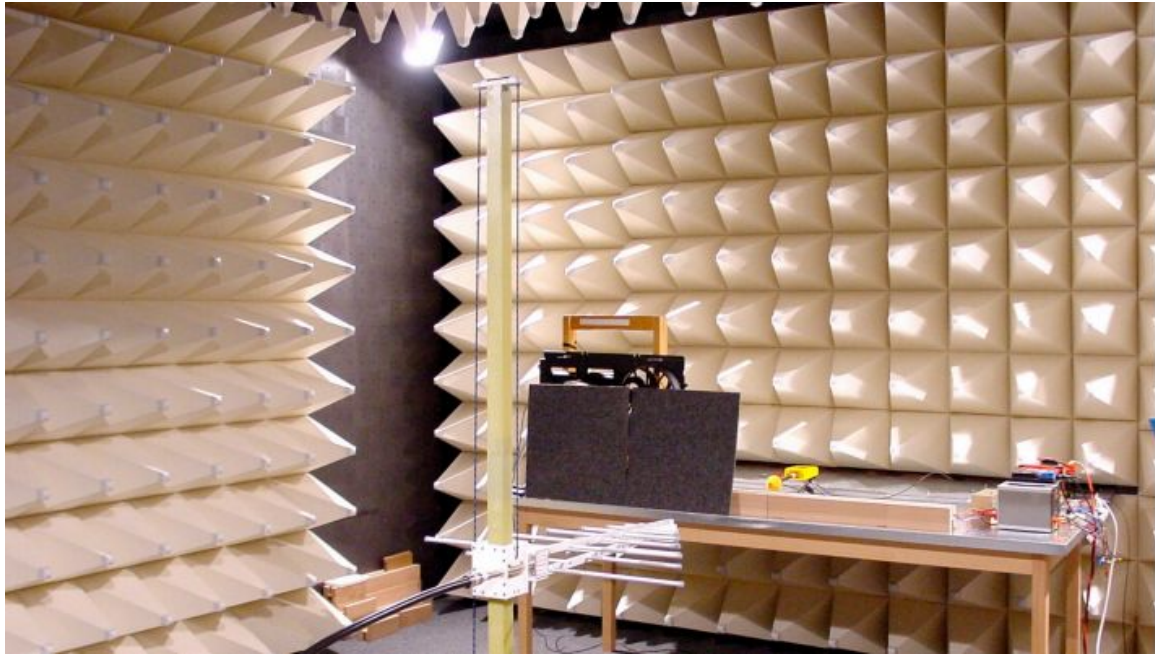


电磁兼容测试方案（EMI 部分）：汽车零部件设备



图一：汽车零部件设备的辐射发射测试现场

1. 概述

汽车零部件的电磁兼容测试。测试项目包括电场、磁场辐射，电源线和控制线的骚扰电压和骚扰电流，以及传导瞬态发射测试。

受试设备举例，如：

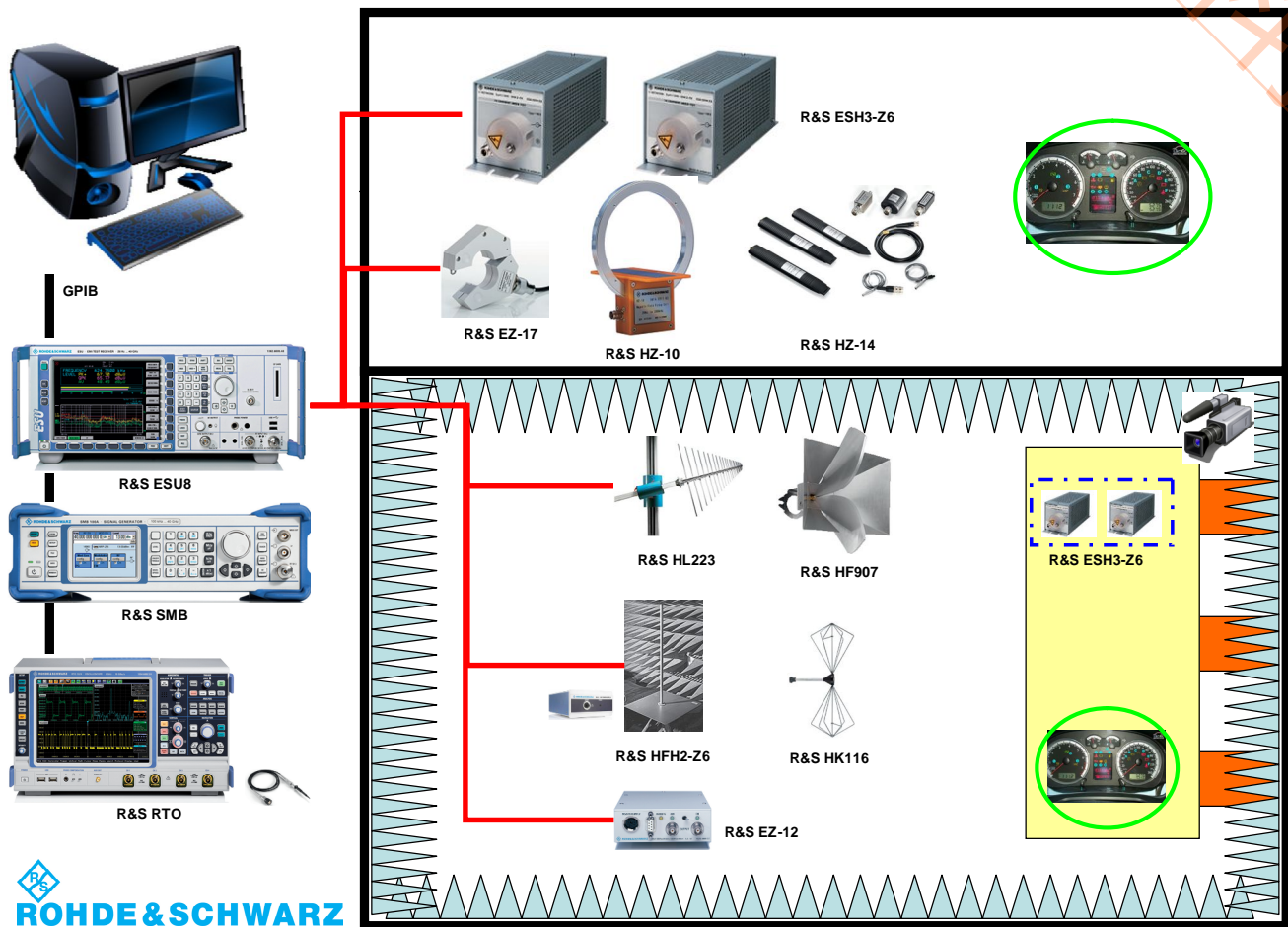
车载收音机，车载 VCD,DVD，车载音响，雨刮等。

2. 适用标准

GB/T18655, CISPR25, EN55025, ISO7637, GMW, FORD

3. 系统配置框图

本测试方案可以根据用户需求，选择不同的仪器、软件及附件。本系统的软硬件为最优配置，软件具有友好的用户界面，操作者易于掌握和操作，而且与认证实验室的测量结果有较好的可比性。



图二：汽车零部件设备的 EMI 测试配置框图

测试软硬件要求：

- 测试接收机：R&S ESx 系列的测试接收机为本测试系统的核心。以上框图以 R&S ESU8 为例，实际可采用 R&S ESU, R&S ESCI 和 R&S ESPI, ESL 以及 FSV(R)，接收机的选择是预认证测试与认证测试的主要差别所在。
- 示波器：对 ISO7637 的瞬态测试，采用示波器 R&S RTO 和对应的电压探头，即可满足 ISO7637 标准规定的瞬态发射测试，同时也可以用于此示波器进行抗扰度干扰信号的计量和检测。
- 测试软件：系统可通过电脑软件 R&S EMC32(或 R&S ES-SCAN)对测试进行远程控制。R&S EMC32 和 R&S ES-SCAN 都可支持 GPIB (National Instrument 公司) 和 LAN 口。
- 接收天线：如 R&S HFH2-Z6 (采用 HZ-9 供电), R&S HK116, R&S HL223, 和 R&S HF907。其中各自频率分别对应 9kHz---30MHz, 20MHz---300MHz, 200MHz---1.3GHz, 1GHz---18GHz。这些测试一般在暗室中进行。某些车厂标准还需要进行低频磁场发射的测试，可采用 HZ-10 的环天线。
- 人工电源网络：R&S ESH3-Z6，此网络是专用与车载产品的 LISN，其电感为 5uH，区别于其他产品的

LISN 为 50uH。可用于传导骚扰和辐射骚扰的测量。

- 电流探头：若受试设备带有控制线，则可采用电流探头 R&S EZ-17（02 版）进行骚扰电流的测试。
- 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： 50 欧姆的射频同轴电缆。

4. 成功案例：

客户名称	地点
ITS2	上海
SGS	上海
上海机动车检测中心	上海
中国汽车工程研究院	重庆
乐来汽车	上海
大陆汽车	上海
一汽研究院	长春
福特汽车	南京
联合汽车电子	上海
国家汽车质量监督检验所	长春
延峰伟世通	上海
国家摩托车质量监督检验中心	西安
日用友捷	上海
上海沪工汽车电器有限公司	上海
上海通用汽车/泛亚汽车技术中心	上海
厦门质检	厦门
江苏计量院	南京
福州中检所	福州
上海计量院	上海
自动化仪表所	上海

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

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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)

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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, 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

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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	GPIB 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

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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, 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® 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® EMC32-K22	1117.7646.02	Measurement of antenna characteristic (azimuth chart)
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® ESH3-Z6	0836.5016.52	Single-phase V-network, 5 μ H/50 Ohm, frequency range 0.1 to 200 MHz, up to 150 A continuous current, 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-12	1026.4800.03	Antenna impedance converter for RFI voltage measurements at vehicle antennas incl. calibration certificate and report
R&S® EZ-17	0816.2063.02	Accessory: RF current probe 20 Hz to 100 MHz for emission measurements incl. calibration certificate and report
	0816.2063.03	Accessory: RF current probe 20 Hz to 100 MHz for immunity measurements incl. calibration certificate and report
R&S® HF907	4070.7000.02	Double-ridged waveguide horn antenna 800 MHz to 18 GHz, linear polarized

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		broadband transmitting/receiving antenna N-female including individual calibration
R&S® HFH2-Z6	0837.1866.54	Active rod antenna 9 kHz - 30 MHz according to MIL and DEF standards incl. calibration certificate and report
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® 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
R&S® HZ-3	0837.3469.02	Accessory: Supply cable length 3 m for HFH2-Z1, HFH2-Z2, HFH2-Z3, HFH2-Z6 and EZ-12
R&S® HZ-4	0816.0519.02	Accessory: Supply-cable (10 m) for HFH2-Z1, HFH2-Z2, HFH2-Z3, HFH2-Z6 and EZ-12
R&S® HZ-9	0816.1015.03	Power supply for active antennas and

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		EMI accessories (stand alone operation), for R&S®HFH2-Z2/Z6, R&S®ESH2-Z2, R&S®EZ-12 and R&S®HZ-14
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