

Keeping Up with Changes to EMI and EMS Test

This newsletter is to inform all R&S representatives and interested customers about new developments in CISPR product standards, arising from changes to EMI and EMS compliance measurements. The newsletter is published regularly after the annual CISPR meeting and additionally if major changes in CISPR product standards take place. The newsletter is structured by the product standard number and describes for each standard;

- the currently valid edition,
- new amendments,
- potential maintenance items,
- whether the amendments shall be published as a European EN standard,
- Date of mandatory use in the European Economic Area (EEA).

Product Standards in this Issue

[CISPR 11](#)

EMI - industrial, scientific and medical equipment

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Which Standard Applies? CISPR Publication Levels

The International Special Committee on Radio Interference (CISPR = "Comité International Spécial des Perturbations Radioélectriques") is a technical committee of the International Electro-technical Commission established in 1933 to protect radio reception from interference. The committee has sub-committees that fulfill both product and basic standardization roles.



The 3 levels of CISPR publications. On the basic level, CISPR 16 defines the measurement apparatus, and how measurements shall be made. How and when changes in CISPR 16 apply to individual product test, is determined by the appropriate product standard.

CISPR publications are structured in 3 levels; basic, generic and product standards.

Basic Standards:

(CISPR sub-committee A)

The CISPR 16 series, made up of 17 parts. It defines apparatus, methods, uncertainty, and test facilities.

Generic Standards:

(CISPR sub-committee H)

The IEC 61000-6 series, composed of 2 parts for both emission measurements and immunity testing, for both residential and industrial environments. Sets limits through an interference model

Product Standards:

(CISPR sub-committees B, D, F, I)

Product and product-family standards for both emission measurements and immunity testing. Provides product-specific requirements, such as operation and arrangement of the EUT, measurement methods, and uncertainty, and permitted deviations for limits.

Major Changes to Product Standards

- The fast FFT-based time-domain scan for EMI receivers such as the R&S@ESW, ESU and ESR is applicable for EMI compliance measurements for CISPR 11, 13, 15, and 32. CISPR 14-1 and 25 will follow in 2016, CISPR 12 in 2017.
- CISPR 11, 13, 15, and 22 have updated the references to CISPR 16 needing new requirements for LISNs (attenuation, isolation, phase) and the procedure to evaluate the influence on radiated disturbance measurements of the set-up table material. Also required by CISPR 32, CISPR 14-1 will follow in 2016.
- The RMS-Average detector as an alternative to quasi-peak and average detector for conducted and radiated disturbance measurements is added to CISPR 13, probably in future to CISPR 14-1 and 32. The corresponding EN 55013:2013 was listed in the Official Journal of the EU on 25 February 2014.
- Measuring radiated disturbance from 30-1000 MHz is mandatory in Europe since 1 May 2012 for testing household appliances and tools according to CISPR 14-1. Or use the disturbance power method for mains powered equipment if the highest internal frequency is under 30 MHz.
- Measuring radiated disturbance from 30 MHz to 300 MHz is mandatory for lighting and similar equipment according to CISPR 15. Alternatively, use the CDN(E) method.
- CISPR 11 and 15 need the full treatment of measurement instrumentation uncertainty (MIU) according to CISPR 16-4-2. Requirements to calculate MIU are incorporated in CISPR 13, 14-1, 22, & 32. CISPR 12 will follow in 2017.
- The linear average detector with meter time constant (CISPR-Average) for radiated disturbance measurements above 1 GHz is now required in CISPR 22, 32 and in future to CISPR 25.
- The new product family standard for multimedia equipment CISPR 32 was updated in March 2015. Measuring radiated disturbance from 30-1000 MHz is applicable in FAR now. CISPR 32 replaces CISPR 13, CISPR 22, and EN 55103-1 on 5 March 2017.

CISPR 11

Industrial, scientific and medical equipment - disturbance measurements

Product committee CISPR/B: Interference relating to industrial, scientific and medical (ISM) radio-frequency apparatus, to other (heavy) industrial equipment; to overhead power lines; to high voltage equipment and to electric traction.

What's New in the 6th Edition (June 2015)?

- This sixth edition of CISPR 11 cancels and replaces the fifth edition published in 2009 and its Amendment 1 (2010).
- **Induction cooking appliances** are being transferred from CISPR 11 to CISPR 14-1. Currently, users can choose CISPR 11 or CISPR 14-1.
- References to the basic standard series CISPR 16 were updated to make the FFT-based time-domain scan of EMI receivers such as the **R&S®ESW, ESU or ESR** applicable for EMI compliance measurements.
- General maintenance had set limits for magnetic field measurements for "small equipment" of Class A Group 2 from 150 kHz - 30 MHz at 3 m. One set of peak limits (CW type) were added for all Group 2 equipment operating above 400 MHz (relaxed limits in table 12 were deleted).
- **Figures for EUT arrangement and routing of cables including the use of common mode absorption devices (CMADs) such as R&S®EZ-24** are introduced for radiated disturbance measurements on small size equipment (distance 3 m), see Figure.
- For radiated disturbance measurements from 1–18 GHz, test sites shall meet the SVSWR criterion (Clause 8 CISPR 16-1-4).
- Requirements for testing **Grid Connected Power Conditioners (GCPC)** were added. The concept of component testing is used for assessing conducted RF disturbance at the DC input power port of GCPC using an artificial network for the DC port (150 Ω DC-AN). The proposed limits apply only to GCPC for use in photovoltaic generating systems. A joint task force with committee CISPR/A was established for validating the DC-AN and the measurement method including the appropriate uncertainty.
- APD method and associated limits for assessment of fluctuating RF disturbances in the range above 1 GHz were added. The **amplitude probability distribution (APD) measurement function** is applicable as alternative to the established Log-AV detector for radiated disturbance measurements on microwave ovens from 1-18 GHz. The oven under test is operated at its maximum microwave power. The weighted APD measurement is made at the highest peak found by preliminary peak measurements in each frequency band (Band I: 1005 MHz – 2395 MHz, Band II: 2505 MHz – 17995 MHz, outside 5720 MHz – 5880 MHz). Measuring at the preliminary peak and ±10 MHz is sufficient. The three frequencies can be measured in sequence.
- The publication of EN 55011:2016 (sixth edition) was ratified by the European Commission on 15 February 2016. The date of withdrawal of the fifth Edition was set as 15 February 2019; this means the sixth Edition becomes mandatory on **15 February 2019 in the European Economic Area.**

What's coming in future amendments to Edition 6?

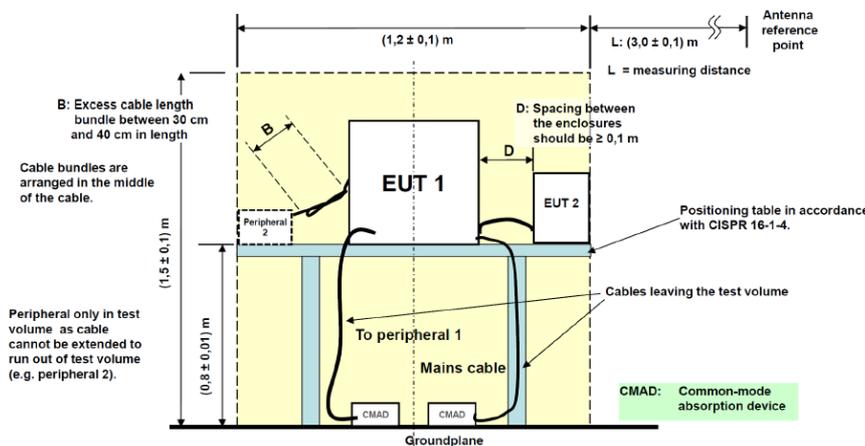
Fully anechoic room (FAR) according to CISPR 16-1-4 and measurement method according to CISPR 16-2-3 will be added for field measurements of frequencies below 1 GHz. Publication of Amendment 1 is scheduled for 2016.

Amplitude Probability Distribution or Log-AV Detector?

A worldwide measurement campaign for APD was conducted to compare results with the established measurement method. The R&S®ESU was one of the approved APD measuring receivers used in Europe, Korea and Japan. The **R&S®ESW** and ESR are also suitable for the measurements.



R&S®ESW; the right choice for APD measurements.



EUT arrangement and routing of cables including the use of common mode absorption devices (CMADs) such as R&S®EZ-24 (Source: CISPR 11:2015)

CISPR 12

Automotive equipment - protection of off-board receivers - disturbance measurements

Product committee CISPR/D: Electromagnetic disturbances related to electric/electronic equipment on vehicles and internal combustion engine powered devices.

What's New in the 6th Edition? (May 2007)

- This sixth edition cancels and replaces the fifth edition published in 2001 and its Amendment 1 (2005).
- It has deleted the determination of narrowband/broadband disturbances. Instead measurements are now performed with both an average detector and a peak or quasi-peak detector. **Both the CISPR-AV detectors with meter time constant, and the linear AV detector are applicable.**
- CISPR 12 was published in Europe as EN 55012:2007, and ratified by the European Commission on 1 September 2007. The date of withdrawal of the 5th edition was set to 1 September 2010, this means the **6th edition became mandatory on 1 September 2010 in the European Economic Area**. It has legal status only for devices equipped with internal combustion engines, e.g. chainsaws, water pumps, snow blowers, air compressors, etc.

Amendment 1 to 6th Edition of CISPR 12 (January 2009)

- Industrial floor cleaning machines (battery and internal combustion powered) covered by IEC 60335-2-72 are added to the scope of CISPR 12 by this amendment. The flowchart in Annex G for checking the applicability has been adopted accordingly. Radio disturbance measurement for such machines are required for the first time.
- In addition the amendment includes an explicit exclusion for floor cleaning machines used in residences, and other household appliances as such equipment is covered by CISPR 14-1.
- The amendment was published in Europe as Amendment 1:2009 to EN 55012:2007, and was ratified by the European Commission on 1 July 2009. The date of withdrawal was set to 1 July 2012, this means the amendment became mandatory on **1 July 2012 in the European Economic Area**. Again, it has legal status only for devices equipped with internal combustion engines, e.g. chainsaws, water pumps, snow blowers, air compressors, etc.



A vehicle being tested to CISPR 12, for interference to objects outside the vehicle.

What's Coming in Edition 7?

- The references to the basic standard series CISPR 16 will be updated to make the **fast FFT-based time-domain scan of EMI receivers such as the R&S®ESW, ESU or ESR** applicable for EMI compliance measurements.
- For the limits given in CISPR 12, the appropriate average detector is the **CISPR-AV detector** with meter time constant. The alternative pure linear AV detector will be deleted.
- The antenna position for emission measurements on vehicles and other devices will be aligned. Proposed is to define the centre position of the EUT as the reference point if the 3 dB beam of the antenna covers the entire EUT; otherwise multiple antenna positions are necessary.
- Measurements in engine running mode of electric and hybrid vehicles: Constant speed 40 km/h \pm 20%, or the top speed if less than 40 km/h, without load, on a dynamometer. But speed and load may have significant influence on the emission result.
- **Additional measurements are made in charging mode**, if the charger is a part of the vehicle;
 - Conducted emission (CISPR 14-1) from 150 kHz to 30 MHz,
 - Radiated emission (CISPR 12) from 30 MHz to 1000 MHz.
 - The engine and all other equipment shall be switched off.
- Artificial mains networks for measurements in charging mode:
 - AC power mains lines (no communication); **50 μ H//50 Ω AMN (eg: R&S®ENV216, ENV432, or ENV4200).**
 - DC power mains lines (no communication). Use a 5 μ H//50 Ω HV-AN (high voltage).
 - Symmetric communication lines use an **asymmetric artificial network (AAN) according to CISPR 16-1-2 (eg: R&S®ENY family)**, between the vehicle and charging station, or any associated equipment.
 - Communication on power lines with AMN/HV-AN and decoupling unit. Use AAN between PLC modem and power mains if the AMN/AN blocks communication.
 - Communication on control pilot line with special decoupling unit. Use AAN between Pilot/PLC modem and vehicle. (AAN is to ensure correct communication, not used for the measurements.)
- New normative Annex H will be added on the **consideration of measurement instrumentation uncertainty (MIU)**, uncertainty budget (sample calculation) is given in informative Annex I.
- **Publication of Edition 7 is expected in 2017.**

CISPR 13 Sound and television broadcast receivers - disturbance measurements

Product committee CISPR/I: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers

What's New in the 5th Edition? (June 2009)

- This fifth edition of CISPR 13 cancels and replaces the fourth edition published in 2001, its Amendment 1 (2003) and Amendment 2 (2006).
- **It introduces the RMS-Average detector as an alternative to quasi-peak and average detector for conducted and radiated disturbance measurements as well as disturbance power measurements.**
- The committee has decided that the Amendment 1:2015 will be the last update of CISPR 13. The standard will be replaced by the new multimedia product standard CISPR 32 on 5 March 2017.
- This fifth edition was published in Europe as EN 55013:2013, the standard was ratified by the European Commission on 22 April 2013, the date of withdrawal has been set to 22 April 2016; **this means the standard became mandatory on 22 April 2016 in the European Economic Area (EEA).**
- The EN 55013:2013 contains common modifications that will limit the application of the RMS-Average detector for measurements of broadband disturbances with a pulse repetition frequency greater than the defined corner frequencies of the RMS-Average detector in the relevant CISPR bands (10 Hz in Band B and 100 Hz in Band C/D). For this purpose an additional Peak limit which is 20 dB above the RMS-Average limit shall be met for disturbance voltage measurements on mains terminals, disturbance power and radiated measurements. In addition, the radiated disturbance limit for frequencies other than fundamental and harmonics is reduced by 6 dB in the frequency range 30 MHz to 230 MHz This reduction is applicable for broadband disturbances only.



Still subject to CISPR 13, to be covered in the future by CISPR 32 (for multimedia equipment - disturbance measurements).

Amendment 1 to 5th Edition of CISPR 13 (Jan 2015)

- **The measurement instrumentation uncertainty (MIU) shall be calculated in accordance with CISPR 16-4-2.** Both the measurement results and the calculated uncertainty shall appear in the test report. But MIU need not be taken into account in the determination of compliance.
- **Antenna distance will be changed from center to boundary of the EUT based on CISPR 32.**
- DAB receivers shall meet the disturbance voltage requirements at the antenna terminal and radiated disturbance requirements with the same limits as defined for TV or SAT-TV for DAB L-band receivers.
- Clarification on integrated audio/video player will be added. It complies with the emission requirements when it meets the provisions of the relevant clauses for television receivers with the audio/video player function in operation, e.g. **USB playback function of TV sets: There is no need to perform disturbance power measurements when a USB port is provided. This is to prevent double testing as broadcast receiver and associated equipment.**
- Audio amplifiers shall be terminated with a resistive load equal to the rated load impedance. The level of the audio output signal shall be set to 1/8 of the rated output power.
- If there is a need for radiated disturbance measurements below 30 MHz, e.g. for large Plasma TV it is proposed to follow public available specification IEC/PAS 62825 Ed. 1.0. For testing use the magnetic field strength measurement method from CISPR 11 in conjunction with the limits for induction cooking appliances in the frequency range from 150 kHz to 30 MHz.
- Published in Europe as Amendment 1:2016 to EN 55013:2013, and was ratified by the European Commission on 15 February 2016. The date of withdrawal has been set to 15 February 2019; this means **the standard becomes mandatory on 15 February 2019 in the European Economic Area (EEA)**, so enforcement will not become effective before replacement by EN 55032 in 2017.

CISPR 14-1

Household appliances and electric tools - disturbance measurements

Product committee CISPR/F: Interference relating to household appliances, tools, lighting equipment and similar apparatus

Amendment 1 to 5th Edition of CISPR 14-1 (November 2008)

- **Radiated disturbance measurements in the frequency range from 30 MHz to 1000 MHz are now applicable for testing household appliances.** For mains operated appliances the existing measurement of disturbance power may alternatively be applied. For battery powered appliances radiated disturbance measurements must be performed. Two flowcharts have been added to the standard for checking the applicability of the new method.
- For mains operated appliances **the maximum clock frequency selects the measurement method.** For frequencies less than 30 MHz the disturbance power measurement is sufficient. For frequencies equal to or more than 30 MHz, the radiated disturbance method must be used. Radiated disturbance must also be used if the quasi-peak limit margin is less than a frequency-dependent level (0 dB at 200 MHz rising linearly to 10 dB at 300 MHz).
- Regulating controllers including semiconductor devices, for electric fence energizers, rectifiers, battery chargers and converters with clock frequencies of 9 kHz or less are not subject to the requirements in the frequency range 30 MHz to 1000 MHz.
- The measurement shall to be performed at a distance of;
 - 10 m on an open-area test site (OATS) or semi-anechoic chamber (SAC) Measurements in a semi-anechoic chamber (SAC) may be made at a closer distance, down to 3 m. An inverse proportionality factor of 20 dB per decade shall be used to normalize the measured data to the specified distance for determining compliance.
 - 3 m in a FAR (fully anechoic room) in accordance with CISPR 16-2-3.
- Battery powered appliances without external cables attached can also be measured in a **transverse electromagnetic (TEM) waveguide** in accordance with IEC 61000-4-20.
- **The measurement instrumentation uncertainty (MIU) shall be calculated in accordance with CISPR 16-4-2.** Both the measurement results and the calculated uncertainty shall appear in the test report. But MIU need not be taken into account in the determination of compliance
- The amendment was published in Europe as Amendment1:2009 to EN 55014-1:2006, and ratified by the European Commission on 22 April 2009. The date of withdrawal was set as 1 May 2012, which means the amendment became mandatory on **1 May 2012 in the European Economic Area.**

Amendment 2 to 5th Edition of CISPR 14-1 (July 2011)

- **Inclusion of induction cooking appliances.** It requires conducted measurements on the mains port as well as magnetic field strength measurements from 9 kHz to 30 MHz. For magnetic field strength measurements: Induction cooking appliances for domestic use which have a diagonal dimension of less than 1.6 m can be measured using a 2 m triple loop antenna such as **R&S®HM020**. Until the removal of induction cooking appliances from the scope of CISPR 11, the measurements in either CISPR 11 or CISPR 14-1 may be used.
- The amendment was published in Europe as Amendment 2:2011 to EN 55014-1:2006, and ratified by the European Commission on 16 August 2011. The date of withdrawal has been set as 16 August 2014, which means amendment 2 became mandatory on **16 August 2014 in the European Economic Area.**

What's Coming in Edition 6?

- Editorial revision & restructuring.
- Description of a general radiated disturbance measurement method to be added. It includes;
 - exemption for battery powered remote controls,
 - introduction of the fully-anechoic room (CISPR 16-1-4 and 16-2-3 or IEC 61000-4-22) as alternative for radiated emission testing.
- Specific radiated disturbance measurement methods for air conditioners and for vacuum cleaners including robotic cleaners.
- Incorporation of **requirements for measuring telecommunication ports based on CISPR 32.**
- Remove voltage probe measurement for load ports other than electric fence ports.
- **Full implementation of measurement instrumentation uncertainty as in CISPR 16-4-2.**
- Clarification on how to handle household appliances with lighting function, e.g. extractor hoods. Such multifunction equipment shall be measured with the lighting function set to maximum together with the fan in operation. This will avoid double testing, i.e. CISPR 15 need not to be applied.
- Alignment of start frequency for conducted measurements from 148.5 kHz to 150 kHz.
- There is general support to **incorporate the RMS-Average detector** as an alternative to quasi-peak and average detector for conducted and radiated disturbance measurements, but this will be considered as future work to amend Edition 6.
- **Publication of Edition 6 is expected in 2016.**



CISPR 15 Lighting equipment - disturbance measurements

Product committee CISPR/F: Interference relating to household appliances, tools, lighting equipment and similar apparatus

What's New in the 8th Edition? (May 2013)

- This eighth edition of CISPR 15 cancels and replaces the seventh edition published in 2005, its amendment 1 (2006) and amendment 2 (2008).
- References to basic standard series CISPR 16 have been updated to the current edition as of 2013. This incorporates;
 - CISPR 16-1-1 and CISPR 16-2-x to make the **fast FFT-based time-domain scan of EMI receivers such as the R&S®ESW, ESU, and ESR** applicable for EMI compliance measurements.
 - CISPR 16-1-2 on new LISN requirements (phase, isolation, attenuation). R&S®ENV216, ENV432, or ENV4200 (model 04) and from 2006 onwards also ESH2-Z5 and ESH3-Z6 are fulfilling the new requirements whereas old R&S®ESH2-Z5 and ESH3-Z5 and ESH3-Z6 don't. Service kits for upgrading old units are available.
 - CISPR 16-1-4 on evaluation procedure for the influence of the set-up table material for radiated disturbance measurements.
- The measurement instrumentation uncertainty (MIU) shall be considered as specified in CISPR 16-4-2. Both the measurement results and the calculated uncertainty shall appear in the test report. But MIU need not be taken into account in the determination of compliance
- **Radiated disturbance measurement in the frequency range from 30 MHz to 300 MHz** shall be performed at a distance of 10 m on an open-area test site (OATS) or in a semi-anechoic chamber (SAC) in accordance with the measurement method specified in Clause 10 of CISPR 22. As an alternative the measurement may be performed using the coupling decoupling network (CDN) method as specified in Annex B with the limits of Table B.1.
- **Lighting of interior cabins and rooms** are considered as indoor lighting equipment and need to be measured in the range 30 to 300 MHz (RE or CDN method).
- Independent converters for LED light sources were added to the scope.
- Requirements for **flashing type emergency lighting luminaries** utilizing xenon lamps were added.
- Disturbance voltage measurement at the mains terminals and radiated disturbance measurements for **Neon lamps** and other advertising signs were added.
- **Requirements for LED light sources (lamps) were added**, but passive (no active electronic switching components) LED sources are excluded.
- New Annex D (informative) with application table.
- CISPR 15:2013 was published in Europe as EN 55015:2013. The standard was ratified by the European Commission on 12 June 2013; the date of withdrawal was set to 12 June 2016, which means **the standard becomes mandatory on 16 June 2016 in the European Economic Area (EEA).**

What's New in Edition 8, Amendment 1?

- **Measurement instrumentation uncertainty fully implemented, as specified in CISPR 16-4-2.**
- Inclusion of radiated disturbance limits at 3 m measurement distance.
- Conducted and if operating frequency >100 Hz also radiated measurement requirements were added for **rope lights with active switching components** together with the measuring arrangement.
- Requirements and test method for conducted and radiated measurements added for **double-capped lamps in New Annex E.**
- **Extra-low voltage (ELV) lamps** with active circuits, for connecting to symmetrical ELV networks, shall comply with the mains disturbance voltage limits of Table 2a plus 26 dB at the ELV terminals. The mains input of the AMN is connected to the output of a suitable magnetic transformer or universal power supply. The 26 dB results from measuring real configurations.
- **Wall dimmers** only suited for lighting equipment apart from incandescent lamps shall be tested with the appropriate manufacturer provided lighting equipment.
- Updates to Figures 5, 6 and text in sub clause 8.2 show the use of an asymmetric artificial network (AAN) on control lines and exact dimension for the EUT arrangement.
- Clarification on how to handle multifunction equipment with lighting function. To avoid double testing **for equipment outside the scope of CISPR 15 and which includes lighting as a secondary function, there is no need to separately assess the lighting function against CISPR 15**, provided that the lighting function was operative during the assessment in accordance with the applicable standard. Examples of such equipment are coking range hoods, fans, freezers, ovens, and TV with ambient lighting.
- Published in Europe as Amendment 1:2015 to EN 55015:2013, ratified by the European Commission on 1 May 2015. The date of withdrawal has been set to 1 May 2018; this means the **standard becomes mandatory on 1 May 2018 in the European Economic Area (EEA).**

What's Coming in Edition 9?

The current specification for CDN (in IEC 61000-4-6) is unsuited to radio frequency disturbance measurements from 30 MHz to 300 MHz. **The CDN will be replaced by new CDNE with an enhanced specification**, e.g. CDNE-M2 or CDNE-M3 with reduced common mode (CM) impedance tolerance and additional parameters for CM phase tolerance and differential mode impedance equal to 100 Ω. A minimum 20 dB for longitudinal conversion loss shall prevent symmetrical voltage influencing measurement results.



R&S®HM020 triple-loop antenna for lighting equipment emission measurements.

CISPR 20

Sound and television broadcast receivers – immunity characteristics

Product committee CISPR/I: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers

What's New in Edition 6.1? (October 2013)

- Edition 6.1 of CISPR 20 incorporates edition 6 and amendment 1. It cancels and replaces the sixth edition published in 2006 and its Amendment 1 (2013).
- Criterion B definition is now aligned with CISPR 24.
- The European Interpretation Sheet EN 55020/IS1 to Edition 6 on digital-only receivers is incorporated.
- The wording in Clauses 4 and 5.2.2 now defines that re-testing shall use the test method originally chosen.
- Immunity testing of Safety Class I products is clarified.
- The new stability date of CISPR 20 is 2018. It is planned to replace CISPR 20 by the new multimedia product standard CISPR 35 in 2016 with a transition period of possibly 5 years.
- **Edition 6.1 is not yet published in Europe.**
- The European Common Modification on LTE will only be included in the European version EN 55020.
- CISPR 20 edition 6 was published in Europe as EN 55020:2007. The standard was ratified by the European Commission on 1 December 2006. The date of withdrawal was set to 1 December 2009, which means the standard is mandatory since **1 December 2009 in the European Economic Area.**



R&S® TS9980 measures the electromagnetic susceptibility (EMS) of sound and TV broadcast receivers, satellite and DVB/DAB receivers in line with EN 55020 and CISPR 20 standards.

Interpretations and Amendments

Two interpretations and two amendments have been added to EN 55020:2007 (edition 6) for the European Economic Area.

Interpretation Sheet 1 (May 2009)

What are the immunity requirements for pure digital receivers? Digital TV receivers have to be tested according to the classification "TV antenna" receivers, digital sound receivers according to "digital radio antenna" receivers.

For a reasonable test on digital sound receivers, beyond just screening effectiveness and ESD tests, a test with the requirements of "FM radio antenna" receivers shall be made as well.

Interpretation Sheet 2 (July 2010)

For a receiver with separate RF input ports for analog/digital terrestrial and digital satellite reception, is it appropriate to test the digital satellite mode only for EFT and ESD? Where different ports are used as described above, in digital satellite mode the full set of immunity tests shall be carried out.

Amendment 11 to 6th Edition of EN 55020 (June 2011)

To address LTE signals from 790 MHz to 862 MHz, an additional test is added. Test this frequency with 3 V/m + 80% AM (1 kHz), except the tuned channel $\pm 0,5$ MHz. The method is according to EN 61000-4-3, and the test applies to digital cable TV mode only. The amendment is mandatory since **1 January 2013 in the European Economic Area.**

Amendment 12 to 6th Edition of EN 55020 (January 2016)

An additional test for the enclosure port is added. An ESD test with 8 kV air discharge and 4 kV contact discharge according to EN 61000-4-2 is defined. The test applies to all equipment. The amendment is going to be mandatory on **4 January 2019 in the European Economic Area.**

CISPR 22

Information technology equipment - disturbance measurements

Product committee CISPR/I: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers

What's New in the 6th Edition? (Sept 2008)

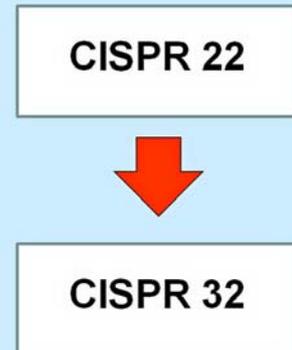
- This sixth edition of CISPR 22 cancels and replaces the fifth edition published in 2005, its Amendment 1 (2005) and Amendment 2 (2006).
- References to basic standard series CISPR 16 have been updated to the current edition as of 2008. This incorporates the application of the **new LISN requirements (phase, isolation, attenuation) and the evaluation procedure for the influence of the set-up table material for radiated disturbance measurements. R&S®ENV216, ENV432, or ENV4200 (model 04) and ESH2-Z5 (from 2006 onwards) fulfill the new requirements; ESH3-Z5, ESH3-Z6, and older R&S®ESH2-Z5, do not. Use Service kits to upgrade old R&S®ESH2-Z5, ESH3-Z5 and -Z6.**
- A non-invasive test method has been added for conducted emission testing on telecommunication ports containing more than four balanced or unbalanced pairs using a combination of a current probe and a capacitive voltage probe.
- Published in Europe as EN 55022:2010. The date of withdrawal of the 5th Edition was 1 December 2013, which means the 6th Edition became mandatory on **1 December 2013 in the European Economic Area (EEA).**

Interpretation Sheet 2 (April 2010)

- ISNs for balanced telecommunication ports for connecting to unshielded balanced pairs shall be selected based on the number of pairs in the cable, not the number of pairs used by the interface in question. This is applicable when measuring in accordance with clause 9.6.3.1, paragraph 2 or clause 9.6.3.2.
- The ISN designs given in Figures D.2 and D.3 like **R&S®ENY41** and **R&S®ENY81** are also suitable for measurements on unshielded cables containing fewer balanced pairs than the maximum number of pairs the ISN is designed for, e.g. for measurements on a single ADSL port.
- Measuring with an ISN (see Figures D.4 to D.7) when not all pairs are 'active', may result in a significant error in the measured emissions. An active pair is a pair of conductors completing an active digital, analog, or power circuit, or is terminated in a defined impedance, or is connected to earth or the equipment frame/chassis. Circuits such as "Power over Ethernet" are included.
- The cable between the telecommunication port and the ISN should be kept as short as possible, **to avoid the need to bundle any excess cable.** Non-inductive bundling of excess cable can result in slightly higher emission levels.

What's Coming After Edition 6?

The committee has decided that the contents of this publication will remain unchanged for the lifetime of the standard. **CISPR 22 will be replaced by the new multimedia product standard CISPR 32 on 5 March 2017.**

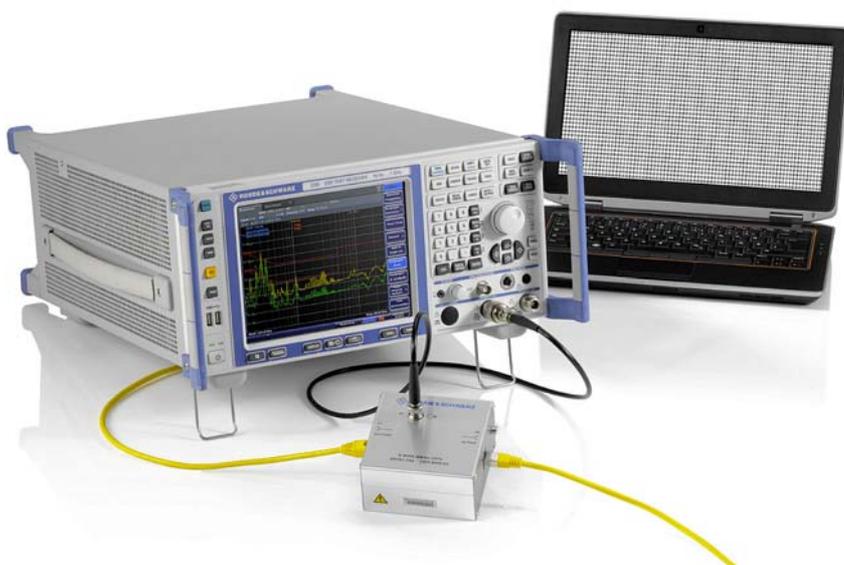


Interpretation Sheets

Two interpretation sheets have been added to CISPR 22 Edition 6.

Interpretation Sheet 1 (October 2009)

- CISPR 22 defines limits for radiated disturbance measurements from 1—6 GHz with respect to both average and peak detectors. The measuring instrument shall comply with CISPR 16-1-1:2006 and its Amendments 1:2006 and 2:2007. This latest CISPR 16-1-1 has defined two types of Average detector for use above 1GHz, but the type to be used has not been defined in CISPR 22 Ed.6. The following interpretation shall be applied: **For the limits given in CISPR 22 the appropriate average detector is the linear average detector defined in CISPR 16-1-1 Edition 2.2, clause 6.4.1 (CISPR-Average).**
- For the measurement of conducted emissions on cabinets containing multiple items the following interpretation shall be applied: **Where the EUT is a cabinet or rack that contains multiple items powered from an AC power distribution strip and where the AC distribution power strip is an integral part of the EUT as declared by the manufacturer, the AC power line conducted emissions should be measured on the input cable of the power distribution strip that leaves the cabinet or rack, not the power cables from the individual items of equipment. This is consistent with the requirements in clause 9.5.1 paragraph 1 and sub paragraph c.**



IT equipment such as laptops are subject to CISPR 22 measured here using the R&S®ENY81 and R&S®ESR.

CISPR 24

Information technology equipment – Immunity characteristics

Product committee CISPR/I: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers

What's New in the 2nd Edition? (September 2010)

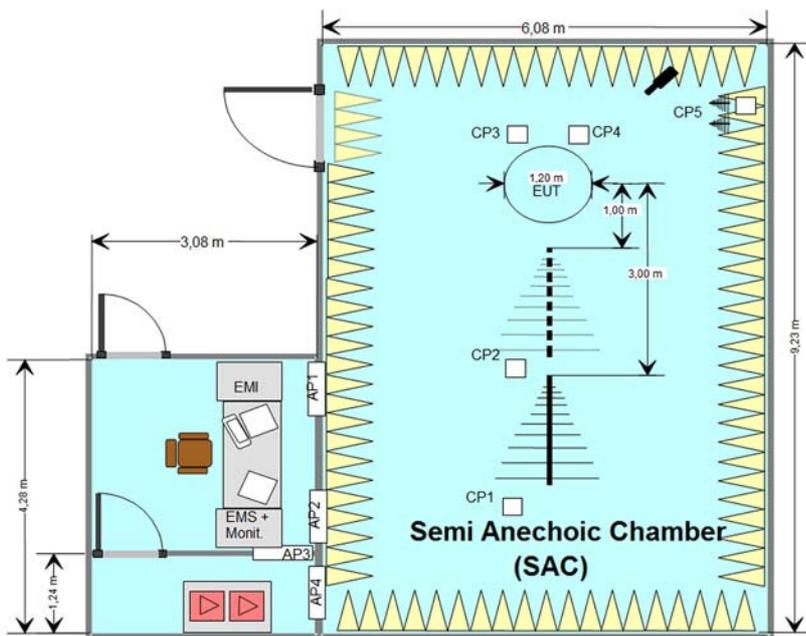
- The second edition of CISPR 24 cancels and replaces the first edition published in 1997, and its Amendment 1 (2001) and Amendment 2 (2002).
- References to basic standard series IEC 61000-4 have been updated to the latest editions.
- The option to use a 4% step size for continuous conducted immunity tests is deleted.
- Annex A for telephony equipment is revised including the methodology for measuring the demodulation from a speaker or a hands-free device.
- A new Annex H (normative) has been added for xDSL terminal equipment.
- The committee has decided that the contents of this publication will remain unchanged. The new multimedia product standard CISPR 35 shall replace CISPR 24, starting from 2016 with a transition period of possibly 5 years.
- CISPR 24 was published in Europe as EN 55024:2010 and ratified by the European Commission on 16 November 2010. The date of withdrawal of the 1st edition has been set to 1 December 2013, which means the 2nd edition is mandatory since **1 December 2013 in the European Economic Area**.

What's Coming in Amendment 1 of Edition 2?

New work started in January 2011. The major subjects are:

- The removal of the 4% step size for continuous conducted immunity tests is causing lively discussion. Some national committees would like to have this possibility reinserted, some want to keep it removed. Please remember that with the increased step size in frequency, the immunity level has to be increased to twice the regular level. From a technical point, an increased step size is acceptable as long as the susceptibility of a device is not related to narrow-band effects.
- Annex A is going to include a method for measuring the level of demodulation sent to line in a digital network during continuous immunity testing.
- Annex H will get an update for the xDSL test configuration.

Example of shielded rooms arrangement



Typical EMS test laboratory setup, as required for CISPR 24.

A committee draft (CD) was circulated in January 2012. Comments were received from the national committees and summed up including the observations of the Secretariat in December 2012.

As already mentioned, there was some debate on the first subject, the 4% step size, and unanimous agreement on the other two points. Requests not to include the possibility for 4% frequency steps were rejected by the Secretariat. A committee draft for vote (CDV) was circulated in July 2014. It continues to allow 4% frequency steps when doubling the immunity level. More clarifications for Annex A were added. The CDV was approved with six (18 %) of the members objecting to it. Four countries keep objecting to the 4% step size. Further concerns are addressing a clarification for ESD testing with only the highest level being required, and the newly introduced Annex on digital networks (A.2.6).

CISPR 24 Ed. 2.1 was published in **April 2015**.

CISPR 25**Automotive equipment - protection of on-board receivers - disturbance measurements**

Product committee CISPR/D: Electromagnetic disturbances related to electric/electronic equipment on vehicles and internal combustion engine powered devices

What's New in the 3rd Edition? (March 2008)

- This third edition cancels and replaces the second edition published in 2002.
- **It has deleted the determination of narrowband/broadband disturbances. Instead, measurements are now performed with both an average detector and a peak or quasi-peak detector. CISPR-AV detector with meter time constant and linear AV detector are applicable.**
- It has added methods and limits for the protection of new analogue and digital radio services, which cover the **frequency range up to 2500 MHz now.**
- It has added the new strip-line measurement method for components in informative Annex G.
- It has deleted the Annex on rod antenna characterization (this is now covered by CISPR 16-1-4).
- It has deleted the Annex on characterization of shielded enclosures. (CISPR 25 will be amended when the CISPR/D-CISPR/A Joint Task Force on chamber validation has finished its work).
- CISPR 25:2008 was published in Europe as EN 55025:2008, the standard was ratified by the European Commission on 1 June 2008, the date of withdrawal was set to 1 June 2011. **EN 55025 is not listed in the Official Journal of the EU and has no legal status.** Therefore, the car component manufacturer has to apply the specific company standards of the car manufacturer, which are usually based on CISPR 25/EN 55025.



CISPR 25 covers interference caused by the vehicle to equipment mounted within the vehicle, such as a radio or GPS receiver.

What's Coming in Edition 4?

- References to the basic standard series CISPR 16 will be updated so that the **fast FFT-based time-domain scan of EMI receivers such as the R&S®ESW, ESU, and ESR apply to EMI compliance measurements.**
- The appropriate average detector for measurements above 1 GHz is the **CISPR-AV detector** with meter time constant. Below 1 GHz the pure linear AV detector as alternative will be deleted.
- Using the minimum dwell time as defined in Table 2 with a measuring receiver can result in enormous measurement result errors. **Therefore, the minimum dwell time in Table 2 shall be longer than the pulse repetition interval of the disturbance signal.**
- There is general support to extend the **maximum frequency beyond 2500 MHz**, but this will be considered as an amendment to Edition 4.
- Dielectric material is no longer used between the cable harness and table in the measurement setup for alternators and generators (Fig. 8).
- Requirements for ignoring correction factors for the Artificial Network (AN) such as the R&S®ESH3-Z6 will be deleted; applying correction factors for the AN and estimating the associated uncertainty is well known and used in test laboratories. The FM band limits affected will not be revised.
- **New measurements are added for the charging mode of electric and hybrid vehicles**, if the charger is part of the vehicle;
 - Vehicle test by measuring voltage at the internal antenna.
 - The engine and all other equipment shall be switched off.
- Artificial mains networks for measurements in charging mode:
 - AC power mains lines (no communication). Use a 50 $\mu\text{H}/50 \Omega$ AMN (eg: R&S ENV 216, 432, or 4200).
 - DC power mains lines (no communication). Use a 5 $\mu\text{H}/50 \Omega$ AN (eg: ESH3-Z6).
 - Symmetric communication lines through **asymmetric artificial network (AAN) according to CISPR 16-1-2** (eg: R&S ENY family) between vehicle and charging station or any associated equipment.
 - Communication on power lines **with AMN/AN and decoupling unit**. Use **AAN** between PLC modem and power mains if the AMN/AN blocks communication
 - Communication on control pilot line **with a special decoupling unit**. Use **AAN** between Pilot/PLC modem and vehicle (AAN is to ensure correct communication, **not used for measurements**).
- Test requirements for shielded power supply systems for **high voltages in electric and hybrid vehicles** will be added;
 - Conducted disturbance voltage and current measurements. Voltage measurement needs specific 5 $\mu\text{H}/50 \text{ W}$ high voltage artificial network (HV-AN), i.e. adaption for the connection of shielded cables and additional resistor for discharging to <50 V within 60 s,
 - Radiated disturbance measurement for components – ALSE method (150 kHz to 2500 MHz)
 - Coupling between high voltage (HV) and low voltage (LV) system by direct S-parameter measurements (coupling attenuation) or based on existing CISPR 25 test set-up (with measurement of voltage, current and electric field).
- A new informative annex on chamber validation will be added. It will contain two alternative validation methods ("long wire" and "reference site method") to provide flexibility.
- **Publication of Edition 4 is expected in 2016.**

CISPR 32 Multimedia equipment - disturbance measurements

Product committee CISPR/I: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers

What's in CISPR 32 Edition 1.0?

CISPR 13
Sound and television broadcast receivers - Radio disturbance characteristics

CISPR 22
Information technology equipment - Radio disturbance characteristics

EN 55103-1
Audio, video and entertainment lighting control apparatus for professional use- Part 1 - Emissions



CISPR 32
Multimedia equipment - Radio disturbance characteristics

- The new product family standard for multimedia equipment CISPR 32 was published on 30 January 2012. **It will replace existing CISPR 13, CISPR 22 and EN 55103-1 on 5 March 2017.**
- CISPR 32 was published in Europe as EN 55032:2012, and ratified by the European Commission on 5 March 2012. The date of withdrawal of previous standards was set to 5 March 2015, then postponed to 5 March 2017, so **EN 55032 becomes mandatory on 5 March 2017 in the European Economic Area.** The listing in the Official Journal of the EU was on 25 February 2014.
- Multimedia equipment (MME) is defined as; Information Technology Equipment, Audio equipment, Video equipment, Broadcast receiving equipment, Entertainment lighting control equipment, or combinations.
- Radio transmission in accordance with ITU Radio Regulations is excluded.
- Port concept; measure the disturbance characteristic of each port.
- The measurement instrumentation uncertainty (MIU) shall be considered as specified in CISPR 16-4-2. But MIU need not be taken into account in the determination of compliance. However, it shall be calculated and both the results and the calculated uncertainty shall appear in the test report.
- **Radiated disturbance measurements shall be performed up to 6 GHz** based on a system concept (same as CISPR 22).
- Disturbance power measurement from CISPR 13 is not required any more.
- If there is a choice of test methods, compliance can be shown against any of the test methods using the appropriate limit. In any situation where it is necessary to re-test the equipment to show compliance, the test method originally chosen shall be used to guarantee consistency of the results.
- Compliance can be shown by measuring the EUT operating all functions simultaneously, individually, or any combination thereof.

What's New in Edition 2?

- For the limits given in CISPR 32 the appropriate average detector is the linear average detector with meter time constant as defined in CISPR 16-1-1; **CISPR-Average Detector.**
- Outdoor units of home satellite receivers are added to the scope (from CISPR 13).
- **Fully anechoic room (FAR)** in accordance with CISPR 16-1-4 and measurement method according to CISPR 16-2-3 for measurements under 1GHz were added.
- Emission-test arrangement for measurements < 1GHz for EUTs with different ways of mounting (floor standing, table-top, wall mounted, handheld) was revised to be measured as table-top even if intended for standing use.
- No need to measure differential voltage emission at each reception channel of broadcast receivers. Use channels that produced highest emission during preview scan.
- **TEM waveguide** in accordance with IEC 61000-4-20 for battery-operated equipment without cables was added (informative Annex).
- **RVC (reverberation chamber)** in accordance with IEC 61000-4-21 for radiated disturbance measurements >1 GHz added (informative Annex).
- Full implementation of measurement instrumentation uncertainty as in CISPR 16-4-2 not approved by National Committees.
- Published in Europe as EN 55032:2015, and was ratified by the European Commission on 5 May 2015. The date of withdrawal has been set to 5 May 2018; **this means the standard becomes mandatory on 5 May 2018 in the European Economic Area (EEA).**

What's Coming after Edition 2?

- **Measurement instrumentation uncertainty (MIU)** implemented fully as specified in CISPR 16-4-2.
- Measure **power spectrum density (PSD) mask** in accordance with ITU as alternative to measurements with AAN on telecommunication port.
- Add the **RMS-Average detector** as an alternative to quasi-peak and average detector for conducted and radiated disturbance measurements.
- **Terminate cables** leaving the test area in SAC, with VHF-LISN on single phase mains cables. (FAR, DC, three-phase, cables other than mains is still open.)
- **Clarification on color bar test pattern** referenced in Clause B.2.2 of CISPR 32; replace ITU-R BT.1729 by ITU-R BT.471 plus adding a small picture, both 100/0/100/0 (a) and 100/0/75/0 (b) leveling will apply.
- Method and limits > 1 GHz based on work in CISPR/A and CISPR/H, 16-2-3 may require full antenna height scan.



Conducted EMI test in accordance with CISPR 32 for a television receiver.

Draft CISPR 35 Multimedia equipment – immunity characteristics

Product committee CISPR/I: Electromagnetic compatibility of information technology equipment, multimedia equipment and receivers

What's in Draft CISPR 35?

CISPR 20

Sound and television broadcast receivers
Immunity characteristics

CISPR 24

Information technology equipment
Immunity characteristics



CISPR 35

Multimedia equipment
Immunity characteristics

- The new product family standard for multimedia equipment CISPR 35 will replace both existing CISPR 20 and CISPR 24.
- Multimedia equipment is defined as: equipment that is Information Technology Equipment, Audio equipment, Video equipment, Broadcast receiving equipment, Entertainment lighting control equipment or combinations of these.
- The device under test has to be prepared in a suitable **configuration**, and an appropriate **mode** has to be selected. **Tests** have to be performed for all relevant **ports**. During each test, all **primary functions** have to be **monitored** for the required performance criteria. Annexes of the standard give specific details on the various functions.
- **Radiated susceptibility measurements shall be performed up to 1 GHz. Some spot frequencies up to 5 GHz test effects of wireless communication devices.** The spot frequency test above 1 GHz is designed to ensure a protection distance. Whenever a device for wireless communications is separated from the device under test by more than a protection distance "X", there should be no performance degradation.
- Those tests within CISPR 20 which are rather performance tests than EMC tests are not carried over to CISPR 35.
- A final draft international standard (FDIS) circulated in December 2013 was rejected due to substantial technical changes between the committee draft for vote (CDV) and FDIS. The project was restarted in June 2014 as a new project.
- A new CDV was circulated in May 2015 and got approved in August 2015. It contains the following highlights:
 - All radiated immunity levels for continuous RF electromagnetic fields are set to 3 V/m.
 - Spot frequencies are also performed at 3 V/m corresponding to a protection distance of 3 m.
 - No enhanced immunity level of 30 V/m for network functions.
 - The basic standards IEC 61000-4-5:2005 and IEC 61000-4-6:2008 are used; the more recent editions from 2014 are not considered.
- An FDIS will be circulated in April/May 2016. A released standard might be published in September 2016.
- The transition period after releasing CISPR 35 is likely to be 5 years.

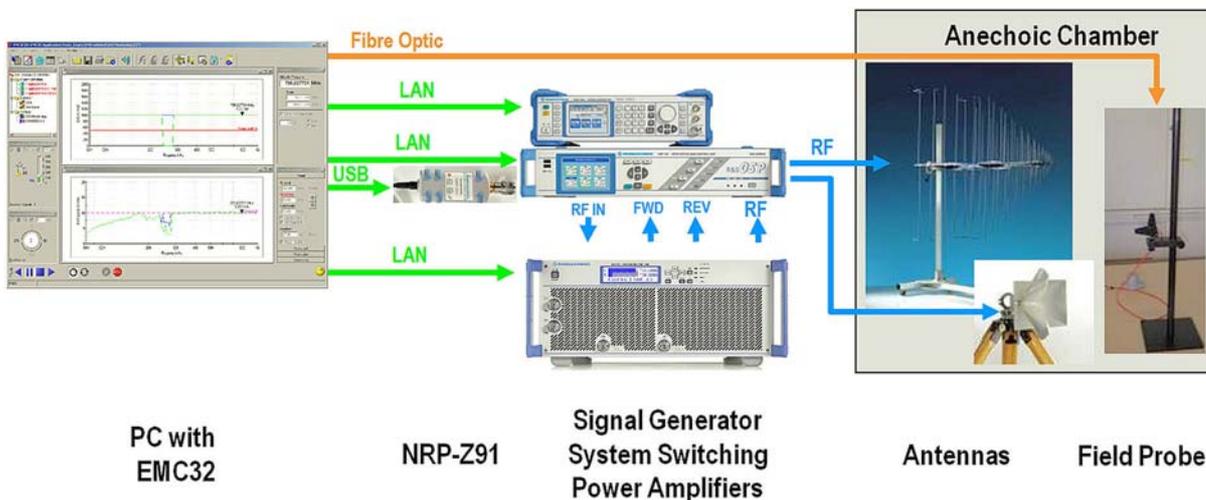
Need More Information?

If you have any questions about measuring to any of the standards covered in this document, do not hesitate to contact Rohde & Schwarz:

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Copies of all the standards are available from the International Electrotechnical Commission webstore:

<http://webstore.iec.ch/>



Rohde & Schwarz test setup for radiated susceptibility measurements.