Product Service

Choose certainty.
Add value.

August 5, 2015

Prüfbericht / *Test Report* Nr. / *No.* 69547-58486-01 (Edition 4)

Applicant:	KABA GmbH
Type of equipment:	KABA Desktop Reader
Type designation:	91 08-K5 SC-2560
Order No.:	--
Test standards:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207, 15.209, 15.215 and 15.225

Trade Register Munich
HRB 85742
VAT ID No. DE129484267
Information pursuant to Section 2(1)
DL-InfoV (Germany) at
www.tuev-sued.com/imprint

Supervisory Board:
Dirk Eilers

Management:
Robert Kees
Dr. Jens Butenandt

Phone: +49 9421 55 22-0
Fax: +49 9421 55 22-99
www.tuev-sued.de

TÜV SÜD Product Service GmbH

Äußere Frühlingstraße 45
94315 Straubing
Germany

Table of Contents

1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation[1]:	91 08-K5 SC-2560
Tested type:	91 08-K5 SC-2560
Parts[2]:	--
Serial number(s):	04043123 - 5033
Art. number(s):	04043123
Manufacturer:	KABA GmbH
Type of equipment:	KABA Desktop Reader
Version:	As received
FCC ID:	NVI-9108L2
Additional parts/accessories:	--

[1] Type designation of the system if EUT consists of more than one part.
[2] Type designations of the parts of the system, if applicable.

Technical data of EUT	
Application frequency range:	13.110 - 14.010 MHz
Frequency range:	13.553 – 13-567 MHz
Operating frequency:	13.56 MHz
Type of modulation:	ASK
Pulse train:	--
Pulse width:	--
Number of RF-channels:	1
Channel spacing:	--
Designation of emissions[3]:	40k2A1D
Type of antenna:	Integrated
Size/length of antenna:	--
Connection of antenna:	☐ detachable ☒ not detachable
Type of power supply:	DC supply
Specifications for power supply:	nominal voltage: 5.0 V minimum voltage: 4.5 V maximum voltage: 5.0 V nominal frequency: DC Hz

[3] Also known as "Class of Emission".

2 Administrative Data

Application details	
Applicant (full address):	KABA GmbH Albertistraße D-78056 Villingen-Schwenningen
Contact person:	Mr. Ralf Altmann
Order number:	--
Receipt of EUT:	2015-03-05
Date(s) of test:	2015-03-05 to 2015-03-18
Note(s):	Mr. Ralf Altmann representing the applicant and attended the test from 2015-03-05 to 2015-03-06

Report details	
Report number:	69547-58486-01
Edition:	4
Issue date:	August 5, 2015

3 Identification of the Test Laboratory

Details of the Test Laboratory	
Company name:	TÜV SÜD Product Service GmbH
Address:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
Laboratory accreditation:	DAkkS Registration No. D-PL-11321-11-01
FCC test site registration number	90926
Industry Canada test site registration:	3050A-2
Contact person:	Mr. Johann Roidt Phone: +49 9421 5522-0 Fax: +49 9421 5522-99

4 Summary

Summary of test results
The tested sample complies with the requirements set forth in the **Code of Federal Regulations CFR 47, Part 15, Sections 15.205, 15.207, 15.209, 15.215 and 15.225** of the Federal Communication Commission (FCC).

Personnel involved in this report	
Laboratory Manager:	 Mr. Johann Roidt
Responsible for testing:	 Mr. Markus Biberger
Responsible for test report:	Mr. Markus Biberger

5 Operation Mode and Configuration of EUT

Operation Mode(s)
The EUT is transmitting continuously and read out TAG with KABA test software.

Configuration(s) of EUT
The EUT is connected via USB to test notebook

List of ports and cables				
Port	*Description*	*Classification*[4]	*Cable type*	*Cable length*
1	USB cable	signal/control port	Shielded	1.3 m

List of devices connected to EUT				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	Notebook	E-540	--	Lenovo
2	PSU of Notebook	ADLX65NDT3A	11S45N0313Z1ZLZC38D4ZL	Lenovo

List of support devices				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
	--	--	--	--

[4] Ports shall be classified as ac power, dc power or signal/control port

6 Measurement Procedures

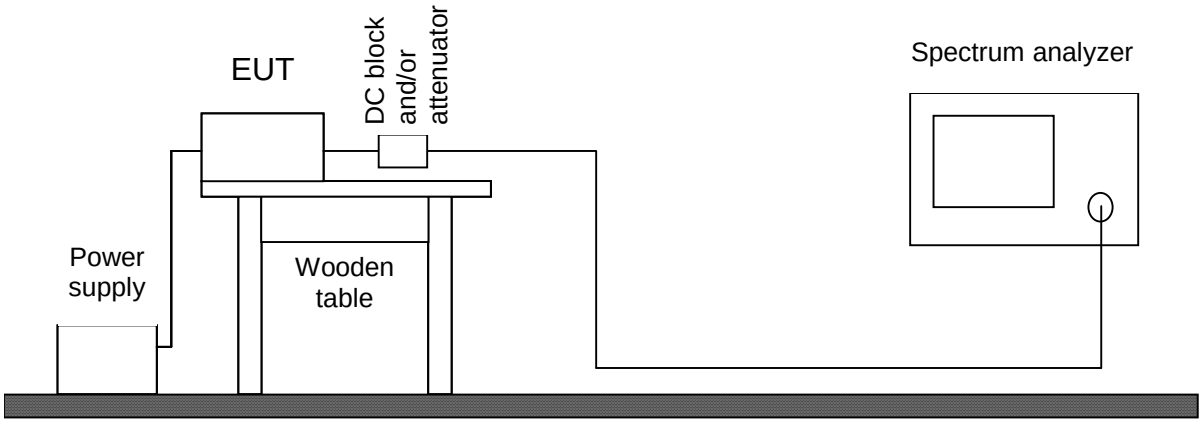
6.1 Bandwidth Measurements

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 2, section 2.202(a) CFR 47 Part 15, section 15.215(c) ANSI C63.10, section 6.9.1
Guide:	ANSI C63.10
Measurement setup:	☐ Conducted: See below ☒ Radiated: Radiated Emission Measurement 9 kHz to 30 MHz (6.3)

If antenna is detachable bandwidth measurements shall be performed at the antenna connector (conducted measurement) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.

If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range.

The analyzer settings are specified by the test description of the appropriate test record(s).



TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test instruments used for conducted measurements:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
☐	EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☐	Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
☒	EMI test receiver	ESU8	2044	100232	Rohde & Schwarz
☐	Preamplifier Cabin no. 2	CPA9231A	1716	3557	Schaffner
☒	Loop antenna	HFH2-Z2	1016	882964/1	Rohde & Schwarz
☐	Microwave cable Cabin no. 2	UFA210A-FG	1681	23516	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 2	KKSF1040016	2020	289854/4	Huber + Suhner
☐	Microwave cable Cabin no. 2	FA210AF020000000	2060	64566-2	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	EF393	2053	---	Albatross Projects
☐	Microwave cable Cabin no. 8	FB293C1050005050	2054	63834-1	Rosenberger Micro-Coax
☒	Microwave cable Cabin no. 8	FB293C1080005050	2055	63833-1	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☒	Microwave cable Cabin no. 8	LCF12-50	2057	P1.4.12	RFS
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☐	Microwave cable Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505G	2056	64567-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☐	Fully anechoic room	No. 2	1452	---	Albatross
☐	Semi anechoic room	No. 3	1453	---	Siemens
☒	Semi anechoic room	No. 8	2057	---	Albatross

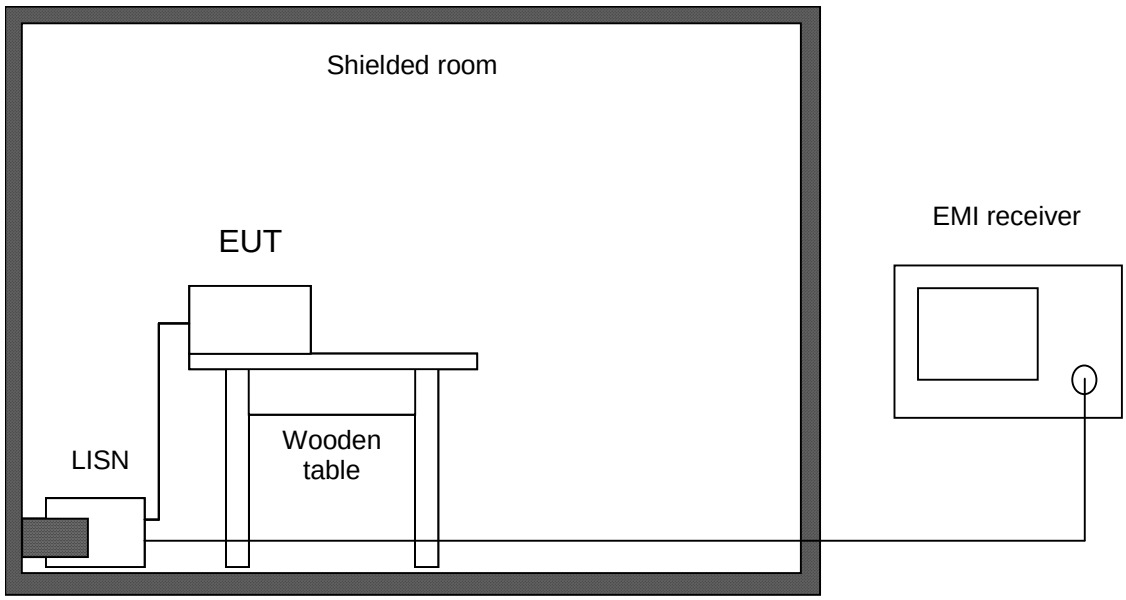
6.2 Conducted AC Powerline Emission

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.207
Guide:	ANSI C63.10 / CISPR 22

Conducted emission tests in the frequency range 150 kHz to 30 MHz are performed using Line Impedance Stabilization Networks (LISNs). To simplify testing with quasi-peak and average detector the following procedure is used:

First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with detector set to peak using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with detector set to quasi-peak.
If average limit is kept with quasi-peak levels no additional scan with average detector is necessary. In cases of emission levels between quasi-peak and average limit an additional scan with detector set to average is performed.

According to ANSI C63.10, testing of intentional radiators with detachable antenna shall be performed using a suitable dummy load connected to the antenna output terminals. Otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended.
Testing with dummy load may be necessary to distinguish (unintentional) conducted emissions on the supply lines from (intentional) emissions radiated by the antenna and coupling directly to supply lines and/or LISN. Usage of dummy load has to be stated in the appropriate test record(s) and notes should be added to clarify the test setup.



Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
☒	V-network	ESH 3-Z5	1059	894785/005	Rohde & Schwarz
☒	V-network	ESH 3-Z5	1060	830952/025	Rohde & Schwarz
☐	Artificial mains network	ESH 2-Z5	1536	842966/004	Rohde & Schwarz
☒	Microwave cable	FB293C1080005050	2157	72110-02	Rosenberger Micro-Coax
☒	Coax cable	RG214 N/N 5m	1188	---	Senton
☐	Shielded room	No. 1	1451	---	Albatross
☒	Shielded room	No. 4	1454	3FD 100 544	Euroshield

6.3 Radiated Emission Measurement 9 kHz to 30 MHz

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205, 15.215(b) and 15.225(a)-(d)
Guide:	ANSI C63.10

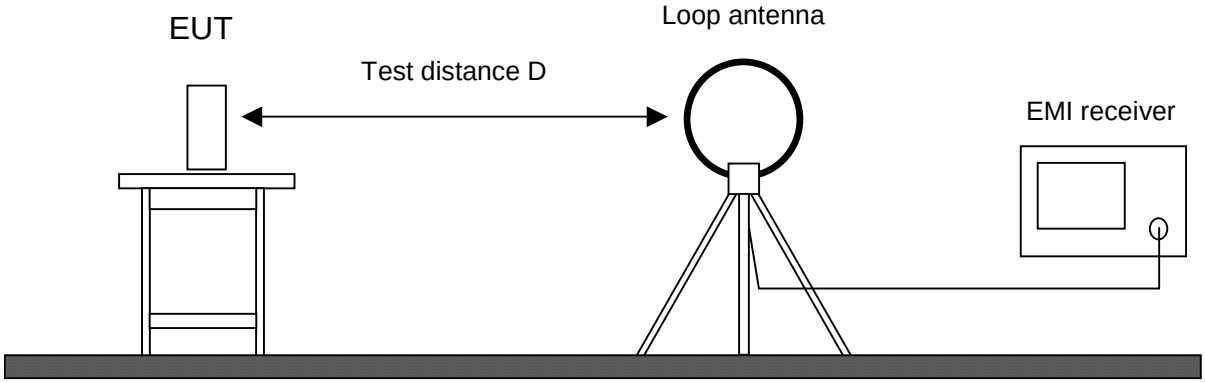
Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. This configuration is also used for recording the spectrum of intentional radiators.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization the EUT (or the radiating part of the EUT) is rotated by 90 degrees instead of changing the loop antenna to horizontal polarization. This procedure is selected to minimize the influence of the environment (e.g. effects caused by the floor especially with longer distances).

Final measurement is performed at a test distance D of 30 meters using an open field test site. In case the regulation requires testing at other distances, the result is extrapolated by either making measurements at an additional distance D of 10 meters to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). In cases of very low emissions measurements are performed at shorter distances and results are extrapolated to the required distance. The provisions of CFR 47 Part 15 sections 15.31(d) and (f)(2) apply. According to CFR 47 Part 15 section 15.209(d) final measurement is performed with detector function set to quasi-peak except for the frequency bands 9 to 90 kHz and 110 to 490 kHz where, for non-pulsed operation, average detector is employed.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.



Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
☐	EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☐	Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
☒	EMI test receiver	ESU8	2044	100232	Rohde & Schwarz
☐	Preamplifier Cabin no. 2	CPA9231A	1716	3557	Schaffner
☒	Loop antenna	HFH2-Z2	1016	882964/1	Rohde & Schwarz
☐	Microwave cable Cabin no. 2	UFA210A-FG	1681	23516	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 2	KKSF1040016	2020	289854/4	Huber + Suhner
☐	Microwave cable Cabin no. 2	FA210AF020000000	2060	64566-2	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	EF393	2053	---	Albatross Projects
☐	Microwave cable Cabin no. 8	FB293C1050005050	2054	63834-1	Rosenberger Micro-Coax
☒	Microwave cable Cabin no. 8	FB293C1080005050	2055	63833-1	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☒	Microwave cable Cabin no. 8	LCF12-50	2057	P1.4.12	RFS
☐	Microwave cable Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☐	Microwave cable Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505G	2056	64567-01	Rosenberger Micro-Coax
☐	Microwave cable Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☐	Fully anechoic room	No. 2	1452	---	Albatross
☐	Semi anechoic room	No. 3	1453	---	Siemens
☒	Semi anechoic room	No. 8	2057	---	Albatross

6.4 Radiated Emission in Fully or Semi Anechoic Room

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d)
Guide:	ANSI C63.10

Radiated emission in fully or semi anechoic room is measured in the frequency range from 30 MHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.

Measurements are made in both the horizontal and vertical planes of polarization using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz (below 1 GHz) or 1 MHz (above 1 GHz).

Testing up to 1 GHz is performed with a linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna"). For testing above 1 GHz horn antennas are used.

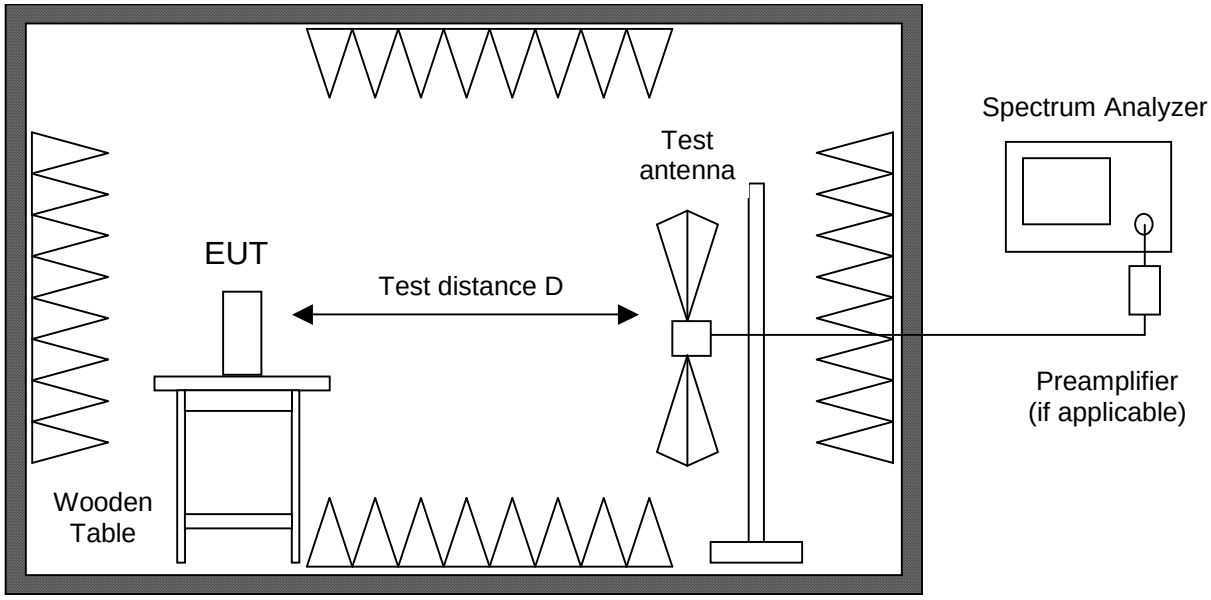
All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For final testing below 1 GHz a semi anechoic room complying with the NSA requirements of ANSI C63.10 for alternative test sites is used (see 6.5). If prescans are recorded in fully anechoic room they are indicated appropriately.



Fully or semi anechoic room

Test instruments used:

	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer		FSP30	1666	100036	Rohde & Schwarz
☐	EMI test receiver	Cabin no. 3	ESPI7	2010	101018	Rohde & Schwarz
☐	EMI test receiver		ESU8	2044	100232	Rohde & Schwarz
☐	EMI test receiver		ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☐	Preamplifier	Cabin no. 2	CPA9231A	1716	3557	Schaffner
☐	Preamplifier		R14601	1142	13120026	Advantest
☐	Preamplifier (1 - 8 GHz)		AFS3-00100800-32-LN	1684	847743	Miteq
☐	Preamplifier (0.5 - 8 GHz)		AMF-4D-005080-25-13P	1685	860149	Miteq

	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Preamplifier (8 - 18 GHz)		ACO/180-3530	1484	32641	CTT
☐	External Mixer		WM782A	1576	845881/005	Tektronix
☐	Harmonic Mixer Accessories		FS-Z30	1577	624413/003	Rohde & Schwarz
☐	Trilog antenna	Cabin no. 2	VULB 9163	1802	9163-214	Schwarzbeck
☐	Trilog antenna	Cabin no. 3	VULB 9163	1722	9163-188	Schwarzbeck
☐	Trilog antenna	Cabin no. 8	VULB 9163	2058	9163-408	Schwarzbeck
☐	Trilog antenna	Cabin no. 2	VULB 9162	2256	9162-048	Schwarzbeck
☐	Horn antenna		3115	1516	9508-4553	EMCO
☐	Horn antenna		3160-03	1010	9112-1003	EMCO
☐	Horn antenna		3160-04	1011	9112-1001	EMCO
☐	Horn antenna		3160-05	1012	9112-1001	EMCO
☐	Horn antenna		3160-06	1013	9112-1001	EMCO
☐	Horn antenna		3160-07	1014	9112-1008	EMCO
☐	Horn antenna		3160-08	1015	9112-1002	EMCO
☐	Horn antenna		3160-09	1265	9403-1025	EMCO
☐	Horn antenna		3160-10	1575	399185	EMCO
☐	Microwave cable	Cabin no. 2	UFA210A-FG	1681	23516	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 2	KKSF1040016	2020	289854/4	Huber + Suhner
☐	Microwave cable	Cabin no. 2	FA210AF020000000	2060	64566-2	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	EF393	2053	---	Albatross Projects
☐	Microwave cable	Cabin no. 8	FB293C1050005050	2054	63834-1	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	FB293C1080005050	2055	63833-1	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☐	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.4.12	RFS
☐	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☐	Microwave cable	Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	FA210AF04000505G	2056	64567-01	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☐	Fully anechoic room		No. 2	1452	---	Albatross
☐	Semi anechoic room		No. 8	2057	---	Albatross

6.5 Radiated Emission at Alternative Test Site

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d)
Guide:	ANSI C63.10

Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.10 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

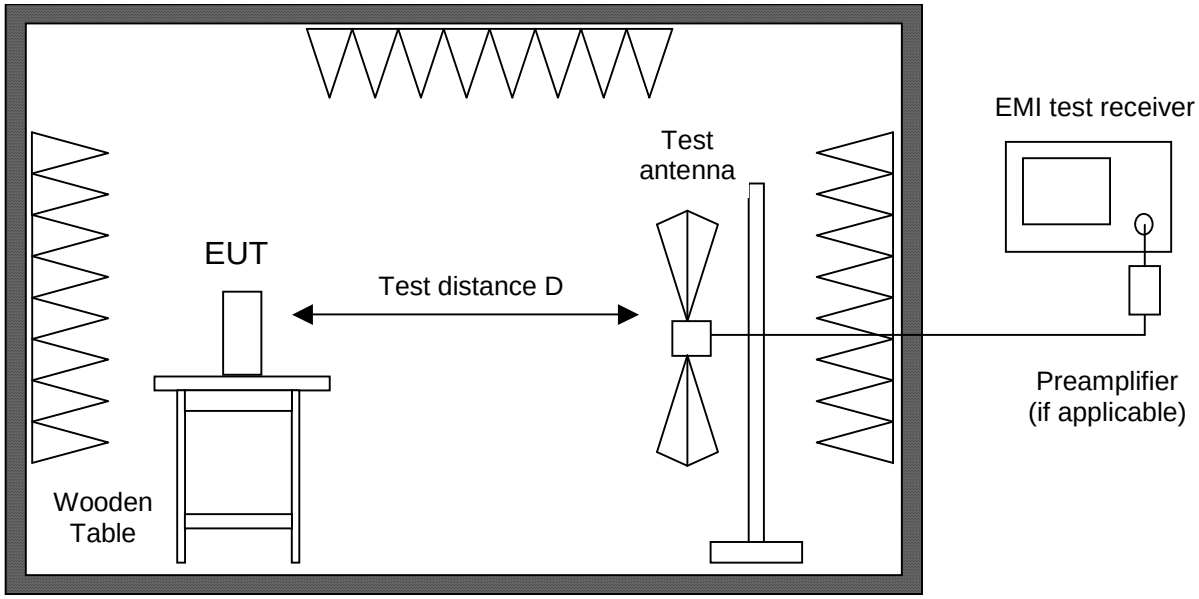
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.

If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is dircharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.



Alternate test site (semi anechoic room)

Test instruments used:

	Type		*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☒	EMI test receiver		ESU8	2044	100232	Rohde & Schwarz
☒	Trilog antenna	Cabin no. 8	VULB 9163	2058	9163-408	Schwarzbeck
☒	Microwave cable	Cabin no. 8	EF393	2053	---	Albatross Projects
☒	Microwave cable	Cabin no. 8	FA210AF04000505G	2056	64567-01	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.6.19	RFS
☒	Microwave cable	Cabin no. 8	LCF12-50	2057	P1.3.9	RFS
☐	Microwave cable	Cabin no. 8	FA210AF04000505	2068	64610-1	Rosenberger Micro-Coax
☐	Microwave cable	Cabin no. 8	FA210AF040005050G	2127	72061-01	Rosenberger Micro-Coax
☐	Semi anechoic room		No. 8	2057	---	Albatross

6.6 Carrier Frequency Stability

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.225(e)
Guide:	ANSI C63.10

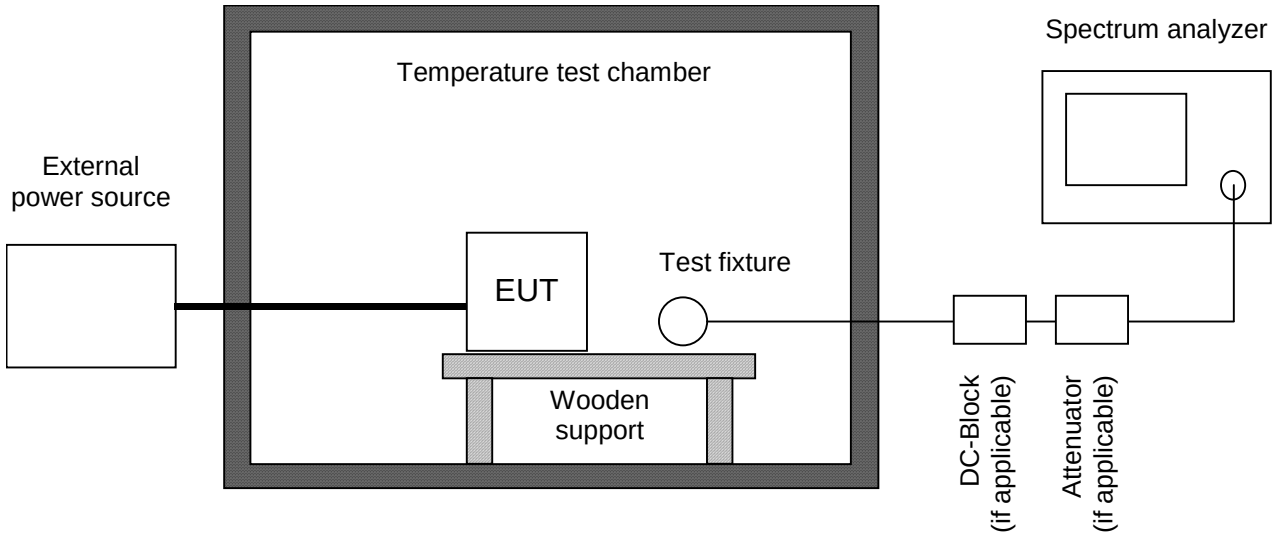
The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 °C.

If the EUT provides an antenna connector the spectrum analyzer is connected to this port. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). In cases where the EUT does not provide an antenna connector a test fixture is used.

For battery operated equipment, the test is performed using a new battery. Alternatively, an external supply voltage can be used and is at least set to:

- the maximum battery voltage as delivered by a new battery or 115% of the battery nominal voltage
- the battery nominal voltage
- 85% of the battery nominal voltage
- the battery operating end point voltage which shall be specified by the equipment manufacturer

The EUT is operating providing an unmodulated carrier. The peak detector of the spectrum analyzer is selected and resolution as well as video bandwidth are set to values appropriate to the shape of the spectrum of the EUT. The frequency counter mode of the spectrum analyzer is used to maximize the accuracy of the measured frequency tolerance.
If an unmodulated carrier is not available a significant and stable point on the spectrum is selected and the span is reduced to a value that delivers an accuracy which shall be better than 1% of the maximum frequency tolerance allowed for the carrier signal. This method may be performed as long as the margin to the frequency tolerance allowed is larger than the uncertainty of the measured frequency tolerance.

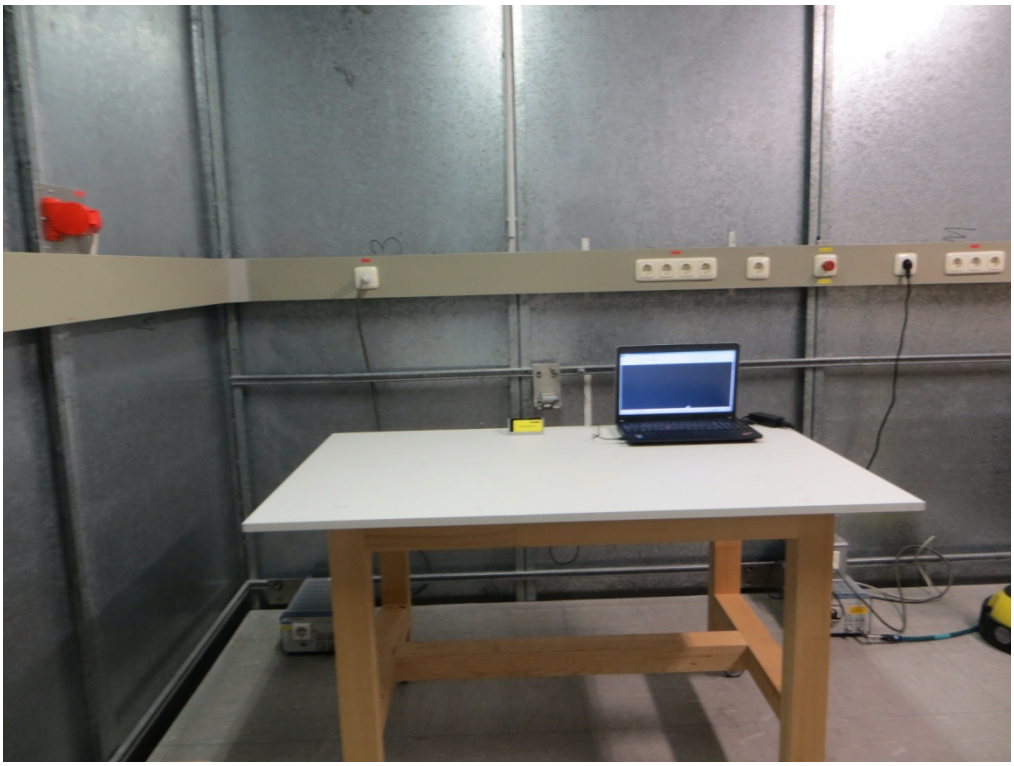


Test instruments used:

	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
☒	EMI test receiver	ESPI7	1711	836914/0002	Rohde & Schwarz
☐	EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☐	DC-block	7006	1636	A2798	Weinschel
☐	Attenuator	4776-10	1638	9412	Narda
☐	Attenuator	4776-20	1639	9503	Narda
☒	Test probe	TP 01	1628	001	TÜV SÜD PS
☒	Multimeter	21 III	1653	76530546	Fluke
☐	Multimeter	21 III	1654	76381229	Fluke
☐	Multimeter	Fluke 77 III	1975	92370108	Fluke
☐	Multimeter	Fluke 77 IV	1976	93090238	Fluke
☐	Multimeter	Fluke 177	2025	96720024	Fluke
☐	Multimeter	Fluke 177	2026	96720025	Fluke
☐	DC power supply	NGSM 32/10	1267	203	Rohde & Schwarz
☐	Isolating transformer	RT 5A	1127	10387	Grundig
☐	Isolating transformer	RT 5A	1128	10416	Grundig
☒	Temperature test chamber	HT 4010	1271	07065550	Heraeus

7 Photographs Taken During Testing

Test setup for conducted AC powerline emission measurement

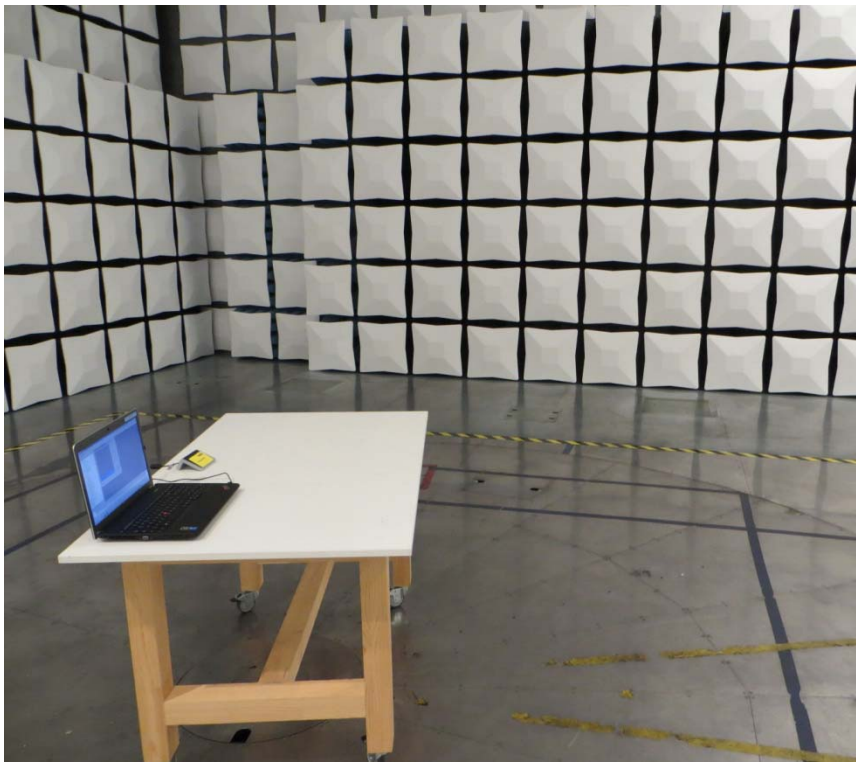


TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test setup for conducted AC powerline emission measurement - continued -

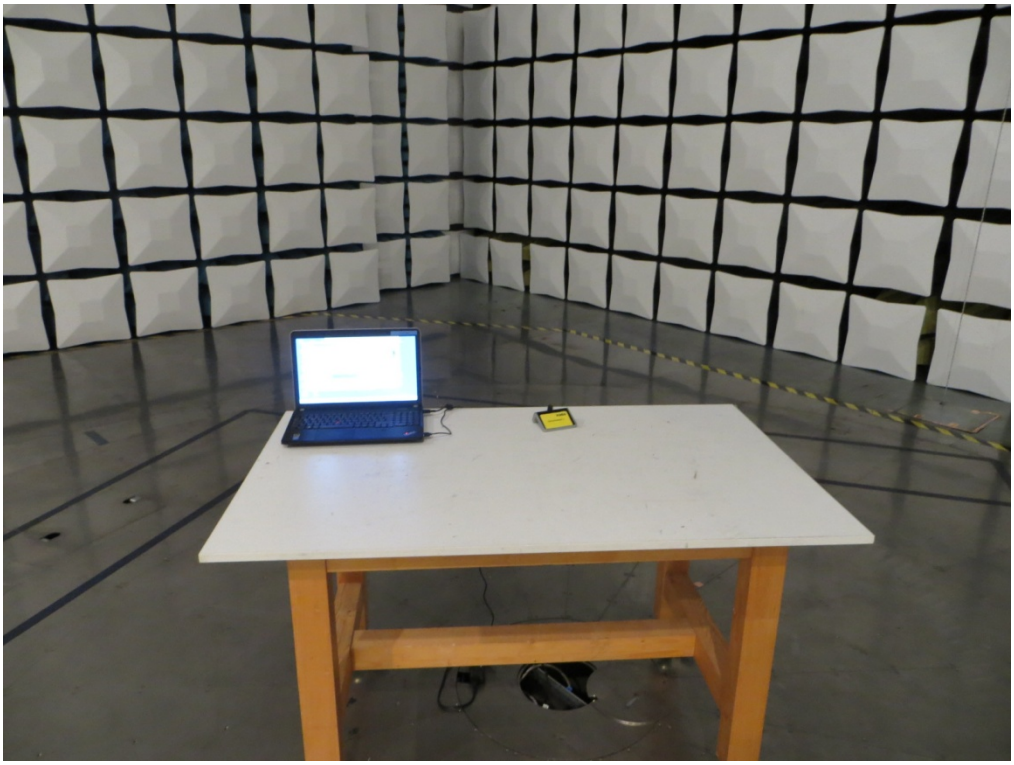
Test setup for radiated emission measurement 9 kHz – 30 MHz



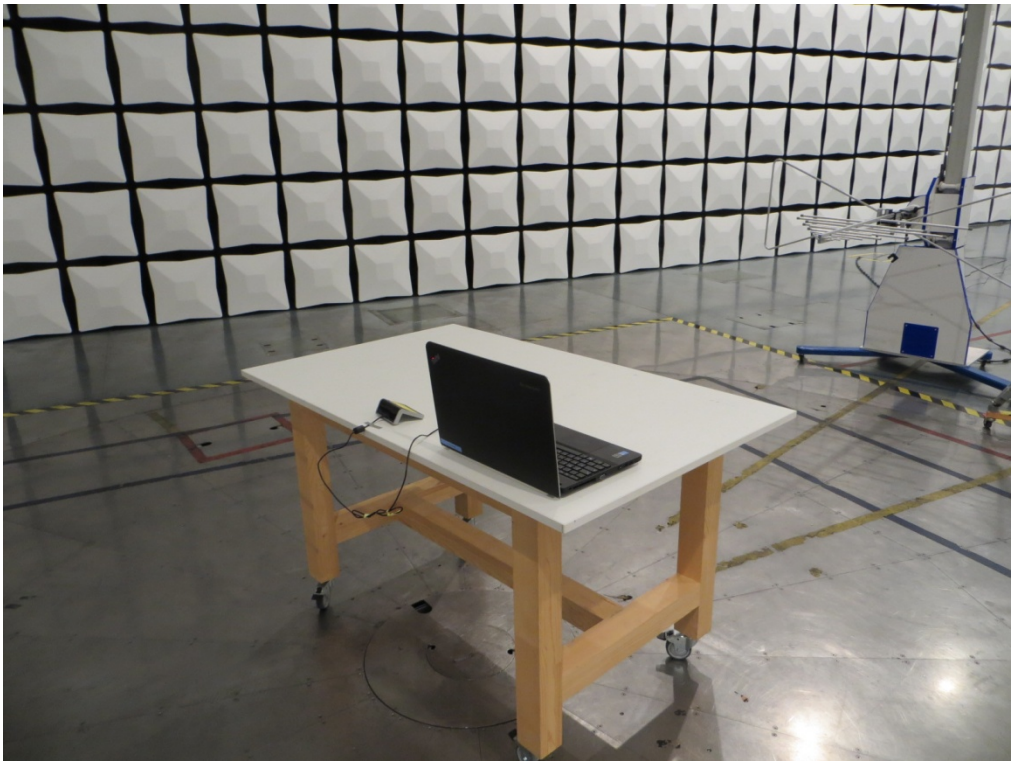
TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

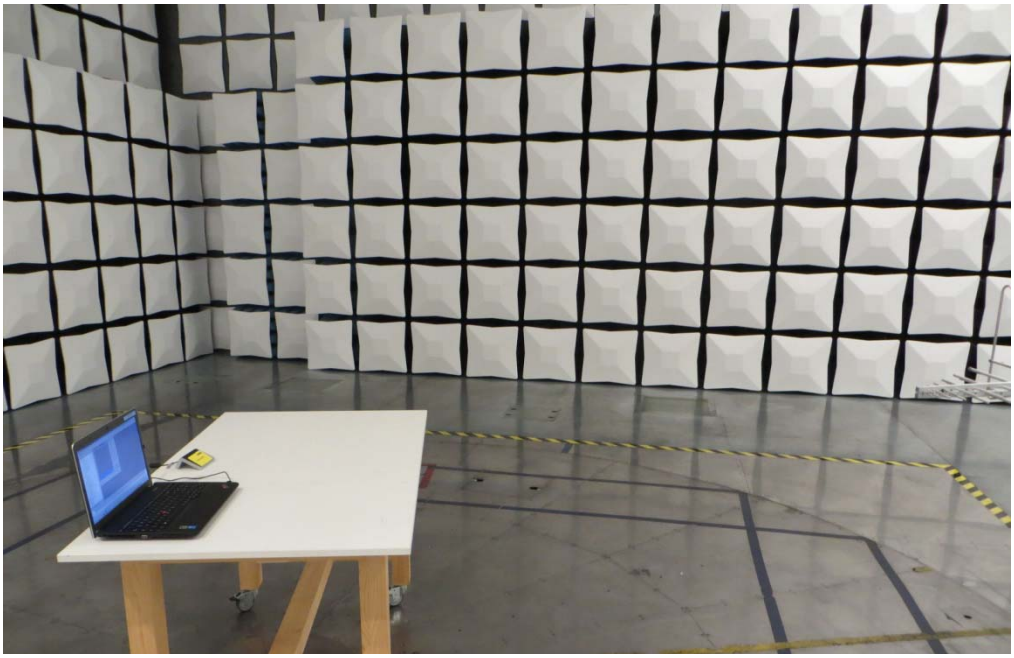
Test setup for radiated emission measurement 9 kHz – 30 MHz
- continued -



Test setup for radiated emission measurement (alternate test site)



Test setup for radiated emission measurement (alternate test site) - continued -



Test setup for carrier frequency stability measurement

8 Test Results

FCC CFR 47 Parts 2 and 15			
Section(s)	*Test*	*Page*	*Result*
2.1046(a)	Conducted output power	---	Not applicable
2.202(a)	Occupied bandwidth	31	Recorded
15.215(c)	Bandwidth of the emission	35	Test passed
2.201, 2.202	Class of emission	37	Calculated
15.35(c)	Pulse train measurement for pulsed operation	---	Not applicable
15.205(a) 15.205(d)(7)	Restricted bands of operation	---[5]	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	38	Test passed
15.225(a)-(d)	Spectrum Mask	41	Test passed
15.205(b) 15.215(b) 15.225(a)(d)	Radiated emission 9 kHz to 30 MHz	43	Test passed
15.205(b) 15.225(d)	Radiated emission 30 MHz to 1 GHz	46	Test passed
15.225(e)	Carrier frequency stability	49	Test passed

[5] See "Spectrum Mask" for the 13.36 to 13.41 MHz band. For all other restricted bands see "Radiated Emission".

8.1 Occupied Bandwidth

Rules and specifications:	CFR 47 Part 2, section 2.202(a)
Guide:	ANSI C63.10
Description:	The occupied bandwidth according to CFR 47 Part 2, section 2.202(a), is measured as the 99% emission bandwidth, i.e. below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission. The occupied bandwidth according to ANSI C63.10; is measured as the frequency range defined by the points that are 26 dB down relative to the maximum level of the modulated carrier. The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

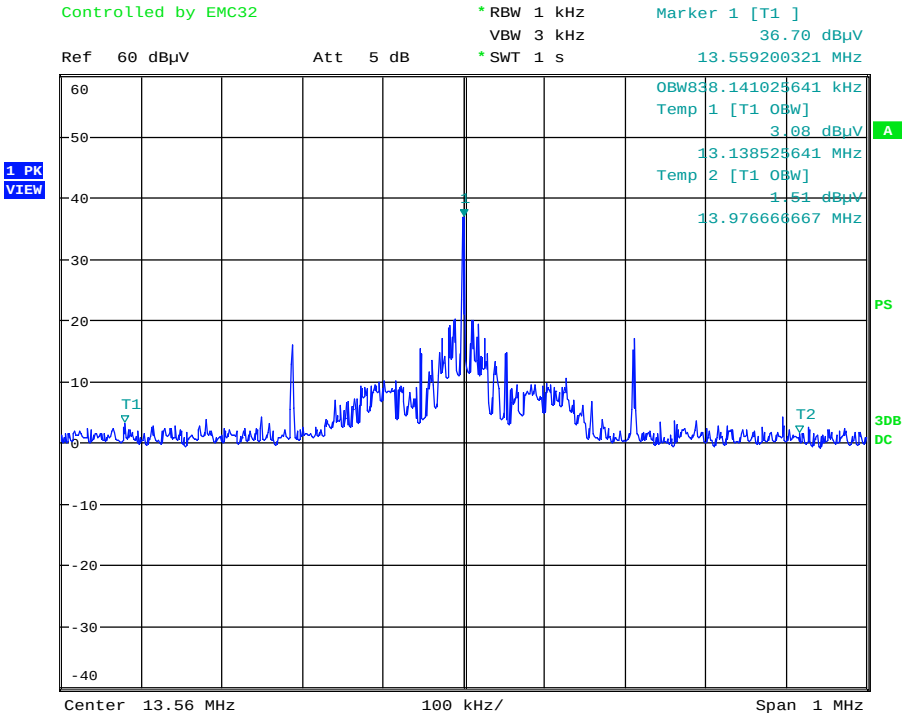
Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 MHz to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

The video bandwidth shall be at least three times greater than the resolution bandwidth.

Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	--
Date of test:	2015-03-06
Test site:	Alternate test site, cabin no. 8

Occupied Bandwidth (99 %):



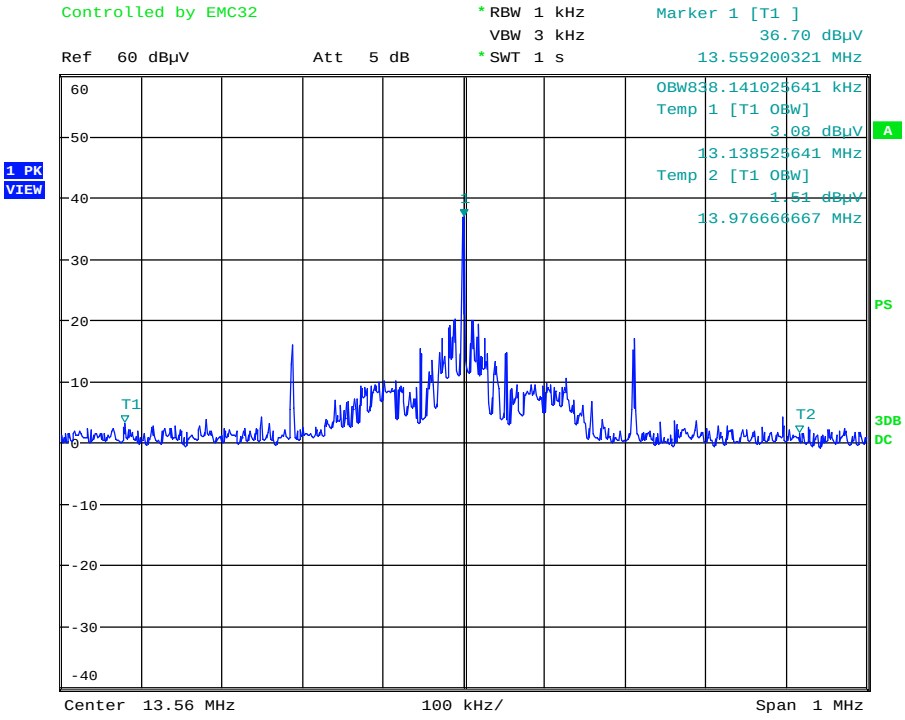
Occupied Bandwidth (99 %):	**838 kHz**

Occupied Bandwidth (continued)

Rules and specifications:	IC RSS-Gen Issue 4, section 6.6
Guide:	IC RSS-Gen Issue 4, section 6.6
Description:	If not specified in the applicable RSS the occupied bandwidth is measuredas the 99% emission bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is also recorded. The span between the two recorded frequencies is the occupied bandwidth.
Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	--
Date of test:	2015-03-06
Test site:	Alternate test site, cabin no. 8

Occupied Bandwidth (99 %):

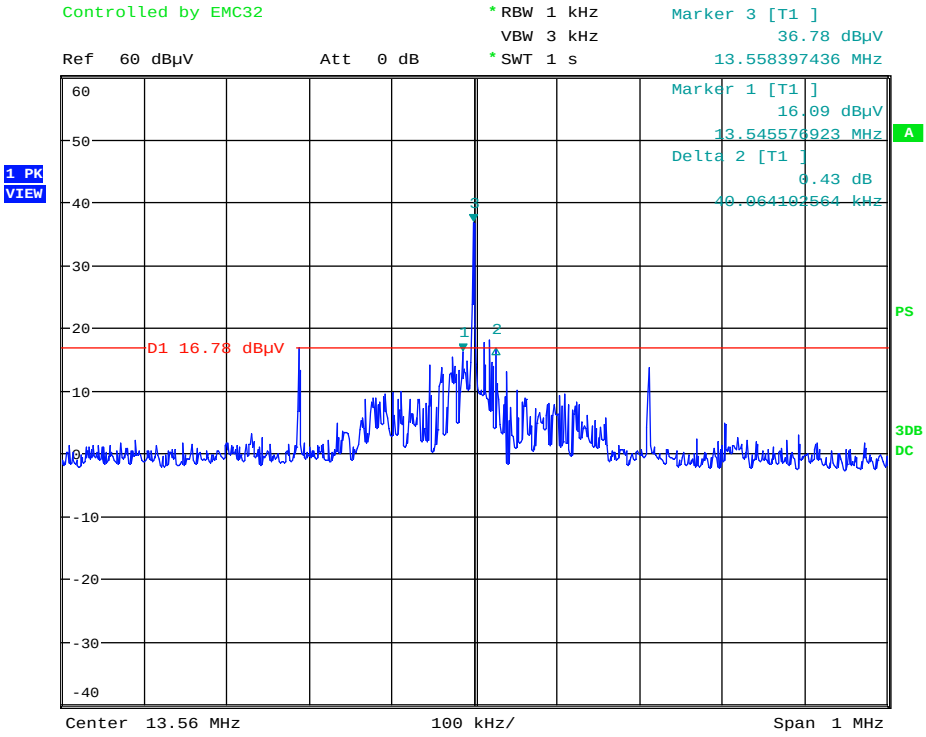


Occupied Bandwidth (99 %):	**838 kHz**

8.2 Bandwidth of the Emission

Rules and specifications:	CFR 47 Part 15, section 15.215(c)
Guide:	ANSI C63.10
Description:	The 20 dB bandwidth of the emission is measured as the frequency range defined by the points that are 20 dB down relative to the maximum level of the modulated carrier. For intentional radiators operating under the alternative provisions to the general emission limits the requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation. The span range of the spectrum analysator display shall be between two times and five times of the occupied bandwidth. The resolution bandwidth of the spectrum analyzer should be approximately 1 % to 5 % of the occupied bandwidth, unless otherwise specified, depending on the applicable requirement. The video bandwidth shall be at least three times greater than the resolution bandwidth. The dynamic range of the spectrum analyzator at the selected resolution bandwidth shall be more than 10 dB below the target “dB down” (attenuation) requirement.
	The video bandwidth shall be at least three times greater than the resolution bandwidth.
Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	--
Date of test:	2015-03-06
Test site:	Alternate test site, cabin no. 8



Permitted frequency band:	**13.110 - 14.010 MHz**	
20 dB bandwidth:	**40.06 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☒ **specified** **+0.073 kHz** **- 0.061 kHz**	☐ **not specified**
Bandwidth of the emission:	**40.2 kHz**	**within permitted frequency band[6]:** ☒ **yes** ☐ **no**

Test Result:	Test passed

[6] If a frequency stability is not specified, it is recommended that the fundamental emission is kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

8.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202
Guide:	ANSI C63.10 / TRC-43

Type of modulation:	Amplitude Modulation

B_n = Necessary Bandwidth	$B_n = 2BK$
B = Modulation rate	B = 20.1 kHz
K = Overall numerical factor	K = 1
Calculation:	$B_n = 2 \cdot (20.1\ kHz) \cdot 1 = 40.2\ kHz$

Designation of Emissions:	**40k2A1D**

8.4 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207		
Guide:	ANSI C63.10 / CISPR 22		
Limit:	Frequency of Emission (MHz)	Conducted Limit (dBµV)	
		Quasi-peak	Average
	0.15 - 0.5	66 to 56	56 to 46
	0.5 - 5	56	46
	5 - 30	60	50
Measurement procedure:	Conducted AC Powerline Emission (6.2)		

Comment:	--
Date of test:	2015-03-06
Test site:	Shielded room, cabin no. 1

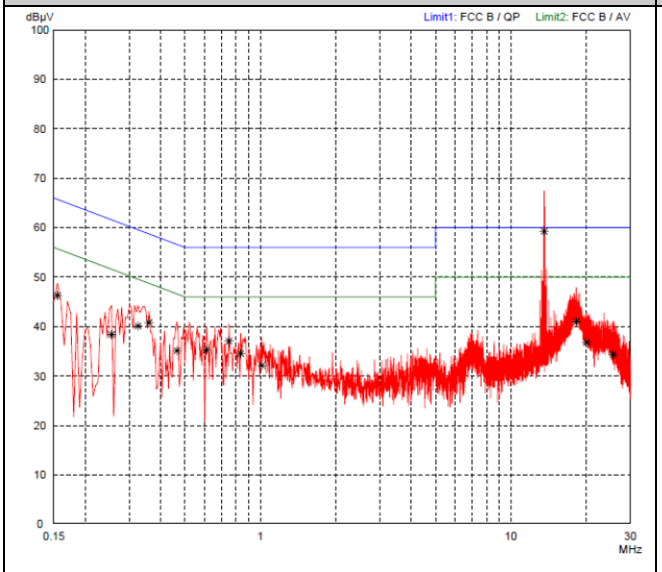
Test Result:	Test passed

TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

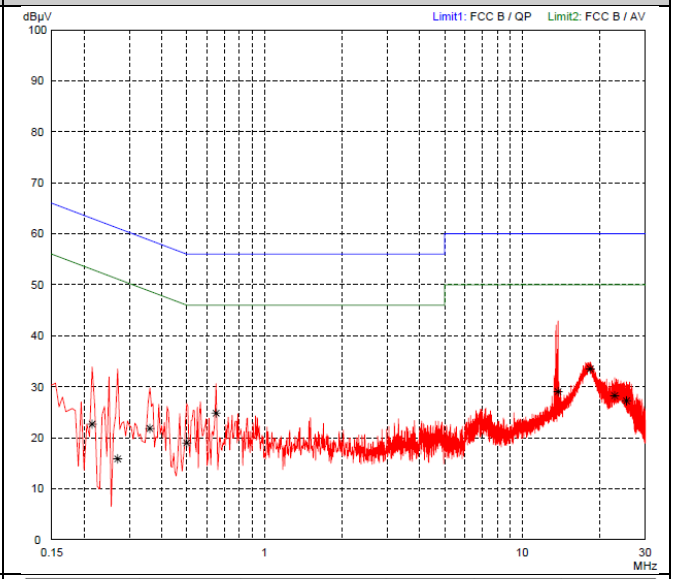
Tested on:	Phase L1 (antenna not terminated, limit kept)

QP (Pk)



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.155	46.3		46.3	65.7	19.4
0.255	38.4		38.4	61.6	23.2
0.325	40.1		40.1	59.6	19.5
0.360	40.8		40.8	58.7	17.9
0.465	35.1		35.1	56.6	21.5
0.610	35.2		35.2	56.0	20.8
0.750	37.0		37.0	56.0	19.0
0.835	34.5		34.5	56.0	21.5
1.015	32.1		32.1	56.0	23.9
13.570	59.2		59.2	60.0	0.8
18.215	41.0		41.0	60.0	19.0
20.060	36.8		36.8	60.0	23.2
25.605	34.3		34.3	60.0	25.7

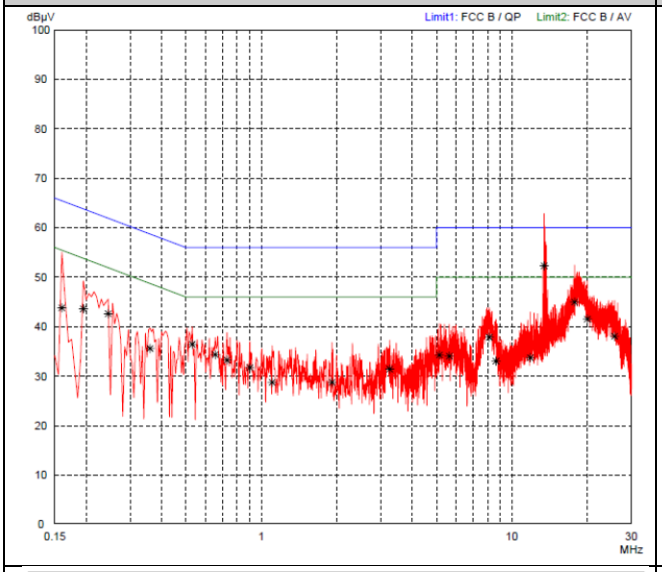
AV



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.215	22.6		22.6	53.0	30.4
0.270	15.8		15.8	51.1	35.3
0.360	21.8		21.8	48.7	26.9
0.500	19.0		19.0	46.0	27.0
0.650	24.8		24.8	46.0	21.2
13.770	29.0		29.0	50.0	21.0
18.350	33.5		33.5	50.0	16.5
22.820	28.2		28.2	50.0	21.8
25.370	27.2		27.2	50.0	22.8

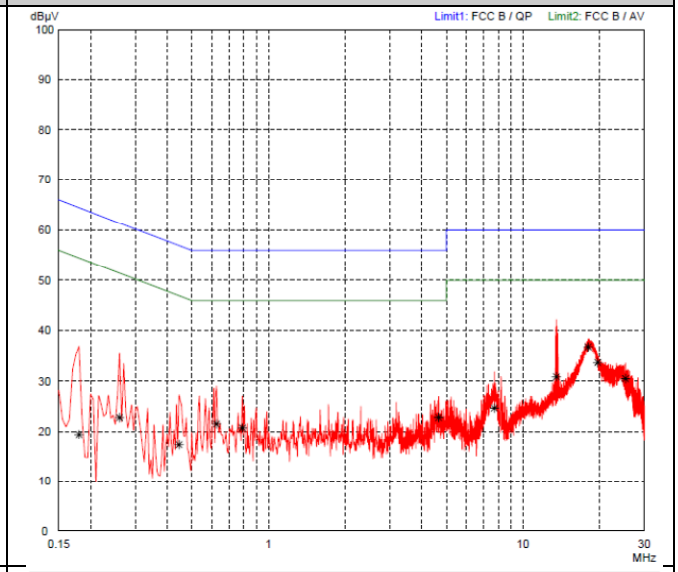
Tested on:	Phase N (antenna not terminated, limit kept)

QP (Pk)



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.160	43.8		43.8	65.5	21.7
0.195	43.6		43.6	63.8	20.2
0.245	42.6		42.6	61.9	19.3
0.360	35.6		35.6	58.7	23.1
0.530	36.4		36.4	56.0	19.6
0.655	34.3		34.3	56.0	21.7
0.730	33.2		33.2	56.0	22.8
0.900	31.7		31.7	56.0	24.3
1.105	28.8		28.8	56.0	27.2
1.915	28.8		28.8	56.0	27.2
3.255	31.4		31.4	56.0	24.6
5.140	34.3		34.3	60.0	25.7
5.625	34.0		34.0	60.0	26.0
8.130	37.9		37.9	60.0	22.1
8.640	33.0		33.0	60.0	27.0
11.850	33.7		33.7	60.0	26.3
13.460	52.3		52.3	60.0	7.7
17.790	45.0		45.0	60.0	15.0
20.005	41.5		41.5	60.0	18.5
25.690	38.0		38.0	60.0	22.0

AV



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.180	19.4		19.4	54.5	35.1
0.260	22.7		22.7	51.4	28.7
0.445	17.2		17.2	47.0	29.8
0.625	21.5		21.5	46.0	24.5
0.790	20.7		20.7	46.0	25.3
4.665	22.7		22.7	46.0	23.3
7.720	24.6		24.6	50.0	25.4
13.530	30.8		30.8	50.0	19.2
18.035	36.7		36.7	50.0	13.3
19.655	33.5		33.5	50.0	16.5
25.280	30.5		30.5	50.0	19.5

Sample calculation of final values:

Final Value (dBµV) = Reading Value (dBµV) + Correction Factor (dB)

8.5 Spectrum Mask

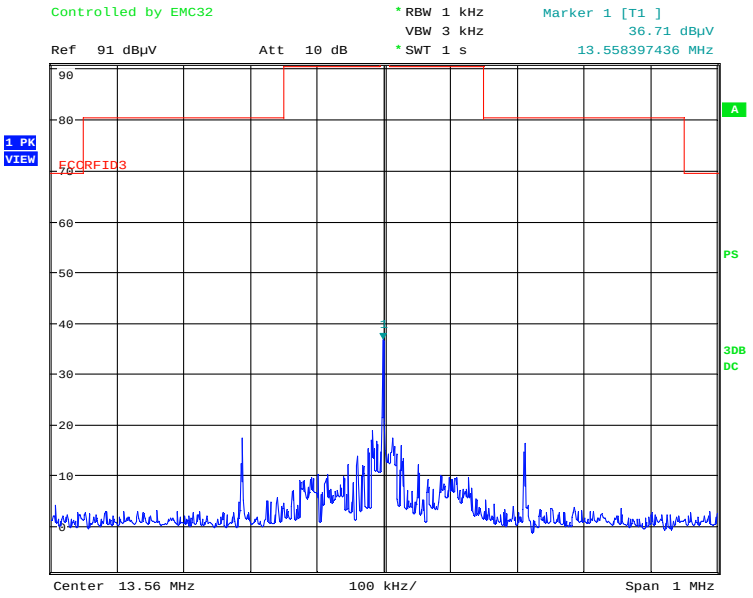
Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d)			
Guide:	ANSI C63.10			
Description:	Compliance with the spectrum mask is tested using a spectrum analyzer with resolution bandwidth set to a 1 kHz for the band 13.553 to 13.567 MHz and to 10 kHz outside this band. The video bandwidth shall be at least three times greater than the resolution bandwidth.			
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
	1.705 - 13.110	30	29.5	30
	13.110 - 13.410	106	40.5	30
	13.410 - 13.553	334	50.5	30
	13.553 - 13.567	15848	84.0	30
	13.567 - 13.710	334	50.5	30
	13.710 - 14.010	106	40.5	30
	14.010 - 30.000	30	29.5	30
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.3)			

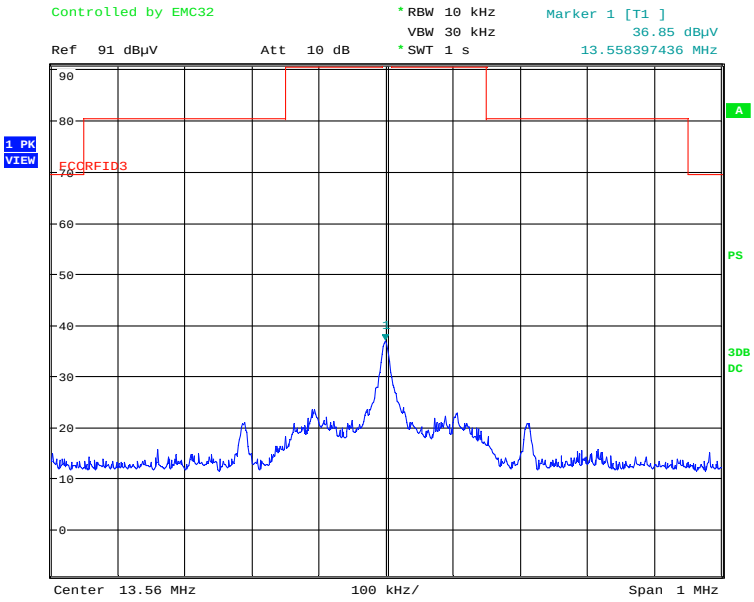
Comment:	--
Date of test:	2015-03-11
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters
Extrapolation Factor:	40 dB/decade

TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.de

Test Result:	Test passed



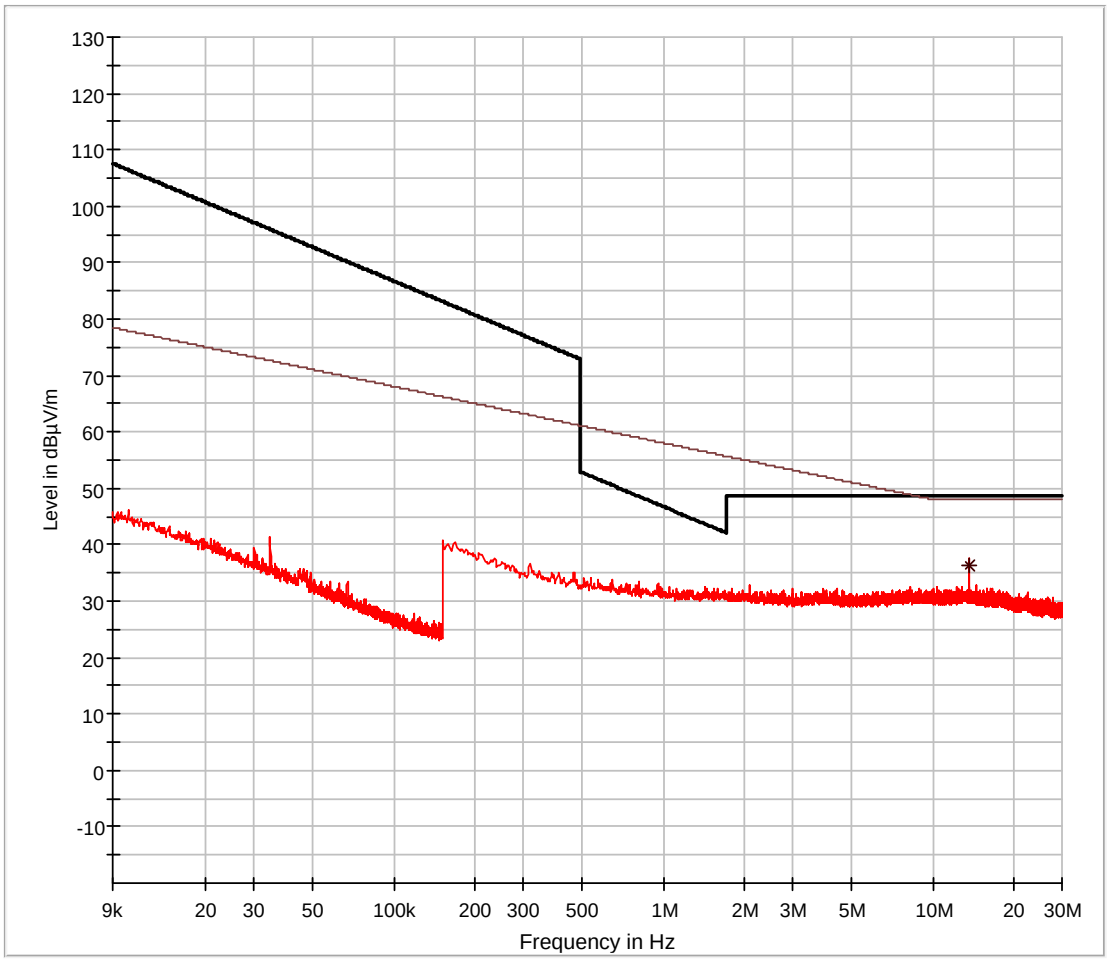


8.6 Radiated Emission Measurement 9 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, sections 15.205 and 15.225(a)-(d)			
Guide:	ANSI C63.10			
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
	0.009 - 0.490	2400/F(kHz)	67.6 - 20 · log(F(kHz))	300
	0.490 - 1.705	24000/F(kHz)	87.6 - 20 · log(F(kHz))	30
	1.705 - 13.110	30	29.5	30
	13.110 - 13.410	106	40.5	30
	13.410 - 13.553	334	50.5	30
	13.553 - 13.567	15848	84.0	30
	13.567 - 13.710	334	50.5	30
	13.710 - 14.010	106	40.5	30
	14.010 - 30.000	30	29.5	30
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.			
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.3)			

Comment:	--
Date of test:	2015-03-11
Test site:	Open field test site

Test Result:	Test passed



Extrapolation factor: -40 dB/decade

Frequency (MHz)	Detector	Distance d1 (m)	Distance d (m)	Reading Value (dBµV)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
13,56000	Quasi-Peak	10	30	11,3	20,0	-19,1		12,2	84,0	**71,8**

Sample calculation of final values:

Extrapolation Factor (dB) = (Log(d) - Log(d_1)) · Extrapolation Factor (dB/decade)

Final Value (dBµV/m) = Reading Value d_1 (dBµV) + Correction Factor (dB/m) + Extrapolation Factor (dB) + Pulse Train Correction (dB)

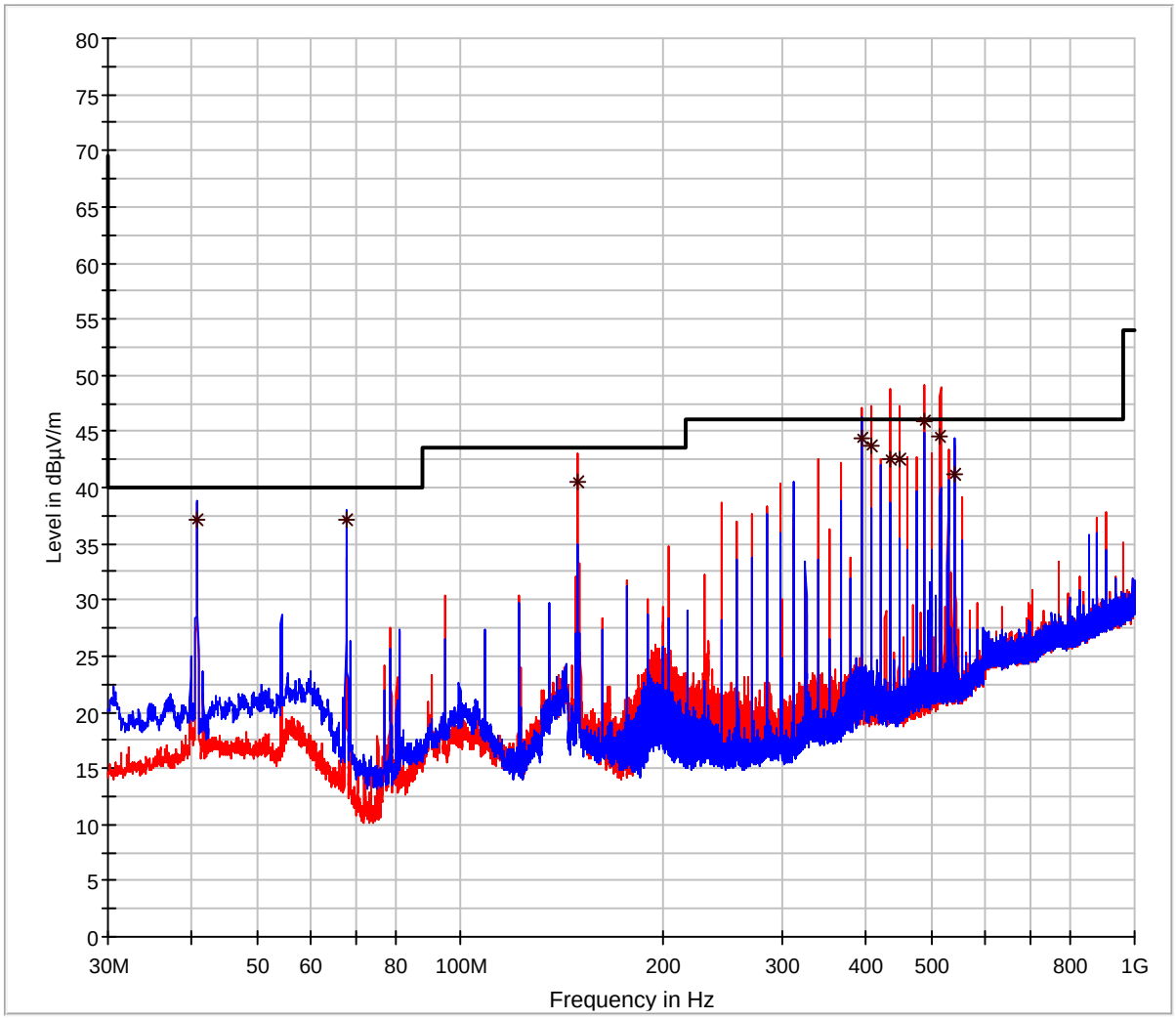
Note: Extrapolation factor (dB) and final value (dBµV/m) are relating to distance d.

8.7 Radiated Emission Measurement 30 MHz to 1 GHz

Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d)		
Guide:	ANSI C63.10		
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
	30 - 88	100	40.0
	88 - 216	150	43.5
	216 - 960	200	46.0
	Above 960	500	54.0
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.		
Measurement procedures:	Radiated Emission in Fully or Semi Anechoic Room (6.4) Radiated Emission at Alternative Test Site (6.5)		

Comment:	--
Date of test:	2015-03-11
Test site:	Frequencies ≤ 1 GHz: Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	Frequencies ≤ 8.2 GHz: 3 meters Frequencies > 8.2 GHz: 1 meter

Test Result:	Test passed



Final Results:

Frequency MHz	*QuasiPeak dBµV/m*	*Average dBµV/m*	*Limit dBµV/m*	*Margin dB*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
40,690000	37,17	0,00	40,00	2,83	120,000	104,0	V	-93,0	15,7
67,810000	37,12	0,00	40,00	2,88	120,000	105,0	V	-98,0	10,7
149,130000	40,57	0,00	43,50	2,93	120,000	200,0	H	144,0	10,0
393,220000	44,44	0,00	46,00	1,56	120,000	104,0	H	-148,0	17,0
406,780000	43,74	0,00	46,00	2,26	120,000	100,0	H	72,0	17,4
433,900000	42,50	0,00	46,00	3,50	120,000	105,0	H	52,0	17,9
447,420000	42,45	0,00	46,00	3,55	120,000	216,0	H	82,0	17,8
488,140000	45,90	0,00	46,00	0,10	120,000	100,0	H	-183,0	18,7
515,220000	44,60	0,00	46,00	1,40	120,000	158,0	H	95,0	19,3
542,380000	41,14	0,00	46,00	4,86	120,000	100,0	V	-157,0	19,5

Sample calculation of final values:

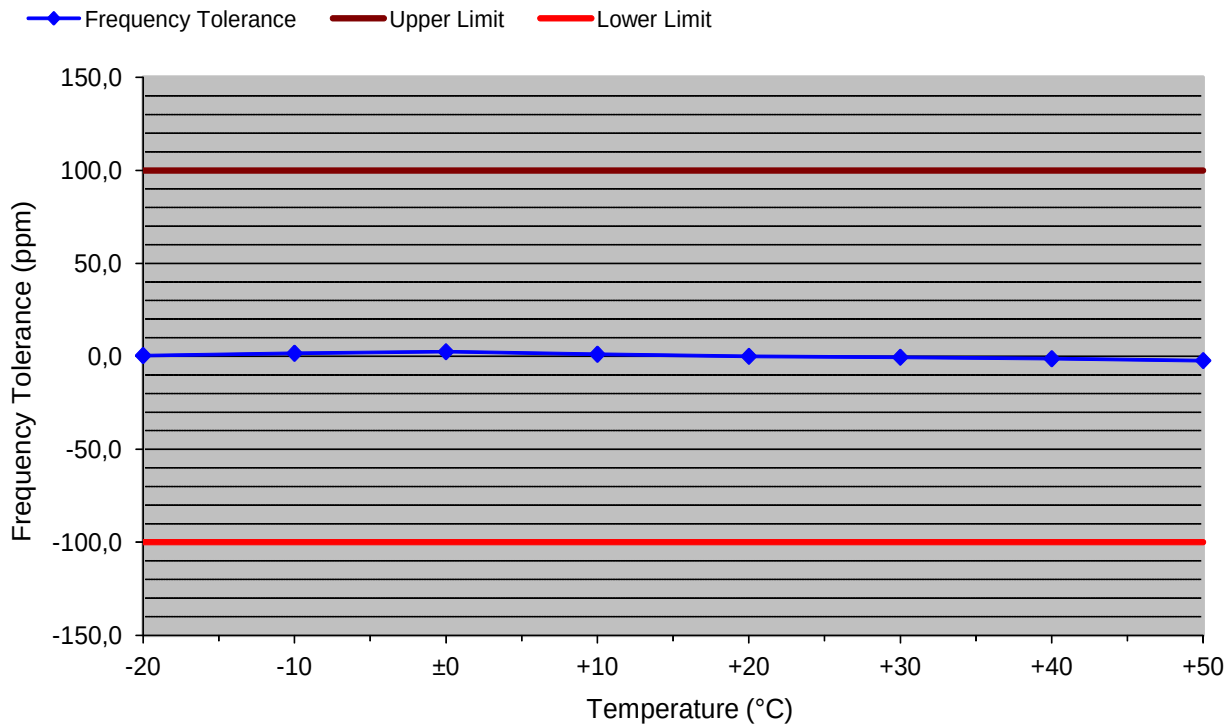
Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

8.8 Carrier Frequency Stability

Rules and specifications:	CFR 47 Part 15, section 15.225(e)
Guide:	ANSI C63.10
Limit:	The frequency tolerance of the carrier signal shall be maintained within ±0.01 % (±100 ppm) of the carrier frequency under nominal conditions.
Temperature range: Voltage range:	-20°C to +50°C (at normal supply voltage) 85% to 115% of the rated supply voltage (at a temperature of +20°C)
Measurement procedure:	Carrier Frequency Stability (6.6)

Comment:	--
Date of test:	2015-03-11

8.8.1 Carrier Frequency Stability vs. Temperature

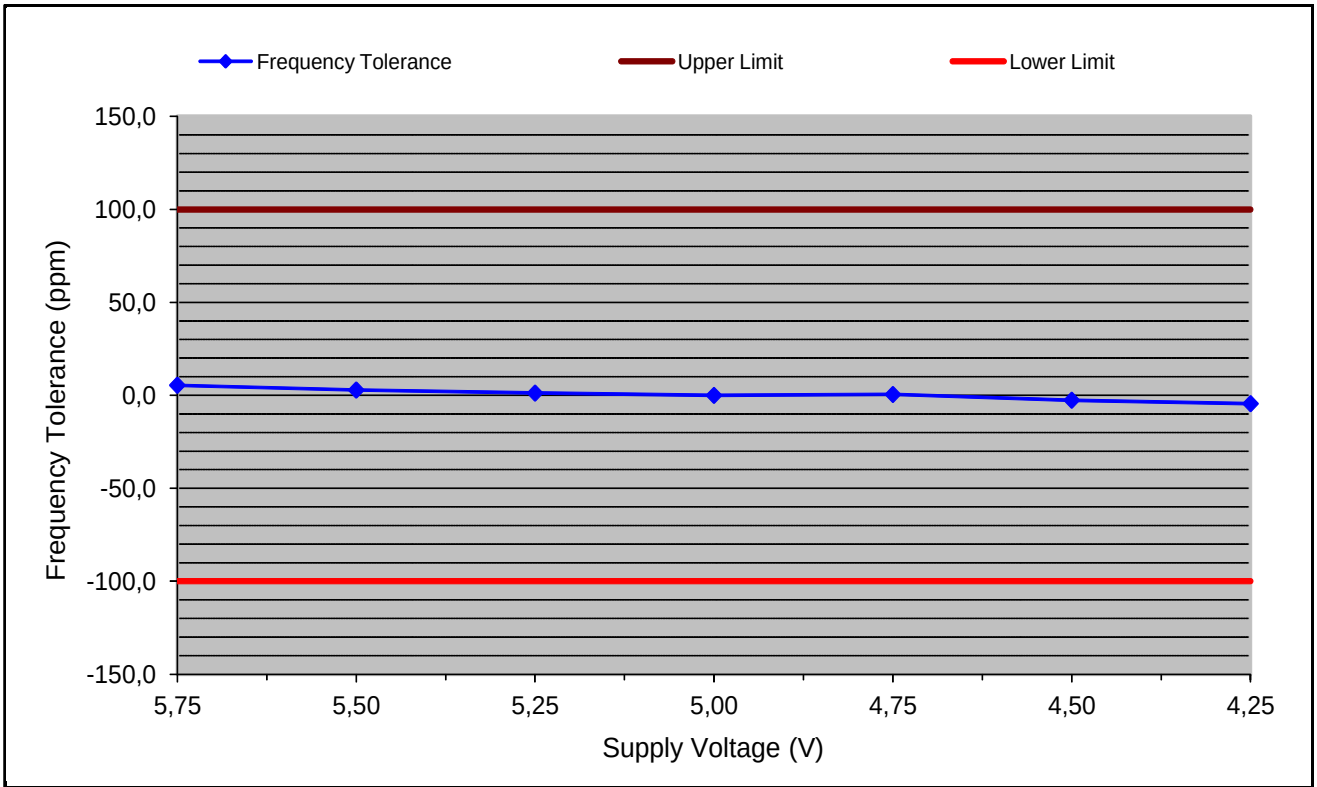


Supply voltage: 12 V Nominal frequency: 13,560008 MHz

Temperature (°C)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
-20	13,560014	6	0,4	+100,0	-100,0	99,6
-10	13,560030	22	1,6	+100,0	-100,0	98,4
±0	13,560041	33	2,5	+100,0	-100,0	**97,5**
+10	13,560023	15	1,1	+100,0	-100,0	98,9
+20	13,560008	0	0,0	+100,0	-100,0	100,0
+30	13,560001	-7	-0,5	+100,0	-100,0	99,5
+40	13,559990	-18	-1,3	+100,0	-100,0	98,7
+50	13,559977	-31	-2,3	+100,0	-100,0	97,7

Test Result:	Test passed

8.8.2 Carrier Frequency Stability vs. Supply Voltage



Temperature:	+20 °C	Battery End Point:	#WERT!
Nominal frequency:	13,560005 MHz		

Supply Voltage (V)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
5,75	13,560078	73	5,4	+100,0	-100,0	**94,6**
5,50	13,560043	38	2,8	+100,0	-100,0	97,2
5,25	13,560021	16	1,2	+100,0	-100,0	98,8
5,00	13,560004	-1	0,0	+100,0	-100,0	100,0
4,75	13,560011	6	0,5	+100,0	-100,0	99,5
4,50	13,559969	-36	-2,6	+100,0	-100,0	97,4
4,25	13,559944	-61	-4,5	+100,0	-100,0	95,5

Test Result:	Test passed

9 Referenced Regulations

All tests were performed with reference to the following regulations and standards:

☒	CFR 47 Part 2	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)	October 1, 2014
☒	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	October 1, 2014
☐	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	December 11, 2003 (published on January 30, 2004)
☐	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	June 7, 2009 (published on September 15, 2009)
☐	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	June 7, 2009 (published on September 15, 2009)
☐	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	June 13, 2014 (published on June 20, 2014)
☐	ANSI C63.10	American National Standard for Testing Unlicensed Wireless Devices	July 3, 2009 (published on September 10, 2009)
☒	ANSI C63.10	American national Standard of Procedures for Compilance Testing of Unlicensed Wireless Devices	June 27, 2013 (published on September 13, 2013)
☐	RSS-Gen	Radio Standards Specification RSS-Gen Issue 4 containing General Requirements for Compilance of Radio Apparatus, published by Industry Canada	November 2014
☐	RSS-210	Radio Standards Specification RSS-210 Issue 8 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada	December 2010

☐	RSS-310	Radio Standards Specification RSS-310 Issue 3 for Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment, published by Industry Canada	December 2010
☐	RSS-102	Radio Standards Specification RSS-102 Issue 4: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), published by Industry Canada	March 2010, footnote 13 updated December 2010
☐	ICES-003	Interference-Causing Equipment Standard ICES-003 Issue 5 (Information Technology Equipment (ITE) - Limits and methods of measurement), published by Industry Canada	August 2012
☐	CISPR 22	Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, “Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement”	1997
☐	CAN/CSA CISPR 22-10	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (Adopted IEC CISPR 22:2008, sixth edition, 2008-09)	2010
☒	TRC-43	Designation of Emissions, Class of Station and Nature of Service, published by Industry Canada	November 2012

10 Test Equipment List with Calibration Data

Type	*Inv.-No.*	*Type Designation*	*Serial Number*	*Manufacturer*	*Calibration Organization*	*Last Calibration*	*Next Calibration*
EMI test receiver	1028	ESHS10	860043/016	Rohde & Schwarz	Rohde & Schwarz	09/2014	09/2015
EMI test receiver	1711	ESPI7	836914/0002	Rohde & Schwarz	Rohde & Schwarz	05/2014	05/2015
EMI test receiver	2044	ESU8	100232	Rohde & Schwarz	Rohde & Schwarz	08/2014	08/2015
Spectrum analyser	1666	FSP30	100063	Rohde & Schwarz	Rohde & Schwarz	06/2014	06/2015
V-network	1059	ESH3-Z5	894785/005	Rohde & Schwarz	Rohde & Schwarz	08/2013	08/2015
V-network	1060	ESH3-Z5	830952/025	Rohde & Schwarz	Rohde & Schwarz	06/2014	06/2016
Loop antenna	1016	HFH2-Z2	882964/0001	Rohde & Schwarz	Rohde & Schwarz	05/2014	05/2015
TRILOG Broadband Antenna	2058	VULB 9163	9163-408	Schwarzbeck	Rohde & Schwarz	05/2014	05/2015
Multimeter	1653	21 III	76530546	Fluke	ZMK	11/2014	11/2016
Temperature test chamber	1271	HT 4010	07065550	Heraeus	TÜV SÜD PS-EMC-STR	06/2013	06/2015

Note 1: No calibration required.
Note 2: Not calibrated separately but with the whole test system when recording calibration data.
Note 3: No calibration required. Devices are checked before use.
Note 4: No calibration required. Devices are checked by calibrated equipment during test.

11 Revision History

Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	2015-03-30	M. Biberger(as)	First Edition
2	2015-04-14	M. Biberger(as)	Nodel name changed
3	2015-07-03	M. Biberger	Upgrade of referenced standards
4	2015-08-04	M. Biberger	C63.4 changed in C63.10, Used Notebook PSU added