HF907	4070.7000.02	Double-ridged waveguide horn antenna 800 MHz to 18 GHz, linear polarized broadband transmitting/receiving antenna N-female including individual calibration
R&S® HFU2-Z4	0252.0090.56	Accessory: RF connecting cable 12 meters; N-connectors, with common mode suppression, for measurements up to 1 GHz
R&S® HFU2-Z5	0252.0055.56	Accessory: RF connecting cable 7 meter, N-connectors, with common mode suppression, for measurements up to 1 GHz
R&S® HK116	4000.7752.02	Biconical Antenna 20MHz to 300MHz, N-female with adapter for tripod HZ-1 including individual calibration
R&S® HL223	4001.5501.02	Log-Periodic Broadband Antenna 200MHz to 1300MHz with adapter for tripod HZ-1 N-female including individual calibration
R&S® HL562	4041.3000.02	ULTRALOG Antenna Combined Biconical and Log-Periodic Broadband Antenna 30 MHz to 3000 MHz N-female, for applications in

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Department: Product Support

Document type: Internal document

Ref: PSD-DD-1205

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		anechoic chambers also suitable for EMS including individual calibration
R&S® HL562Z1	4041.3900.02	Tripod for HL562 ULTRALOG Antenna movable
R&S® HM020	4023.4508.02	Triple Loop Antenna 9kHz to 30MHz, N-female system van Veen/Bergervoet including individual calibration
R&S® HM020Z1	4023.5504.02	Basic Pedestal for HM020 Triple Loop Antenna for DUT support
R&S® HM020Z2	4023.5604.02	Adapter Pedestal for HM020 Triple Loop Antenna for raising up the DUT from HM020Z1 Basic Pedestal
R&S® HM020Z3	4023.5704.02	Calibration Dipole to HM020 Triple Loop Antenna
R&S® HZ-1	0837.2310.02	Wooden tripod as antenna mount for EMC measurements with HFH2-Z6, HK116, HL223 and HUF-Z4
R&S® HZ-14	1026.7744.03	Probe set for E and H near-field measurements, 9kHz to 1GHz
R&S® HZ-15	1147.2736.02	Probe set for E and H nearfield emissions 30 MHz to 3 GHz
R&S® HZ-16	1147.2720.02	Preamplifier 100 kHz to 3 GHz, 20 dB power supply 100 - 230 V for probe HZ-15