

EMC Day - March 2021

CISPR UPDATE 2021

NEW DEVELOPMENTS IN CISPR PRODUCT STANDARDS FOR EMISSION MEASUREMENTS

Jens Medler

ROHDE & SCHWARZ

Make ideas real



OVERVIEW

- ▶ **CISPR – Purpose and publication levels**
- ▶ **CISPR 16 – Normative references**
- ▶ **CISPR product standards for emission measurements**
 - ┆ **CISPR 11 – Industrial, scientific and medical equipment**
 - ┆ **CISPR 12 – Automotive, protection of off-board receivers**
 - ┆ **CISPR 14-1 – Household appliances and electric tools**
 - ┆ **CISPR 15 – Lighting equipment**
 - ┆ **CISPR 25 – Automotive, protection of on-board receivers**
 - ┆ **CISPR 32 – Multimedia equipment**
 - ┆ **CISPR 36 – Automotive, Radiated emission below 30 MHz**

CISPR – PURPOSE

- ▶ **CISPR = International Special Committee on Radio Interference** ¹⁾
 - ▮ **Technical committee within the International Electrotechnical Commission (IEC)**
 - ▮ **The committee is constituted of 7 sub-committees that fulfil both product (vertical) and basic (horizontal) standardisation roles**
 - ▮ **CISPR was established in 1933 and had its first meeting in June 1934 in Paris, with representatives of 6 national committees of the IEC (Belgium, The Netherlands, Luxembourg, France, Germany and UK)**
 - ▮ **Today CISPR is one of 108 technical committees of the IEC**
 - ▮ **Members of CISPR are 41 National Committees (23 participate/18 observer), EBU, ETSI, CIGRE, IARU and both ITU-R and ITU-T**

- ▶ **CISPR was established to consider the protection of radio reception from interference**



Source: Franklin Delano Roosevelt Memorial, Washington DC

1) “Comité International Spécial des Perturbations Radioélectriques”

CISPR – PUBLICATION LEVELS

▶ **Basic Standards: Developed by CISPR sub-committee A**

- ▮ The CISPR 16 series is composed of 17 parts
- ▮ Defines the measurement apparatus, measurement methods, measurement uncertainty and test facilities

▶ **Generic Standards: Developed by CISPR sub-committee H**

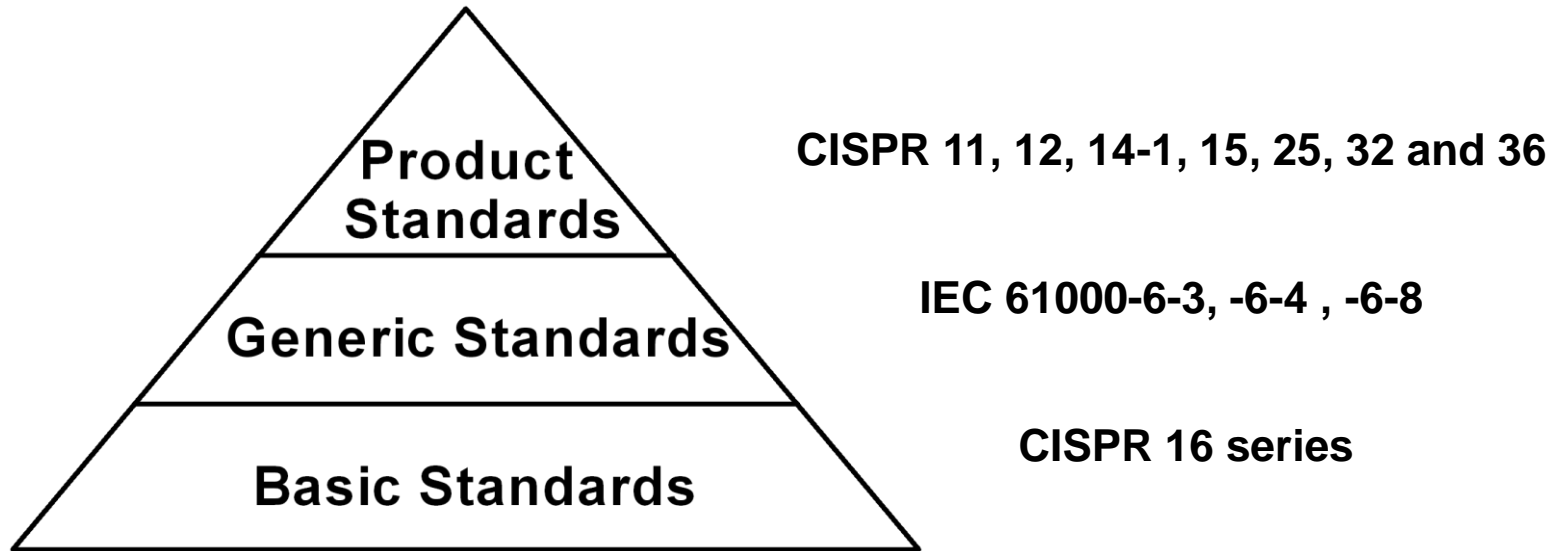
- ▮ IEC 61000-6 series for both emission and immunity testing
 - IEC 61000-6-3 Residential, commercial and light-industrial environments
 - IEC 61000-6-4 Industrial environments
 - **New: Separate IEC 61000-6-8 for commercial and light-industrial**
- ▮ Sets limits through an interference model

▶ **Product Standards: Developed by CISPR sub-committees B, D, F, I**

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

CISPR – PUBLICATION LEVELS

- ▶ CISPR publications are structured into 3 levels
- ▶ Basic standards come into force with normative references in generic and product standards
→ today all standards have dated references, specific edition applies!



CISPR 11 – INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT (ISM)

- ▶ **Developed by CISPR sub-committee B**
 - ▮ 6th Edition was published on 9 June 2015
 - ▮ In Europe published as EN 55011:2016, became mandatory **15 Feb 2019** in the European Economic Area (EEA)
- ▶ **What's New in the 6th Edition?**
 - ▮ Induction cooking appliances were removed from CISPR 11 and transferred to CISPR 14-1.
 - ▮ The reference to CISPR 16-1-1 was updated to make **FFT-based receivers** like R&S®ESW, R&S®ESR and R&S®ESU applicable for EMI compliance measurements



CISPR 11 – INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT (ISM)

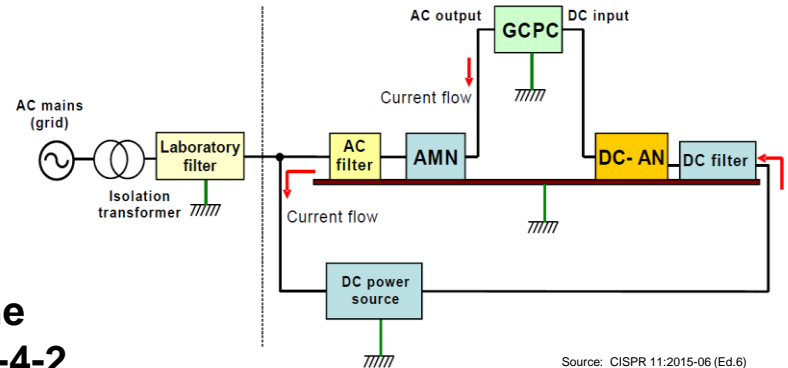
► What's New in Edition 6? (continued)

- **Appropriate limits for magnetic field measurements for "small equipment" of Class A Group 2 from 150 kHz to 30 MHz, distance = 3 m**
*Equipment is to be considered as **small** if it is either standing on the floor or a table, and would fit, including cables, in a **cylindrical volume of 1.2 m in diameter and 1.5 m height to ground plane (inclusive of table)***
- **Field strength measurements on small size equipment in 3 m distance and figures for arrangement and routing of cables - [use of CMADs](#)**
- **Application of one set of peak limits (CW type) for all Group 2 equipment operating above 400 MHz (relaxed limits in Ed.5 Table 15 were deleted)**
- **Wireless power transfer (WPT) equipment covered by the scope of other CISPR standards is excluded from the scope of CISPR 11**
- **For radiated disturbance measurements in the range 1 GHz to 18 GHz the test site shall meet the SVSWR criterion in Clause 8 of CISPR 16-1-4**

CISPR 11 – INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT (ISM)

► What's New in Edition 6? (continued)

- Adds requirements for "Grid Connected Power Converters" (GCPC) (this includes converters for photovoltaic systems)
- The concept of component testing is used for assessing conducted RF disturbances at the DC input power port of GCPCs using a **DC-AN** port (150 Ω Δ -AN)
- Specification for the DC-AN is included
- The proposed limits apply only to GCPCs intended for photovoltaic systems
- Separate limits and measurement configurations for GCPCs >20 kVA
- 150 Ω Δ -AN specification and corresponding measurement method have been added to the basic standards CISPR 16-1-2, 16-2-1 and 16-4-2



CISPR 11 – INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT (ISM)

► What's New in Edition 6? (continued)

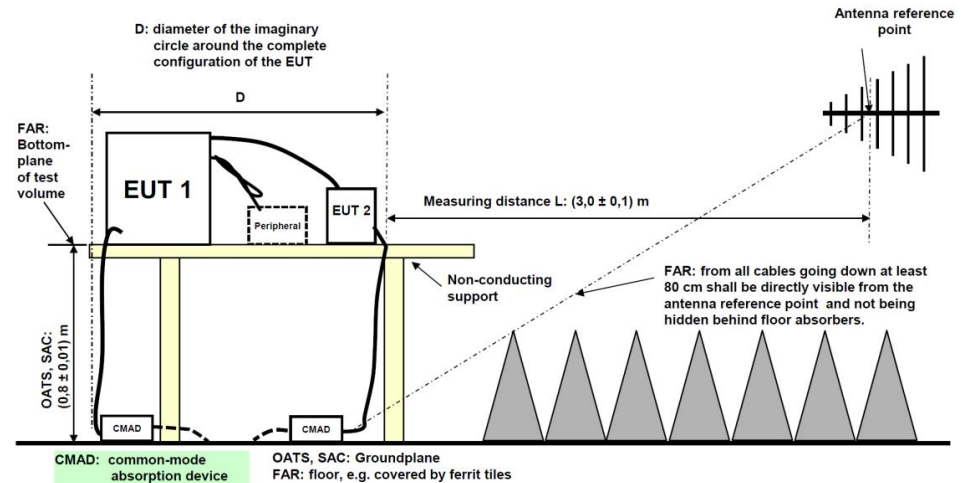
- **Adds APD method and associated limits for assessment of fluctuating RF disturbances in the range above 1 GHz**
- **The amplitude probability distribution (APD) measurement function is introduced as alternative to the established Log-AV (VBW=10Hz) detector for RE measurements of microwave ovens in the frequency range 1 to 18 GHz**
 - Oven under test is operated at maximum microwave power setting
 - APD measurement is performed at the highest peak captured during preliminary peak measurements in each of the two bands, Band I: 1005-2395 MHz and Band II: 2505-17995 MHz but outside the band 5720-5880 MHz
 - It is sufficient to measure at three frequencies around the preliminary peak (the centre and the both ends of a 10 MHz span), can be measured in sequence
- **A worldwide measurement campaign was conducted to compare APD results with the established measurement method. For the measurements the **Test Receiver R&S®ESU** was used (R&S®ESW and R&S®ESR also applicable)**



CISPR 11 – INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT (ISM)

► What's New in Amendment 1 to Edition 6?

- **Fully anechoic room (FAR)** acc. to CISPR 16-1-4 and measurement method acc. to CISPR 16-2-3 were added for field measurements <1 GHz
- For table top equipment only, measurement distance = 3 m
- The 3 m measurement distance applies only to small equipment (D_{\max} 1,2m)
- Amendment 1 was published on 23 June 2016
- In Europe published as EN 55011:2016/A1:2017, became mandatory on **21 April 2020** in EEA



Source: CISPR 11:2015/AMD1:2016

CISPR 11 – INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT (ISM)

► What's New in Amendment 2 to Edition 6?

- **Revision of APD method**
- **Measure in 7 subranges instead at 2 highest peaks as before**
- **Span of 10 MHz will be increased to 20 MHz, this results into 5 final measurements now (the critical frequency itself, +/- 5 MHz and +/- 10 MHz) → [Use Receiver with APD Multi-Channel function such as R&S®ESW](#)**
- **Measurement time of 30 s remains unchanged**
- **[Amendment 2 was published on 18 January 2019](#)**
- **In Europe not published and d.o.w. not assigned yet**

Harmonics of 2,45 GHz, Order no.	Frequency sub-ranges GHz
Not defined	1,005 to 2,395
2	2,505 to 6,125 ^a
3	6,125 to 8,575
4	8,575 to 11,025
5	11,025 to 13,475
6	13,475 to 15,925
7	15,925 to 17,995

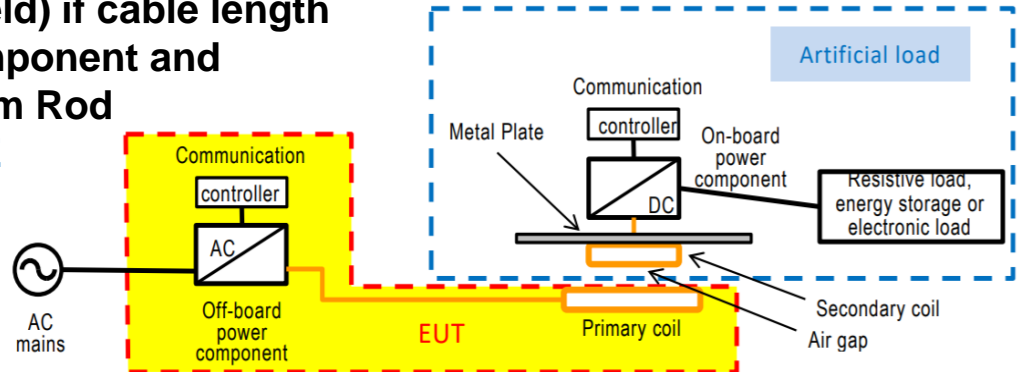
^a Measurements in the ISM band 5,720 GHz to 5,880 GHz are excluded, see Table 1.

Source: CISPR 11:2015/AMD2:2019

CISPR 11 – INDUSTRIAL, SCIENTIFIC AND MEDICAL EQUIPMENT (ISM)

► What's Coming in Edition 7?

- **Wireless Power Transfer** (Source: Document CISPR/B/737/CDV)
- WPT equipment for charging electric vehicles (EV) and industrial applications with operation frequency <150 kHz, e.g. 79 kHz - 90 kHz for EV
- RE 9 kHz - 30 MHz (magnetic field), with 60 cm Loop Antenna such as **R&S®HFH2-Z2E**, three orthogonal directions (X,Y,Z), centre at 1,3 m height, measurement distance 10 m
- RE 150 kHz to 30 MHz (electric field) if cable length between the off-board power component and primary coil exceeds 3 m, with 1 m Rod Antenna such as **R&S®HFH2-Z6E**
- Use EV or artificial load
- CE is postponed till work on compatibility levels is completed



CISPR 12 – AUTOMOTIVE EQUIPMENT PROTECTION OF OFF-BOARD RECEIVERS

► Developed by CISPR sub-committee D

- 6th Edition was published in May 2007
- Amendment 1 to CISPR 12:2007 was published in January 2009, in Europe published as Amendment 1:2009 to EN 55012:2007, **mandatory since 1 July 2012 in the European Economic Area** ¹⁾

► What's Coming in Edition 7?

- The references to CISPR 16 will be updated to make **FFT-based receivers like R&S®ESW, ESR and ESU** applicable for EMI compliance measurements
- The appropriate average detector is the **CISPR-AV detector** with meter time constant, the alternative use of the pure linear AV detector will be deleted

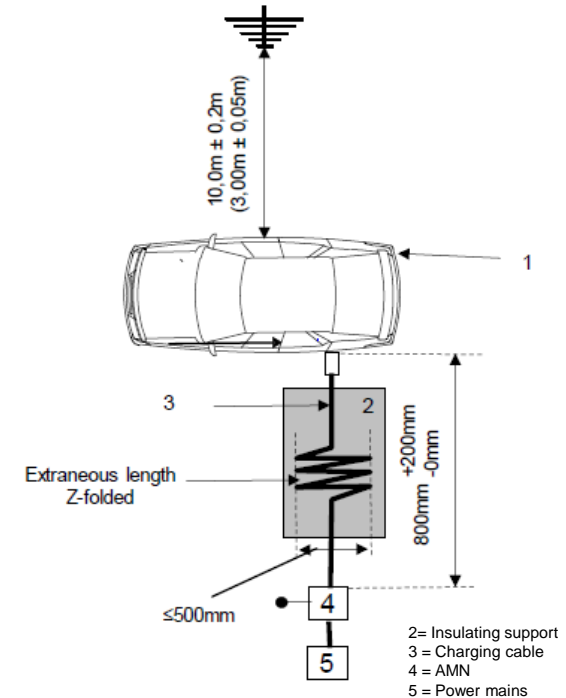


1) Only for devices equipped with internal combustion engines, e.g. chainsaws, water pumps, snow blowers, air compressors, etc.

CISPR 12 – AUTOMOTIVE EQUIPMENT PROTECTION OF OFF-BOARD RECEIVERS

► What's Coming in Edition 7? (continued)

- Antenna position for vehicles, it is proposed to define the center position of the EUT as reference point if 3 dB antenna beam width covers the entire EUT
- Measurements in charging mode of electric and hybrid vehicles if the charger is part of the vehicle
 - Conducted emission **not** in CISPR 12, (e.g. on-board chargers in IEC 61851-21-1)
 - Radiated emission 30 MHz to 1000 MHz acc. to CISPR 12
 - The measurements shall be performed in engine off mode and all other equipment shall be switched off
 - AC Power mains lines through a **50 μ H//50 Ω AMN (R&S® ENV216/432/4200)**
 - DC Power mains through a **5 μ H//50 Ω DC-charging-AN**



Source: CIS/D/467/CD

CISPR 12 – AUTOMOTIVE EQUIPMENT PROTECTION OF OFF-BOARD RECEIVERS

► What's Coming in Edition 7? (continued)

- Measurements in “**engine running**” mode of electric and hybrid vehicles
 - Constant speed 40 km/h \pm 20 % driven on a dynamometer without load
 - or maximum if top speed of vehicle is less than 40 km/h
 - But speed and load may have significant influence on the emission result
- New normative Annex F will be added on the consideration of **measurement instrumentation uncertainty (MIU)**, uncertainty budget (sample calculation) is given in informative Annex G
- **Edition 7 failed in final voting stage, Revised committee draft done in 2020, Publication expected in 2021**



CISPR 14-1 – HOUSEHOLD APPLIANCES AND ELECTRIC TOOLS

- ▶ **Developed by CISPR sub-committee F**
 - ▮ 7th Edition was published on 7 September 2020
 - ▮ In Europe to be published as EN 55014-1:2021, will become mandatory **12 Oct 2023** in the European Economic Area (EEA)
- ▶ **Major Changes in Edition 7?**
 - ▮ Radiated Emission above 1 GHz
 - ▮ Inductive power transfer equipment (IPTE)
 - ▮ FFT-based click analyzers and use of 4-channel analyzers



CISPR 14-1 – HOUSEHOLD APPLIANCES AND ELECTRIC TOOLS

► What's new in Edition 7?

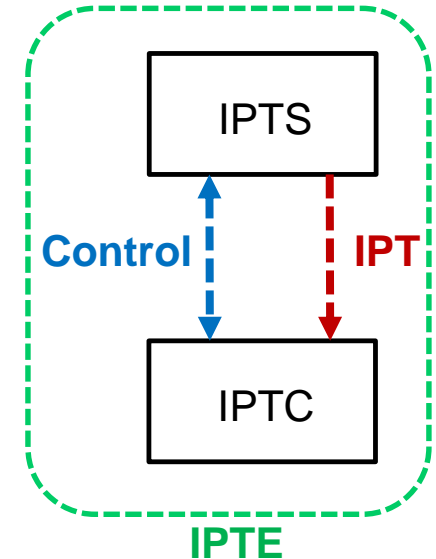
- **Radiated disturbance measurements up to 6 GHz.** This extension will be conditional with the highest clock frequency F_x used in the EUT as criteria:
 - 1 GHz if $F_x \leq 108$ MHz
 - 2 GHz if $108 \text{ MHz} < F_x \leq 500$ MHz
 - 5 GHz if $500 \text{ MHz} < F_x \leq 1$ GHz
 - $5 \times F_x$ up to 6 GHz if $F_x > 1$ GHz or 6 GHz if F_x is unknown
- **Use FAR or SAC/OATS with RF absorbers on the RGP according to CISPR 16-1-4 and measurement method acc. to CISPR 16-2-3**
In addition, FAR according to IEC 61000-4-22
- **Make statement about highest clock frequency in the test report**



CISPR 14-1 – HOUSEHOLD APPLIANCES AND ELECTRIC TOOLS

► What's new in Edition 7? (continued)

- **Inductive power transfer (IPT)**, adds inductive power transfer equipment and apparatus other than induction cooking appliances, e.g. for heating and charging
- **Inductive power transfer source (IPTS)**
 - device that transfers electric energy to an IPTC through IPT e.g. induction powering equipment and cooking appliances
- **Inductive power transfer client (IPTC)**
 - device which receives electric energy through IPT, e.g. vessel on induction cooking appliances
- **Inductive power transfer equipment (IPTE)**
 - combination of a specific IPTS and specific IPTC(s), e.g. shaver or tooth brush provided with a dedicated charging cradle



CISPR 14-1 – HOUSEHOLD APPLIANCES AND ELECTRIC TOOLS

► What's new in Edition 7? (continued)

■ Clarification on click measurements:

- **FFT-based click analyzers such as R&S®ESW or R&S®ESR are applicable**
- Use of 4-channel versus 1-channel analyzer
- The click rate shall be calculated for each of the four frequencies separately
- The upper quartile method shall be applied at each of the four frequencies (Upper Quartile Method defines the number of clicks, which are allowed to exceed the limit)



CISPR 15 – LIGHTING EQUIPMENT

- ▶ **Developed by CISPR sub-committee F**
 - ▮ 9th Edition was published on 15 May 2018
 - ▮ In Europe published as EN 55015:2019, becomes **mandatory on 30 August 2022 in the EEA**
- ▶ **What's New in Edition 9?**
 - ▮ **Full editorial revision and restructuring, that includes introduction of**
 - ▮ Three basic ports
(wired network, local wired and enclosure)
 - ▮ Term 'module' instead of independent auxiliary
 - ▮ More technology-independent approach
(number of applications has been reduced significantly)



CISPR 15 – LIGHTING EQUIPMENT

► What's New in Edition 9? (continued)

- **Maximum frequency extended to 1 GHz for RE measurements**
Use SAC/OATS or fully anechoic room (FAR) in line with CISPR 16-1-4 and measurement method according to CISPR 16-2-3 or TEM waveguide acc. to IEC 61000-4-20 for battery operated EUTs without cables
- Deletion of the insertion-loss requirements and the associated Annex A
- Adds new conducted measurement method for GU10 self-ballasted lamp
- Addition of current probe measurement method and limits for various types of ports (in addition to voltage limits and measurement method)
- For large EUT (> 1,6 m), addition of the **magnetic field measurement method using a 60 cm loop antenna like R&S®HFH2-Z2E** at 3 m distance (method from CISPR 14-1) as alternative to 3 m and 4 m LLAS



CISPR 15 – LIGHTING EQUIPMENT

► What's New in Edition 9? (continued)

- Conducted CDNE method up to 300 MHz as an alternative to RE measurement
- **CDNE method is restricted in use, only applicable if:**
 - All clock frequencies of the EUT are below or equal to 30 MHz – Test report!
 - EUT size less than 3 m x 1 m x 1 m (L x W x H) without wiring
- **CDNE has replaced the currently used CDN (from IEC 61000-4-6) as it is not suitable for performing radio frequency disturbance measurements in the frequency range from 30 MHz to 300 MHz**
- **CDNE comes with enhanced specification, e.g. CDNE-M2 or CDNE-M3 with reduced common mode (CM) impedance tolerance and additional CM phase tolerance; DM mode impedance equal to 100 Ω ; minimum 20 dB for longitudinal conversion loss (LCL) to prevent influence of the symmetrical voltage on the measurement results**
- **CDNE limits between 200 MHz and 300 MHz are more stringent versus Ed.8 (2013), that incorporates an increasing margin of up to 10 dB at 300 MHz**

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► Developed by CISPR sub-committee D

- 4th Edition was published on 27 October 2016 and Corrigendum COR1:2017
- In Europe published on national level only, e.g. BS EN 55025:2017 (UK), DIN EN 55025:2018 (Germany)
- **EN 55025 is not listed in the Official Journal of the EU and has no legal status**

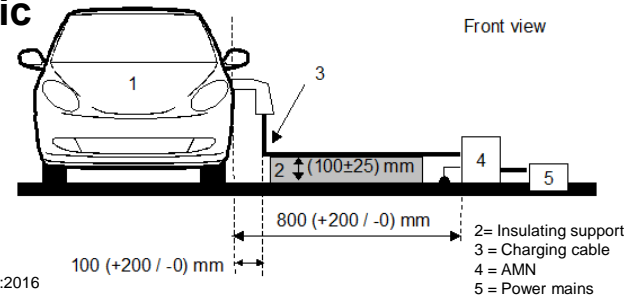
Therefore, the car component manufacturer has to apply the specific company standards of the car manufacturer, which are usually based on CISPR 25 or EN 55025 respectively



CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► What's New in Edition 4?

- The reference to CISPR 16-1-1 was updated to **make FFT-based receivers like the R&S®ESW, R&S®ESR and R&S®ESU** applicable for EMI compliance measurements
- The appropriate average detector is the **CISPR-AV detector** with meter time constant, the alternative use of the pure linear AV detector was deleted
- Frequency range was not extended, **maximum = 2.5 GHz**
- Dielectric material is not used any more between cable harness and table in the component measurement setup for alternators and generators (Figure 8)
- Disturbance measurements in **charging mode** of electric and hybrid vehicles if the charger is part of the vehicle
 - Vehicle test – Voltage at internal antenna
 - The measurements are made without the engine running and all other equipment shall be switched off
 - AMN/AN-HV same as for CISPR 12



Source: CISPR 25:2016

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► What's New in Edition 4? (continued)

- **Apply correction factor for the AN**, it is available from the manufacturer of the AN and can easily be added as transducer factor in the receiver or system software
- **A new informative Annex on chamber validation was added**, it contains two alternative validation methods (**“long wire”** and **“reference site method”**)
- **Disturbance measurements on the high voltage (HV) propulsion system of electric vehicles**
 - Disturbance voltage and current, voltage measurement requires specific $5 \mu\text{H}/50 \Omega$ HV-AN, i.e. in shielded box, adaption for shielded cables and additional resistor for discharging to $<50 \text{ V}$ within 60 s
 - RE for components, ALSE method (150 kHz to 2500 MHz)
 - Coupling between HV and LV system by direct S-parameter measurements (decoupling factor) or based on existing CISPR 25 test set-up (voltage, current and electric field)



CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► What's New in Edition 4? (continued)

■ Using the minimum dwell time as defined in Table 2 with a measuring receiver can result in enormous measurement result errors

■ In a worst case the receiver will not capture the disturbance signal at all if the dwell time is shorter than the pulse repetition interval of the disturbance signal

■ **Not suitable for measuring intermittent narrowband signals with CISPR-AV detector!**
Should be at least:

■ **160 ms in AM Band (<30 MHz)**

■ **100 ms in Bands >30 MHz**

Table 2 – Scanning receiver parameters

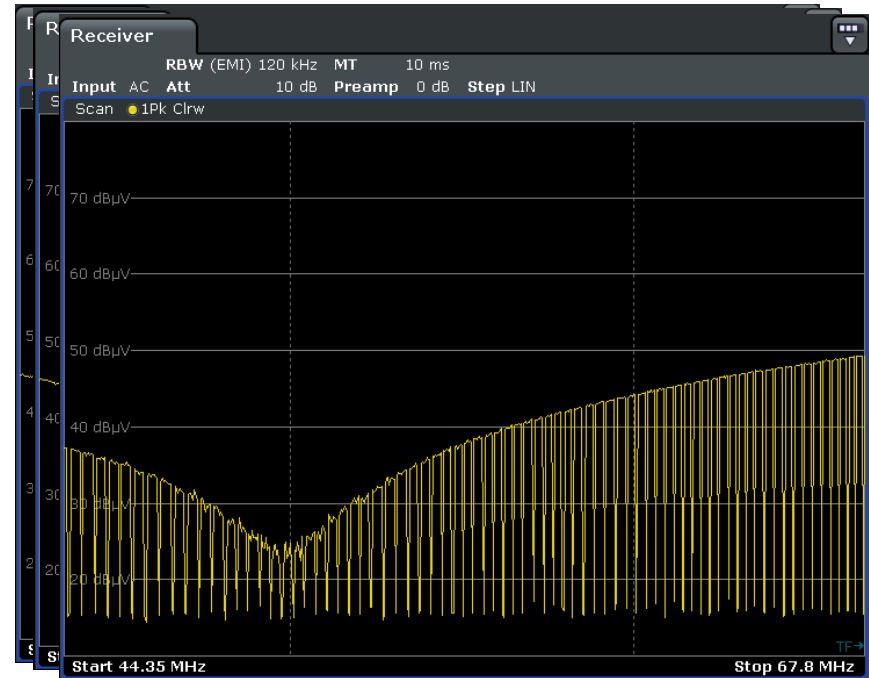
Service / Frequency range MHz	Peak detection			Quasi-peak detection			Average detection		
	BW at -6 dB	Step size	Dwell time	BW at -6 dB	Step size	Dwell time	BW at -6 dB	Step size	Dwell time
AM broadcast and mobile services 0,15 - 30	9 kHz	5 kHz	50 ms	9 kHz	5 kHz	1 s	9 kHz	5 kHz	50 ms
FM broadcast 76 - 108	120 kHz	50 kHz	5 ms	120 kHz	50 kHz	1 s	120 kHz	50 kHz	5 ms
Mobile services 30 to 1 000									
TV Band I 41 - 88									
TV Band III 174 - 230									
TV Band IV/V 470 - 890									
DAB 171 - 245									
DTTV 470 - 770	120 kHz	50 kHz	5 ms	Does not apply	Does not apply	Does not apply	120 kHz	50 kHz	5 ms
Mobile service 1 000 - 2 500	120 kHz	50 kHz	5 ms	Does not apply	Does not apply	Does not apply	120 kHz	50 kHz	5 ms
GPS L1 civil 1 567 - 1 583	Does not apply	Does not apply	Does not apply	Does not apply	Does not apply	Does not apply	9 kHz	5 kHz	5 ms

NOTE For emissions generated by brush commutator motors without an electronic control unit, the maximum step size may be increased up to 5 times the bandwidth.

CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► Wrong measurement time can result in enormous errors!

- Pulse modulated carrier with 12 ms pulse period, **Time Domain Scan** shows closed trace with 12 ms measurement time
- Gaps in **TD Scan** trace with 10 ms measurement time
- Even when 10 ms yields a closed trace in **Stepped Scan**, zooming in reveals gaps in the trace
- **Important Measurement time \geq signal period!**



CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

► What's Coming in Edition 5?

- Maximum frequency will be extended beyond 2500 MHz for both component (ALSE method) and vehicle (voltage at internal antenna) testing, **this will add new frequency bands up to 6 GHz:**
 - 4G: 2496 to 2690 MHz, 3300 to 3800 MHz and 5150 to 5925 MHz
 - WiFi: 5150 to 5350 MHz and 5470 to 5725 MHz
 - C2X (Car-to-X Communication): 5850 to 5925 MHz
- Adds new GNSS band: BDS (BeiDou System)
- Revision of measurement methods in charging mode of electric and hybrid vehicles based on charging mode concept in IEC 61851-1 (Mode 1 to 4)
- New Annexes will be added on the consideration of **measurement instrumentation uncertainty (MIU)**, also uncertainty budget is given (sample calculation)



CISPR 32 – MULTIMEDIA EQUIPMENT

► Developed by CISPR sub-committee I

CISPR 13 (Radio & TV)

CISPR 22 (ITE)

EN 55103-1 (prof. AV)



CISPR 32 (Multimedia)

- 2nd Edition was published on 31 March 2015
- In Europe published as EN 55032:2015, **became mandatory on 5 May 2018** in the European Economic Area, is listed in the Official Journal (3 November 2020)

■ Definition of term multimedia equipment (MME):

“... equipment that is information technology equipment, audio equipment, video equipment, broadcast receiver equipment, entertainment lighting control equipment or combinations of these”



CISPR 32 – MULTIMEDIA EQUIPMENT

► What's New in Edition 2?

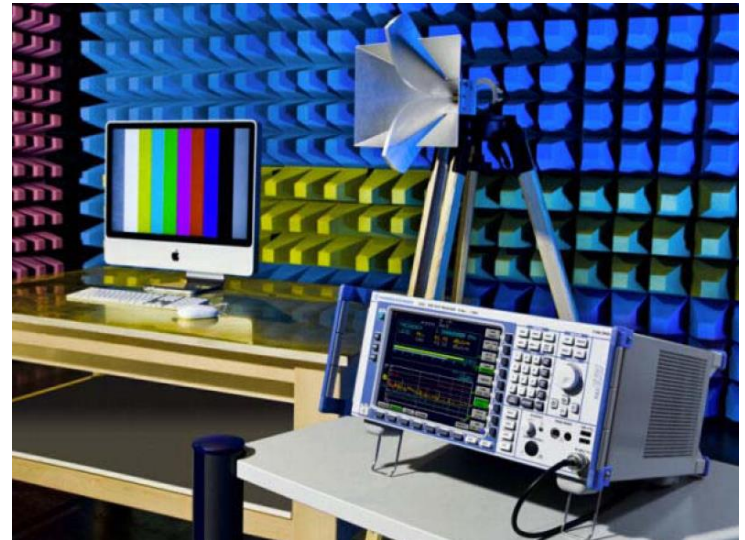
- For the limits given in CISPR 32 the appropriate average detector is the linear average detector with meter time constant = **CISPR-Average detector**
- Adds outdoor units of home satellite receivers (LNB) to the scope
- **Fully anechoic room (FAR)** acc. to CISPR 16-1-4 and measurement method acc. to CISPR 16-2-3 was added for field measurements <1 GHz
- Emission-test arrangement for EUTs with different ways of mounting and application in practice (floor standing, table-top, wall mounted, handheld)
→ such EUTs shall be measured as table-top
- No need to measure DM voltage at each reception channel of broadcast receivers
→ use channels that produced highest emission during preview scan
- TEM waveguide IEC 61000-4-20 for battery operated EUT without cables (informative)
- RVC acc. to IEC 61000-4-21 for RE measurements >1 GHz (informative Annex)

CISPR 32 – MULTIMEDIA EQUIPMENT

Multimedia equipment – **AMD1 to 2nd Edition published**

► **Developed by CISPR sub-committee I**

- **Amendment 1 to 2nd Edition was published on 1 October 2019**
- **Will be published in Europe as EN 55032:2015/A1:202x, d.o.w. has not been defined yet**
- **The amendment received a negative assessment by the HAS consultant, therefore it can be **considered as non-harmonized standard and will not be listed in the OJEU****



CISPR 32 – MULTIMEDIA EQUIPMENT

► What's New in Amendment 1 to Edition 2?

- **Full implementation of MIU** as specified in CISPR 16-4-2
- **Wired network port**, measure only launched common mode if wanted signal power is below the power spectral density (PSD) limit as alternative to AAN with appropriate LCL
- **Clarification on color bar test pattern** referenced in Clause B.2.2 of CISPR 32
 - in addition to ITU-R BT.1729, new informative Annex J describes color bar image for exercising displays, both 100/0/100/0 and 100/0/75/0 will be applicable
- **Measurement method and limits for above 1 GHz**
 - will require a continuous antenna height scan from 1 m to 4 m (tilting is not required)
 - for both FSOATS (SAC with floor absorbers) and FAR, even for small table-top equipment!
 - limits relaxed by 4 dB in the frequency range 1-3 GHz (same as FCC Part 15 now)
- **Antenna calibration in line with CISPR 16-1-6**
 - for easy transition use methods which emulate those of ANSI C63.5, e.g. SSM

CISPR 32 – MULTIMEDIA EQUIPMENT

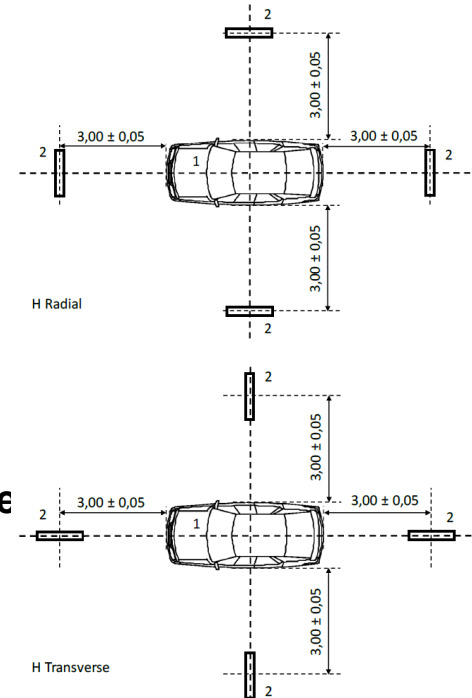
► What's Coming in future Edition 3?

- Requirements for testing MME with Wireless Power Transfer (WPT) ports
- Termination of cables leaving the test area in SAC
 - **VHF-LISN** on single phase mains cable (FAR, DC, three-phase and other cables still open)
- In-situ measurement methods and requirements
- Specify wanted signal level for TV Tuner Port (Revision of C4.2.1 and Table B.3)
- **APD measurement function >1 GHz**, applied when peak value exceeds the peak limit
- Revise measurement method in FAR above 1 GHz
 - may not require antenna height scan for small EUT
- **Satellite Receivers - Conducted emission requirements 30 MHz to 950 MHz**
- Further work items: Alignment of scope with CISPR 35, Radio enabled Products, Warm-up time, **Reverberation Chamber >1 GHz (RVC) and Radiated Emission 6-40 GHz**

CISPR 36 – AUTOMOTIVE EQUIPMENT PROTECTION OF OFF-BOARD RECEIVERS

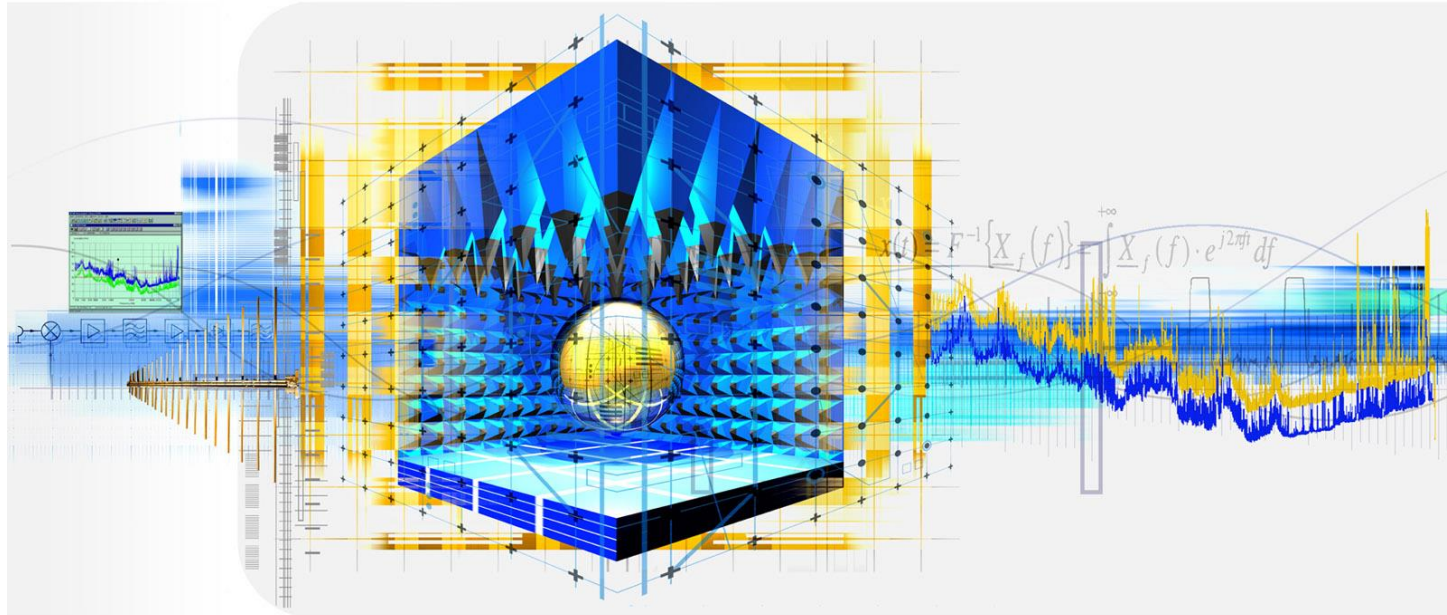
► Developed by CISPR sub-committee D

- 1st Edition was published 22 July 2020
- **Electric and hybrid electric road vehicles**
- Quasi-peak limits for radiated emission (magnetic field) 150 kHz to 30 MHz, similar to CISPR 11 Class B Group 2 but more stringent above 4 MHz
- Measurement with 60 cm Loop Antenna like R&S®HFH2-Z2E in Radial (X) and Transverse (Y) direction at four positions, centre of loop at fixed height of 1,30 m, measurement distance
- Measurements with **electric engine running only**, constant speed $40 \text{ km/h} \pm 20 \%$ driven on dynamometer without load
- New normative Annex A on MIU, sample calculation in informative Annex B



Source: CISPR 36:2020

THANK YOU FOR YOUR INTEREST !

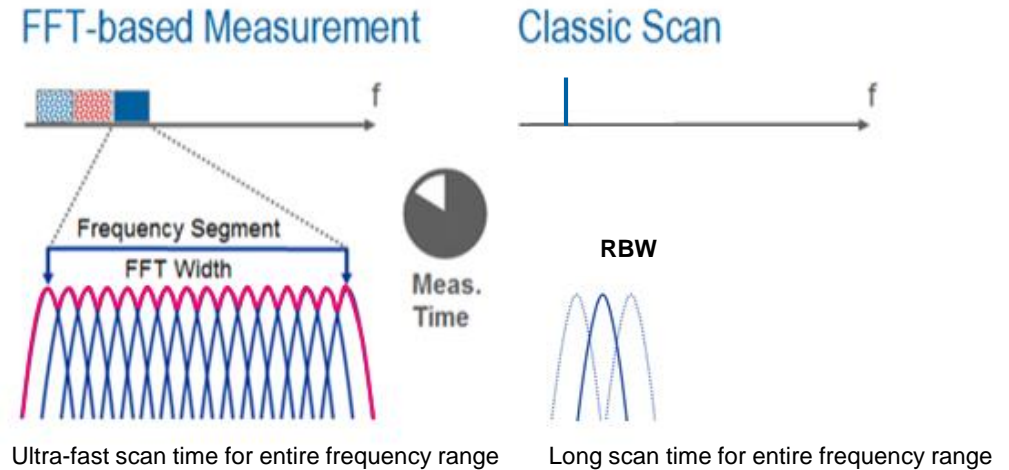


APPENDIX

CISPR 16 – FFT-BASED MEASURING RECEIVERS

Motivation for FFT-based measurement instrumentation

- I **More Speed** – FFT-based receivers are measuring spectral segments much wider than the resolution bandwidth during the measurement time by parallel calculation at several frequencies
- I **More Reliable** – FFT allows application of longer measurement times, e.g. for measuring intermittent signals
- I **More Insight** – FFT makes enhanced measurement functions like scan spectrogram and persistence display applicable



CISPR 16 – FFT-BASED MEASURING RECEIVERS

Amendment 1:2010-06 to CISPR 16-1-1 (3rd Ed.)

► Blackbox approach



► FFT-based **measurement receiver** for compliance testing



“instrument such as a tunable voltmeter, an EMI receiver, a spectrum analyzer or an FFT-based measuring instrument, with or without preselection, that meets the relevant parts of this standard”

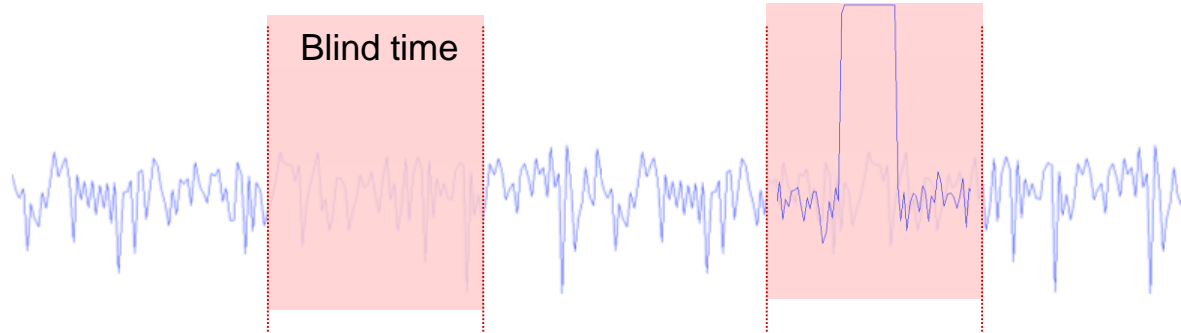


CISPR11

CISPR 16 – FFT-BASED MEASURING RECEIVERS

Amendment 1:2010-06 to CISPR 16-1-1 (3rd Ed.)

- ▶ With traditional instruments there is a blind time between capturing the signal
- ▶ Information might be and will be overlooked



”for EMI measurements, FFT-based measuring instruments shall sample and evaluate the signal continuously during the measurement time”



CISPR11

CISPR 16 – FFT-BASED MEASURING RECEIVERS

FFT-based measurement instrumentation

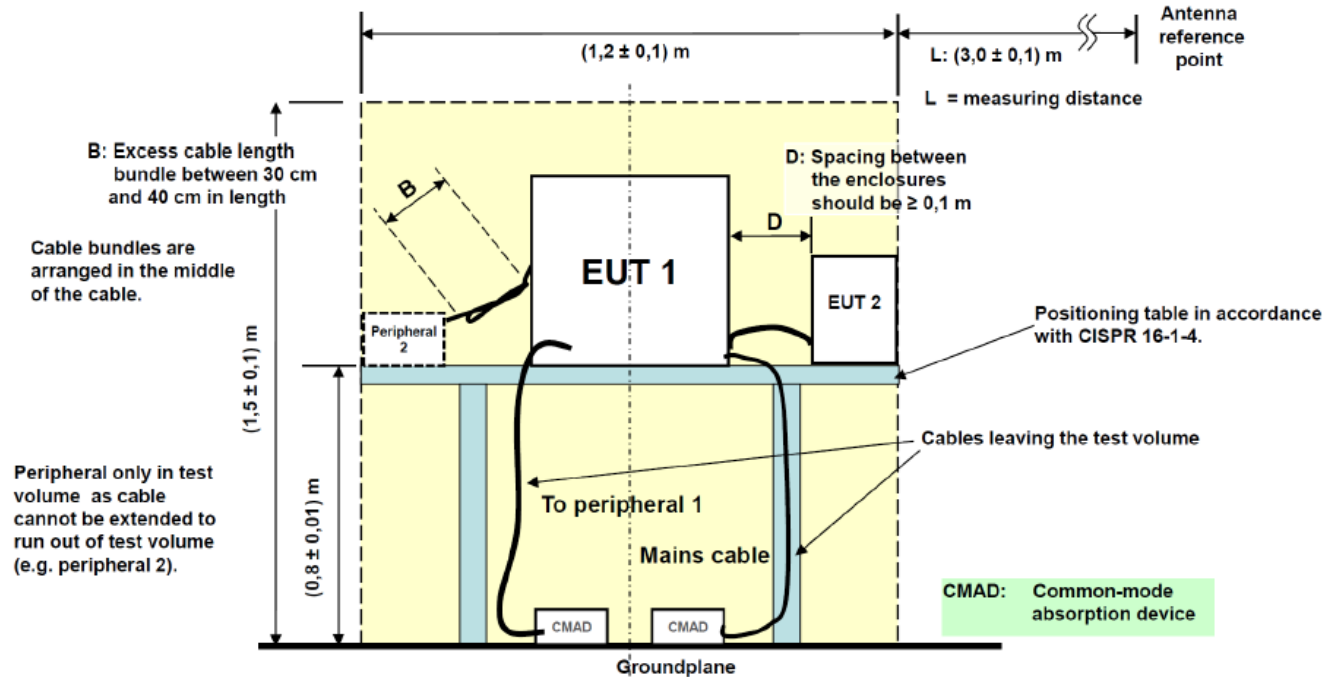
I Applicability

- | | |
|--------------------------------------|--|
| I CISPR 32:2012 (Multimedia) | Applicable since 30.01.2012 |
| I CISPR 15:2013 (Lighting) | Applicable since 08.05.2013 |
| I CISPR 11:2015 (ISM) | Applicable since 09.06.2015 |
| I CISPR 14-1:2016 (Household) | Applicable since 10.08.2016 |
| I CISPR 25:2016 (Automotive) | Applicable since 27.10.2016 |
| I IEC 61000-6-4 (Generic Industrial) | Applicable since 07.02.2018 |
| I IEC 61000-6-3/-8 (Generic Res+Li) | Applicable since 30.07.2020 |
| I CISPR 12:202x (Automotive) | Publication of Ed. 7 expected in 2021 |
| I FCC Part 15, ANSI C63.4 | Applicable (referencing ANSI C63.2:2016) |
| I MIL-STD 461 Rev. G | Applicable since 11.12.2015 |



CISPR 11 – GENERAL MAINTENANCE ED. 6

Typical cable arrangement for small table-top EUT (3 m)

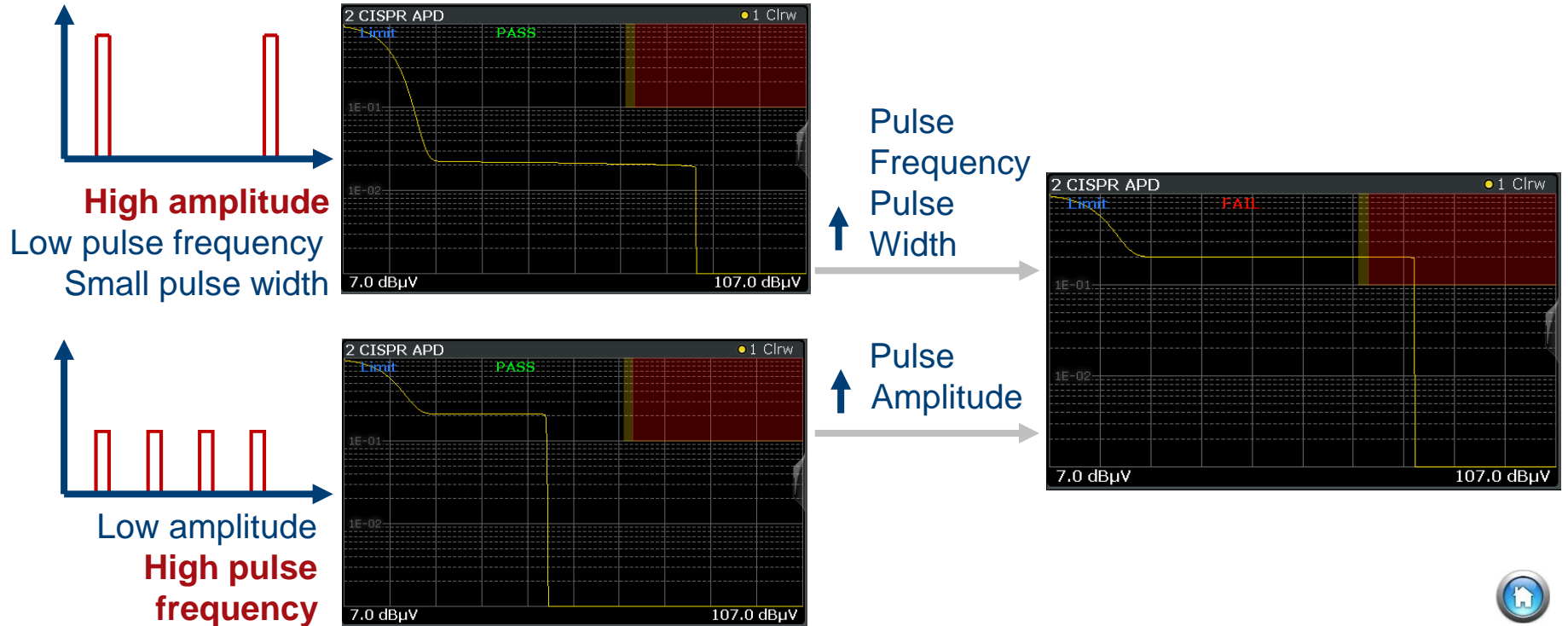


Source: CISPR 11:2015-06 (Ed.6)



CISPR 11 – APD MEASUREMENT FUNCTION

Weighting of interference signals by APD

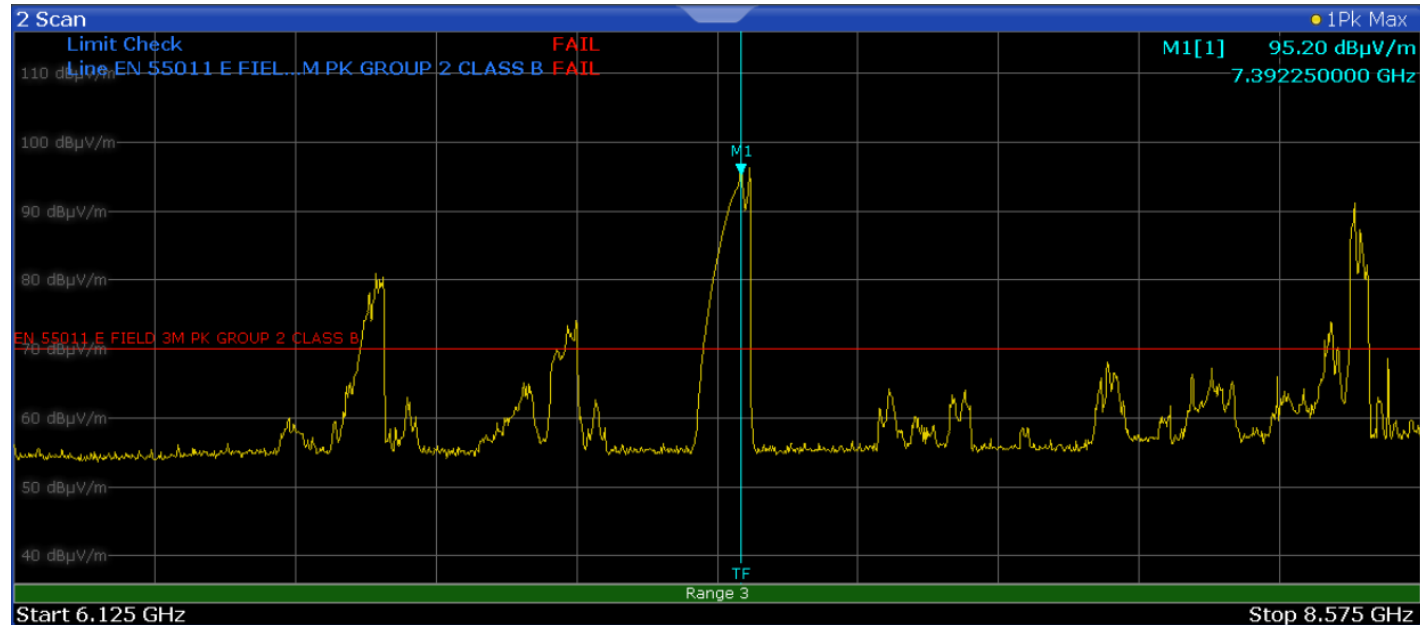


CISPR 11 – APD MEASUREMENT FUNCTION

R&S®ESW-K58 APD Multi-Channel Measurements

Preview measurement in subrange 3 (6.125 GHz to 8.575 GHz)

Peak level exceeds the CISPR 11 peak limit by far → Preview **FAIL**



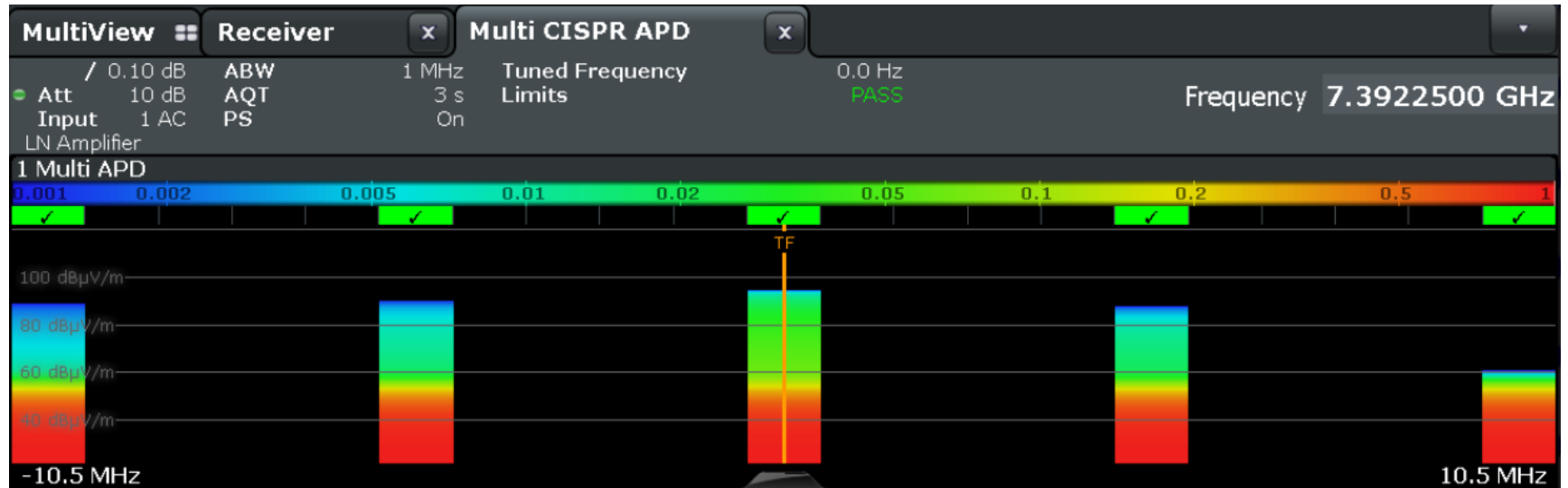
CISPR 11 – APD MEASUREMENT FUNCTION

R&S®ESW-K58 APD Multi-Channel Measurements

Final APD measurement at the highest peak that exceeds the peak limit

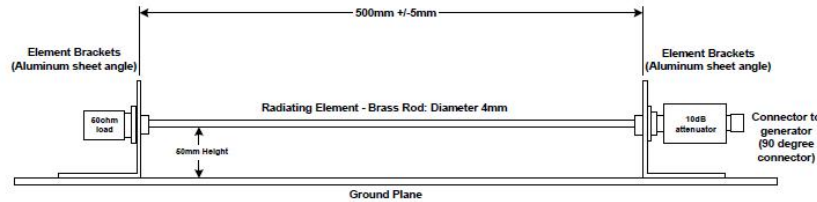
2D chart for visualization for all measurement channels, Tuned Frequency ± 5 and ± 10 MHz

→ Final Result **PASS**

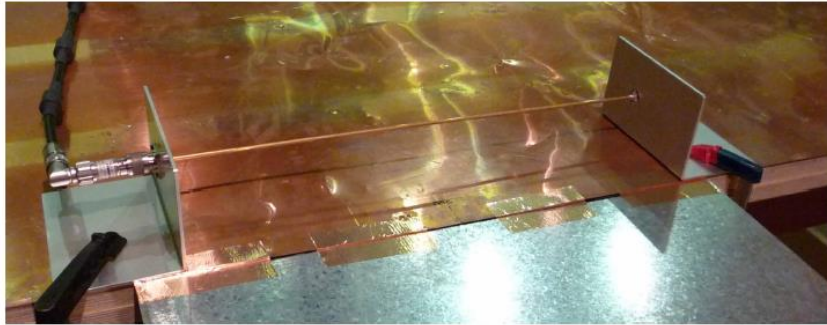


CISPR 25 – AUTOMOTIVE EQUIPMENT PROTECTION OF ON-BOARD RECEIVERS

Long wire method for chamber validation 150 kHz to 1 GHz



e J.8 - Radiator side view 50 Ω terminations



Source: CISPR 25:2016-10 (Ed.4)

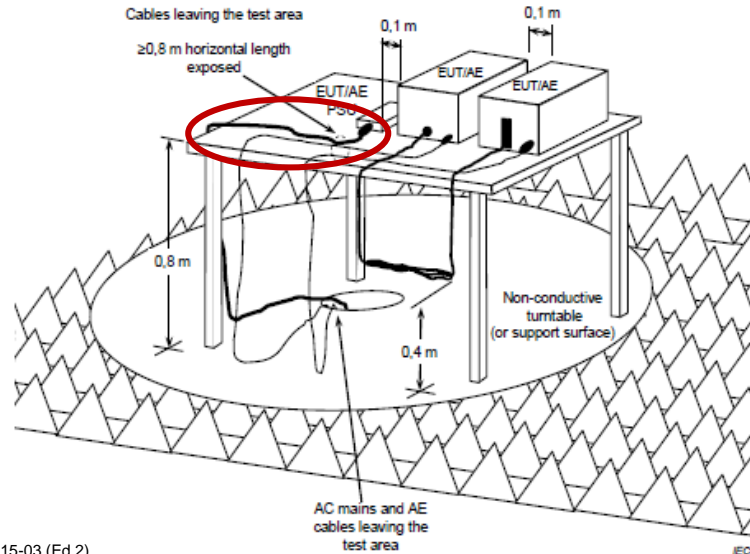


CISPR 32 – MEASUREMENT IN FAR

I Class B Limits in FAR (Table A.4 in CISPR 32 Ed. 2)

A4.3	30 to 230	FAR	10	Quasi Peak / 120 kHz	32 to 25
	230 to 1 000				32
A4.4	30 to 230	FAR	3		42 to 35
	230 to 1 000				42

- I Set-up for table top equipment
→ for cables leaving the test area horizontal length $\geq 0,8\text{m}$



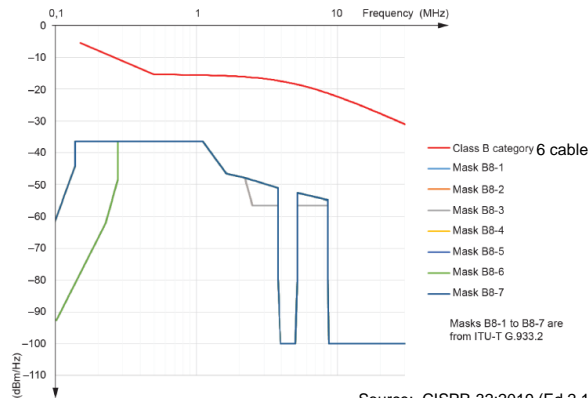
Source: CISPR 32:2015-03 (Ed.2)



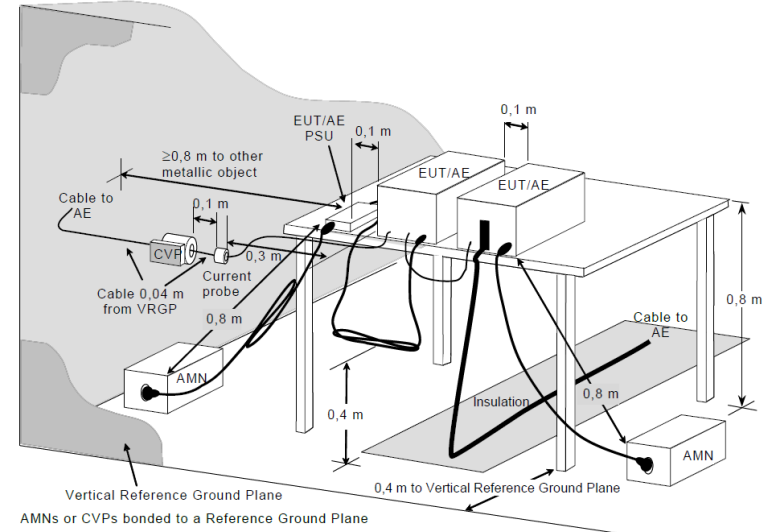
CISPR 32 – MULTIMEDIA EQUIPMENT

Wired network port: Measurement of launched common mode

- ▶ if defined wanted signal power does not exceed the power spectral density (PSD) limit and if Quasi-peak to Average ratio is less or equal to 10 dB
 - ▮ Use new AAN with highest LCL value such as R&S®ENY81-CA6 (LCL = 75 dB) that doesn't interrupt normal operation
 - ▮ Use combination of CP/CVP (non-invasive methodology)



Source: CISPR 32:2019 (Ed.2.1)



Source: CISPR 32:2015-03 (Ed.2)



CISPR 32 – MULTIMEDIA EQUIPMENT

Clarification on color bar test pattern

- I ITU-R BT.1729 Multi Zone Test Pattern 16:9 High Definition Television (HDTV)
- I ITU-R BT.1729 Color Bar Test Pattern 16:9 for SDTV and HDTV
- I New informative Annex J in CISPR 32 Color Bar Image
→ with moving element, shall cover the full width of the display and \geq half of display height

- 1080i / 25 frames per second
- 1080p / 50 frames per second

- 1080i / 29.97 frames per second
- 1080i / 25 frames per second)

