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July 8, 2013

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Prüfbericht / Test Report

Nr. / No. 69557-18434-3 (Edition 3)

Applicant: Brooks Automation (Germany) GmbH
RFID Division

Type of equipment: RFID TIRIS Reader

Type designation: LF60 Solid

Order No.: Order of 30.01.13

Test standards: FCC Code of Federal Regulations,
CFR 47, Part 15,
Sections 15.205, 15.207 and 15.209

Note:

The test data of this report is related only to the individual item which has been tested. This report shall not be reproduced except in full extent without the written approval of the testing laboratory.

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1 Description of the Equipment Under Test (EUT)

General data of EUT

Type designation ¹ :	LF60 Solid
Parts ² :	Reader LF60 Mini Antenna ANT-7K15
Serial number(s):	4812 0004
Manufacturer:	Brooks Automation GmbH
Type of equipment:	RFID TIRIS Reader
Version:	With modifications according to documentation of applicant
FCC ID:	N5GLF60C
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:	134.2 kHz
Frequency range:	134.2 kHz
Operating frequency:	134.2 kHz
Type of modulation:	AM / FM
Pulse train:	---
Pulse width:	---
Number of RF-channels:	1
Channel spacing:	---
Designation of emissions ³ :	1K80A1D
Type of antenna:	Dedicated antenna
Size/length of antenna:	Ø 1 x 7 cm
Connection of antenna:	<input checked="" type="checkbox"/> detachable <input type="checkbox"/> not detachable
Type of power supply:	DC supply
Specifications for power supply:	nominal voltage: 24 V minimum voltage: 18 V maximum voltage: 30 V
Specifications for AC power supply:	nominal voltage: 110 V nominal frequency: 60 Hz

³ Also known as "Class of Emission".

2 Administrative Data

Application details

Applicant (full address):	Brooks Automation (Germany) GmbH RFID Division Gartenstraße 19 D-95490 Mistelgau
Contact person:	Mr. Lothar Düngfelder
Order number:	Order of 30.01.13
Receipt of EUT:	2013-01-22
Date(s) of test:	2013-02-01 to 2013-02-25
Note(s):	

Report details

Report number:	69557-18434-3
Edition:	3
Issue date:	2013-07-08

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
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 and 15.209

of the Federal Communication Commission (FCC).

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 in stand alone configuration. For conducted power line emissions the antenna was replaced by a 50 Ohms termination resistor.

List of ports and cables

Port	Description	Classification ⁴	Cable type	Cable length
1	DC supply of EUT	dc power	Unshielded	2 m
2	Ethernet	signal/control port	Shielded	2 m
3	RS-232	signal/control port	Shielded	2 m
4	Remote I/O ⁵	signal/control port	Shielded	---
5	Antenna	signal/control port	Shielded	1 m

List of devices connected to EUT

Item	Description	Type Designation	Serial no. or ID	Manufacturer
1	Antenna	ANT-7K15	---	Brooks

List of support devices

Item	Description	Type Designation	Serial no. or ID	Manufacturer

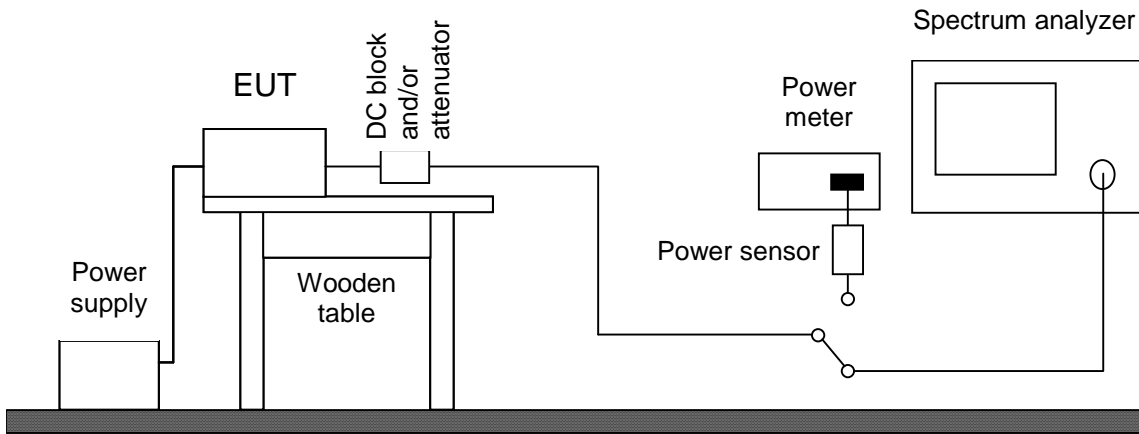
⁴ Ports shall be classified as ac power, dc power or signal/control port

⁵ This port was excluded from testing by the applicant. No cable was attached.

6 Measurement Procedures

6.1 Conducted Output Power

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 2, section 2.1046(a)
Guide:	CFR 47 Part 2, section 2.1046
<p>Conducted output power is measured at the RF output terminals (e.g. antenna connector if antenna is detachable) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer and/or a power meter with appropriate sensor. 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.</p> <p>If a spectrum analyzer is used and no other settings are specified resolution bandwidth shall be selected according to the carrier frequency f_c and set to 10 kHz ($150\text{ kHz} \leq f_c < 30\text{ MHz}$), 100 kHz ($30\text{ MHz} \leq f_c < 1\text{ GHz}$) or 1 MHz ($f_c \geq 1\text{ GHz}$). The video bandwidth shall be at least three times greater than the resolution bandwidth. The settings used have to be indicated within the appropriate test record(s).</p>	



Test instruments used:

Type	Designation	Inv.-no.	Serial No. or ID	Manufacturer
<input type="checkbox"/> Spectrum analyzer	FSP30	1666	100063	Rohde & Schwarz
<input checked="" type="checkbox"/> EMI test receiver	ESPI7	1711	836914/0002	Rohde & Schwarz
<input type="checkbox"/> EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
<input type="checkbox"/> Power meter	NRVS	1264	836856/015	Rohde & Schwarz
<input type="checkbox"/> Peak power sensor	NRV-Z31	1701	8579604.03	Rohde & Schwarz
<input type="checkbox"/> Power sensor	NRV-Z52	1499	837901/030	Rohde & Schwarz
<input type="checkbox"/> Power sensor	NRV-Z4	1034	863828/015	Rohde & Schwarz
<input type="checkbox"/> DC-block	7006	1636	A2798	Weinschel
<input checked="" type="checkbox"/> Attenuator	4776-10	1638	9412	Narda
<input type="checkbox"/> Attenuator	4776-20	1639	9503	Narda

6.2 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 3, sections 4.6.1 and 4.6.2 IC RSS-210 Issue 8, section A1.1.3 ANSI C63.4, annex H.6
Guide:	ANSI C63.4 / IC RSS-Gen Issue 3, sections 4.6.1 and 4.6.2
Measurement setup:	<input type="checkbox"/> Conducted: See below <input checked="" type="checkbox"/> Radiated: Radiated Emission Measurement 9 kHz to 30 MHz (6.4)
<p>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.</p> <p>If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range.</p> <p>The analyzer settings are specified by the test description of the appropriate test record(s).</p>	

6.3 Conducted AC Powerline Emission

Measurement Procedure:

Rules and specifications: CFR 47 Part 15, section 15.207
IC RSS-GEN Issue 3, section 7.2.4

Guide: ANSI C63.4 / CISPR 22

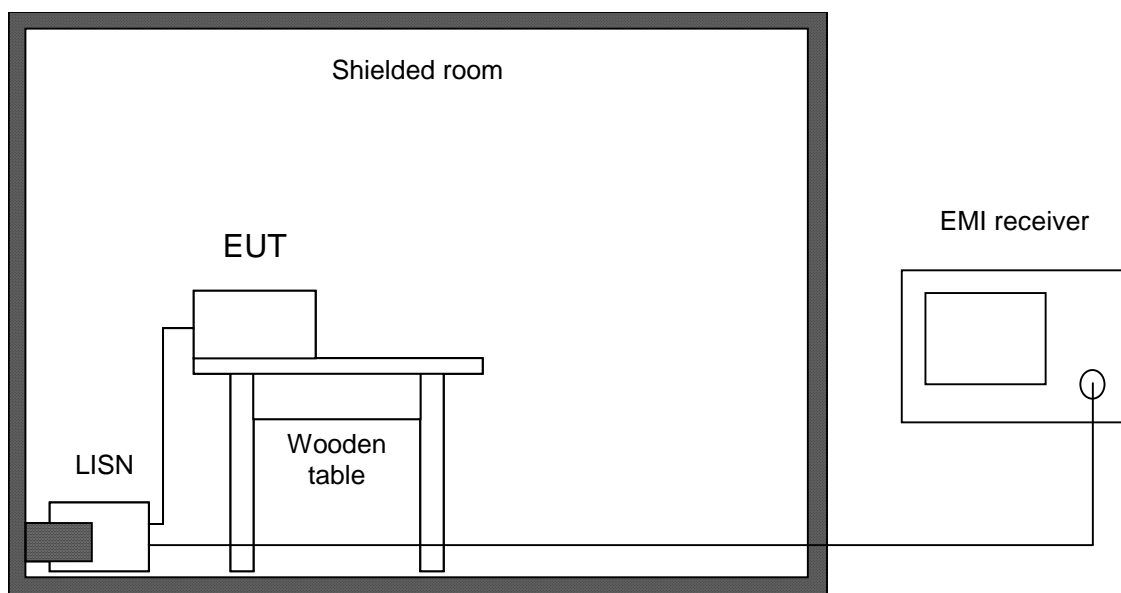
Conducted emission tests in the frequency range 150 kHz to 30 MHz are performed using Line Impedance Stabilization Networks (LISNs). To simplify testing with quasi-peak and average detector the following procedure is used:

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 C63.4, section 13.1.3.1, 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
<input checked="" type="checkbox"/> Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
<input checked="" type="checkbox"/> V-network	ESH 3-Z5	1059	894785/005	Rohde & Schwarz
<input checked="" type="checkbox"/> V-network	ESH 3-Z5	1218	830952/025	Rohde & Schwarz
<input type="checkbox"/> Artificial mains network	ESH 2-Z5	1536	842966/004	Rohde & Schwarz
<input type="checkbox"/> Shielded room	No. 1	1451	---	Albatross
<input checked="" type="checkbox"/> Shielded room	No. 4	1454	3FD 100 544	Euroshield

6.4 Radiated Emission Measurement 9 kHz to 30 MHz

Measurement Procedure:

Rules and specifications: CFR 47 Part 15, sections 15.205 and 15.209
 IC RSS-GEN Issue 3, sections 7.2.2 and 7.2.5

Guide: ANSI C63.4

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.

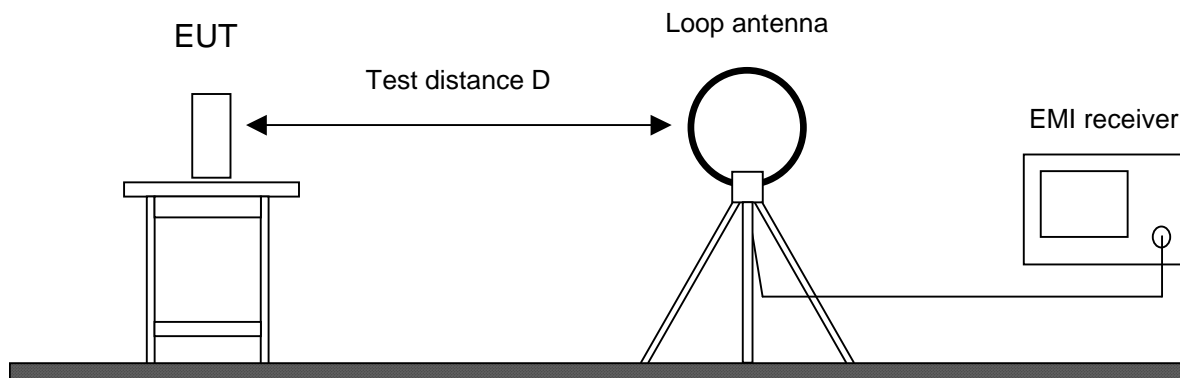
Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

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
<input type="checkbox"/> Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
<input type="checkbox"/> EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
<input type="checkbox"/> Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
<input checked="" type="checkbox"/> EMI test receiver	ESU8	2044	100232	Rohde & Schwarz
<input type="checkbox"/> Preamplifier	Cabin no. 2 CPA9231A	1716	3557	Schaffner
<input checked="" type="checkbox"/> Loop antenna	HFH2-Z2	1016	882964/1	Rohde & Schwarz
<input type="checkbox"/> Fully anechoic room	No. 2	1452	---	Albatross
<input type="checkbox"/> Semi anechoic room	No. 3	1453	---	Siemens
<input checked="" type="checkbox"/> Semi anechoic room	No. 8	2057	---	Albatross

6.5 Radiated Emission at Alternative Test Site

Measurement Procedure:

Rules and specifications:	CFR 47 Part 15, section 15.209 IC RSS-GEN Issue 3, section 7.2.5
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Guide:	ANSI C63.4
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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 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.

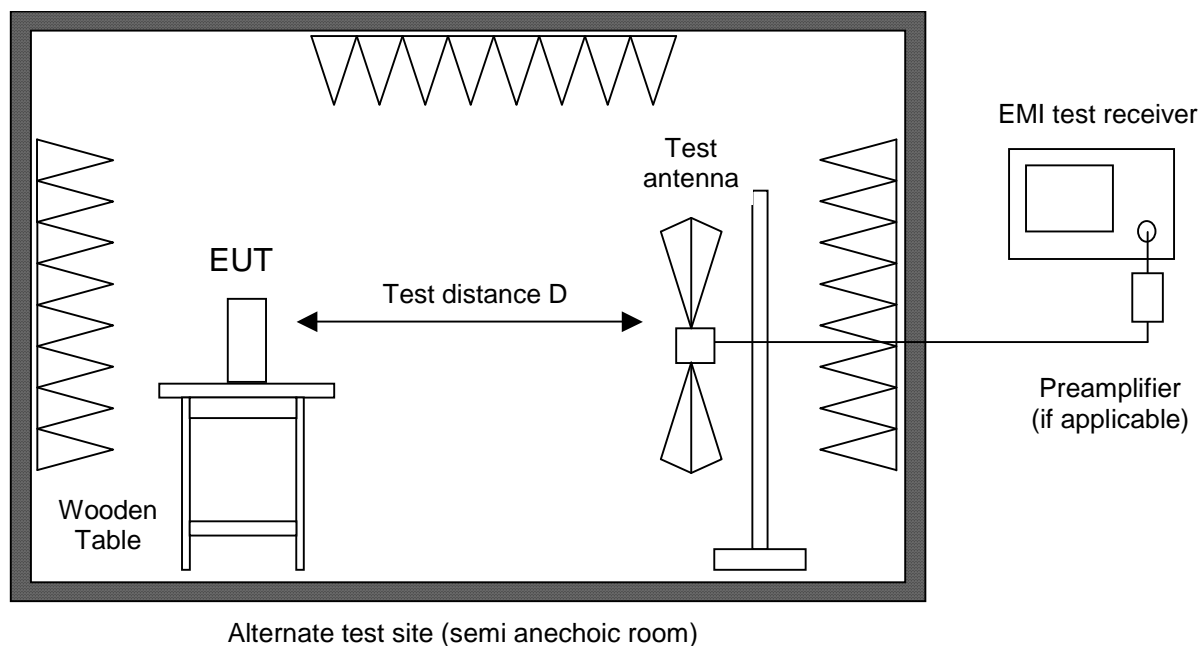
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.

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 discharged 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.



Test instruments used:

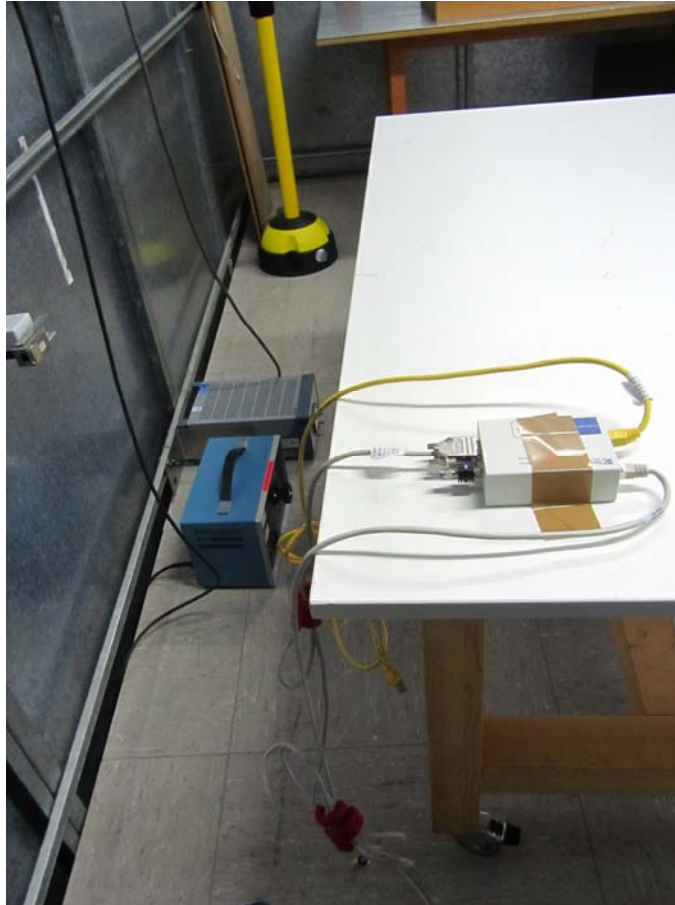
Type		Designation	Inv.-no.	Serial No. or ID	Manufacturer
<input checked="" type="checkbox"/>	EMI test receiver	ESU8	2044	100232	Rohde & Schwarz
<input checked="" type="checkbox"/>	Trilog antenna	Cabin no. 8 VULB 9163	2058	9163-408	Schwarzbeck
<input checked="" type="checkbox"/>	Semi anechoic room	No. 8	2057	---	Albatross

7 Photographs Taken During Testing

Test setup for conducted DC powerline emission measurement



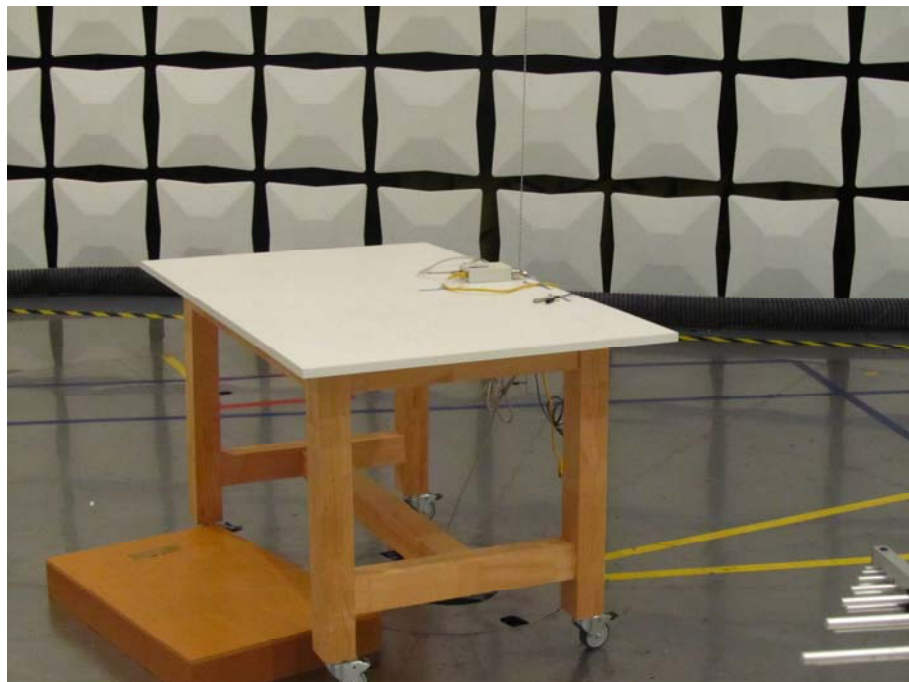
Test setup for conducted DC powerline emission measurement - continued -



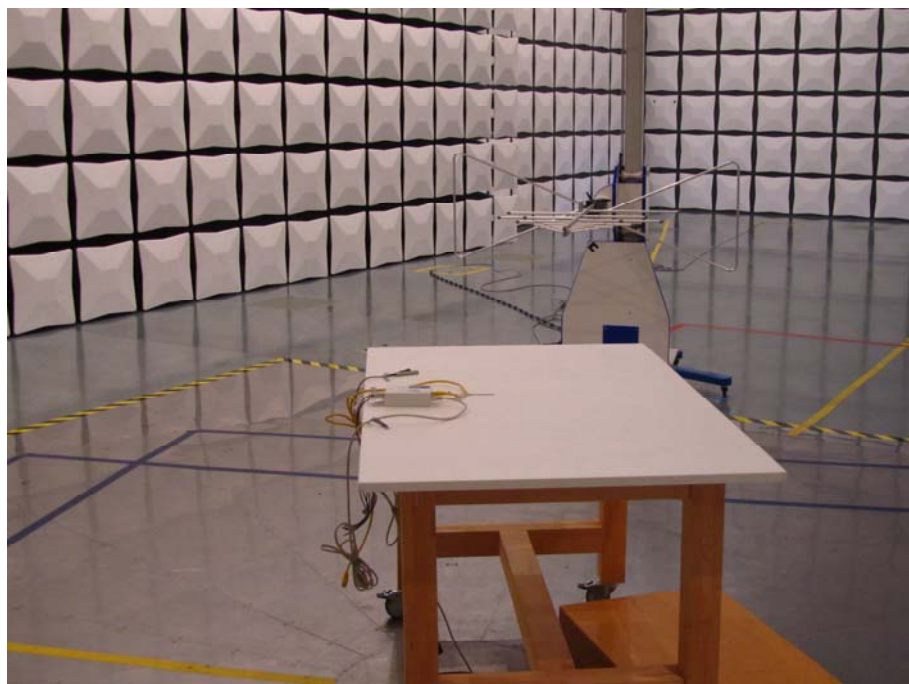
Test setup for radiated emission measurement 9 kHz – 30 MHz



Test setup for radiated emission measurement (alternate test site)



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	25	Recorded
2.202(a)	Occupied bandwidth	27	Recorded
2.201, 2.202	Class of emission	31	Calculated
15.35(c)	Pulse train measurement for pulsed operation	---	Not applicable
15.205(a)	Restricted bands of operation	32	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	---	Not applicable
15.207	Conducted DC powerline emission 150 kHz to 30 MHz	33	Test passed
15.205(b) 15.209	Radiated emission 9 kHz to 30 MHz	35	Test passed
15.205(b) 15.209	Radiated emission 30 MHz to 1 GHz	36	Test passed

8.1 Conducted Output Power

Rules and specifications:	CFR 47 Part 2, section 2.1046(a)
Guide:	CFR 47 Part 2, section 2.1046
Description:	Conducted output power shall be measured at the RF output terminals (e.g. antenna connector if antenna is detachable) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.
Measurement procedure:	Conducted Output Power (6.1)

Comment:	
Date of test:	2013-02-25
Test site:	Unshielded room

Test Result:	Test passed
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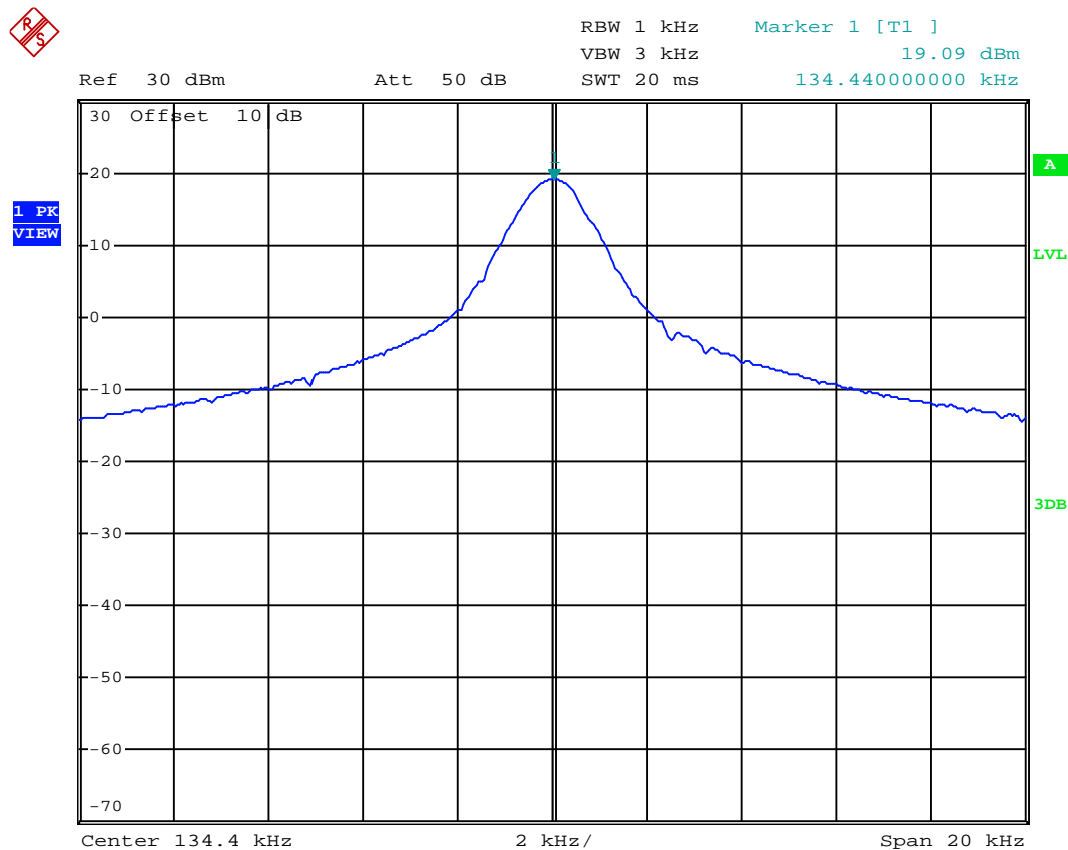
Antenna gain: dBi							
Mode	Frequency (MHz)	Power Type	Reading (dBm)	Correction (dB)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Transmitting	0,1	Peak	19,1	0,0	19,1		

Note 1: If applicable, PEP (peak envelope power) and RMS values are measured using a power meter with appropriate sensor.

Note 2: If applicable, peak or average values are measured using a spectrum analyzer with resolution and video bandwidth set to: RBW = 1 kHz, VBW = 3 kHz

Note 3: If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power limit is reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Conducted Output Power:



Date: 25.FEB.2013 12:56:14

8.2 Occupied Bandwidth

Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.4, annex H.6	
Guide:	ANSI C63.4	
Description:	<p>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.</p> <p>The occupied bandwidth according to ANSI C63.4, annex H.6; is measured as the frequency range defined by the points that are 26 dB down relative to the maximum level of the modulated carrier.</p> <p>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:</p>	
	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 (6.2)	

Comment:	
Date of test:	2013-02-06
Test site:	Fully anechoic room, cabin no. 8

Occupied Bandwidth (99 %):

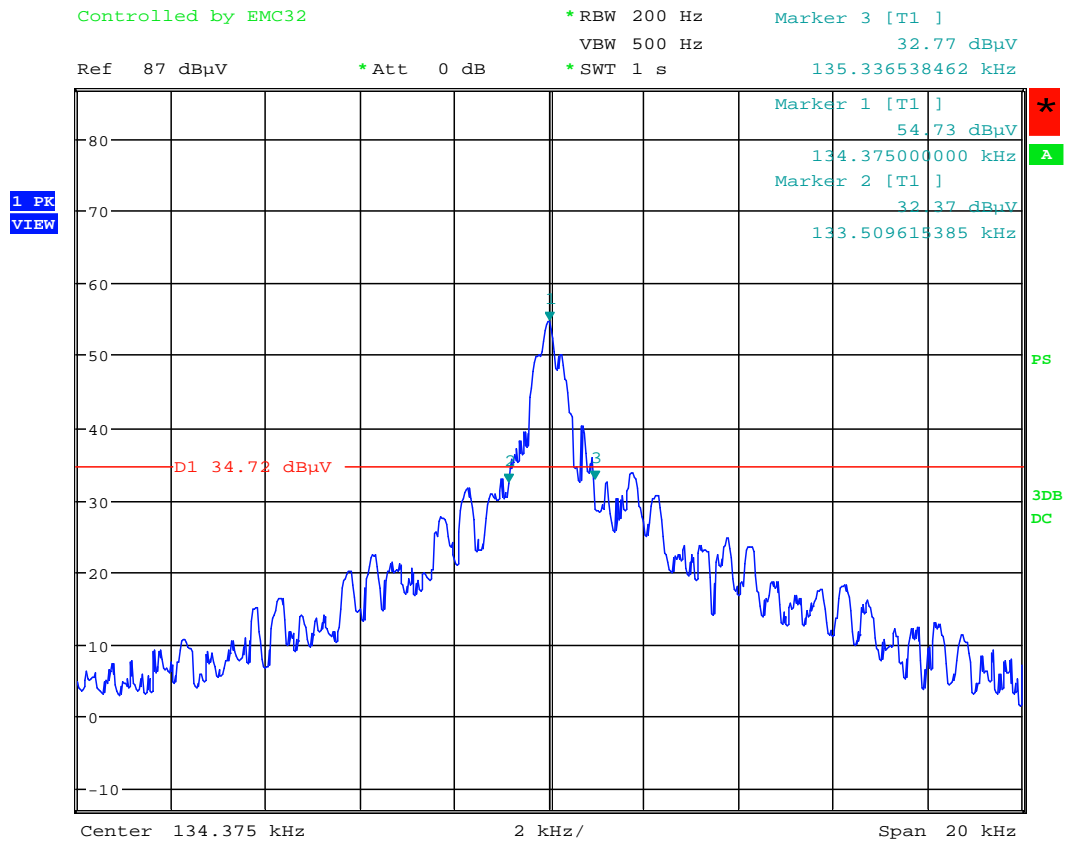


Date: 6.FEB.2013 15:11:21

Occupied Bandwidth (99 %): **3.878 kHz**

8.3 Bandwidth of the Emission

Rules and specifications:	CFR 47 Part 15, section 15.209	
Guide:	ANSI C63.4	
Description:	<p>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.</p> <p>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.</p> <p>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:</p>	
	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 (6.2)	
Comment:		
Date of test:	2013-02-06	
Test site:	Fully anechoic room, cabin no. 8	



Date: 6.FEB.2013 15:14:25

Bandwidth of the emission: **1.827 kHz**

8.4 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202
Guide:	ANSI C63.4 / TRC-43

Type of modulation:	Amplitude Modulation
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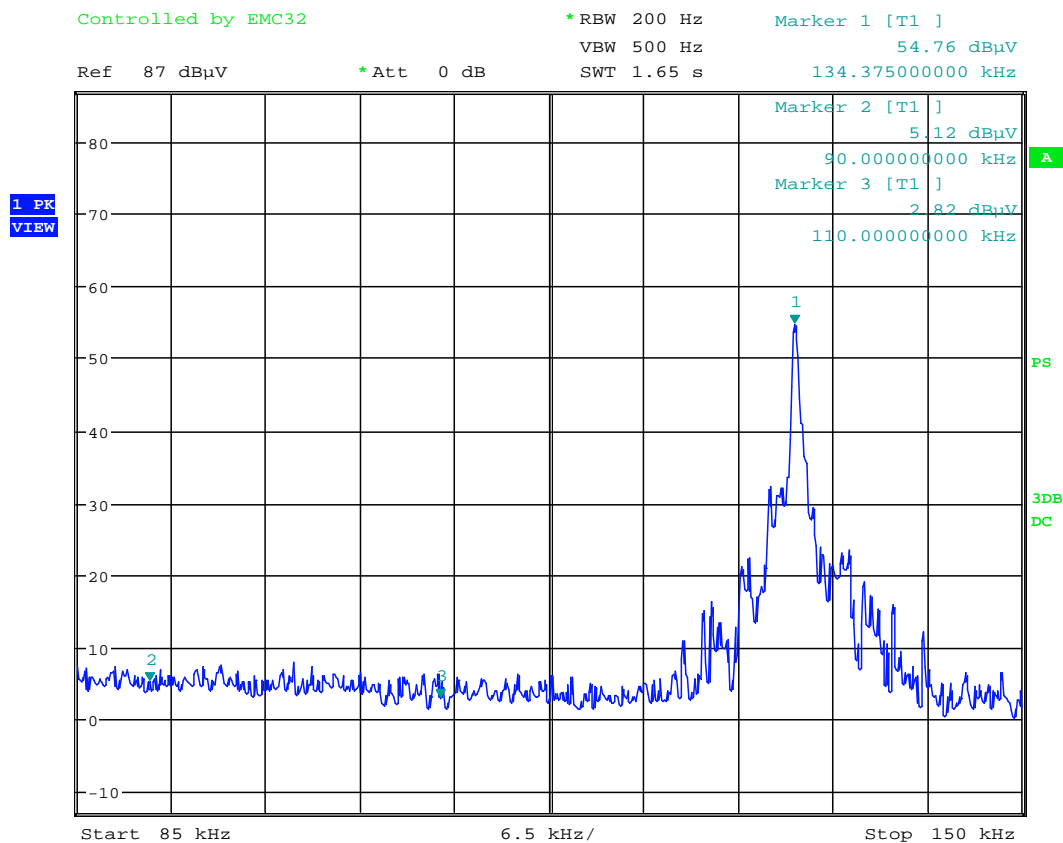
B_n = Necessary Bandwidth	$B_n = 2BK$
B = Modulation rate	$B = 0.9 \text{ kHz}$
K = Overall numerical factor	$K = 1$
Calculation:	$B_n = 2 \cdot (0.9 \text{ kHz}) \cdot 1 = 1.8 \text{ kHz}$

Designation of Emissions:	1K80A1D
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8.5 Restricted Bands of Operation

Rules and specifications:	CFR 47 Part 15, section 15.205(a)
Guide:	ANSI C63.4
Limit:	Only spurious emissions are permitted in any of the frequency bands listed in CFR 47 Part 15, section 15.205(a).
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.4)

Comment:	
Date of test:	2013-02-06
Test site:	Fully anechoic room, cabin no. 8
Test distance:	10 meters



Date: 6.FEB.2013 15:09:02

Test Result:	Test passed
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8.6 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207		
Guide:	ANSI C63.4 / 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 (6.3)		

Comment:	Since the applicant does not provide an appropriate AC/DC adapter the conducted emissions were tested on the DC supply of the EUT.
Date of test:	2013-02-25
Test site:	Shielded room, cabin no. 4

Test Result:	Test passed
--------------	-------------

Tested on:	Plus
------------	------

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
0,285	Quasi-Peak	54,4	0,0	54,4	60,7	6,3
0,285	Average	50,6	0,0	50,6	50,7	0,1
1,140	Average	27,4	0,0	27,4	46,0	18,6
19,439	Average	31,5	0,0	31,5	50,0	18,5
21,725	Average	38,2	0,0	38,2	50,0	11,8
25,899	Quasi-Peak	40,0	0,0	40,0	60,0	20,0
28,877	Average	40,4	0,0	40,4	50,0	9,6

Tested on: Minus

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
0,285	Quasi-Peak	51,7	0,0	51,7	60,7	9,0
22,205	Quasi-Peak	40,7	0,0	40,7	60,0	19,3
24,484	Quasi-Peak	42,4	0,0	42,4	60,0	17,6
0,285	Average	50,6	0,0	50,6	50,7	0,1
0,570	Average	28,8	0,0	28,8	46,0	17,2
1,140	Average	28,4	0,0	28,4	46,0	17,6
1,710	Average	27,1	0,0	27,1	46,0	18,9
3,990	Average	26,0	0,0	26,0	46,0	20,0
19,390	Average	33,9	0,0	33,9	50,0	16,1
21,677	Average	40,1	0,0	40,1	50,0	9,9
24,531	Average	42,4	0,0	42,4	50,0	7,6

Sample calculation of final values:

$$\text{Final Value (dB}\mu\text{V)} = \text{Reading Value (dB}\mu\text{V)} + \text{Correction Factor (dB)}$$

8.7 Radiated Emission Measurement 9 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, sections 15.205 and 15.209			
Guide:	ANSI C63.4			
Limit:	Frequency of Emission (MHz)	Field Strength ($\mu\text{V/m}$)	Field Strength (dB $\mu\text{V/m}$)	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 - 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 (6.4)			

Comment:	
Date of test:	2013-02-06
Test site:	Open field test site

Test Result:	Test passed
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Extrapolation factor: -40 dB/decade										
Frequency (MHz)	Detector	Distance d1 (m)	Distance d (m)	Reading Value (dB μV)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dB $\mu\text{V/m}$)	Limit (dB $\mu\text{V/m}$)	Margin (dB)
0,13435	Peak	10	300	50,7	20,0	-59,1		11,6	25,0	13,4

Sample calculation of final values:

$$\text{Extrapolation Factor (dB)} = (\text{Log}(d) - \text{Log}(d_1)) \cdot \text{Extrapolation Factor (dB/decade)}$$

$$\begin{aligned} \text{Final Value (dB}\mu\text{V/m)} &= \text{Reading Value } d_1 \text{ (dB}\mu\text{V)} + \text{Correction Factor (dB/m)} \\ &\quad + \text{Extrapolation Factor (dB)} + \text{Pulse Train Correction (dB)} \end{aligned}$$

Note: Extrapolation factor (dB) and final value (dB $\mu\text{V/m}$) are relating to distance d.

8.8 Radiated Emission Measurement 30 MHz to 1 GHz

Rules and specifications:	CFR 47 Part 15, section 15.209		
Guide:	ANSI C63.4		
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 (6.5)		

Comment:			
Date of test:	2013-02-07		
Test site:	Frequencies ≤ 1 GHz: Semi-anechoic room, cabin no. 8 Frequencies > 1 GHz: Fully anechoic room, cabin no. 2		
Test distance:	3 meters		

Test Result:	Test passed
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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)
37,700	vertical	Quasi-Peak	18,7	15,0		33,7	40,0	6,3
42,900	vertical	Quasi-Peak	16,9	15,8		32,7	40,0	7,3
43,180	vertical	Quasi-Peak	13,7	15,8		29,5	40,0	10,5
64,920	vertical	Quasi-Peak	19,4	12,2		31,6	40,0	8,4
293,860	horizontal	Quasi-Peak	15,7	14,7		30,4	46,0	15,6
303,010	horizontal	Quasi-Peak	20,8	14,8		35,6	46,0	10,4
316,910	horizontal	Quasi-Peak	20,4	15,2		35,6	46,0	10,4
334,070	horizontal	Quasi-Peak	21,6	15,8		37,4	46,0	8,6
355,620	horizontal	Quasi-Peak	23,3	16,5		39,8	46,0	6,2
380,570	horizontal	Quasi-Peak	25,9	16,6		42,5	46,0	3,5

Sample calculation of final values:

$$\text{Final Value (dBµV/m)} = \text{Reading Value (dBµV)} + \text{Correction Factor (dB/m)} + \text{Pulse Train Correction (dB)}$$

9 Referenced Regulations

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

<input checked="" type="checkbox"/>	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, 2012
<input checked="" type="checkbox"/>	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	October 1, 2012
<input checked="" type="checkbox"/>	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)
<input type="checkbox"/>	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)
<input type="checkbox"/>	RSS-Gen	Radio Standards Specification RSS-Gen Issue 3 containing General Requirements and Information for the Certification of Radiocommunication Equipment, published by Industry Canada	December 2010
<input type="checkbox"/>	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
<input type="checkbox"/>	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
<input checked="" type="checkbox"/>	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
<input type="checkbox"/>	ICES-003	Interference-Causing Equipment Standard ICES-003 Issue 4 for Digital Apparatus, published by Industry Canada	February 7, 2004
<input checked="" type="checkbox"/>	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

<input type="checkbox"/>	CAN/CSA- CEI/IEC CISPR 22	Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment	2002
		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)	
<input type="checkbox"/>	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
<input checked="" type="checkbox"/>	TRC-43	Notes Regarding Designation of Emissions (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service, published by Industry Canada	October, 2008

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	04/2012	10/2013
EMI test receiver	1569	ESMI	839699/006	Rohde & Schwarz	Rohde & Schwarz	11/2012	11/2014
EMI test receiver	1711	ESPI7	836914/0002	Rohde & Schwarz	Rohde & Schwarz	11/2012	05/2014
EMI test receiver	2044	ESU8	100232	Rohde & Schwarz	Rohde & Schwarz	07/2012	01/2014
V-network	1059	ESH3-Z5	894785/005	Rohde & Schwarz	Rohde & Schwarz	08/2011	08/2013
V-network	1218	ESH3-Z5	830952/025	Rohde & Schwarz	Rohde & Schwarz	08/2011	08/2013
Loop antenna	1016	HFH2-Z2	882964/0001	Rohde & Schwarz	Rohde & Schwarz	11/2012	05/2014
TRILOG Broadband Antenna	2058	VULB 9163	9163-408	Schwarzbeck	Rohde & Schwarz	11/2012	05/2014

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.

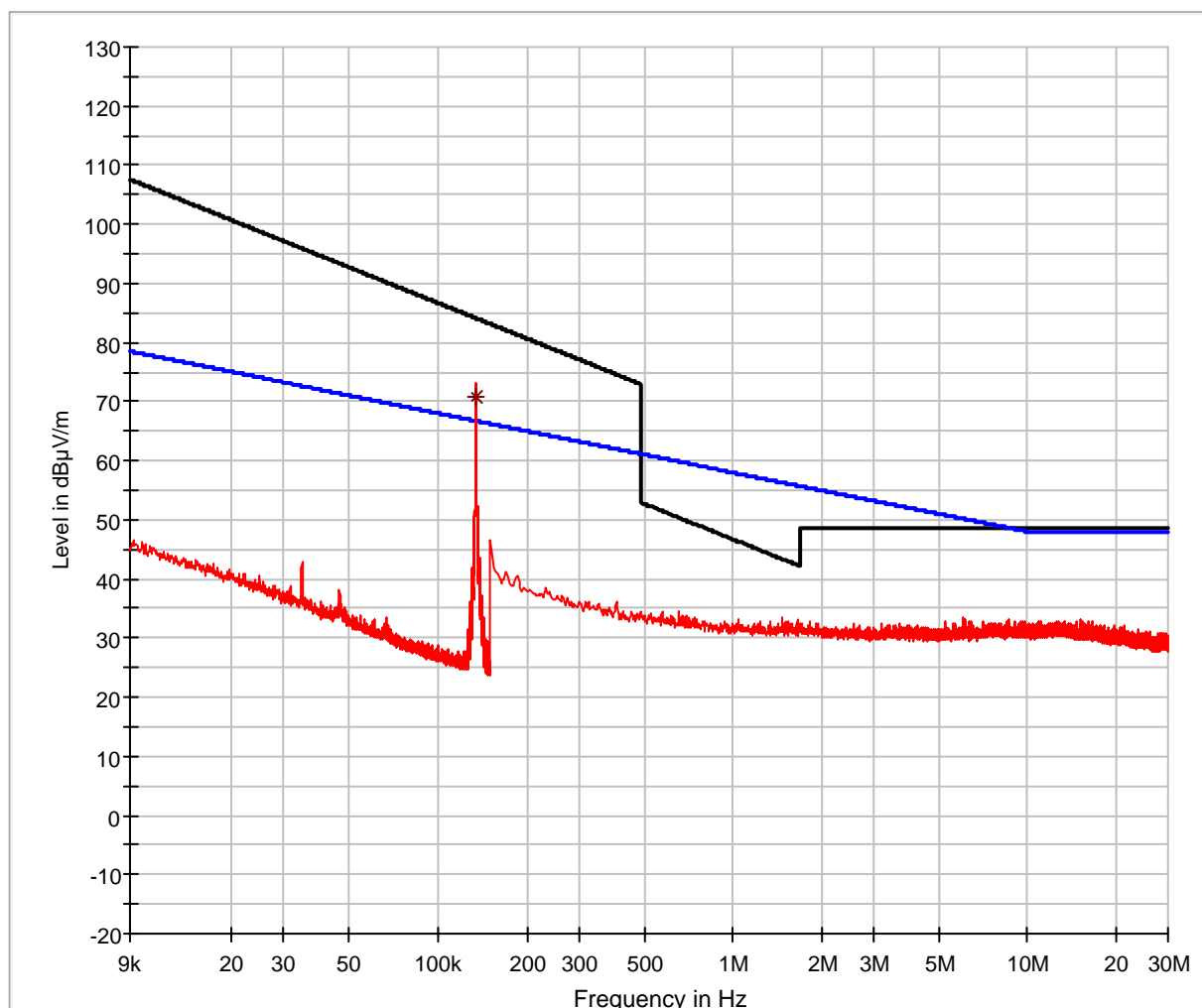
11 Revision History

Revision History			
<i>Edition</i>	<i>Date</i>	<i>Issued by</i>	<i>Modifications</i>
1	2013-02-28	Martin Steindl (gz)	First Edition
2	2013-05-06	J. Roidt (aw)	Page 4; Operating frequency: 134,2 kHz
3	2013-07-08	J. Roidt (aw)	Page 3 and page 8; Antenna ANT-7K15



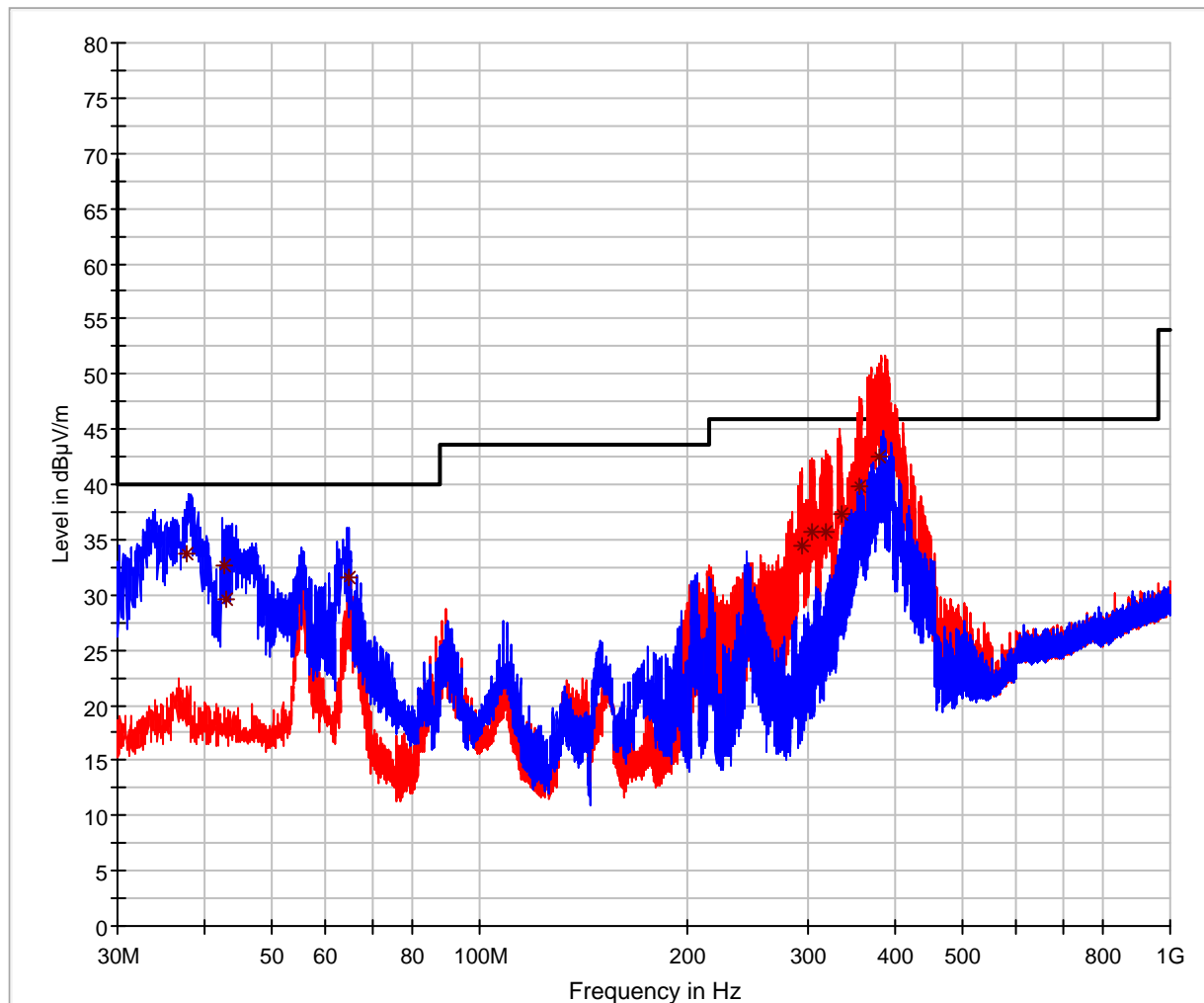
Annex A Charts taken during testing

A.1 Plots taked during testing



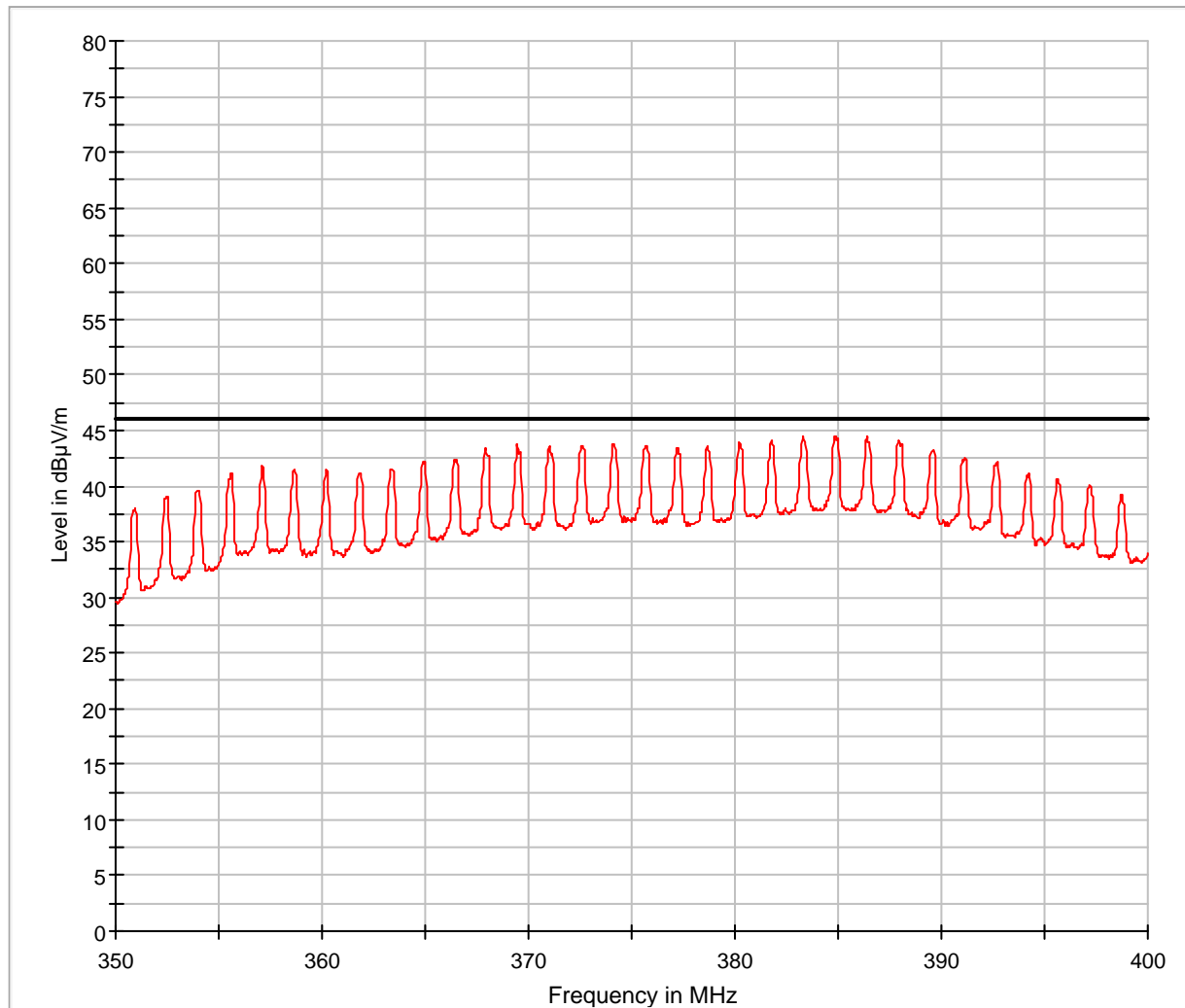
— FCC 15.209 mag (10 m) — EN 300 330 tx mag
 — Preview Result 1-PK+ * Final Result 1-QPK

Radiated emission 9 kHz – 30 MHz



— FCC 15.209
— Preview Result 1V-PK+
— Preview Result 1H-PK+
* Final Result 1-QPK

Radiated emissions 30 MHz – 1 GHz



— QuasiPeak-MaxHold-QPK — Average-MaxHold-AVG — FCC 15.209

Radiated emission 350 MHz – 400 MHz in maximum position, horizontal polarisation with quasi-peak detector