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February 12, 2016

Prüfbericht / *Test Report* Nr. / *No.* 14912-60778-03 (Edition 3)

Applicant:	Siemens AGPD PA CI R&D 1
Type of equipment:	Inductive RFID Reader
Type designation:	RF250R IO-Link (with ANT 30 and ANT 8)
Order No.:	9701197874
Test standards:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207, 15.215 and 15.225 Industry Canada Radio Standards Specifications RSS-GEN Issue 4, Sections 8.8, 8.9 and 8.10 and RSS-210 Issue 8, Section A2.6 (Category I Equipment)

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1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation[1]:	RF250R IO-Link (with ANT 30 and ANT 8)
Parts[2]:	
Serial number(s):	#03
Manufacturer:	Siemens AG
Type of equipment:	Inductive RFID Reader
Version:	As received
FCC ID:	NXW-RF250RIOL
Industry Canada ID:	267X-RF250RIOL
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:	13.11 - 14.01 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]:	3K12A1D
Type of antenna:	External antenna
Size/length of antenna:	ANT8: ø 8 mm ANT30: ø 30 mm
Connection of antenna:	☒ detachable ☐ not detachable
Type of power supply for AC/DC adapter:	AC supply
Specifications for power supply :	nominal voltage: 110 V nominal frequency: 60 Hz
Type of power supply:	DC supply
Specifications for power supply:	nominal voltage: 24.0 V minimum voltage: 20.4 V maximum voltage: 27.6 V

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

2 Administrative Data

Application details	
Applicant (full address):	Siemens AGPD PA CI R&D 1 Siemensstraße 2 - 4 D-90766 Fürth
Contact person:	Mr. Clemens Bopp
Order number:	9701197874
Receipt of EUT:	2015-04-22
Date(s) of test:	2015-04-22 to 2015-04-14
Note(s):	Mr. Bopp attended testings on April, 22 to April 24 and on May 18.sw

Report details	
Report number:	14912-60778-03
Edition:	3
Issue date:	2016-02-12

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, 15.215 and 15.225** of the Federal Communication Commission (FCC) and the **Radio Standards Specifications** **RSS-GEN Issue 4, Sections 8.8, 8.9 and 8.10 and** **RSS-210 Issue 8, Section , A2.6 (Category I Equipment)** of Industry Canada (IC).

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

5 Operation Mode and Configuration of EUT

Operation Mode(s)
Reading tag continuously

Configuration(s) of EUT
The EUT was configured as Input/Output device of a S7 SIMATIC System

List of ports and cables

Port	*Description*	*Classification*[4]	*Cable type*	*Cable length*
1	AC supply of S7 system	ac power	Unshielded	2 m
2	Internal DC supply of S7 system	dc power	Unshielded	30 cm
3	IO-LINK cable	signal/control port	Shielded	3 m
4	Antenna cable	signal/control port	Shielded	3 m

List of devices connected to EUT (S7 system)

Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	AC/DC power supply	PS307	307-1EA01-0AA0	Siemens
2	SIMATIC PLC	S7-300 CPU317	317-2EJ10-0AB0	Siemens
3	SIMATIC Perepheral	S7 SM322	322-1BH01-0AA0	Siemens
4	SIMATIC Perepheral	IM151-1	6ES7 151-1AA05-0AB0	Siemens
5	SIMATIC Perepheral	PM-E DC24V 6ES7	138-4CA01-0AA0	Siemens
6	SIMATIC Perepheral	IO-Link-Master 6ES7	138-4GA50-0AB0	Siemens

List of support devices

Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	Transponder tag used with ANT 30	MDS D160	6GT260-0AB10	Siemens
2	Transponder tag used with ANT 8	MDS D421	6GT2600-4AE00	Siemens

[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) IC RSS-Gen Issue 4, section 6.6 IC RSS-210 Issue 8, section A1.1.3 ANSI C63.10, section 6.9.1
Guide:	ANSI C63.10 / IC RSS-Gen Issue 4, section 6.6
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).

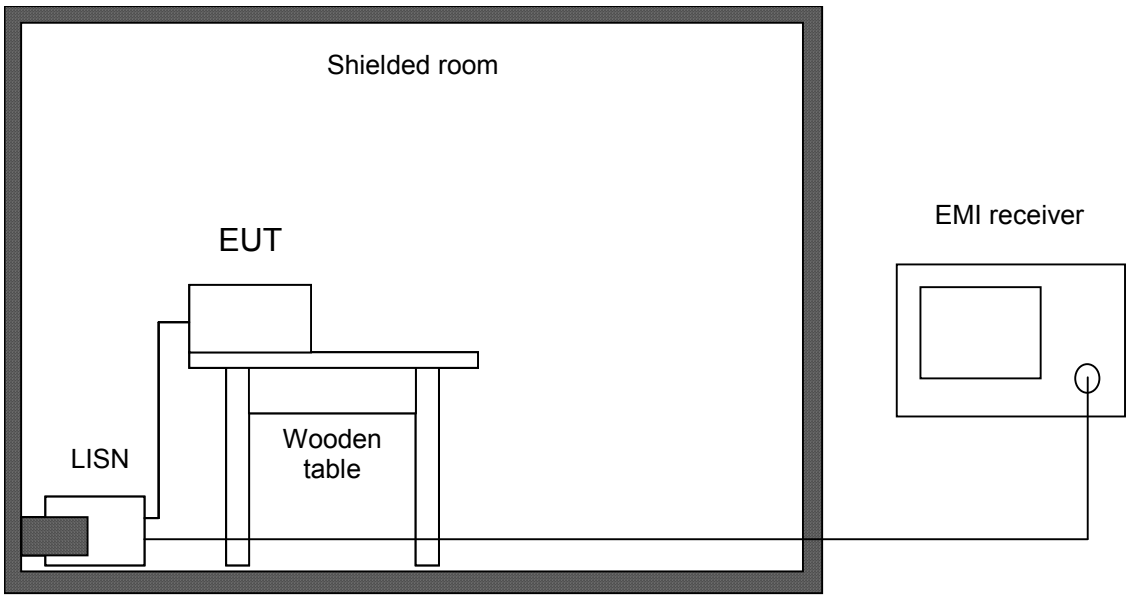
6.2 Conducted AC Powerline Emission

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-Gen Issue 4, section 8.8
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, section 6.2.5, 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	1218	830952/025	Rohde & Schwarz
☐	Artificial mains network	ESH 2-Z5	1536	842966/004	Rohde & Schwarz
☐	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) IC RSS-GEN Issue 4, sections 8.9 and 8.10 and IC RSS-210 Issue 8, section A2.6
Guide:	ANSI C63.10

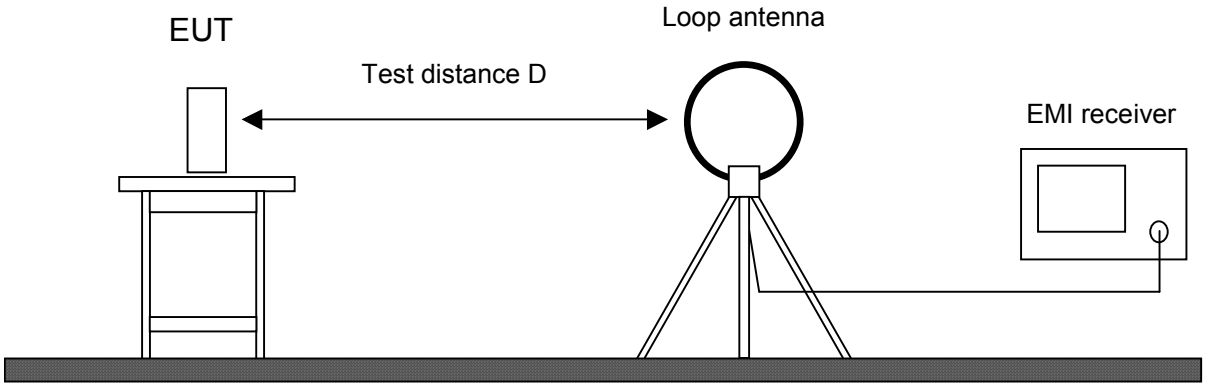
Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. 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
☒	EMI test receiver		ESPI7	2010	101018	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
☒	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 at Alternative Test Site

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-GEN Issue 4, sections 8.9 and 8.10(b)(c) and IC RSS-210 Issue 8, section A2.6
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 C63.4 respectively 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.

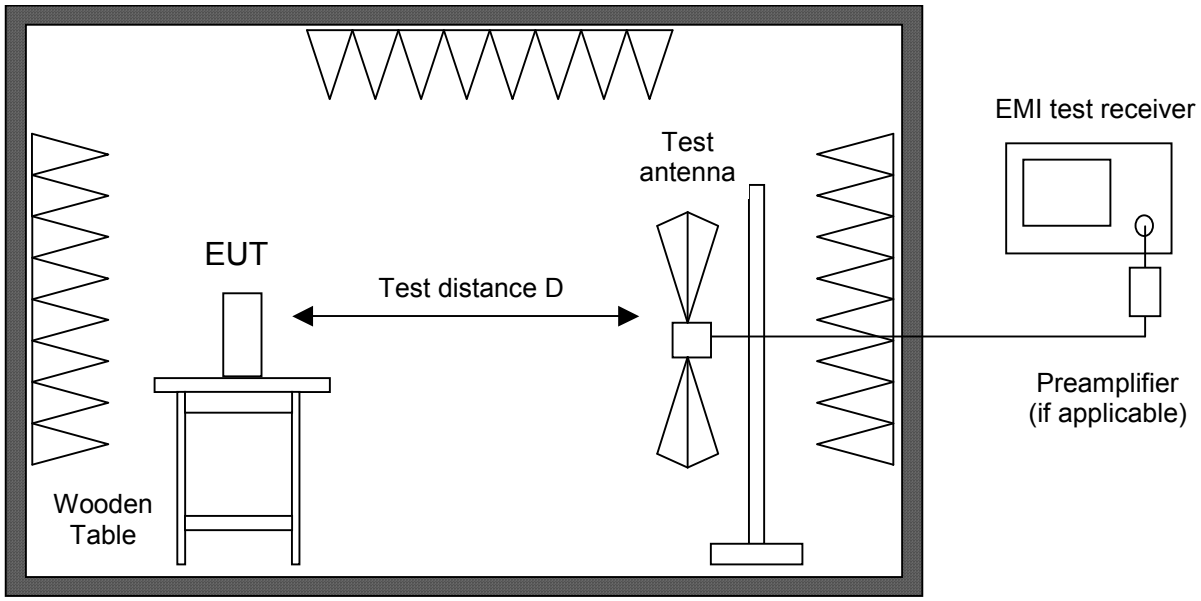
If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete 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
☒	Semi anechoic room		No. 8	2057	---	Albatross

6.5 Carrier Frequency Stability

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-Gen Issue 4, section 6.11 and IC RSS-210 Issue 8, section A2.6
Guide:	ANSI C63.10

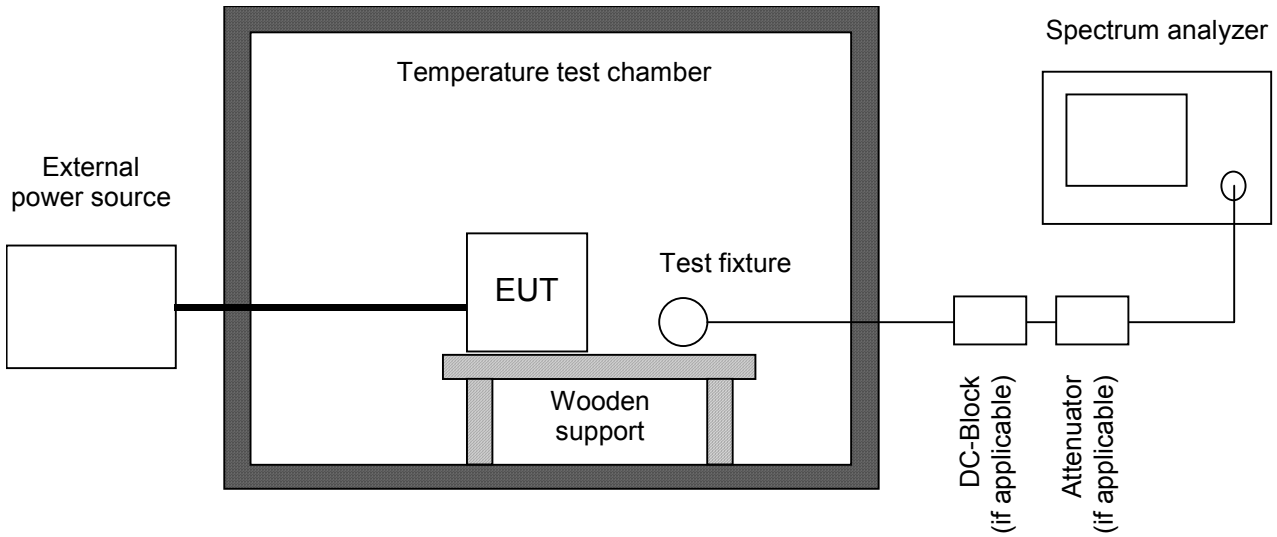
The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 °C.

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.

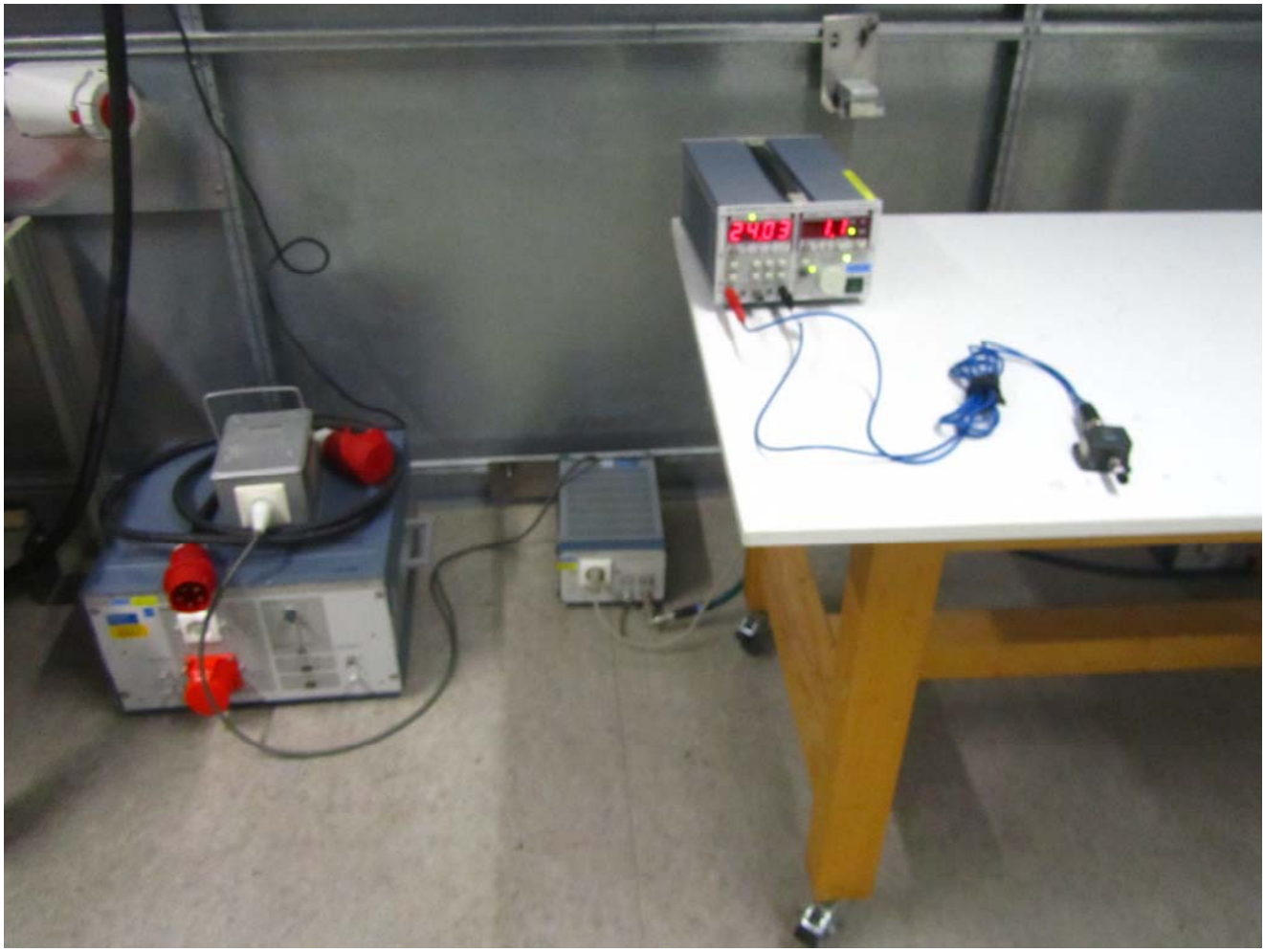


Test instruments used:

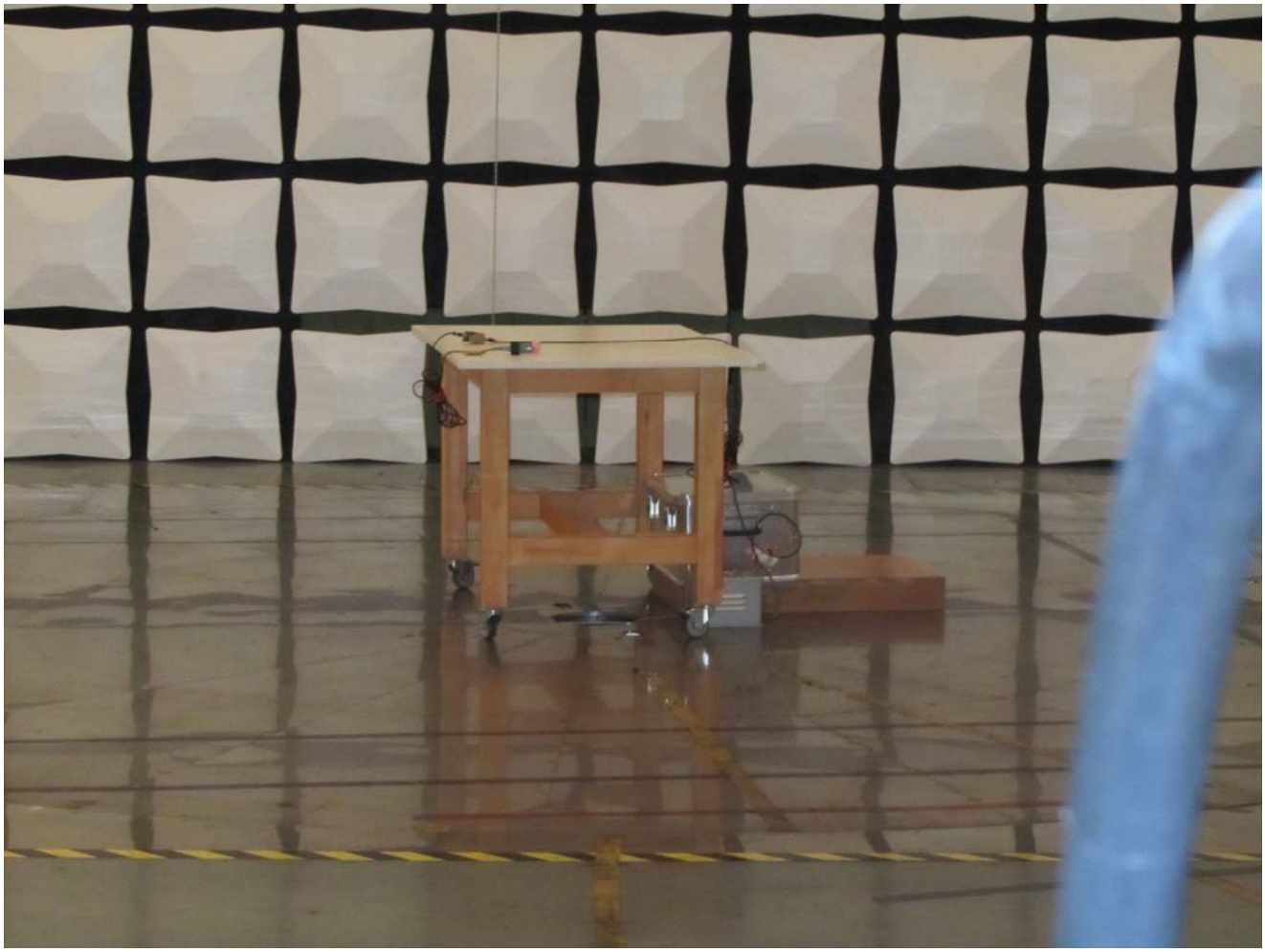
	Type	*Designation*	*Inv.-no.*	*Serial No. or ID*	*Manufacturer*
☐	Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
☒	EMI test receiver	ESPI7	2010	101018	Rohde & Schwarz
☐	EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
☐	DC-block	7006	1636	A2798	Weinschel
☐	Attenuator	4776-10	1638	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

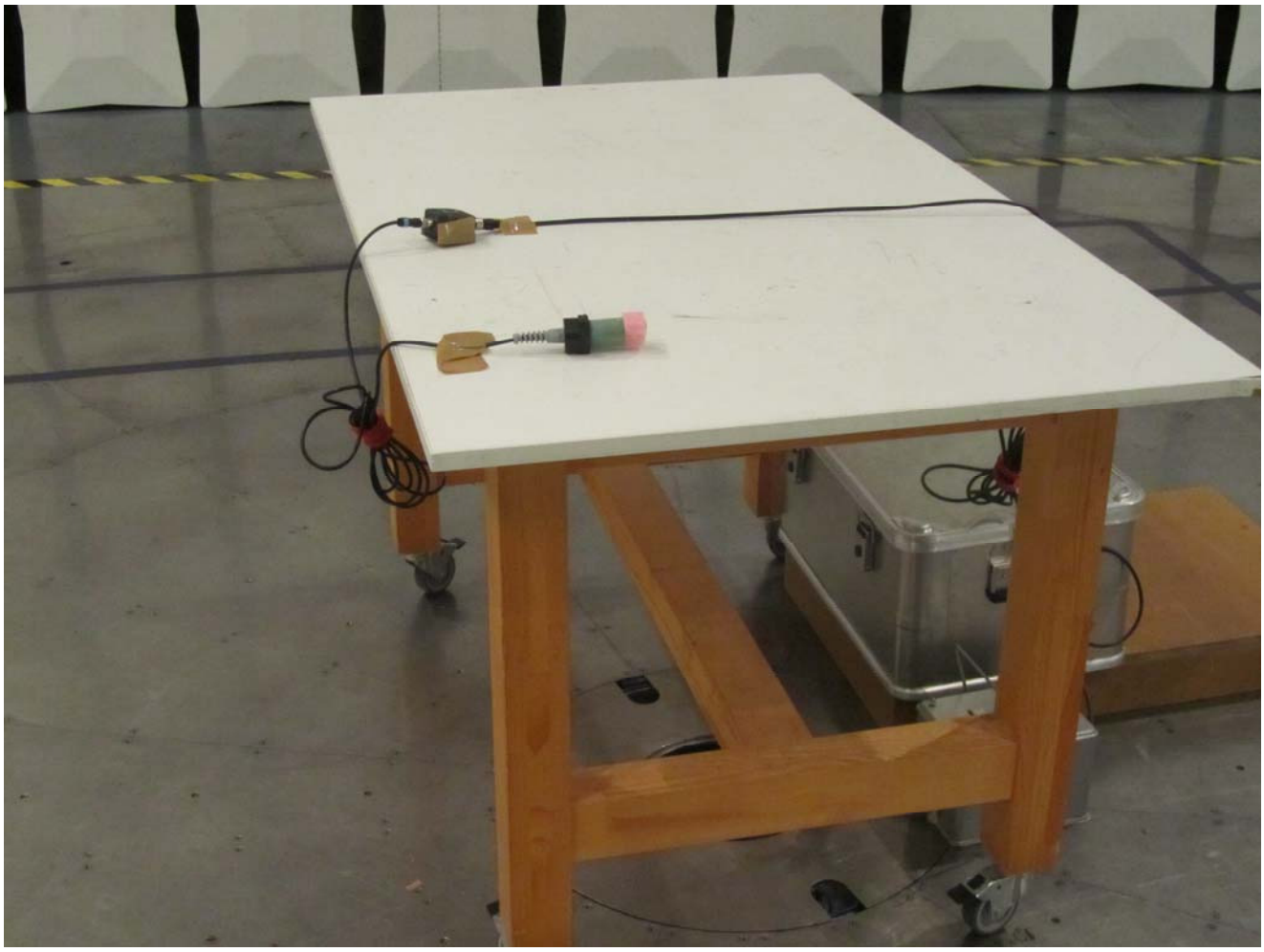
7 Photographs Taken During Testing

Test setup for conducted AC powerline emission measurement

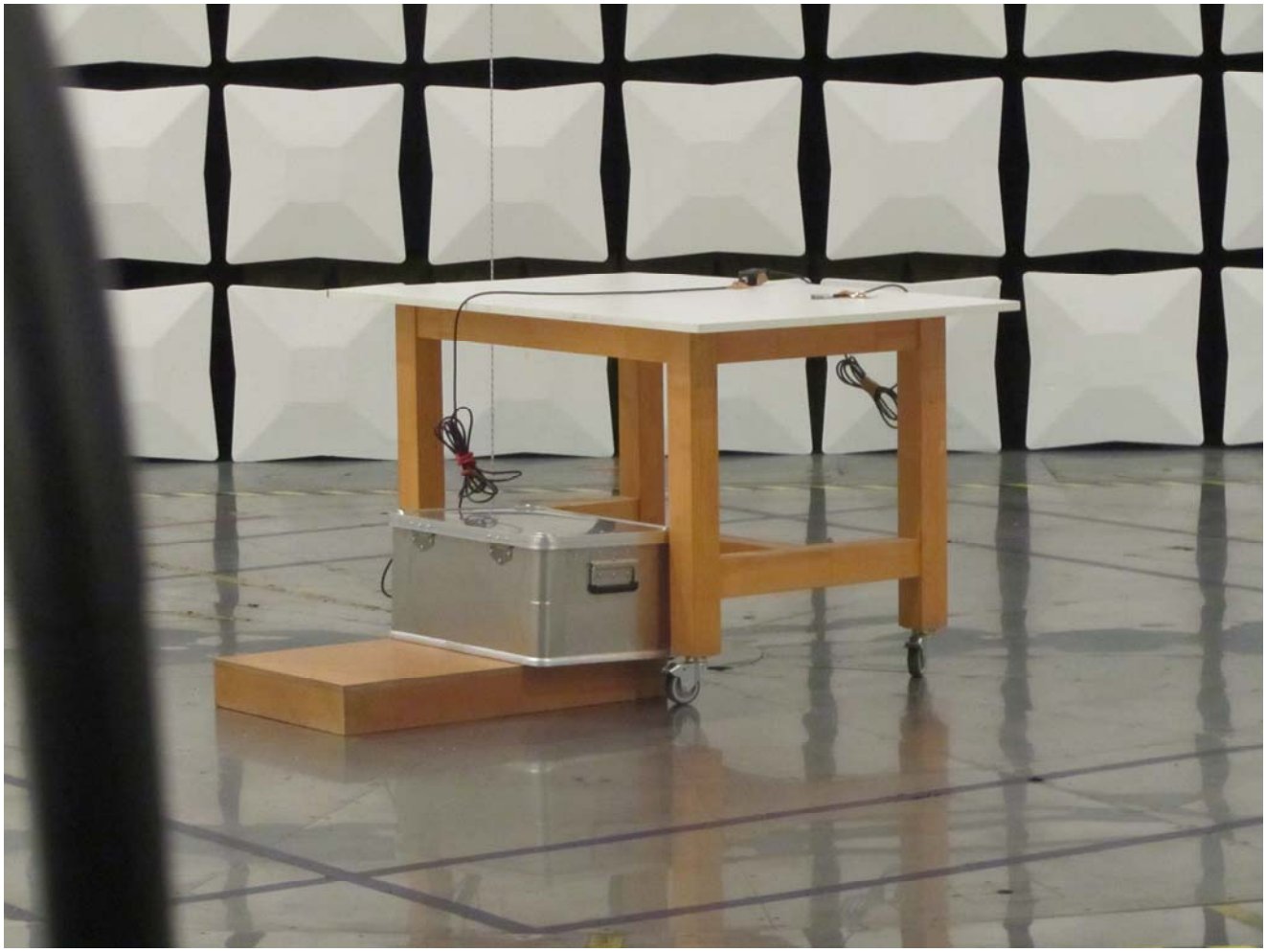


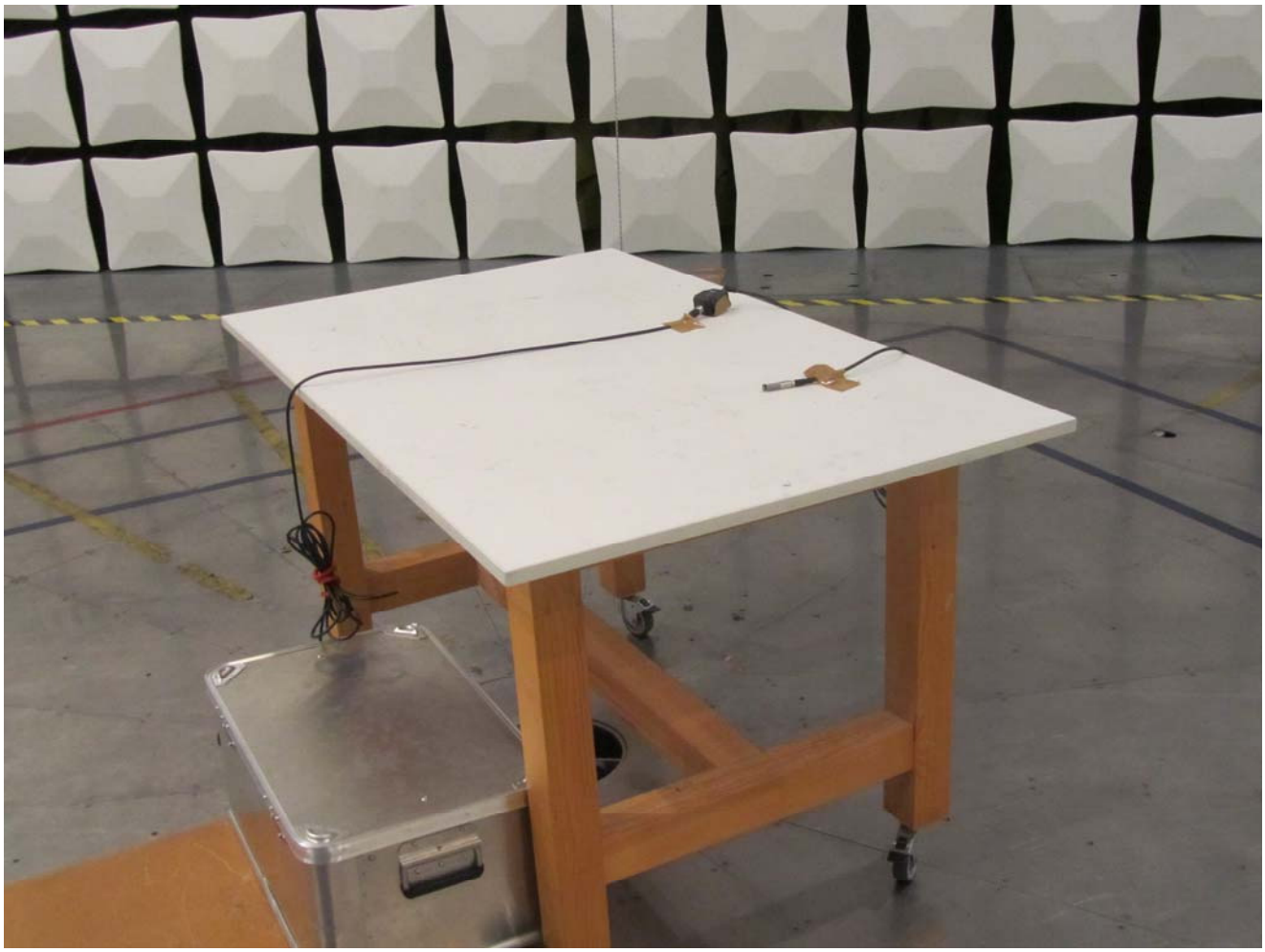
Test setup for radiated emission measurement 9 kHz – 30 MHz





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





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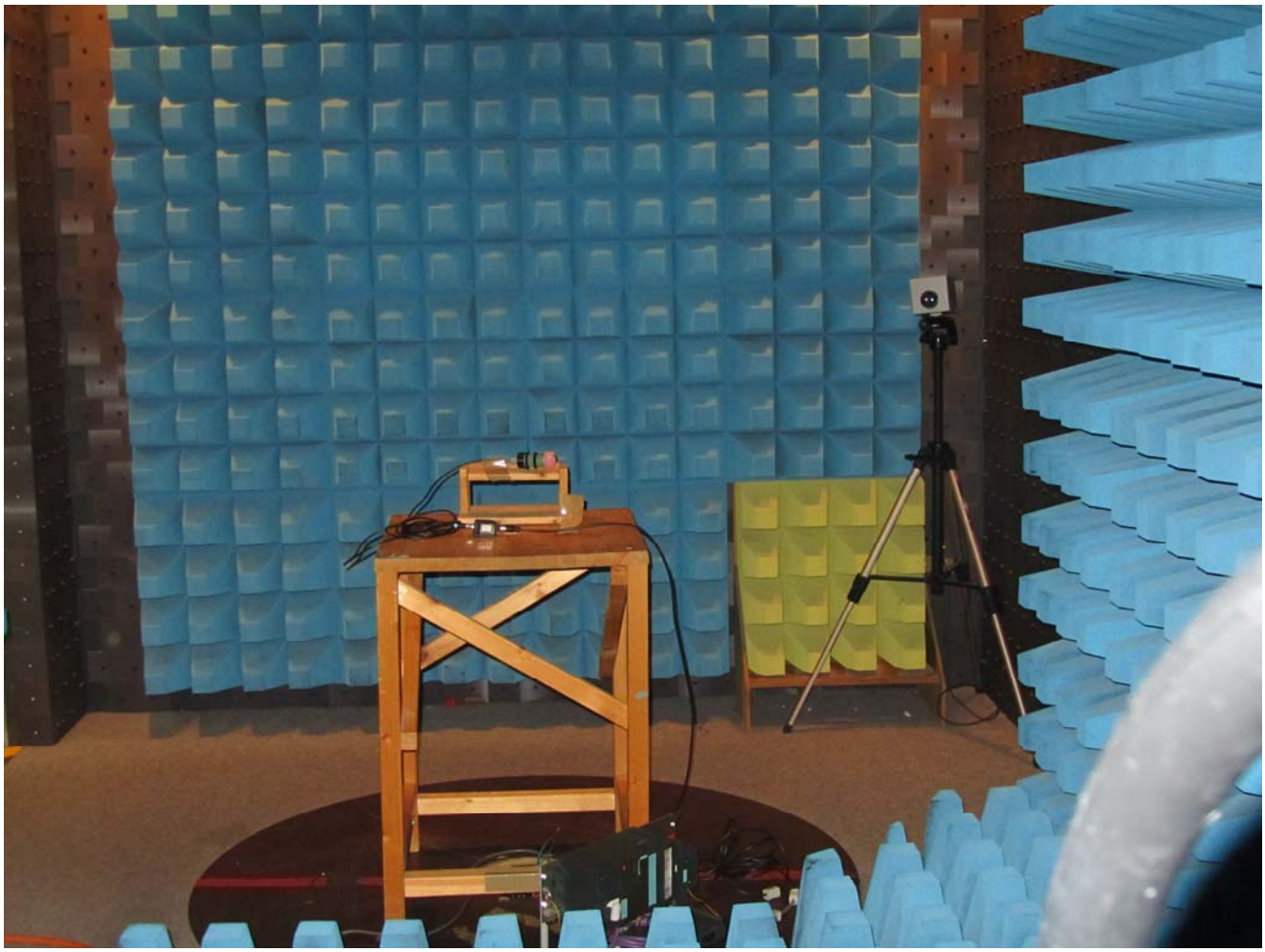
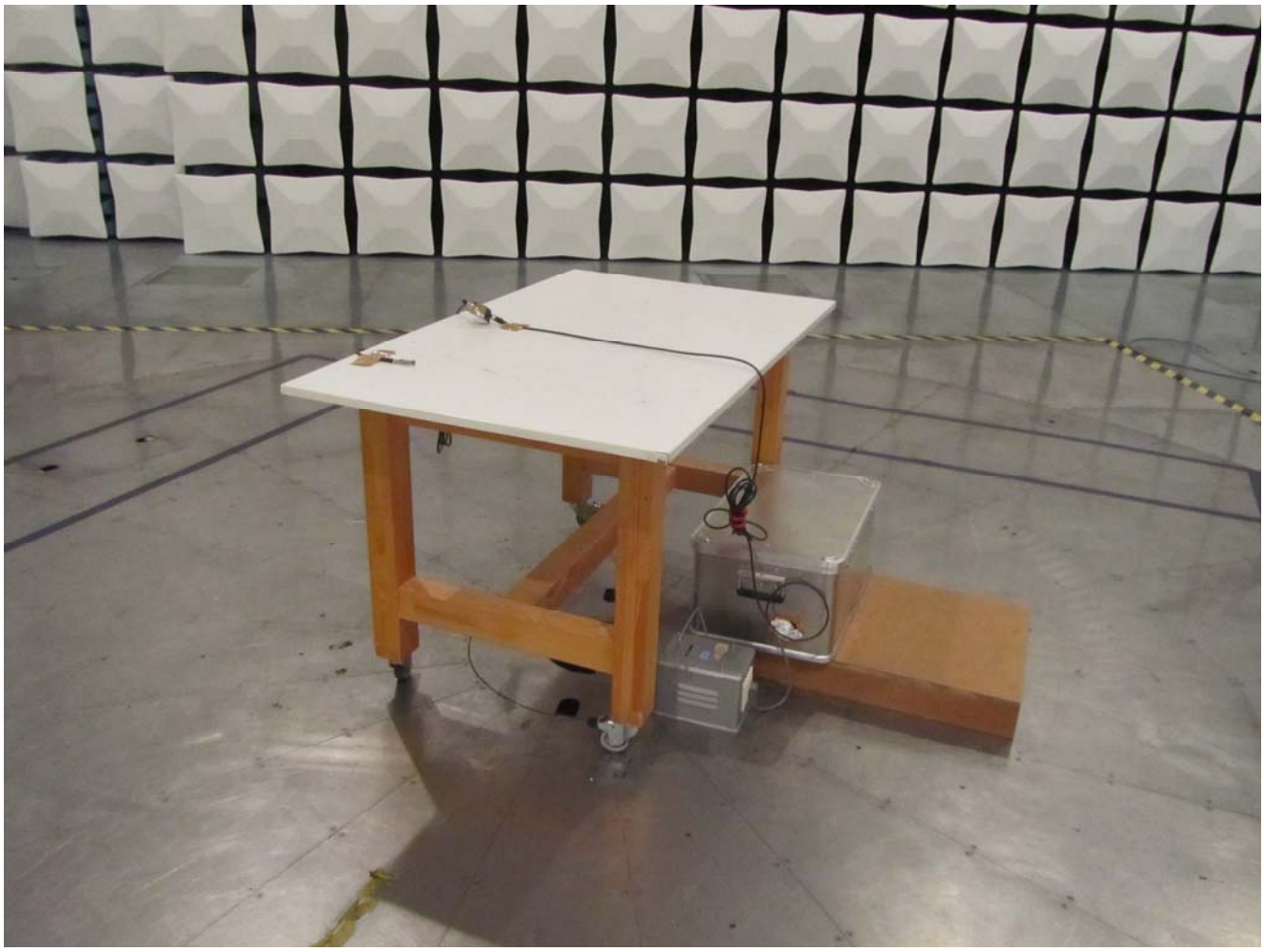
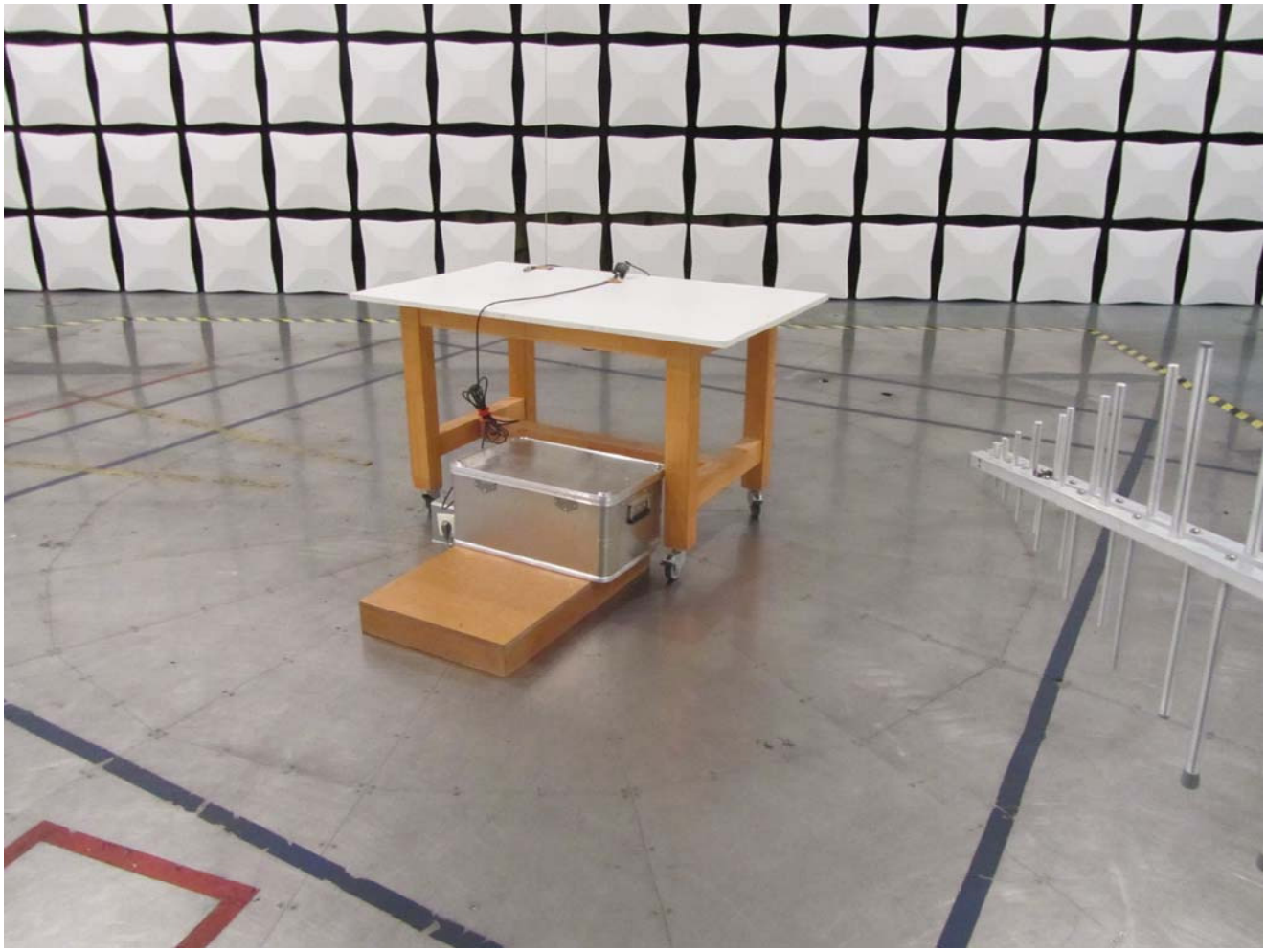
Test setup for radiated emission measurement 9 kHz – 30 MHz - continued -

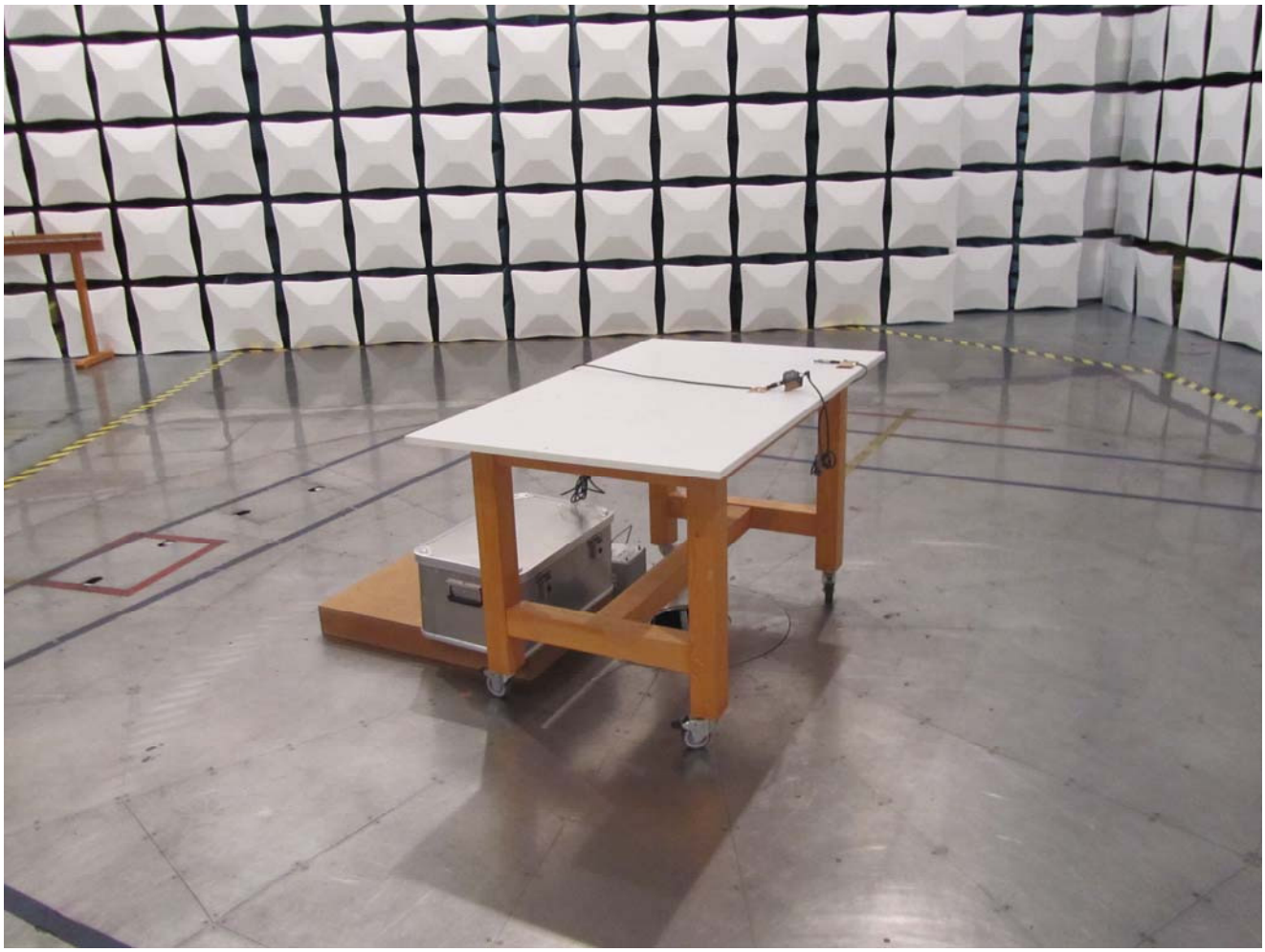


Test setup for radiated emission measurement (alternate test site)



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





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

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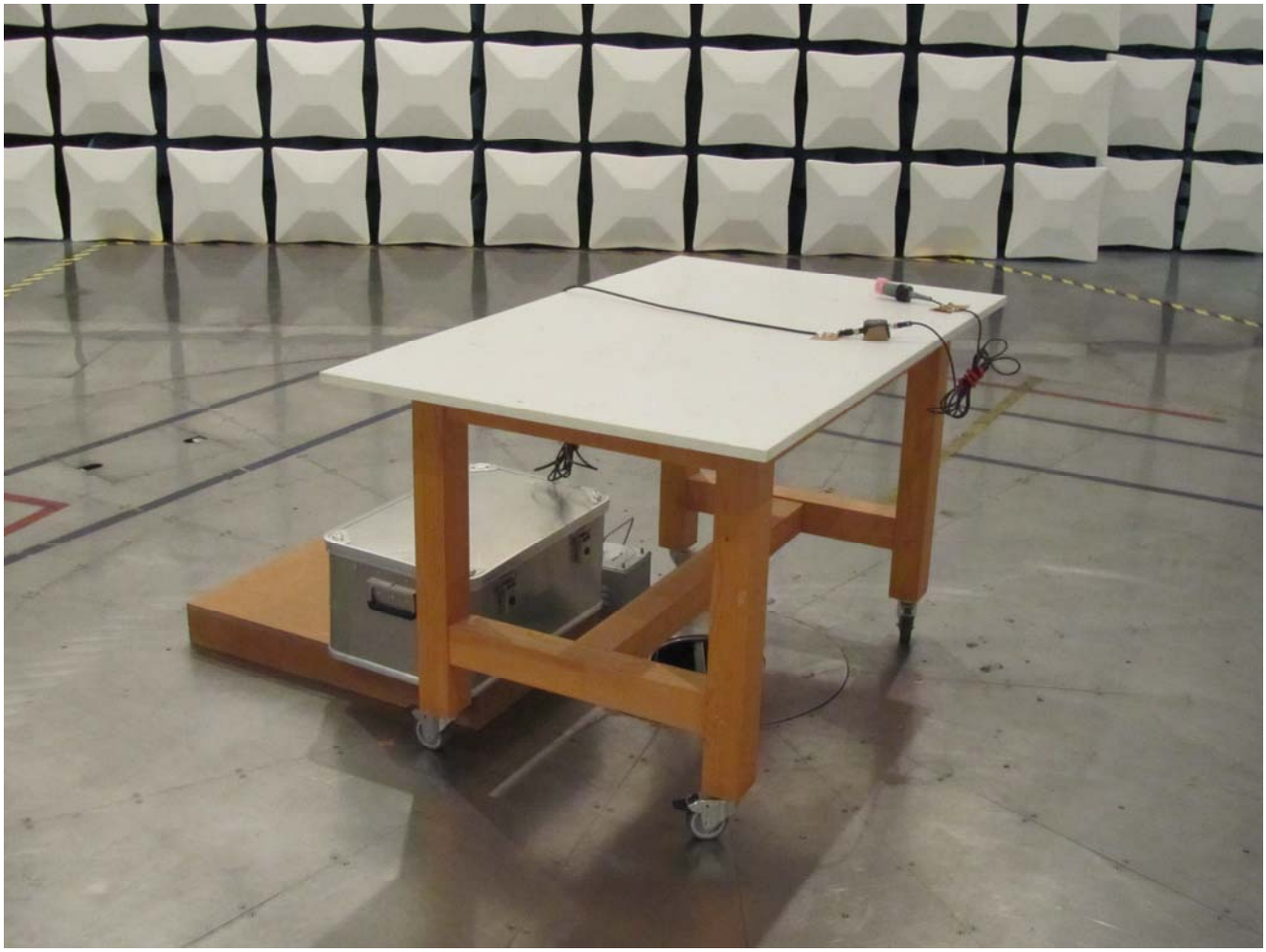
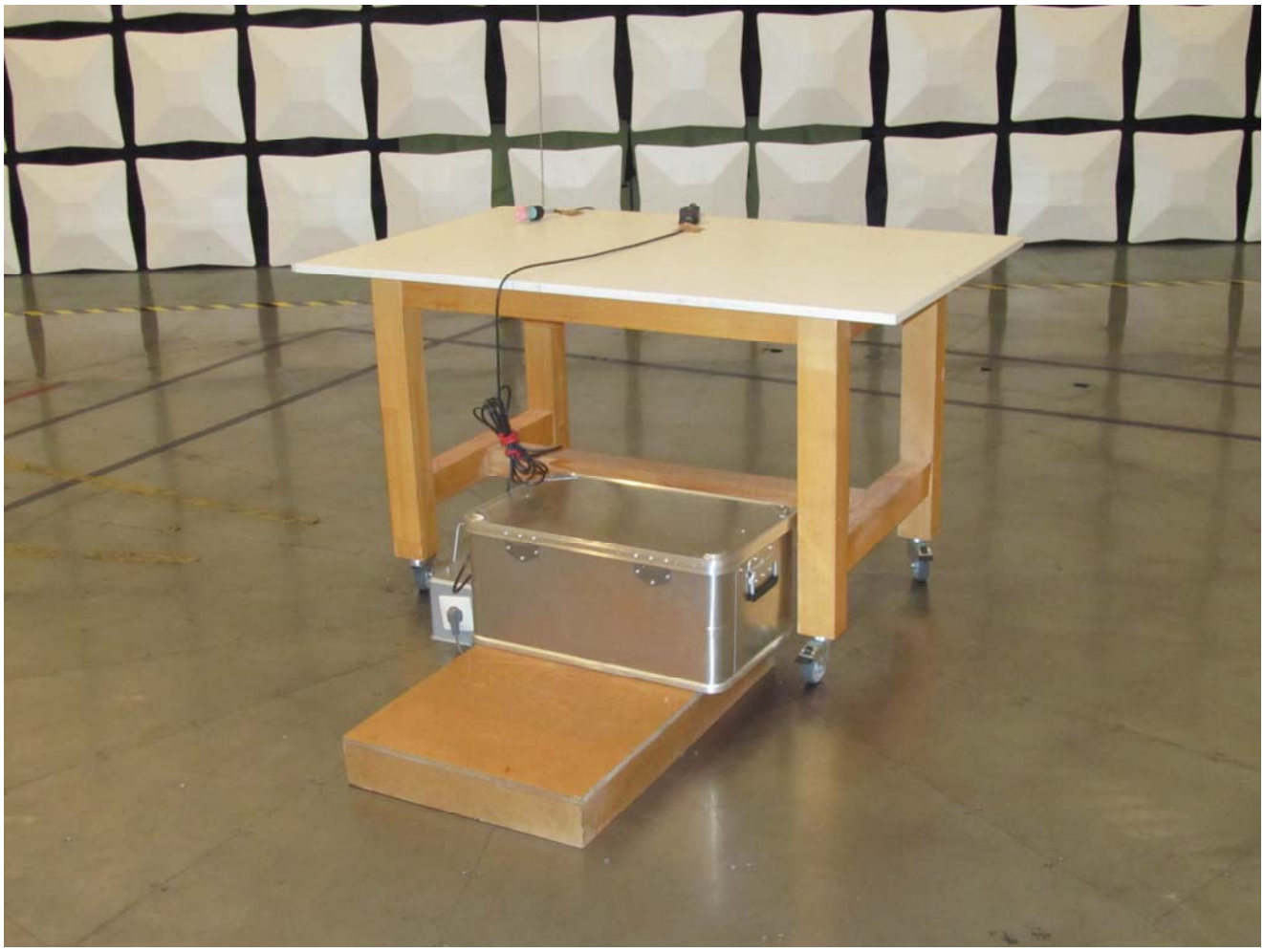
Test setup for radiated emission measurement (alternate test site) - continued -





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	29	Recorded
15.215(c)	Bandwidth of the emission	34	Test passed
2.201, 2.202	Class of emission	36	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	37	Test passed
15.225(a)-(d)	Spectrum Mask	40	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".

IC RSS-GEN Issue 4			
Section(s)	*Test*	*Page*	*Result*
6.12	Transmitter output power (conducted)	---	Not applicable
6.6	Occupied Bandwidth	29	Recorded
9	Designation of emissions	36	Calculated
6.10	Pulsed operation	---	Not applicable
8.10	Restricted bands and unwanted emission frequencies	---[6]	Test passed
6.4, 6.13, 8.9	Unwanted emissions 9 kHz to 30 MHz	43	Test passed
6.4, 6.13, 8.9	Unwanted emissions 30 MHz to 1 GHz	46	Test passed
8.8	Transmitter AC power lines conducted emissions 150 kHz to 30 MHz	37	Test passed
3.2	Exposure of Humans to RF Fields	52	Exempted from SAR and RF evaluation

IC RSS-210 Issue 8			
Section(s)	*Test*	*Page*	*Result*
A2.6	Spectrum Mask	40	Test passed
A2.6	Unwanted emissions 9 kHz to 30 MHz	43	Test passed
A2.6	Unwanted emissions 30 MHz to 1 GHz	46	Test passed
A2.6	Carrier frequency stability	49	Test passed

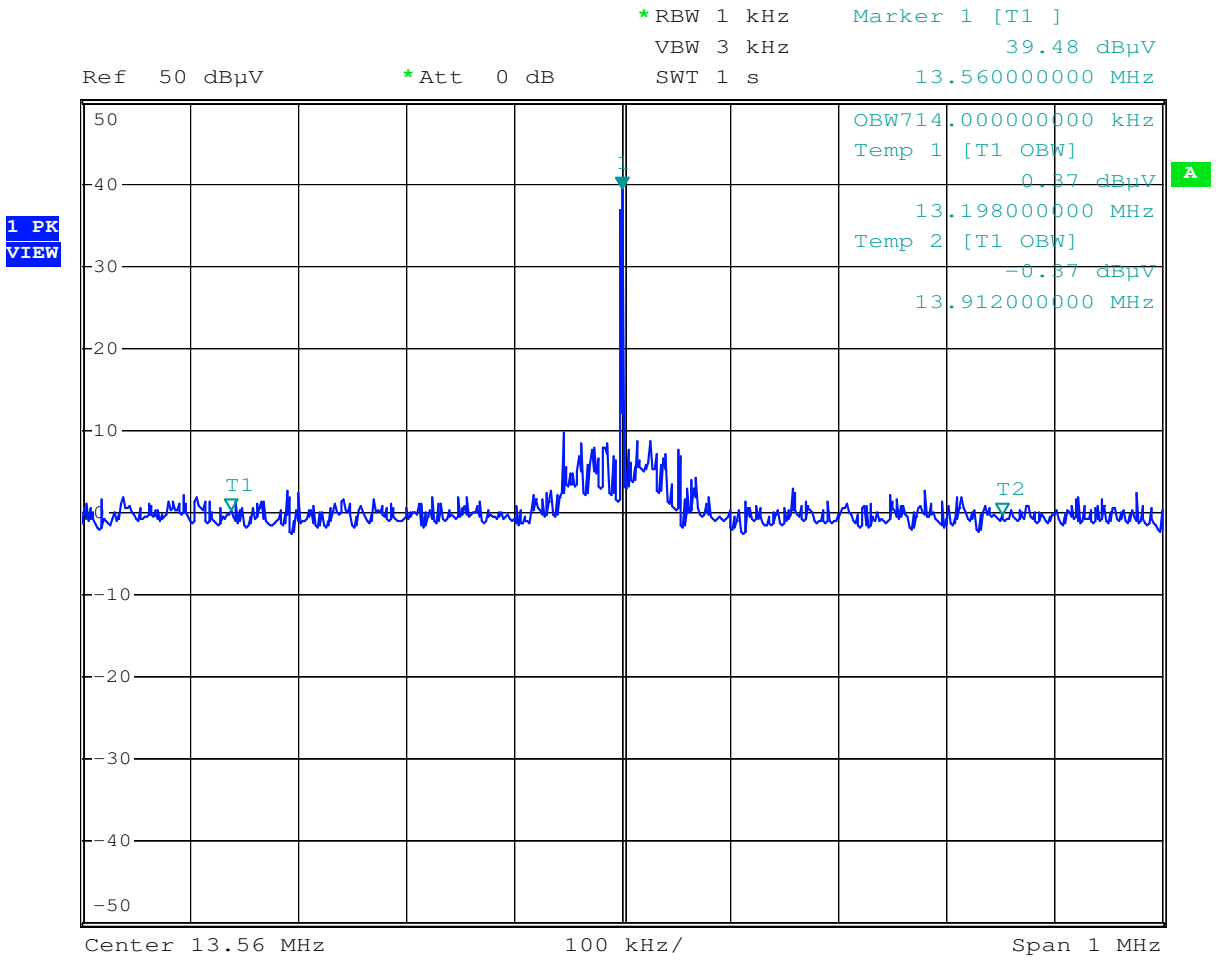
[6] See "Spectrum Mask" and "Unwanted emissions".

8.1 Occupied Bandwidth

Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.10, section 6.9.1
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, section 6.9.1; is measured as the frequency range defined by the points that are 20 dB down relative to the maximum level of the modulated carrier. 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.
Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	Test charts shown for ANT 30, only, which has maximum field strength
Date of test:	2015-05-18
Test site:	Fully anechoic room, cabin no. 2

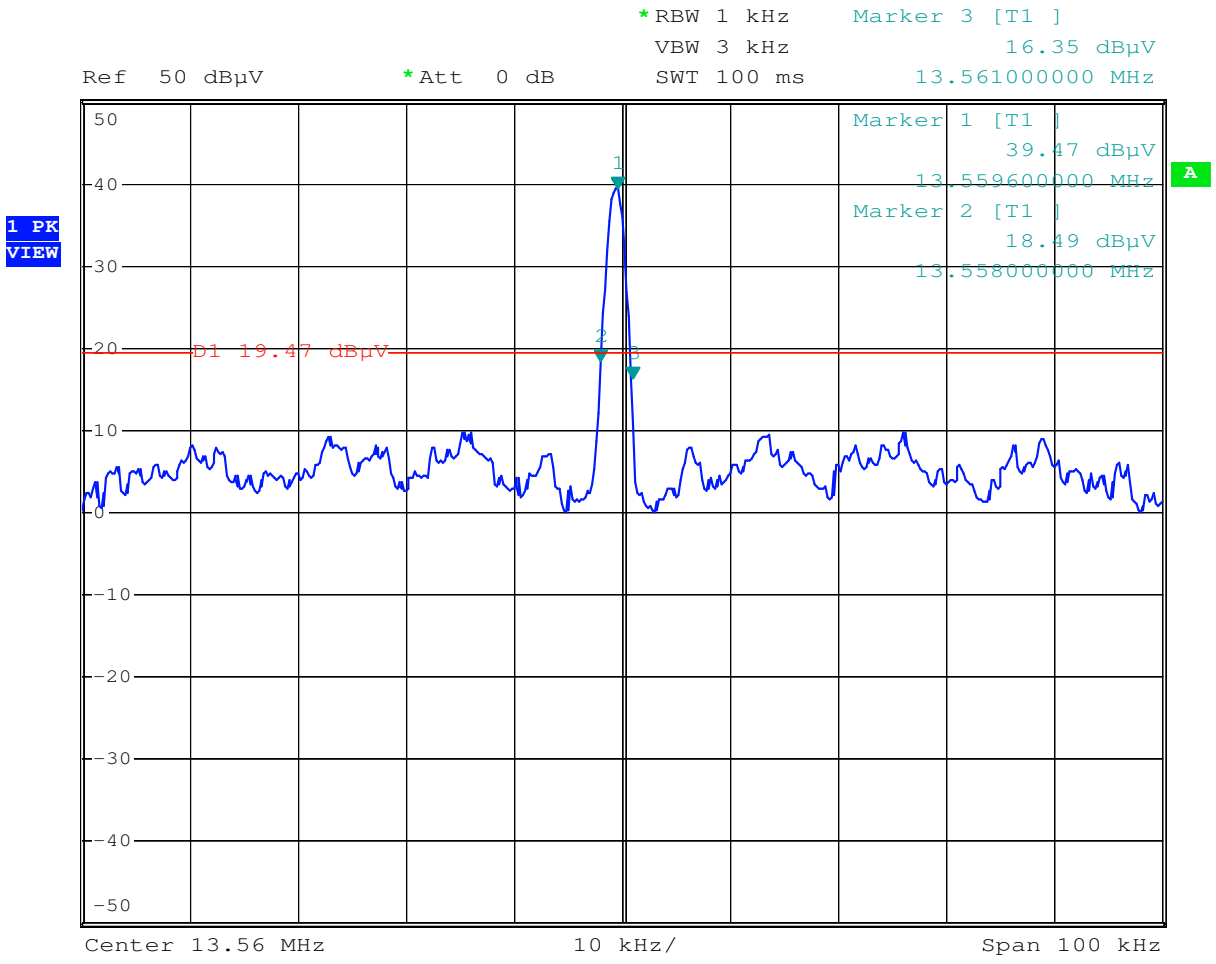
Occupied Bandwidth (99 %):



Date: 18.MAY.2015 12:02:32

Occupied Bandwidth (99 %):	**714 kHz**

Occupied Bandwidth (-20 dB):



Date: 18.MAY.2015 12:09:49

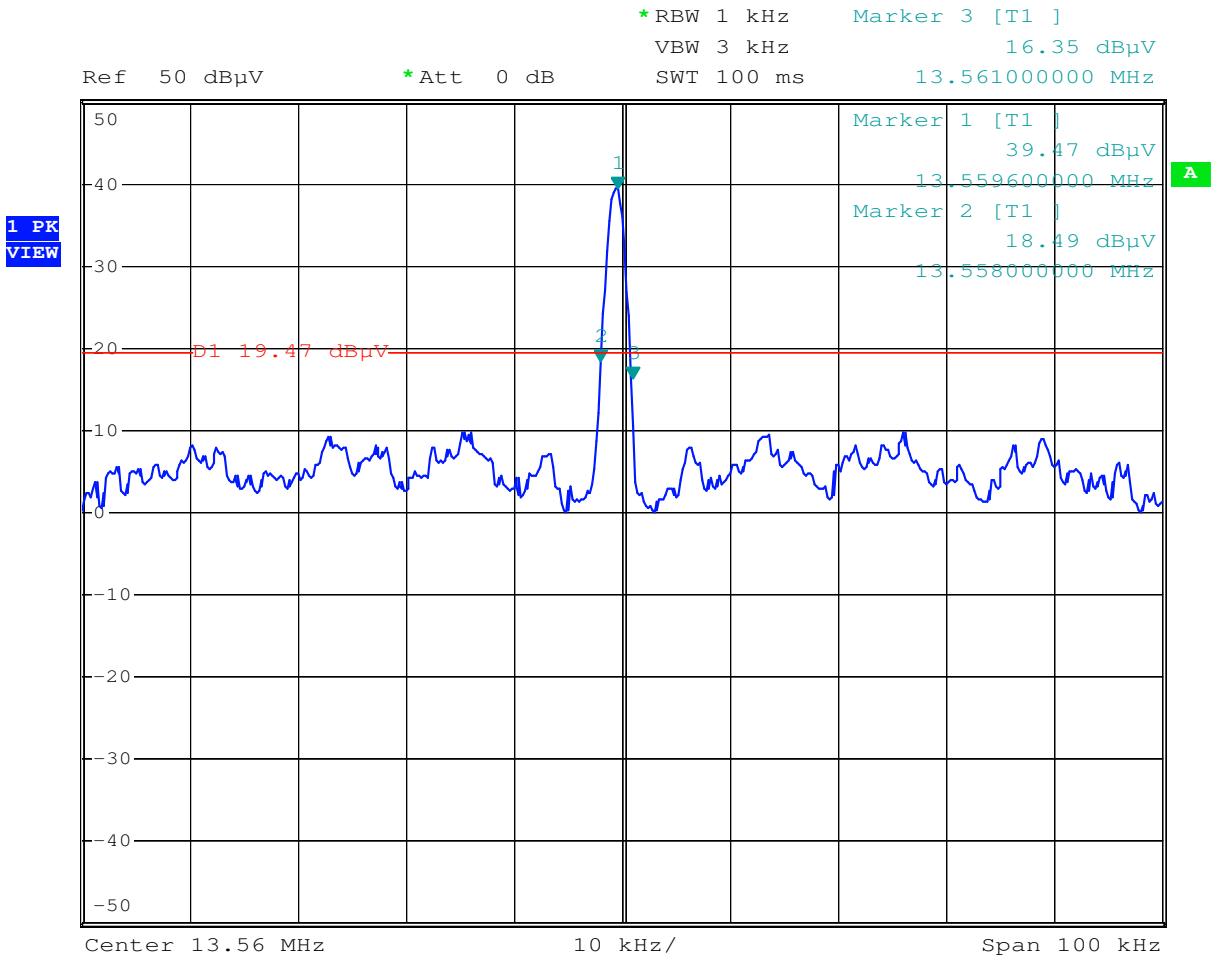
Occupied Bandwidth (-20 dB):	**3 kHz**

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:	Test charts shown for ANT 30, only, which has maximum field strength
Date of test:	2015-04-18
Test site:	Fully anechoic room, cabin no. 2

Occupied Bandwidth (99 %):

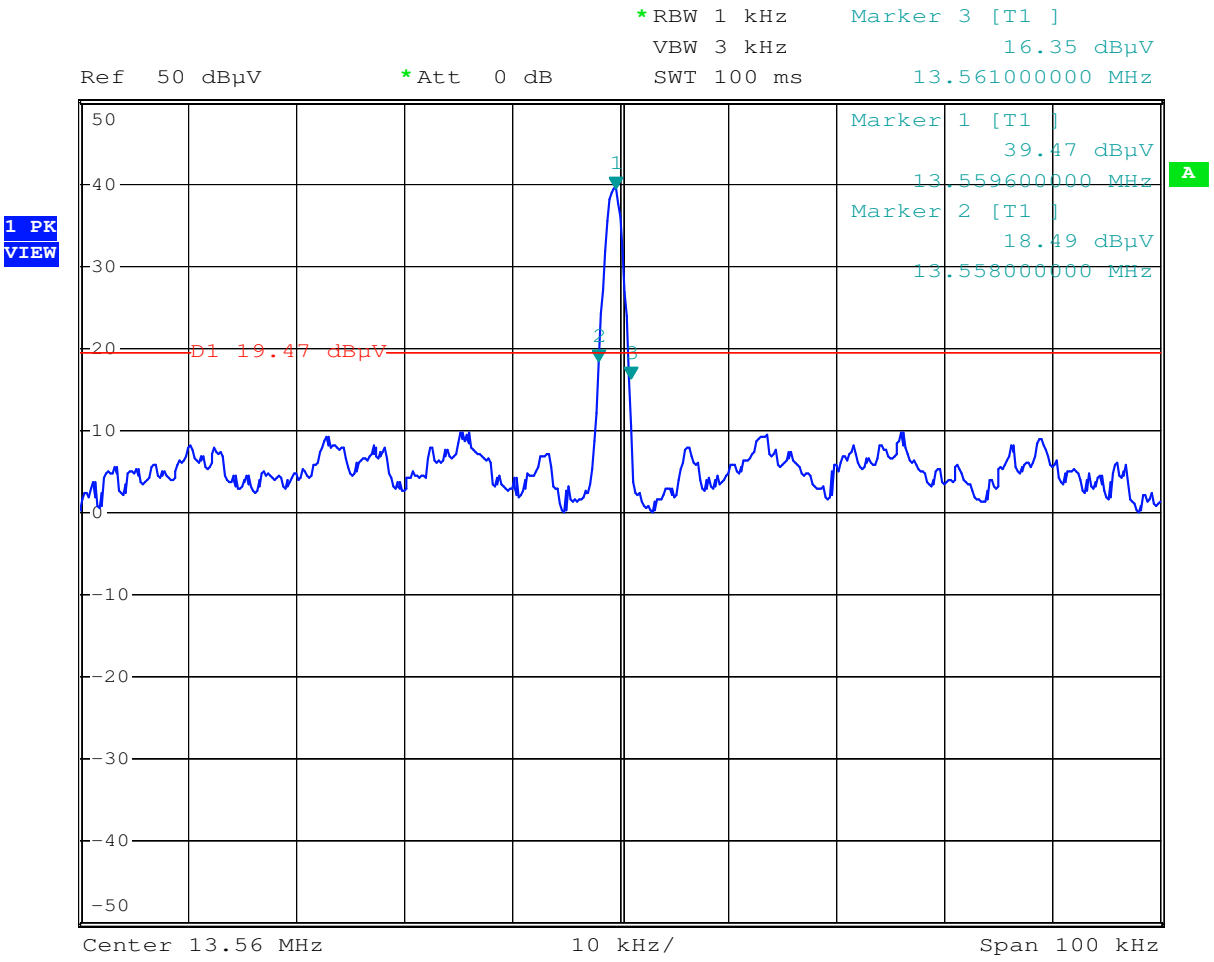


Occupied Bandwidth (99 %):	**3 kHz**

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:	Test charts shown for ANT 30, only, which has maximum field strength
Date of test:	2015-04-18
Test site:	Fully anechoic room, cabin no. 2



Date: 18.MAY.2015 12:09:49

Permitted frequency band:	**13.11 - 14.01 MHz**	
20 dB bandwidth:	**3.00 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☒ **specified** **+0.077 kHz** **-0.053 kHz**	☐ **not specified**
Bandwidth of the emission:	**3.13 kHz**	**within permitted frequency band[7]:** ☒ **yes** ☐ **no**

Test Result:	Test passed

[7] 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 IC RSS-Gen Issue 4, section 9
Guide:	ANSI C63.10 / TRC-43

Type of modulation:	Amplitude Modulation

B_n = Necessary Bandwidth	B_n = 2BK
B = Modulation rate	B = 1.56 kHz
K = Overall numerical factor	K = 1
Calculation:	$B_n = 2 \cdot (1.56\ kHz) \cdot 1 = 3.12\ kHz$

Designation of Emissions:	**3K12A1D**

8.4 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-GEN Issue 4, section 8.8		
Guide:	ANSI C63.10 / CISPR 22		
Limit:	Frequency of Emission (MHz)	Conducted Limit (dBµV)	
		Quasi-peak	Average
	0.15 - 0.5 0.5 - 5 5 - 30	66 to 56 56 60	56 to 46 46 50
Measurement procedure:	Conducted AC Powerline Emission (6.2)		

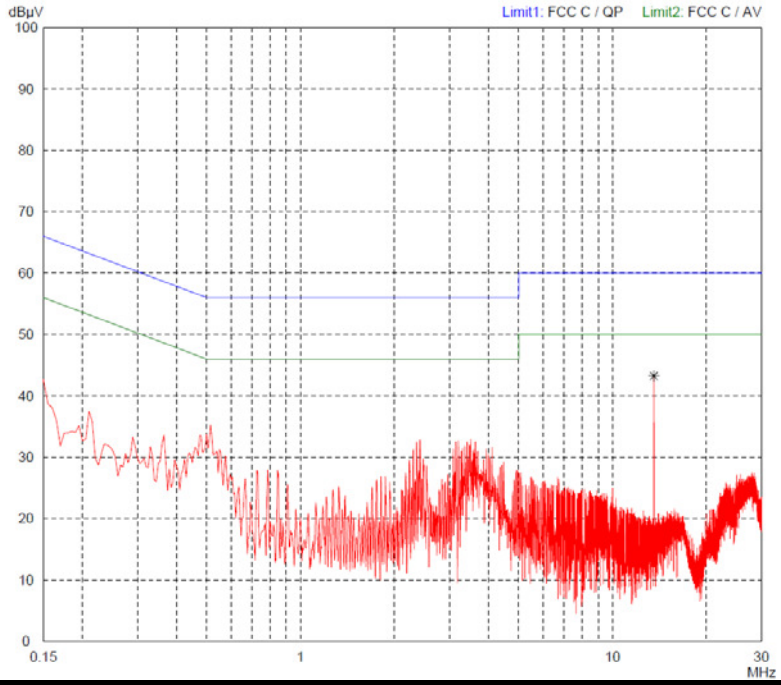
Comment:	With dummy load connected to the antenna output terminals
Date of test:	2015-04-22
Test site:	Shielded room, cabin no. 4

Test Result:	Test passed

Sample calculation of final values:

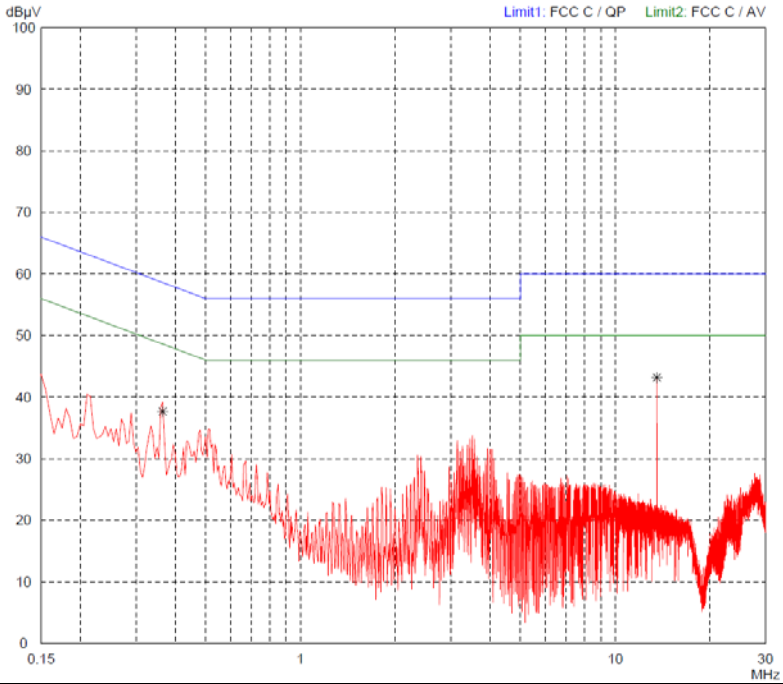
Final Value (dBµV) = Reading Value (dBµV) + Correction Factor (dB)

Tested on:	L1



Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
13.560	Quasi-Peak	43.2	0.0	43.2	60.0	**16.8**

Tested on:	N



Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
0.365	Quasi-Peak	37.7	0.0	37.7	58.6	20.9
13.560	Quasi-Peak	43.2	0.0	43.2	60.0	**16.8**

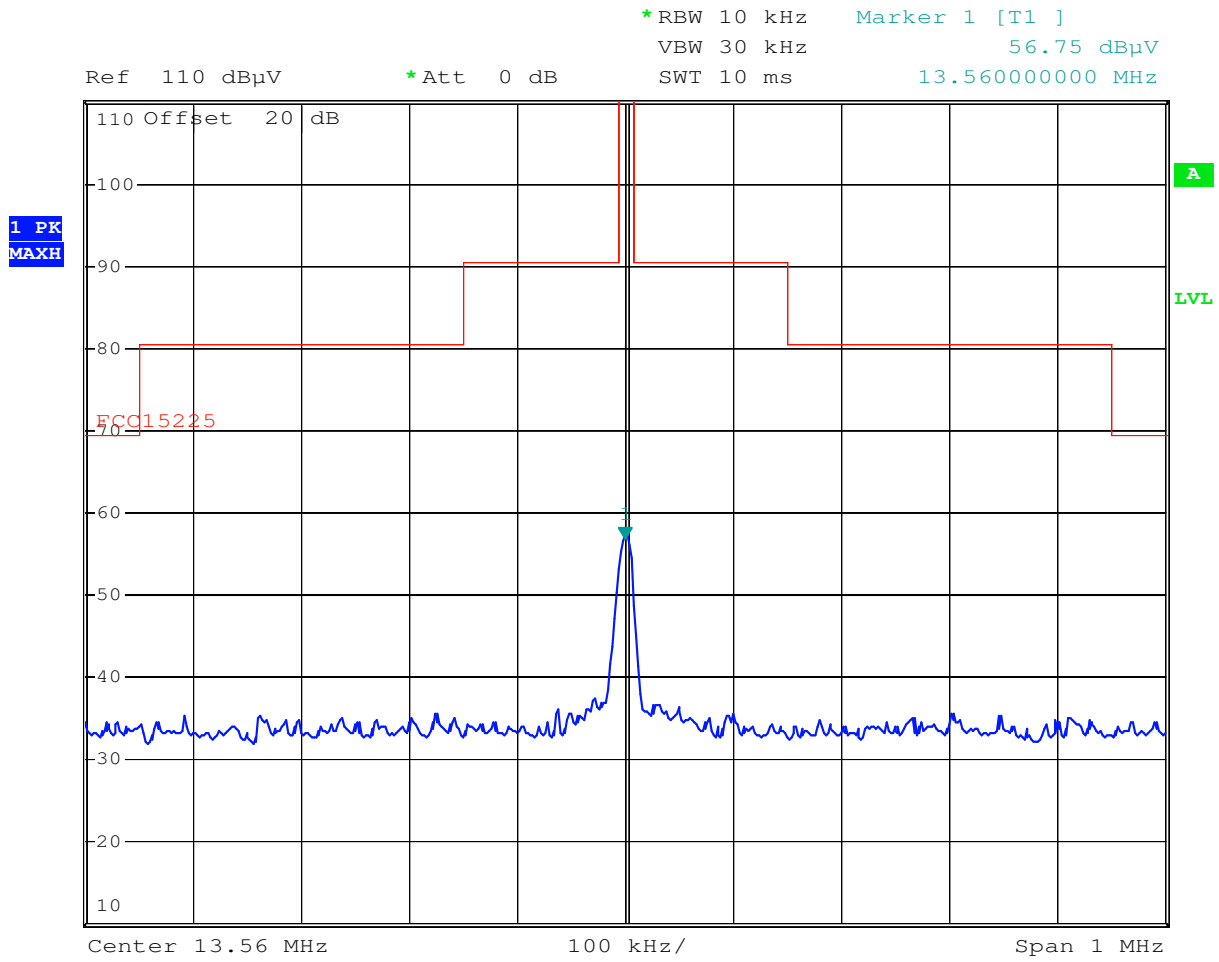
8.5 Spectrum Mask

Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d) IC RSS-210 Issue 8, section A2.6			
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)			

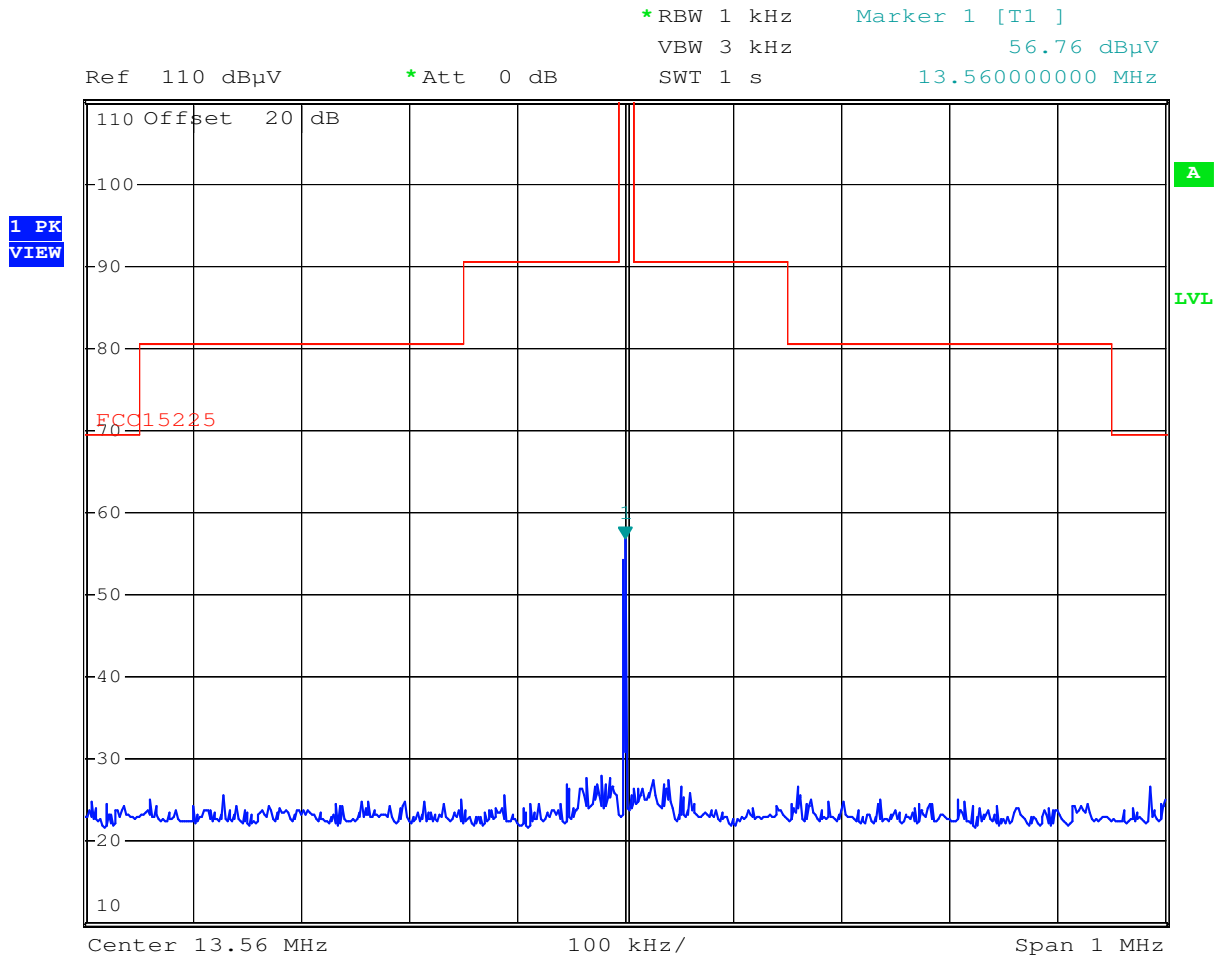
Comment:	
Date of test:	2015-05-18
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters
Extrapolation Factor:	40 dB/decade

Test Result:	Test passed

Comment:	With ANT 8

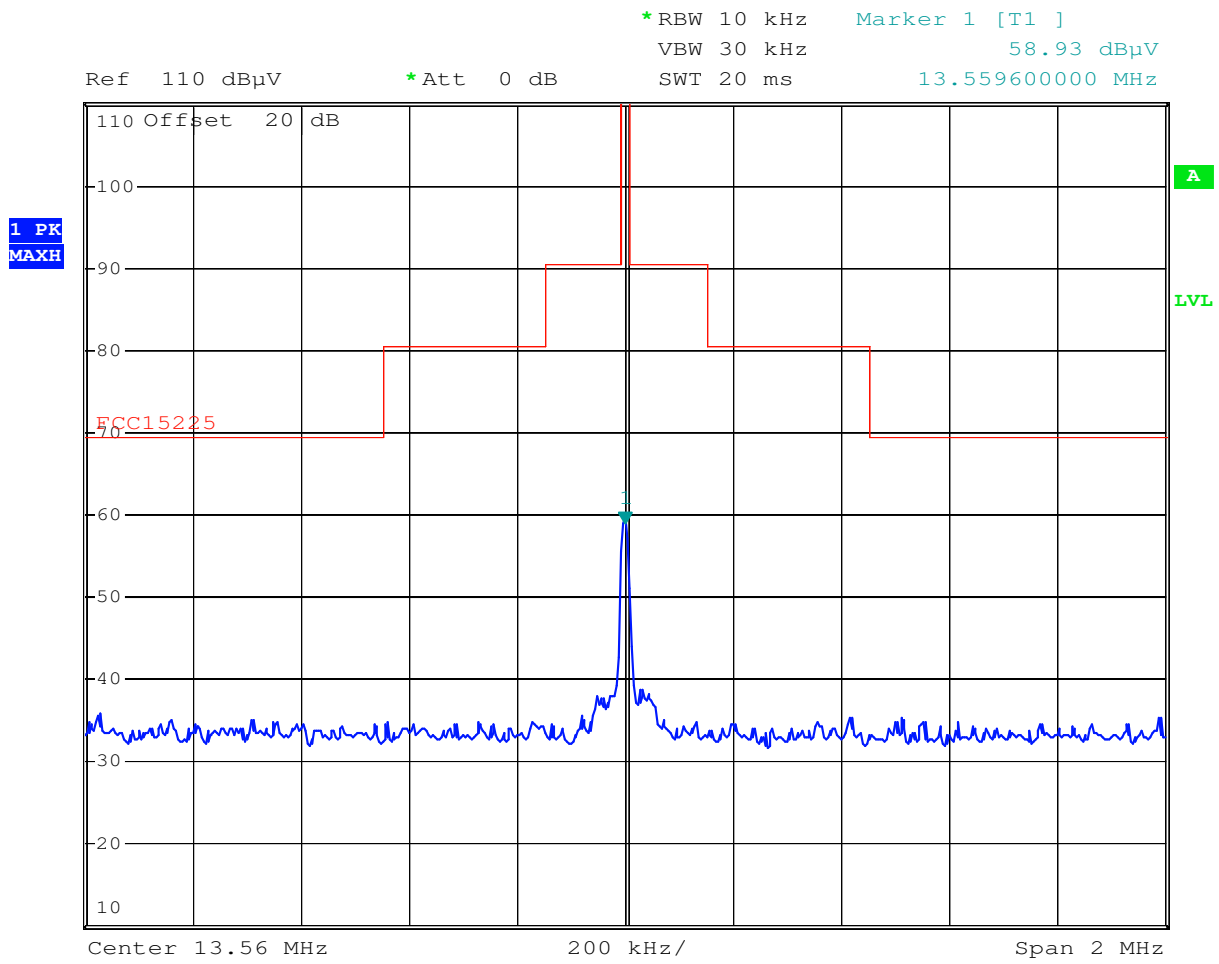


Date: 18.MAY.2015 13:11:49

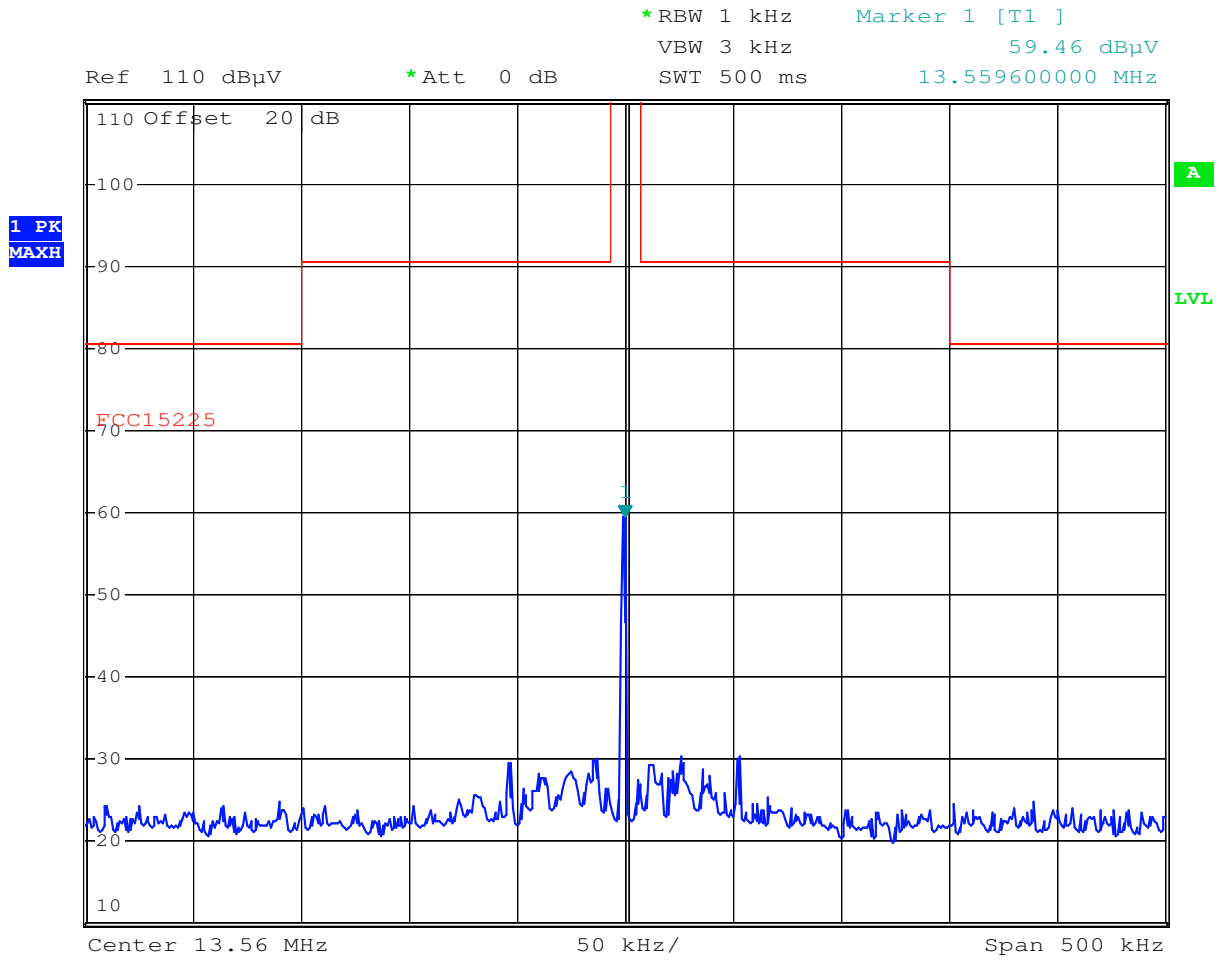


Date: 18.MAY.2015 13:14:44

Comment:	With ANT 30



Date: 18.MAY.2015 12:12:06



Date: 18.MAY.2015 12:11:21

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) IC RSS-GEN Issue 4, sections 8.9 and 8.10(b)(c) and IC RSS-210 Issue 8, section A2.6			
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:	2015-04-23
Test site:	Alternate test side

Test Result:	Test passed

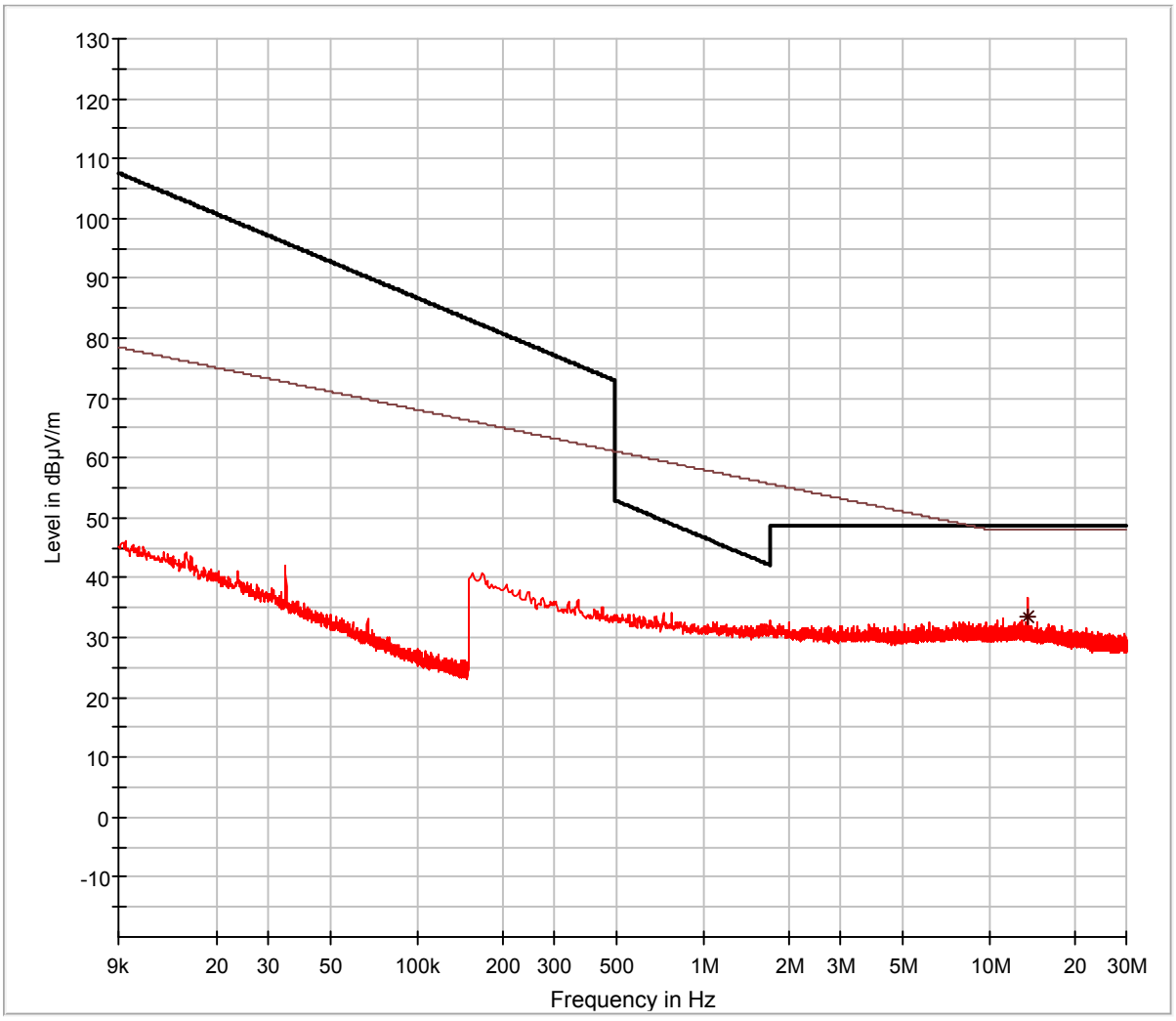
Sample calculation of final values:

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.

Comment:	With ANT 30
Test Result:	Test passed

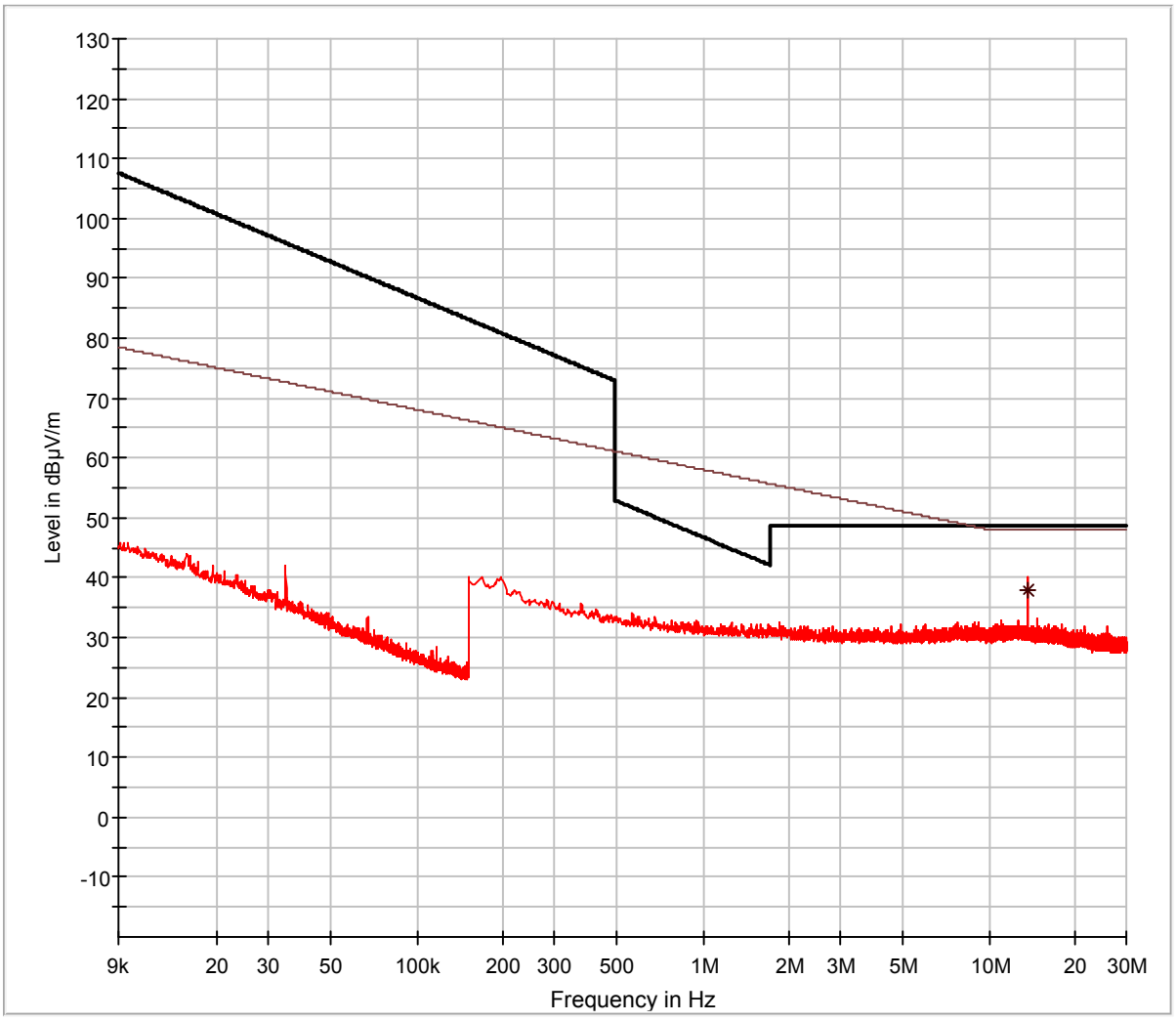


Preview Result 1-PK+
Final_Result QPK
FCC 15.209 mag (10 m)
Final_Result PK+
EN 300 330 tx mag

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	13.3	20.0	-19.1		14.3	84.0	**69.7**

Comment:	With ANT 30
Test Result:	Test passed



Preview Result 1-PK+
Final_Result QPK
FCC 15.209 mag (10 m)
Final_Result PK+
EN 300 330 tx mag

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	17.8	20.0	-19.1		18.7	84.0	**65.3**

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) IC RSS-GEN Issue 4, sections 8.9 and 8.10(b)(c) and IC RSS-210 Issue 8, section A2.6		
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 at Alternative Test Site (6.4)		

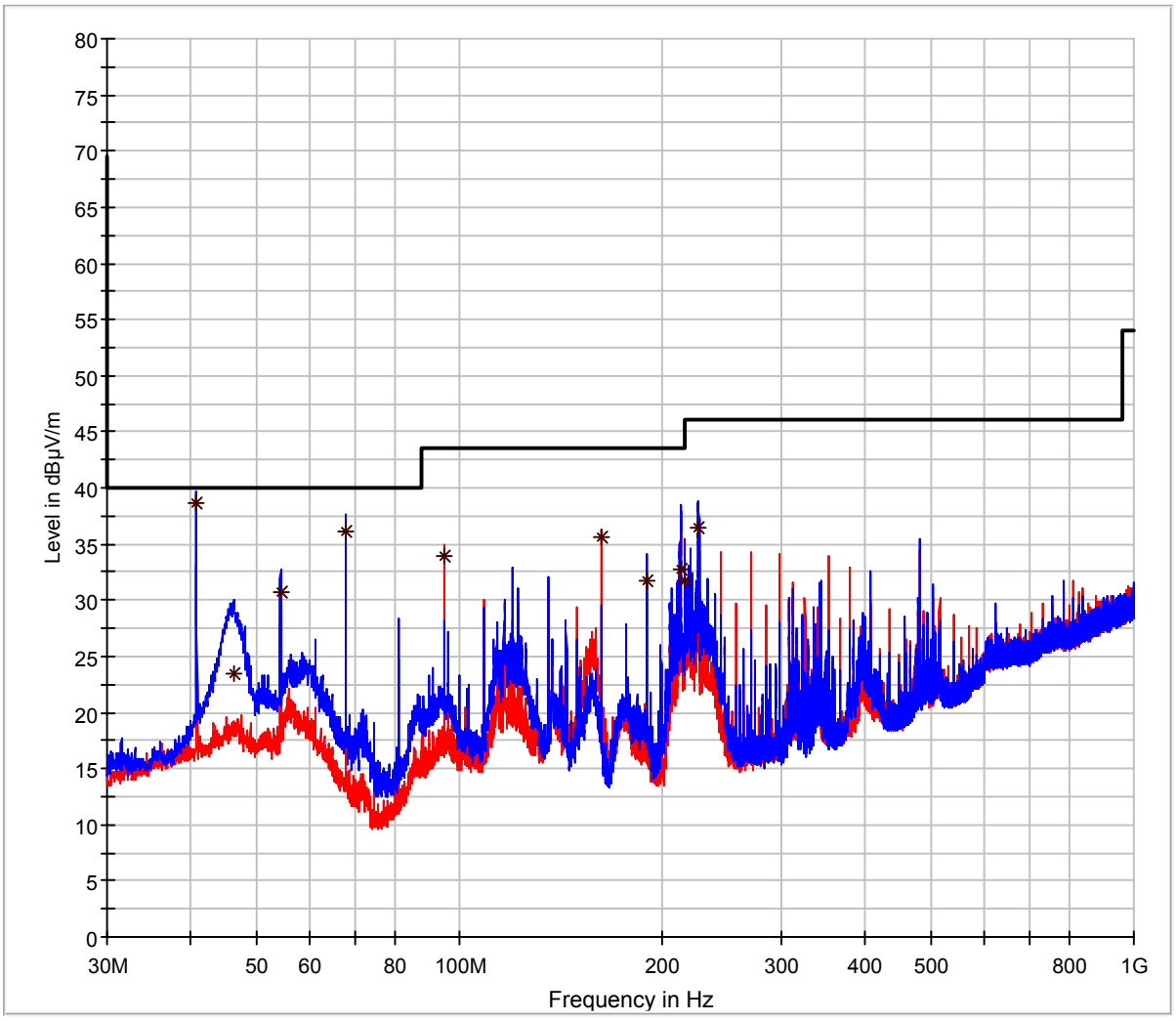
Comment:	
Date of test:	2015-04-23
Test site:	Frequencies ≤ 1 GHz: Semi-anechoic room, cabin no. 8
Test distance:	3 meters

Test Result:	Test passed

Sample calculation of final values:

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

Comment:	With ANT 8
Test Result:	Test passed

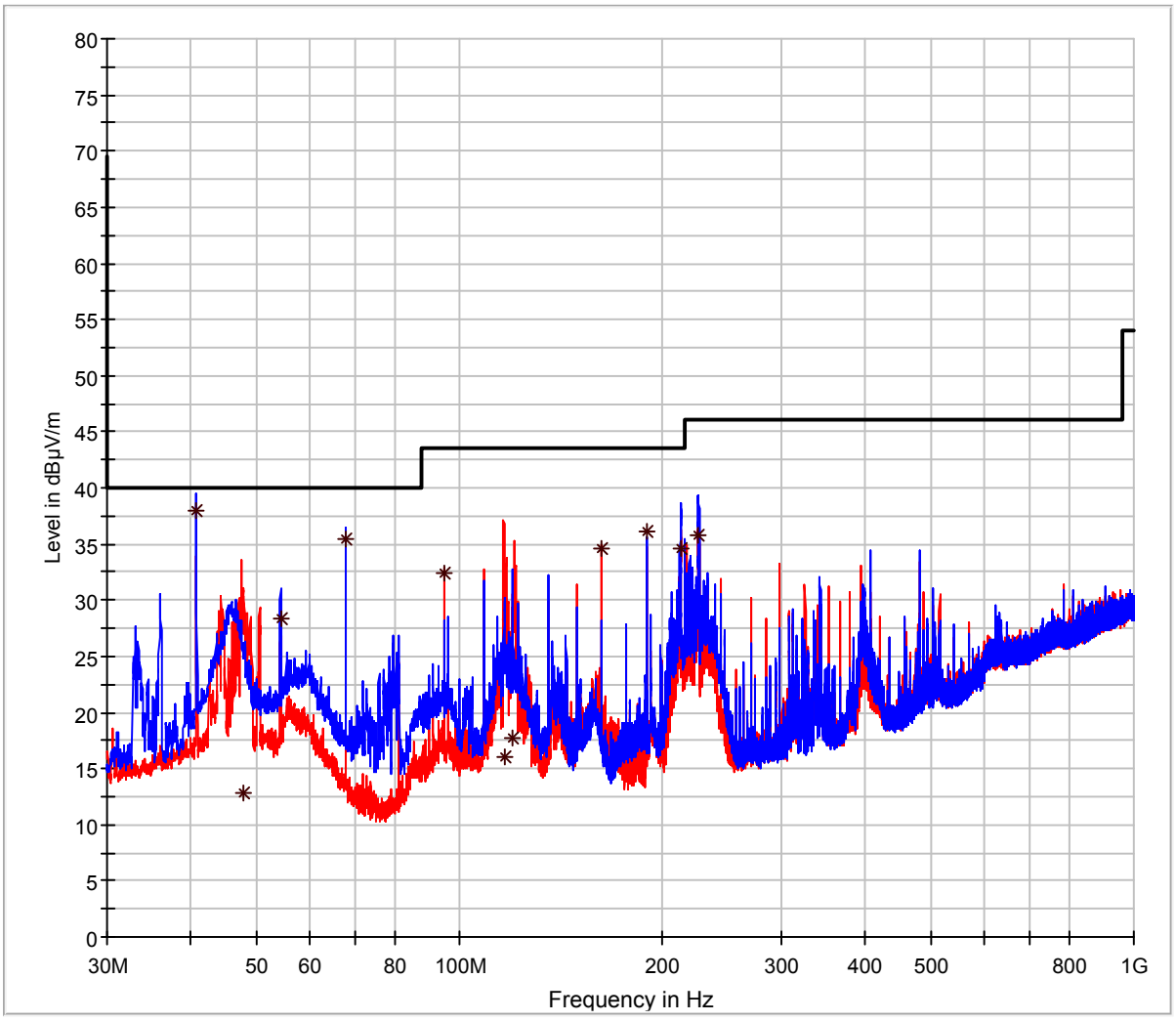


TÜV SÜD Product Service GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

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

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
40.690	vertical	Quasi-Peak	22.9	15.7		38.6	40.0	**1.4**
46.250	vertical	Quasi-Peak	7.5	16.0		23.5	40.0	16.5
54.250	vertical	Quasi-Peak	15.8	14.9		30.7	40.0	9.3
67.810	vertical	Quasi-Peak	25.5	10.7		36.2	40.0	3.8
94.930	horizontal	Quasi-Peak	20.6	13.3		33.9	43.5	9.6
162.730	horizontal	Quasi-Peak	25.3	10.3		35.6	43.5	7.9
189.850	vertical	Quasi-Peak	19.6	12.2		31.8	43.5	11.7
212.490	vertical	Quasi-Peak	20.5	12.3		32.8	43.5	10.7
215.980	vertical	Quasi-Peak	19.2	12.5		31.7	43.5	11.8
226.480	vertical	Quasi-Peak	23.4	13.1		36.5	46.0	9.5

Comment:	With ANT 30
Test Result:	Test passed



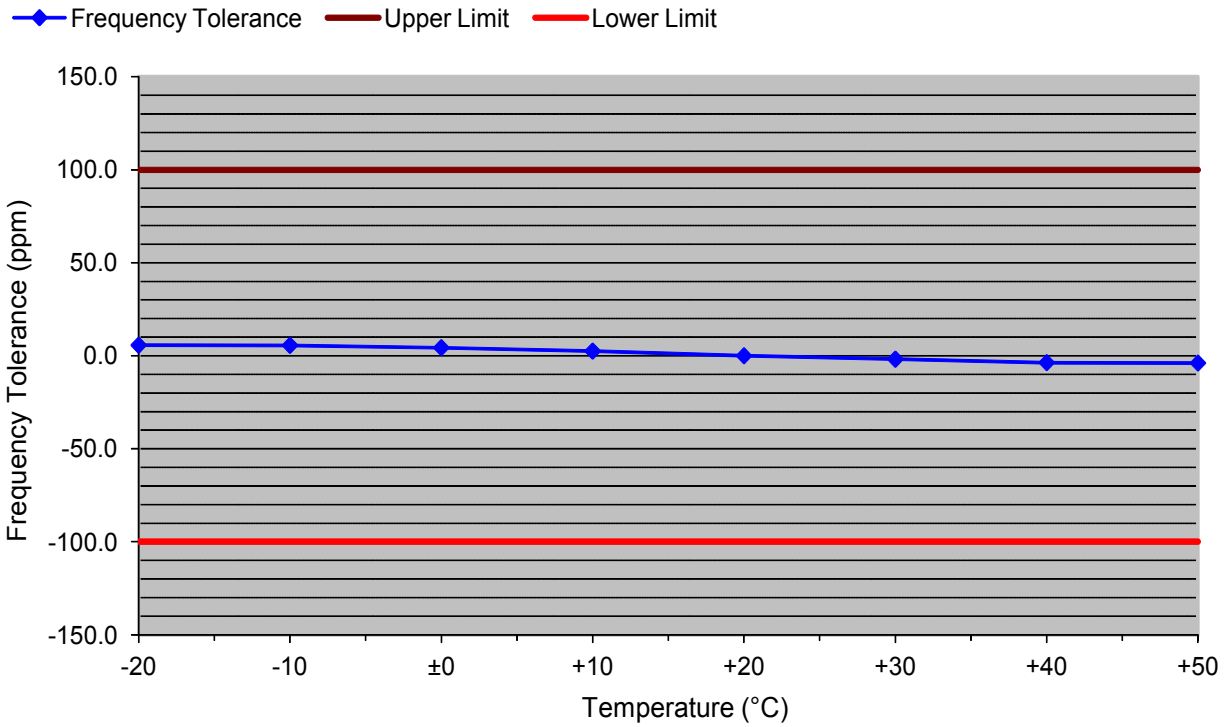
Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
40.690	vertical	Quasi-Peak	22.3	15.7		38.0	40.0	**2.0**
47.670	horizontal	Quasi-Peak	-3.2	16.0		12.8	40.0	27.2
54.250	vertical	Quasi-Peak	13.5	14.9		28.4	40.0	11.6
67.810	vertical	Quasi-Peak	24.8	10.7		35.5	40.0	4.5
94.930	horizontal	Quasi-Peak	19.1	13.3		32.4	43.5	11.1
116.630	horizontal	Quasi-Peak	3.4	12.6		16.0	43.5	27.5
120.060	horizontal	Quasi-Peak	5.7	12.0		17.7	43.5	25.8
162.730	horizontal	Quasi-Peak	24.2	10.3		34.5	43.5	9.0
189.850	vertical	Quasi-Peak	23.8	12.2		36.0	43.5	7.5
212.490	vertical	Quasi-Peak	22.2	12.3		34.5	43.5	9.0
226.510	vertical	Quasi-Peak	22.7	13.1		35.8	46.0	10.2

8.8 Carrier Frequency Stability

Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-Gen Issue 4, section 8.11 and IC RSS-210 Issue 8, section A2.6
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 (6.5)

Comment:	
Date of test:	2015-05-12

8.8.1 Carrier Frequency Stability vs. Temperature

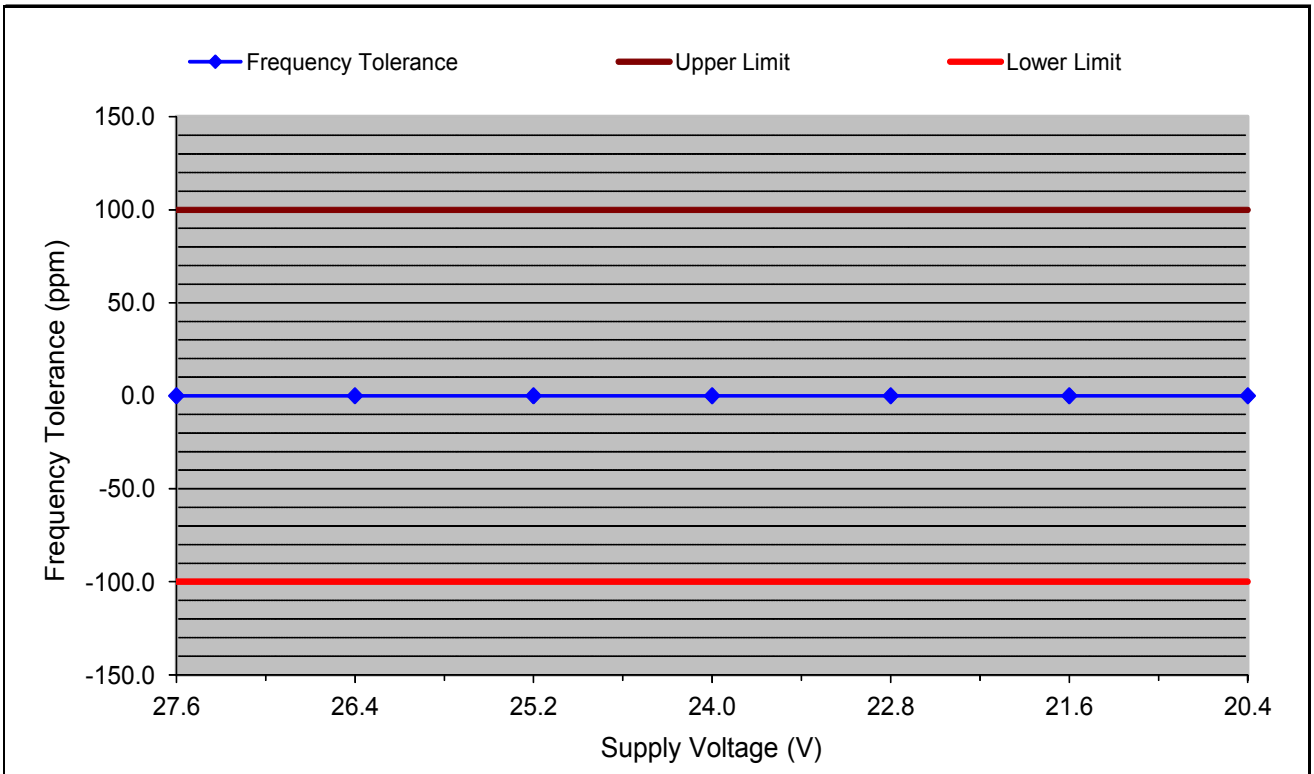


Supply voltage: 24 V Nominal frequency: 13.559454 MHz

Temperature (°C)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
-20	13.559531	77	5.7	+100.0	-100.0	**94.3**
-10	13.559530	76	5.6	+100.0	-100.0	94.4
±0	13.559513	59	4.4	+100.0	-100.0	95.6
+10	13.559488	34	2.5	+100.0	-100.0	97.5
+20	13.559454	0	0.0	+100.0	-100.0	100.0
+30	13.559429	-25	-1.8	+100.0	-100.0	98.2
+40	13.559404	-50	-3.7	+100.0	-100.0	96.3
+50	13.559401	-53	-3.9	+100.0	-100.0	96.1

Test Result:	Test passed

8.8.2 Carrier Frequency Stability vs. Supply Voltage



Temperature: +20 °C
Nominal frequency: 13.559454 MHz
Battery End Point: Not applicable

Supply Voltage (V)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
27.6	13.559454	0	0.0	+100.0	-100.0	**100.0**
26.4	13.559454	0	0.0	+100.0	-100.0	**100.0**
25.2	13.559454	0	0.0	+100.0	-100.0	**100.0**
24.0	13.559454	0	0.0	+100.0	-100.0	**100.0**
22.8	13.559454	0	0.0	+100.0	-100.0	**100.0**
21.6	13.559454	0	0.0	+100.0	-100.0	**100.0**
20.4	13.559454	0	0.0	+100.0	-100.0	**100.0**

Test Result:	Test passed

8.9 Exposure of Humans to RF Fields

Rules and specifications:	IC RSS-Gen Issue 4, section 3.2
Guide:	IC RSS-102 Issue 5, section 2.5

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP = **..... W** The effective isotropic radiated power (EIRP in watts) is calculated using ☐ the numerical antenna gain: G = **.....** $EIRP = G \cdot CP \Rightarrow EIRP$ = **..... W** ☐ the field strength[8] in V/m: FS = **..... V/m** $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **..... W** with: Distance between the antennas in m: D = **..... m**		☐	☐ ☐ ☐	
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by[8]: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **234 nW** with: Field strength in V/m: FS = **884.1 µV/m** Distance between the two antennas in m: D = **3 m**			☒ ☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **234 nW**				

[8] The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses.
If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

Exposure of Humans to RF Fields (continued)		Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is					
☐ less than or equal to 20 cm	☒ greater than 20 cm		☒		
Transmitting device is					
☐ in the vicinity of the human head	☐ body-worn		☐		

SAR evaluation				
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.				
Frequency (MHz) / Exemption limits (mW)[9] at separation distance of				

Frequency (MHz)	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 [10]	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

Carrier frequency:	f	=	..... **MHz**	
Distance:	d	=	..... **mm**	
Transmitter output power:	TP	=	..... **mW**	
Limit:	TP_{limit}	=	..... **mW**	☐

☐ SAR evaluation is documented in test report no. .....

[9] The exemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separaton distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from alinear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from athird order polynomial fit.

[10] Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
RF exposure evaluation				
RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows: ☒ below 20 MHz[11] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance). ☐ between 3 kHz and 10 MHz exposure limits apply as following: ☐ In a uncontrolled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than 2.7 · 10-4 *f* V/m_{rms} at any part of the body where *f* is in Hz. The instantaneous RF field strength is equal or less than 83 V/m_{rms} and equal or less than 90 A/m_{rms}. ☐ In a controlled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than 1.35 · 10-4 *f* V/m_{rms} at any part of the body where *f* is in Hz. The instantaneous RF field strength is equal or less than 170 V/m_{rms} and equal or less than 180 A/m_{rms}. ☐ at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 4,49/$f^{0.5}$ W (adjusted for tune-up tolerance, where *f* is in MHz. ☐ at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance). ☐ at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 · $10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where *f* is in MHz. ☐ at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance). In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.				
Carrier frequency: f = **13.56 MHz** Transmitter output power: TP = **234 nW** Limit: TP_{limit} = **1 W**				☒
☐ RF exposure evaluation is documented in test report no.				

[11] Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine RF Exposure evaluation, shall demostrate compilance tot he instanteneous limits in IC RSS-102, issue 5, section 4.

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	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 5: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), published by Industry Canada	March 2015
☐	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 Measurement Uncertainty Values

Radio Testing			
Test	k_p	*Expanded Uncertainty*	*Note*
RF-Frequency error	1.96	$\pm 1 \cdot 10^{-7}$	7
RF-Power, conducted carrier	1.96	+0.077 dB / -0.078 dB	7
RF-Power uncertainty for given BER	1.96	+0.94 dB / -1.05	7
RF power, conducted, spurious emissions	1.96	+1.4 dB / -1.6 dB	7
RF power, radiated			
25 MHz – 4 GHz	1.96	+3.6 dB / -5.2 dB	8
1 GHz – 18 GHz	1.96	+3.8 dB / -5.6 dB	8
18 GHz – 26.5 GHz	1.96	+3.5 dB / -4.5 dB	8
26.5 GHz – 66 GHz	1.96	+4.0 dB / -6.5 dB	8
Spectral Power Density, conducted	1.96	+1.4 dB / -1.6 dB	5
Maximum frequency deviation			
300 Hz – 6 kHz	2	±2,89 %	2
6 kHz – 25 kHz	2	±0.2 dB	2
Maximum frequency deviation for FM	2	±2,89 %	2
Adjacent channel power 25 MHz – 1 Ghz	2	±2.31 %	2
Temperature	2	±0.39 K	4
(Relative) Humidity	2	±2.28 %	2
DC- and low frequency AC voltage			
DC voltage	2	±0.01 %	2
AC voltage up to 1 kHz	2	±1.2 %	2
Time	2	±0.6 %	2

Radio Interference Emission Testing			
Test	k_p	*Expanded Uncertainty*	*Note*
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1

Radio Interference Emission Testing (continued)			
Test	k_p	*Expanded Uncertainty*	*Note*
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes, Voltage Fluctuations and Flicker			4

Immunity Testing			
Test	k_p	*Expanded Uncertainty*	*Note*
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%

Note 2:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%

Note 3:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2.05, providing a level of confidence of p = 95.45%

Note 4:
It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95%confidence.

Note 5:
The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%

Note 6:
The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%

Note 7:
The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of k_p = 1.96, providing a level of confidence of p = 95.45%

Note 8:
The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96, providing a level of confidence of p = 95.45%

11 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	2010	ESPI7	101018	Rohde & Schwarz	Rohde & Schwarz	06/2014	12/2015
EMI test receiver	2044	ESU8	100232	Rohde & Schwarz	Rohde & Schwarz	10/2014	10/2015
V-network	1059	ESH3-Z5	894785/005	Rohde & Schwarz	Rohde & Schwarz	08/2013	08/2016
Loop antenna	1016	HFH2-Z2	882964/0001	Rohde & Schwarz	Rohde & Schwarz	05/2014	05/2016
TRILOG Broadband Antenna	2058	VULB 9163	9163-408	Schwarzbeck	Rohde & Schwarz	06/2014	05/2016
Digital multimeter	2026	Fluke 177	96720025	Fluke	ZMK	07/2013	07/2015
Temperature test chamber	1271	HT 4010	07065550	Heraeus	TÜV SÜD PS-EMC-STR	06/2013	06/2015
DC power supply	1267	NGSM 32/10	203	Rohde & Schwarz		see note 4	

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.

12 Revision History

Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	2015-05-25	M. Steindl (as)	First Edition
2	2016-01-28	M. Steindl (cb)	Added measurement uncertainties Updated reference of ANSI C63.10 from version 10-2009 to 10-2013. Updated reference to RSS-102 to issue 5.
3	2016-02-12	M. Steindl (as)	Altered foto for conducted emissions.