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07 June 2009

Prüfbericht / *Test Report* Nr. / *No.* 50420-080059-4(Edition 1)

Applicant:	Dräger Medical AG
Type of equipment:	RFID Reader Module with Antennas
Type designation:	M21 + Antenna CO2, Antenna WAL, Antenna SET
Order No.:	N/A (Verbal Order)
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 2, Section 7.2.2 and RSS-210 Issue 7, Sections 2.2, 2.6, A2.6 (Category I Equipment)

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1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation[1]:	RFID Reader Module M21
Parts[2]:	RFID Reader Module M21 (Model No. MP02001/MP02101) Antenna CO2 MP02131-01 Antenna WAL (Part No. MP02091) Antenna SET (Part No. 8607311-04)
Serial number(s):	0001
Manufacturer:	Dräger Medical AG & Co. KG
Type of equipment:	RFID Reader Module
Version:	As delivered
FCC ID:	
Additional parts/accessories:	

Technical data of EUT		
Application frequency range:	13.11 - 14.01 MHz	
Frequency range:	13.56 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]:	10K0A1D	
Type of antenna:	Integrated loop on printed boards	
Size/length of antenna:	30 x 16 mm,	
Connection of antenna:	☐ detachable	☒ not detachable
Type of power supply:	AC supply	
Specifications for power supply:	nominal voltage:	110 V
	nominal frequency:	60 Hz

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

2 Administrative Data

Application details	
Applicant (full address):	Dräger Medical AG & Co. KG Moislinger Allee 53-55 D-23558 Lübeck
Contact person:	Mr. Markus Steeger
Contract identification:	
Receipt of EUT:	January 23, 2008
Date(s) of test:	- January 24 to 25, 2008 - October 2008 - May 2009 - June 2009
Note(s):	

Report details	
Report number:	50420-080059-3
Edition:	1
Issue date:	June 7, 2009

3 Identification of the Test Laboratory

Details of the Test Laboratory	
Company name:	Senton GmbH EMI/EMC Test Center
Address:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
Laboratory accreditation:	DAR-Registration No. DAT-P-171/94-02
FCC test site registration number	90926
Industry Canada test site registration:	3050A-1
Contact person:	Mr. Johann Roidt Phone: (+49) (0)9421 5522-0 Fax: (+49) (0)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 2, Section 7.2.2 and** **RSS-210 Issue 7, Sections 2.2, 2.6, A2.6 (Category I Equipment)** of Industry Canada (IC).

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

5 Operation Mode and Configuration of EUT

Operation Mode(s)
Transmitting continuously, reading tags. Conducted AC emissions were performed with antenna and with the antennas replaced by a 50 Ohms terminator..

Configuration(s) of EUT
The EUT was configured as RS232-controlled device of a laptop PC. To allow a realistic examination of the emissions the module, the WAL antenna were mounted in a "WAL Halter EAST IE" on its normal position. The other antennas were tested in a stand alone configuration. The applicant provided different AC/DC-convertors for radiated emission and conducted AC-power-line emissions.

List of ports and cables

Port	*Description*	*Classification*[4]	*Cable type*	*Cable length*
1	AC supply of AC/DC convertor	ac power	Unshielded	1 m
2	DC supply of TTL-Convertor	dc power	Unshielded	1.5 m
3	RS232 control interface to TTL-Convertor	signal/control port	Shielded	1 m
4	Module Control line	signal/control port	Unshielded	50 cm
5	RF supply to antenna	signal/control port	Shielded	

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

List of devices connected to EUT				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	AC/DC adapter [5]	AED26US24	26240-0001348	XP
2	AC/DC adapter [6]	M7.3	5506028	Dräger Medical AG & Co. KG
3	Antenna CO2	MP02131	N/A	Dräger Medical AG & Co. KG
3	Antenna WAL	MP02091	N/A	Dräger Medical AG & Co. KG
4	Antenna SET	N/A	8607311-04	Dräger Medical AG & Co. KG

List of support devices				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	TTL-Convertor	Mod. 232LPTTL33		B&B electronics
2	Laptop PC	Latitude D810		DELL
3	WAL Halter EAST IE			Dräger Medical AG & Co. KG

[5] Used for testings for radiated emissions.
[6] Used for testings for conducted AC emissions.

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 2, sections 4.6.1 and 4.6.2 IC RSS-210 Issue 7, section A1.1.3 ANSI C63.4, annex H.6
Guide:	ANSI C63.4 / IC RSS-Gen Issue 2, sections 4.6.1 and 4.6.2
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).

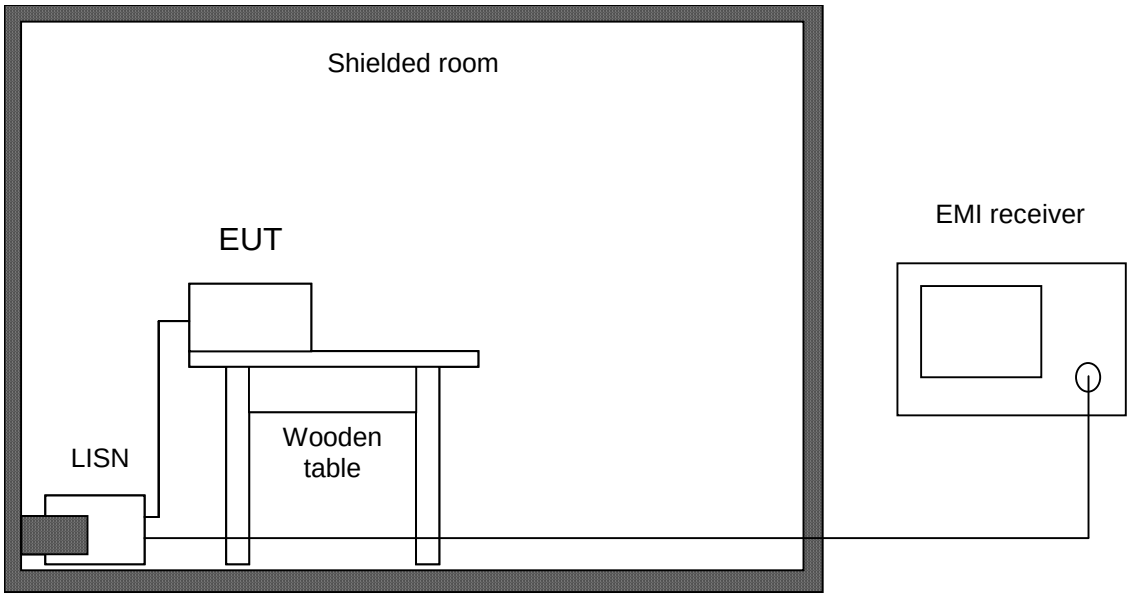
6.2 Conducted AC Powerline Emission

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-Gen Issue 2, section 7.2.2
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:

Used	Type	Model	Serial No. or ID	Manufacturer
☒	EMI receiver	ESHS 10	860043/016	Rohde & Schwarz
☒	LISN	ESH3-Z5	862770/021	Rohde & Schwarz
☐	LISN	ESH3-Z5	830952/025	Rohde & Schwarz
☐	Artificial mains network	ESH 2-Z5	842966/004	Rohde & Schwarz
☐	Shielded room	No. 1	1451	Albatross Projects
☒	Shielded room	No. 4	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-210 Issue 7, sections 2.2, 2.6 and A2.6
Guide:	ANSI C63.4

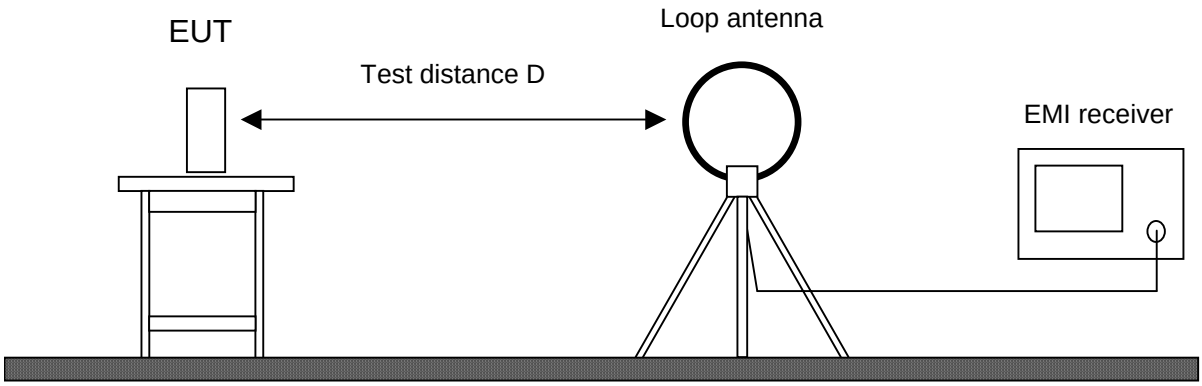
Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak.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

Used	Type	Model	Serial No. or ID	Manufacturer
☒	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
☐	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
☒	Test receiver	ESHS 10	860043/016	Rohde & Schwarz
☒	Preamplifier	CPA9231A	3393	Schaffner
☐	Loop antenna	HFH2-Z2	882964/1	Rohde & Schwarz
☒	Fully anechoic room	No. 2	1452	Albatross Projects
☐	Semi-anechoic room	No. 3	1453	Siemens
☒	Open field test site	EG 1	1450	Senton

6.4 Radiated Emission in Fully or Semi Anechoic Room

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6
Guide:	ANSI C63.4

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

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

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

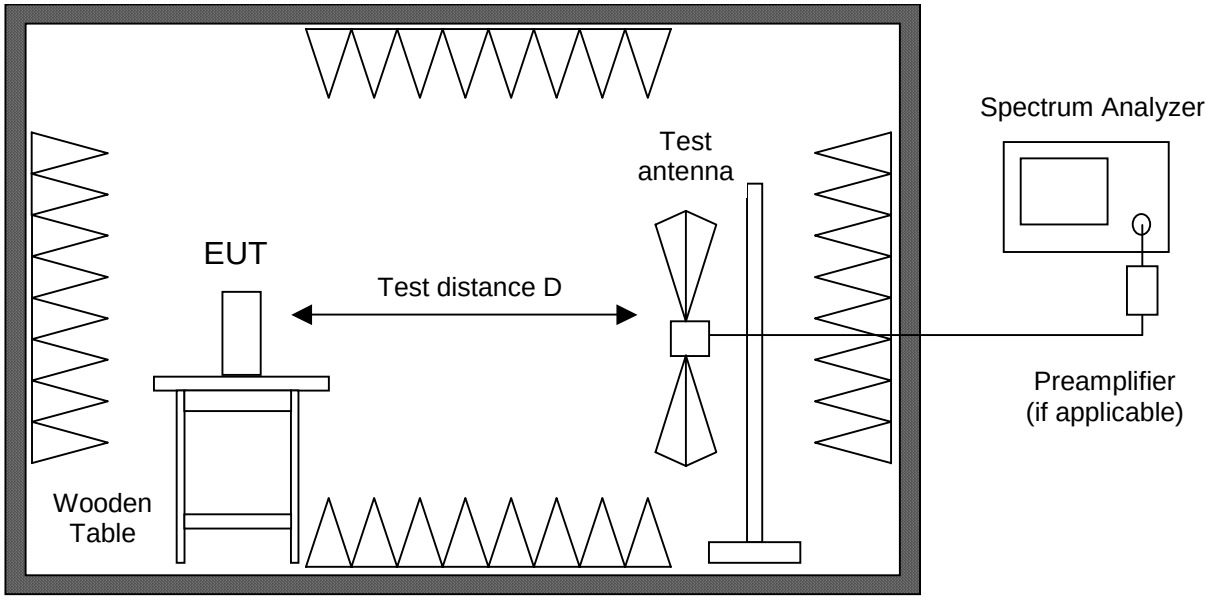
All tests below 18 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance is reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.

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

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

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

For final testing below 1 GHz an open field test-site is used and the plots recorded in the fully or semi anechoic room are indicated as prescans.



Fully or semi anechoic room

Test instruments used:

Used	Type	Model	Serial No. or ID	Manufacturer
☒	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
☐	Spectrum analyzer	R 3271	05050023	Advantest
☐	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
☒	Preamplifier	CPA9231A	3393	Schaffner
☐	Preamplifier	R14601		Advantest
☐	Preamplifier 1-8 GHz	AFS3-00100800-32-LN	847743	Miteq
☐	Preamplifier 0.5-8 GHz	AMF-4D-005080-25-13P	860149	Miteq
☐	Preamplifier 8-18 GHz	ACO/180-3530	32641	CTT
☐	External Mixer	WM782A	845881/005	Tektronix
☐	Harmonic Mixer	FS-Z30	843389/007	Rohde & Schwarz
	Accessories			
☒	Trilog broadband antenna	VULB 9163	9163-188	Schwarzbeck
☐	Horn antenna	3115	9508-4553	EMCO
☐	Horn antenna	3160-03	9112-1003	EMCO
☐	Horn antenna	3160-04	9112-1001	EMCO
☐	Horn antenna	3160-05	9112-1001	EMCO
☐	Horn antenna	3160-06	9112-1001	EMCO
☐	Horn antenna	3160-07	9112-1008	EMCO
☐	Horn antenna	3160-08	9112-1002	EMCO
☐	Horn antenna	3160-09	9403-1025	EMCO
☐	Horn antenna	3160-10	399185	EMCO
☒	Fully anechoic room	No. 2	1452	Albatross Projects
☐	Semi-anechoic room	No. 3	1453	Siemens

6.5 Radiated Emission at Open Field Test Site

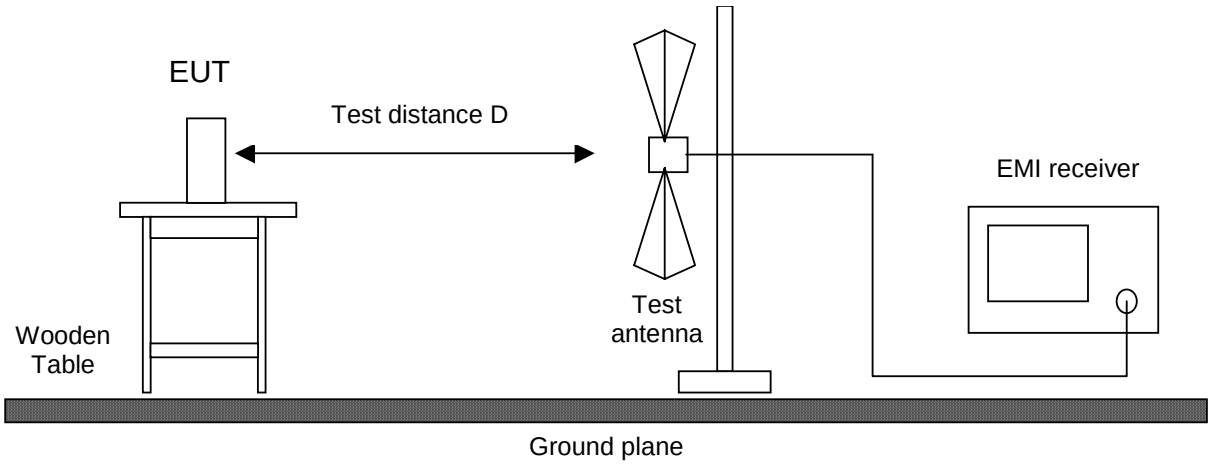
Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6
Guide:	ANSI C63.4

Radiated emission at open field test site is measured in the frequency range 30 MHz to 1 GHz using a biconical antenna up to 300 MHz and a logarithmic periodic antenna above. 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 the fully anechoic room. EUT is rotated all around and receiving antenna is raised and lowered 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:

Used	Type		Model	Serial No. or ID	Manufacturer
☒	EMI receiver		ESVP	881120/024	Rohde & Schwarz
☒	Biconical antenna	EG 1	HK 116	842204/001	Rohde & Schwarz
☒	Log. per. antenna	EG 1	HL 223	841516/023	Rohde & Schwarz
☒	Open field test site		EG 1	1450	Senton

6.6 Carrier Frequency Stability

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-Gen Issue 2, section 4.7 and IC RSS-210 Issue 7, section A2.6
Guide:	ANSI C63.4

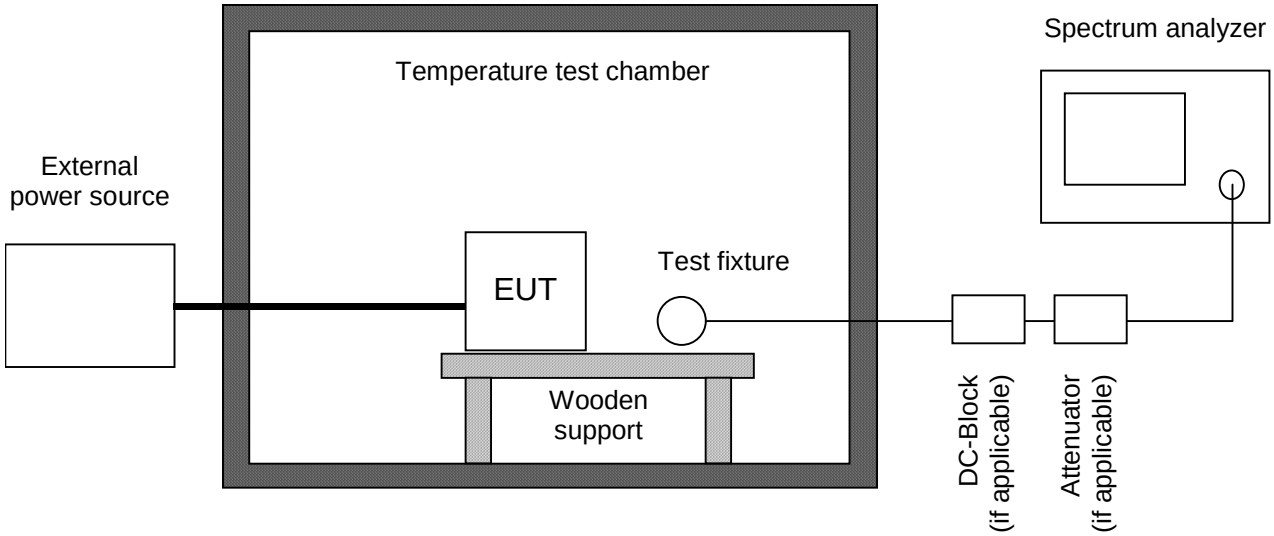
The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 °C.

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:

Used	Type	Model	Serial No. or ID	Manufacturer
☐	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
☐	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz
☒	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
☒	DC-block	7006	A2798	Weinschel
☒	Attenuator	4776-10	9412	Narda
☐	Attenuator	4776-20	9503	Narda
☐	Test probe	TP01	001	Senton
☐	DC power supply	NGSM 32/10	203	Rohde & Schwarz
☐	Isolating transformer	RT 5A	10387	Grundig
☐	Isolating transformer	RT 5A	10416	Grundig
☒	Temperature test chamber	HT4010	07065550	Heraeus

7 Photographs Taken During Testing

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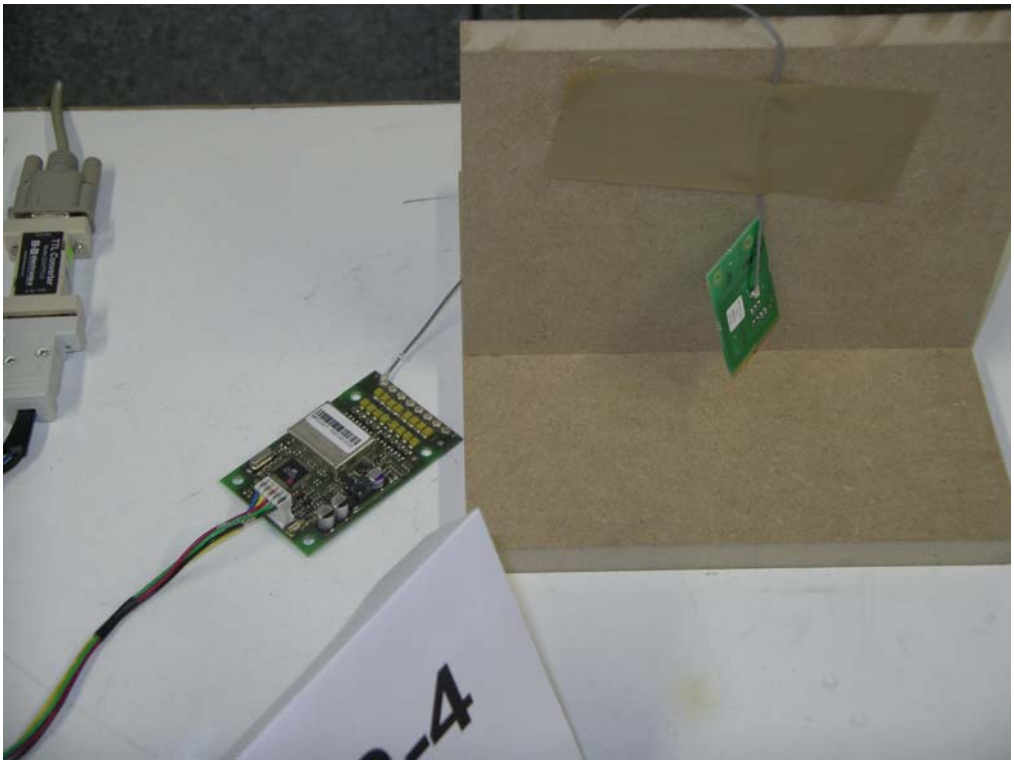
Test setup for conducted AC powerline emission measurement - Antenna CO2 -



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Test setup for radiated emission measurement 9 kHz – 30 MHz - Antenna CO2 -

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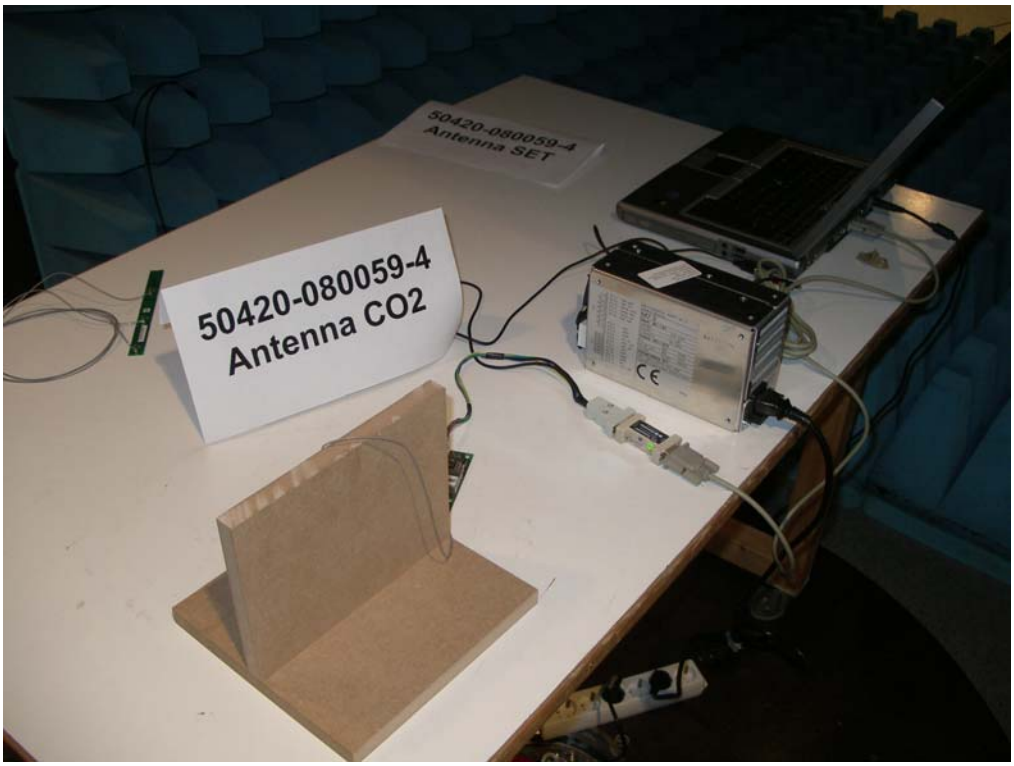
Test setup for radiated emission measurement 30 MHz – 1 GHz
- Antenna CO2 -




50420-080059-4
Antenna CO2

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Test setup for conducted AC powerline emission measurement
- Antenna WAL -

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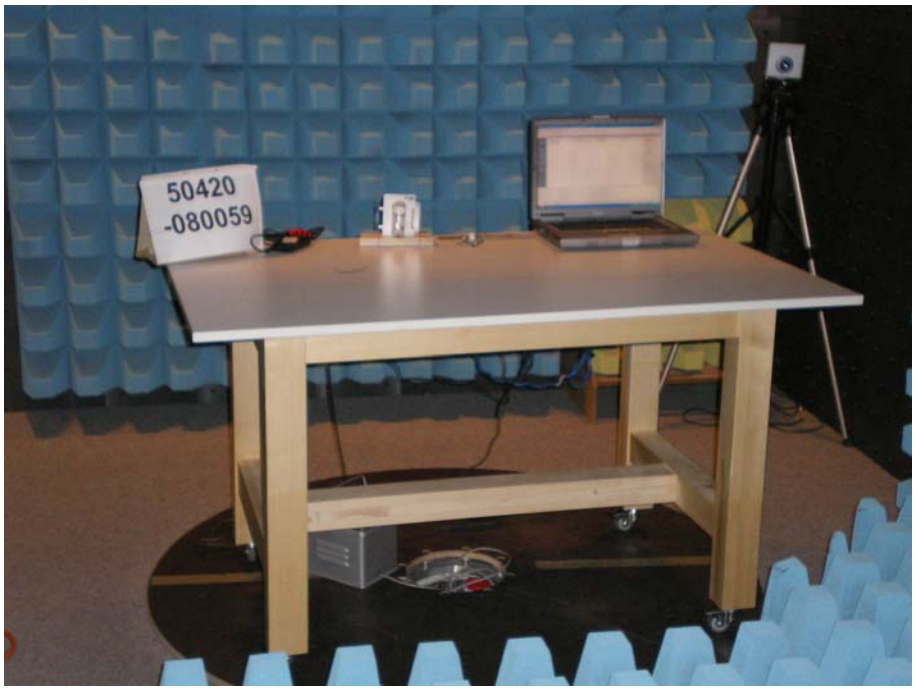
Test setup for radiated emission measurement 9 kHz – 30 MHz
- Antenna WAL -



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Test setup for radiated emission measurement (fully anechoic room) - Antenna WAL -

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Test setup for radiated emission measurement (open field test site) - Antenna WAL -

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Test setup for conducted AC powerline emission measurement 9 kHz – 30 MHz - Antenna SET -

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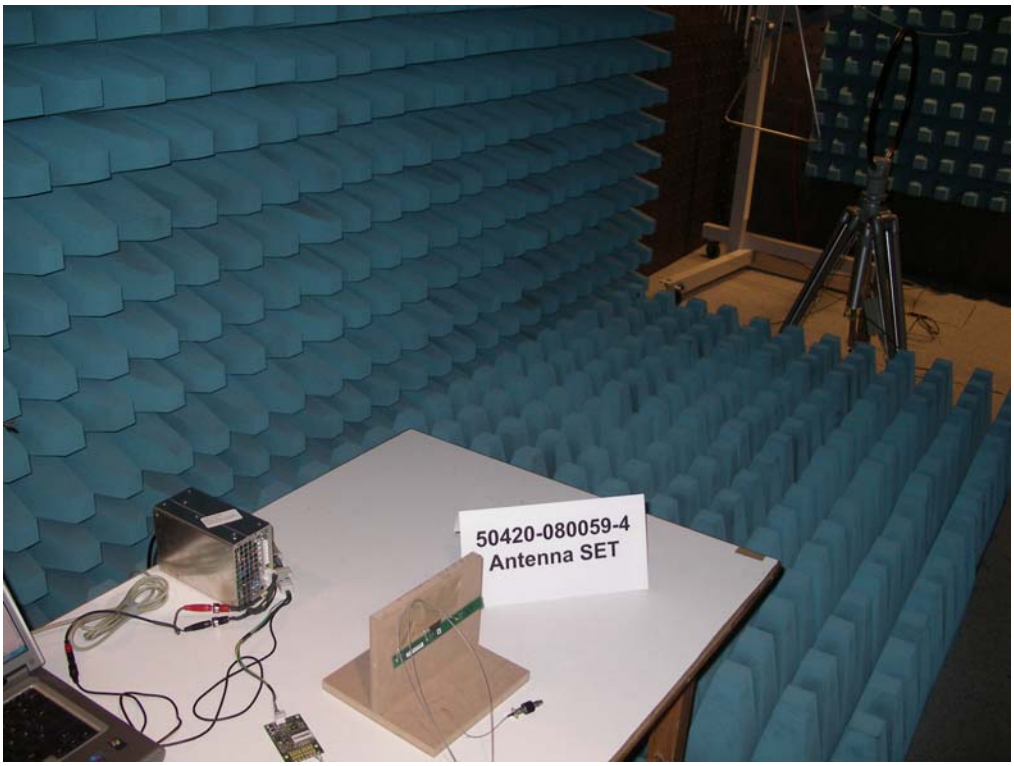
Test setup for radiated emission measurement 9 kHz – 30 MHz
- Antenna SET -



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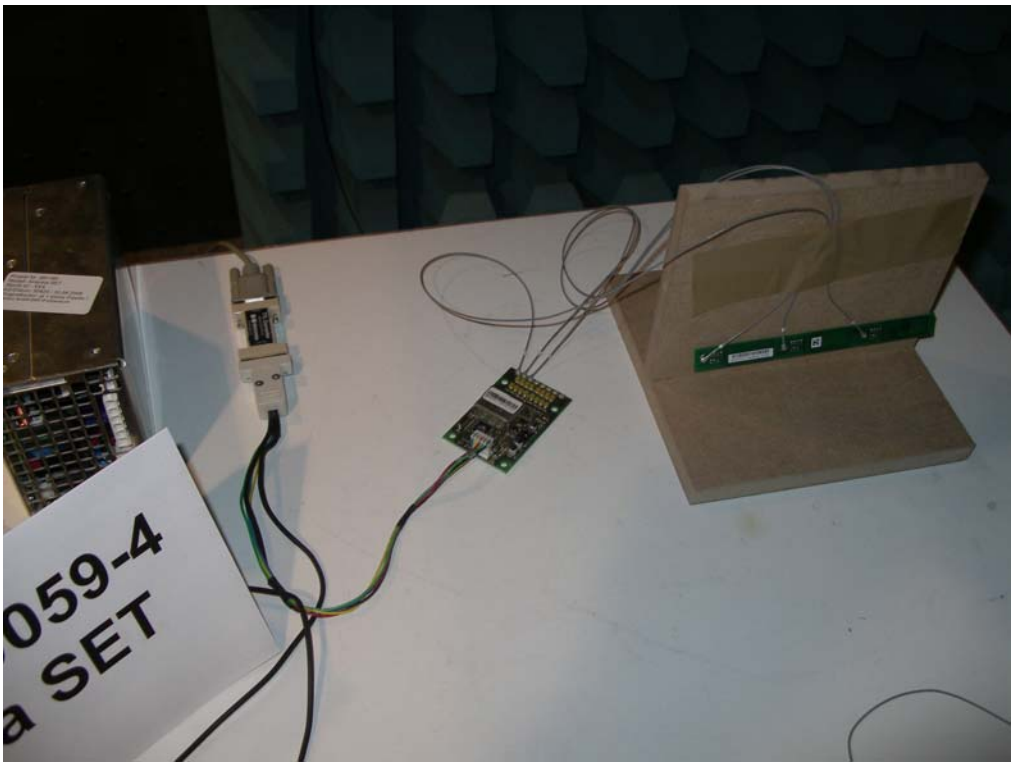
Test setup for radiated emission measurement
- Antenna SET -



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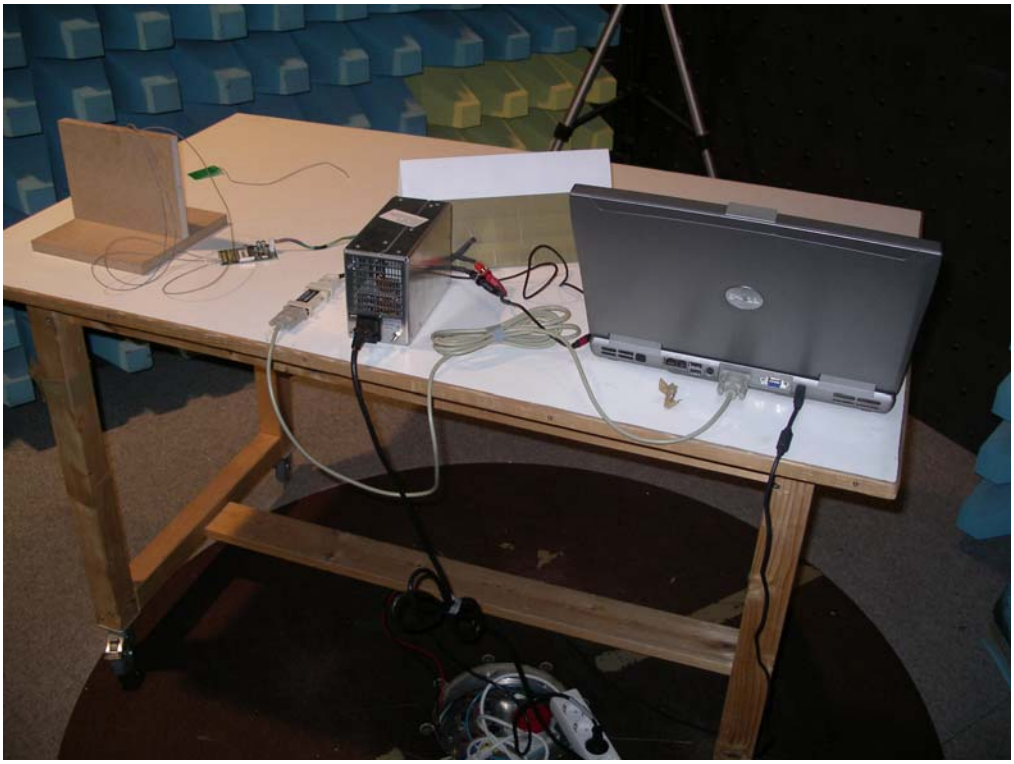

8 Test Results

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

IC RSS-Gen Issue 2		
Section(s)	*Test*	*Result*
4.8	Transmitter output power (conducted)	Not applicable
4.6.1	Occupied Bandwidth	Recorded
3.2(h), 8	Designation of emissions	Calculated
4.5	Pulsed operation	Not applicable
7.2.2	Transmitter AC power lines conducted emissions 150 kHz to 30 MHz	Test passed
5.5	Exposure of Humans to RF Fields	Exempted from SAR and RF evaluation

IC RSS-210 Issue 7		
Section(s)	*Test*	*Result*
2.2(a)	Restricted bands and unwanted emission frequencies	Test passed
A2.6	Spectrum Mask	Test passed
2.2(b)(c), 2.6 A2.6	Unwanted emissions 9 kHz to 30 MHz	Test passed
2.2(b)(c), 2.6 A2.6	Unwanted emissions 30 MHz to 1 GHz	Test passed
A2.6	Carrier frequency stability	Test passed

8.1 Test Results for Antenna CO2

8.1.1 Occupied Bandwidth

Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.4, annex H.6
Guide:	ANSI C63.4
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 C63.4, 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. The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

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

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

Measurement procedure:	Radiated Measurement

Comment:	
Date of test:	June 2, 2009
Test site:	Fully anechoic room, cabin no. 2

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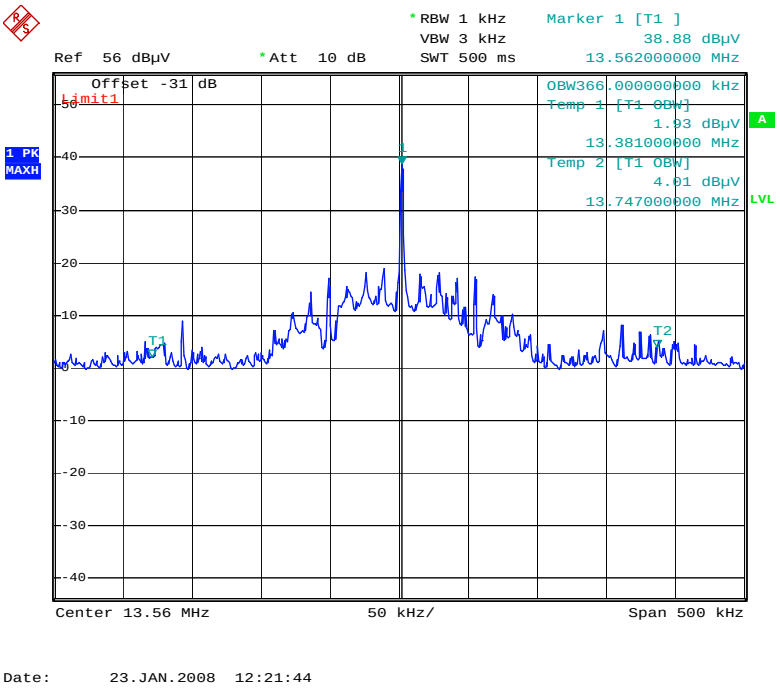
Occupied Bandwidth (99 %):



Occupied Bandwidth (99 %):	**366 kHz**

8.1.2 Bandwidth of the Emission

Rules and specifications:	CFR 47 Part 15, section 15.215(c)
Guide:	ANSI C63.4
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 resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

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

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

Measurement procedure:	Radiated Measurement

Comment:	
Date of test:	January 23, 2008
Test site:	Fully anechoic room, cabin no. 2

Test Result:	Test passed

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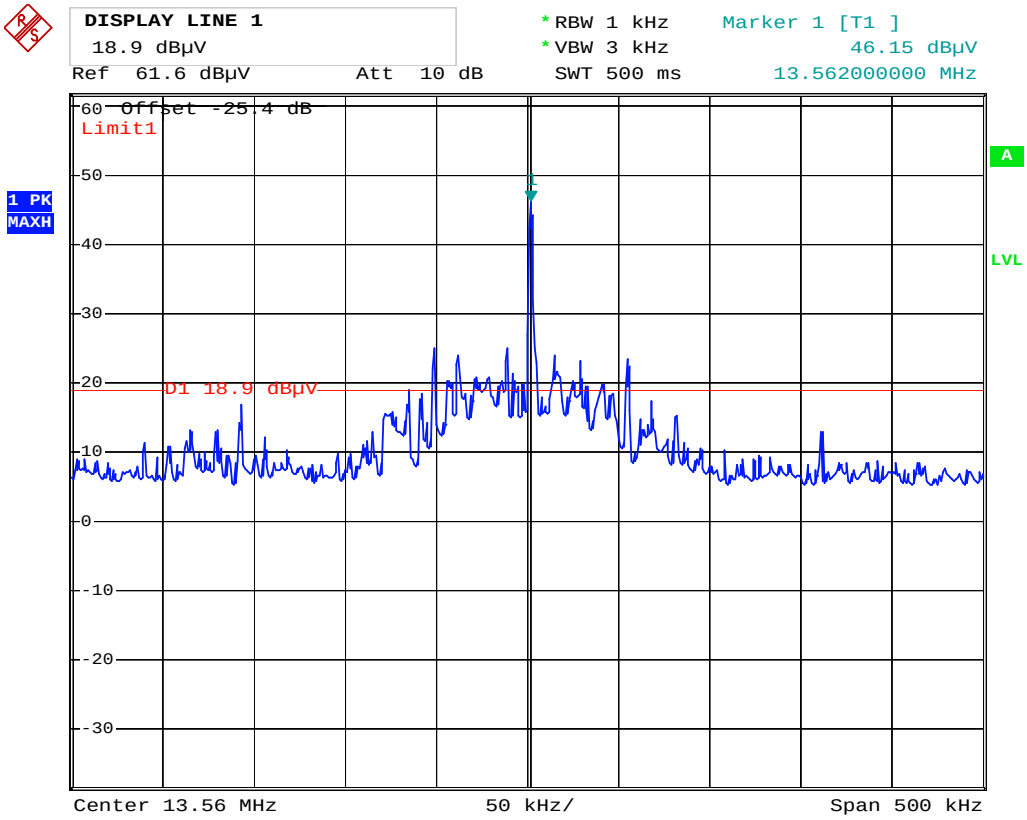

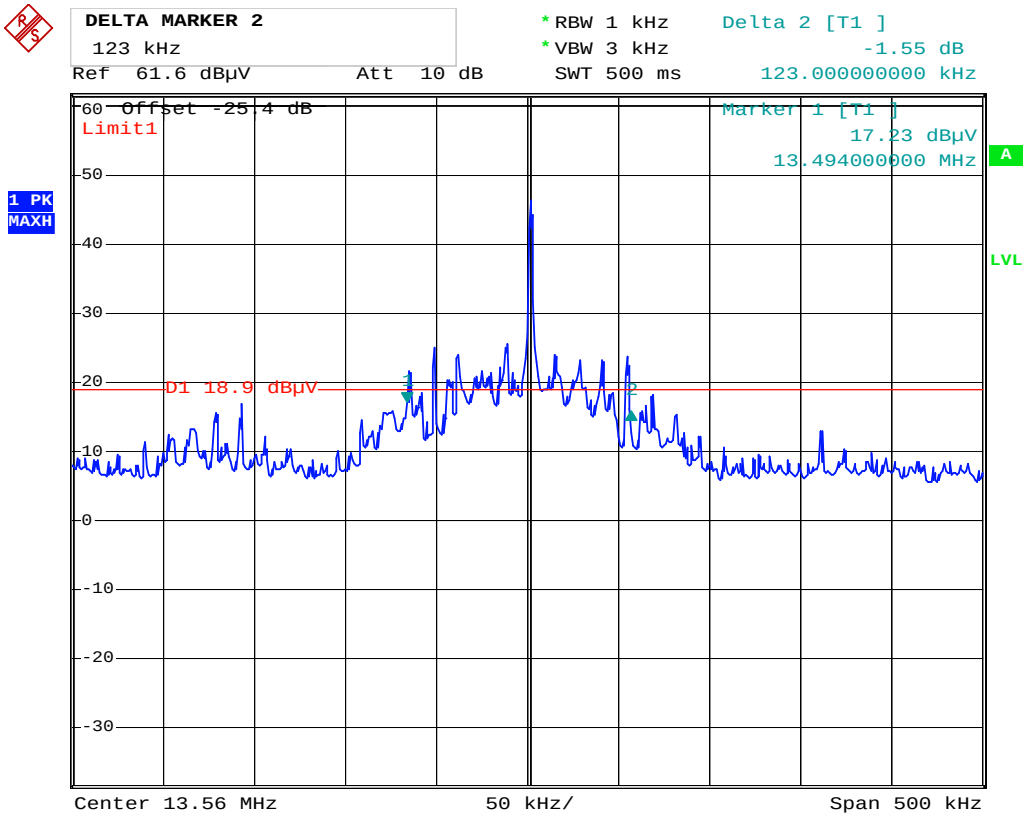

Permitted frequency band:	**13.11 - 14.01 MHz**	
20 dB bandwidth:	**123 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☒ **specified** **+127 Hz** **-76 Hz**	☐ **not specified**
Bandwidth of the emission:	**123 kHz**	**within permitted frequency band[7]:** ☒ **yes** ☐ **no**

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.

8.1.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202 IC RSS-Gen Issue 2, sections 3.2(h) and 8
Guide:	ANSI C63.4 / TRC-43

Type of modulation:	Amplitude Modulation

B_n = Necessary Bandwidth	B_n = 2BK
B = Modulation rate	B = 5.0 kHz
K = Overall numerical factor	K = 1
Calculation:	$B_n = 2 \cdot (5.0\ kHz) \cdot 1 = 10.0\ kHz$

Designation of Emissions:	**10K0A1D**

8.1.4 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-Gen Issue 2, section 7.2.2		
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 (6.2)		

Test Result:	Test passed

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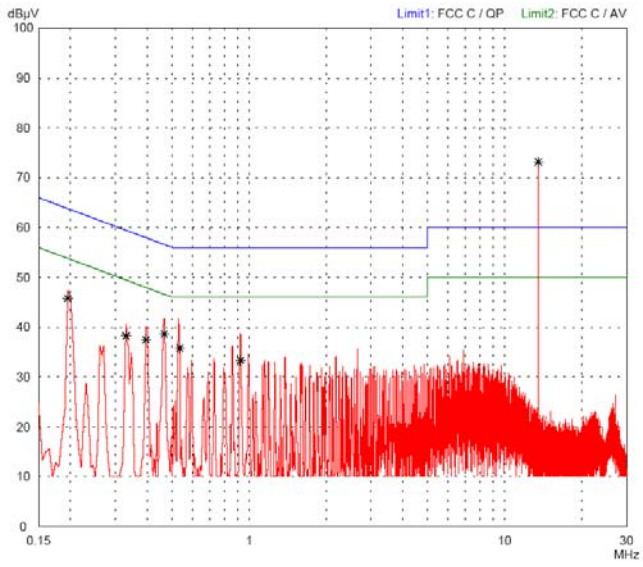
Comment:	Unit retested with antenna connector terminated with 50 Ohms resistive load, see test results for antenna SET for reference
Date of test:	June 02, 2009
Test site:	Shielded room, cabin no. 4

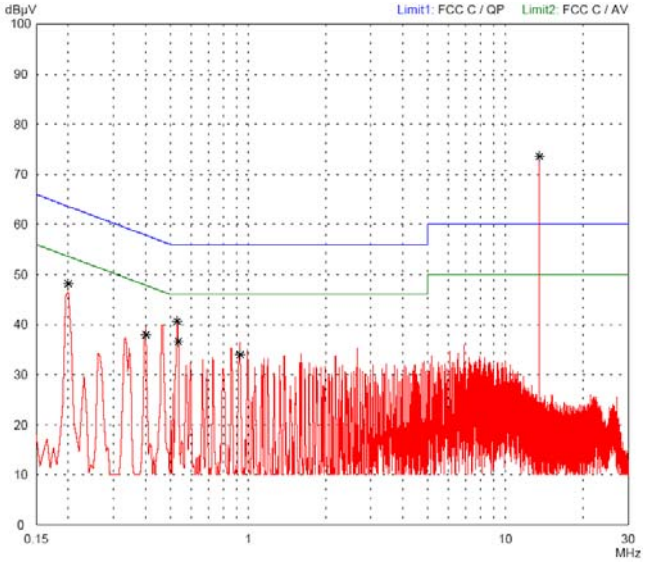
Test Result:	Test passed - with antenna terminated

Live Wire, Qasi-Peak Detector



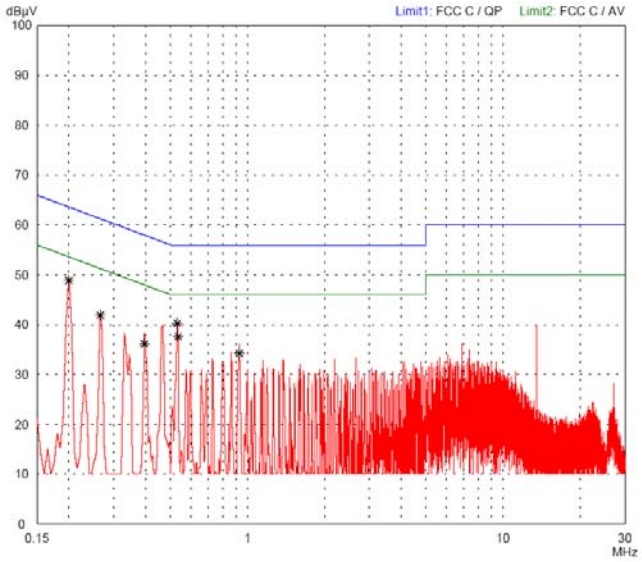
Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.195	45.8		45.8	63.8	18.0
0.330	38.2		38.2	59.5	21.3
0.395	37.5		37.5	58.0	20.5
0.465	38.5		38.5	56.6	18.1
0.535	35.8		35.8	56.0	20.2
0.925	33.4		33.4	56.0	22.6
13.560	73.1		73.1	60.0	-13.1

Neutral Wire, Quasi-Peak Detector

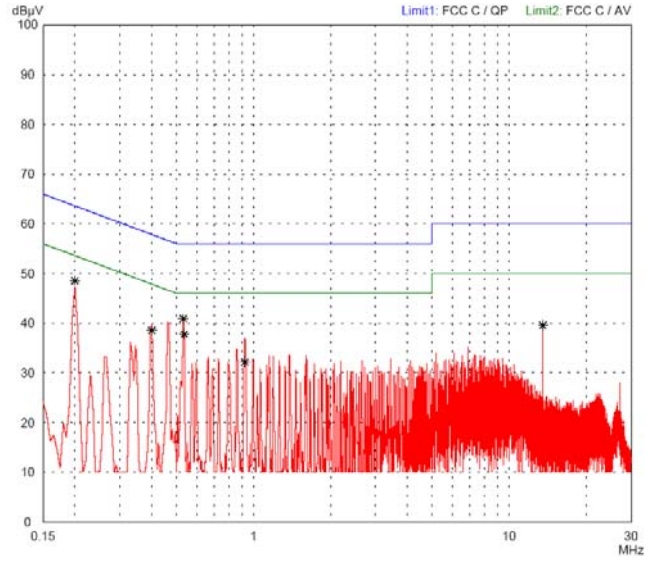


Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.200	48.2		48.2	63.6	15.4
0.400	38.0		38.0	57.9	19.9
0.530	40.6		40.6	56.0	15.4
0.535	36.6		36.6	56.0	19.4
0.930	34.0		34.0	56.0	22.0
13.560	73.6		73.6	60.0	-13.6

Live Wire, Qasi-Peak Detector Antenna terminated	Neutral Wire, Quasi-Peak Detector Antenna terminated



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.200	48.9		48.9	63.6	14.7
0.265	41.9		41.9	61.3	19.4
0.395	36.2		36.2	58.0	21.8
0.530	40.3		40.3	56.0	15.7
0.535	37.7		37.7	56.0	18.3
0.930	34.3		34.3	56.0	21.7



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.200	48.6		48.6	63.6	15.0
0.400	38.5		38.5	57.9	19.4
0.530	40.9		40.9	56.0	15.1
0.535	37.9		37.9	56.0	18.1
0.925	32.2		32.2	56.0	23.8
13.560	39.6		39.6	60.0	20.4

Sample calculation of final values:

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

8.1.5 Spectrum Mask

Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d) IC RSS-210 Issue 7, section A2.6
Guide:	ANSI C63.4
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.

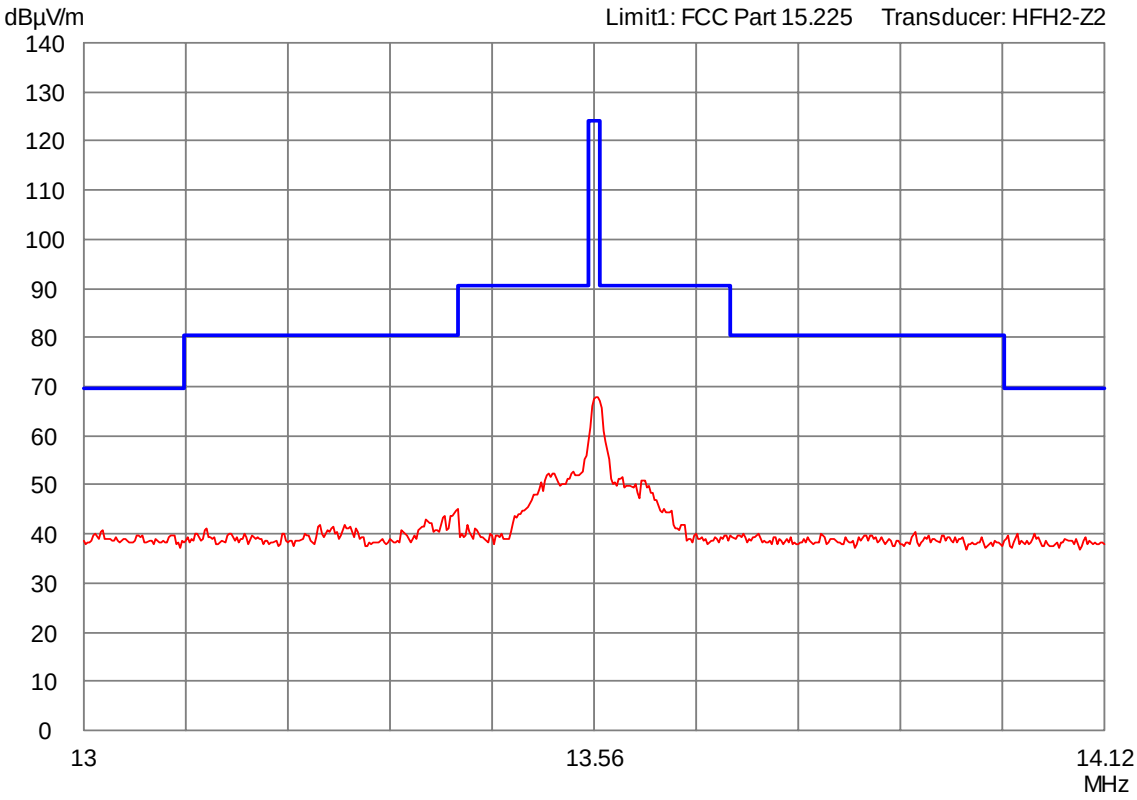
Limit:

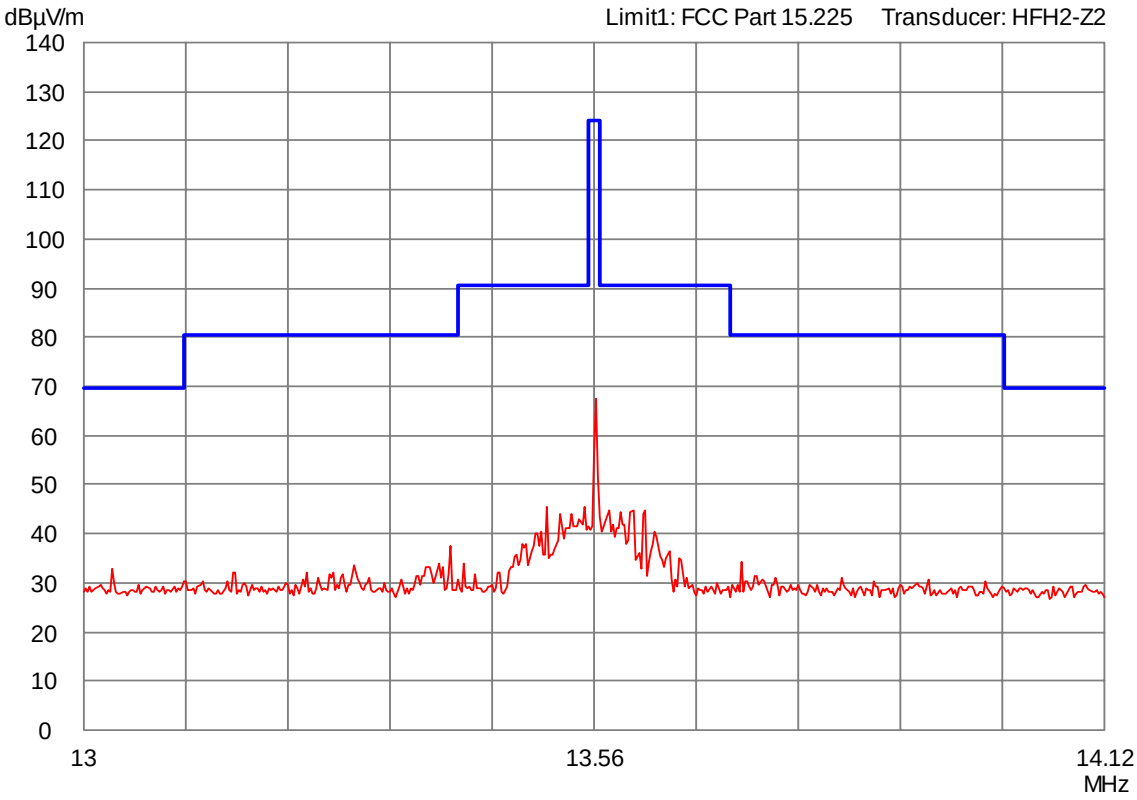
Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
1.705 - 13.110	30	29.5	30
13.110 - 13.410	106	40.5	30
13.410 - 13.553	334	50.5	30
13.553 - 13.567	15848	84.0	30
13.567 - 13.710	334	50.5	30
13.710 - 14.010	106	40.5	30
14.010 - 30.000	30	29.5	30

Measurement procedure:	Radiate Emission Measurement

Comment:	Tested with antenna in standalone configuration
Date of test:	June 02, 2009
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters
Extrapolation Factor:	40 dB/decade

Test Result:	Test passed


dBµV/m
Limit1: FCC Part 15.225
Transducer: HFH2-Z2
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
13
13.56
14.12
MHz


dBµV/m
Limit1: FCC Part 15.225
Transducer: HFH2-Z2
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
13
13.56
14.12
MHz

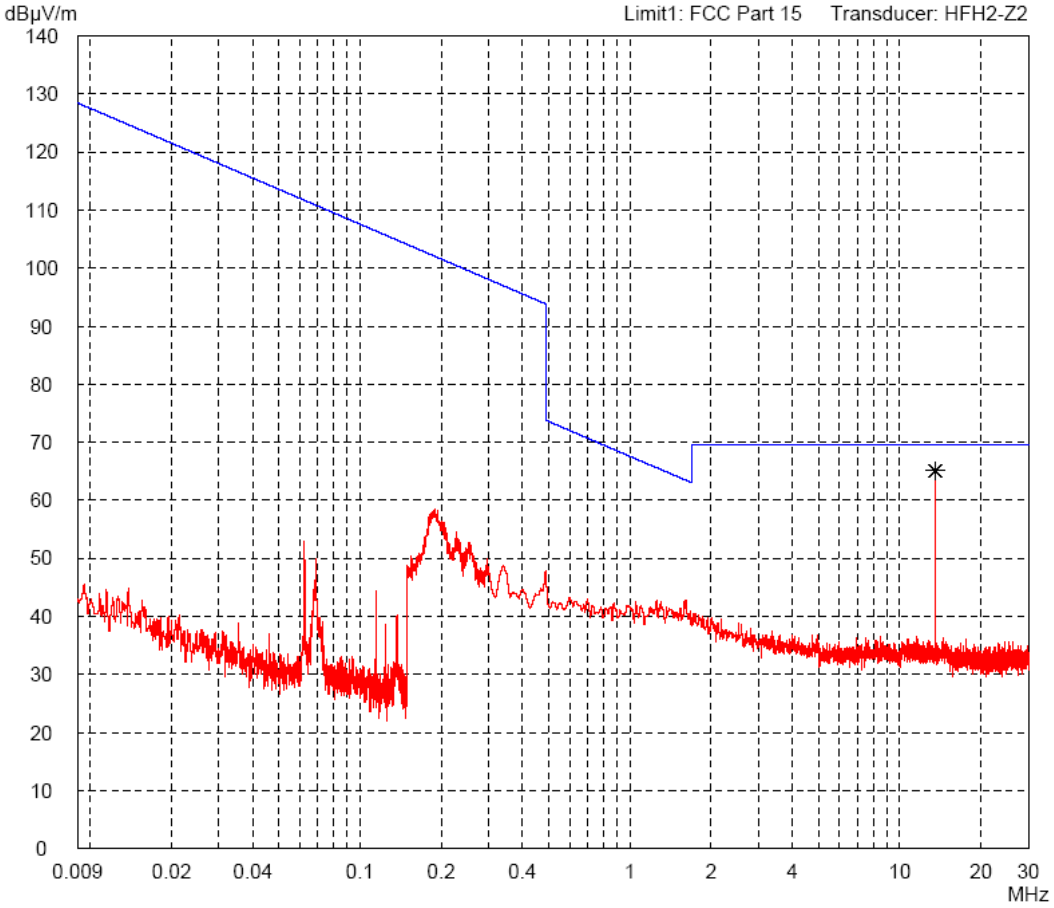
8.1.6 Radiated Emission Measurement 9 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, sections 15.205 and 15.225(a)-(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6			
Guide:	ANSI C63.4			
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 Test			

Comment:	
Date of test:	January 24, 2008
Test site:	Open field test site

Test Result:	Test passed

Prescan at 3 distance in a shielded enclosure (FAR)



Final Test results (Open area test Site without ground plane

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	3	30	49	20,0	-40	N/A	29.0	84,0	**55.0**

Sample calculation of final values:

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

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

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

8.1.7 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-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6		
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:	Frequencies < 1 GHz: Open field test site Frequencies > 1 GHz: Fully anechoic room, cabin no. 2		

Comment:	
Date of test:	June 02, 2009
Test site:	Frequencies ≤ 1 GHz: Open field test site Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

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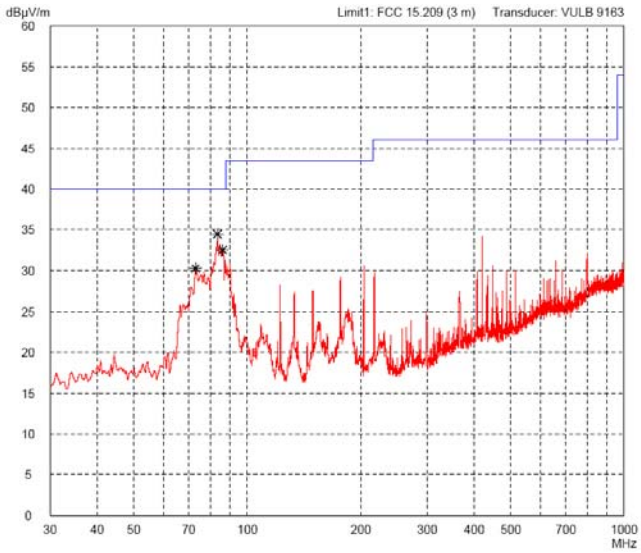
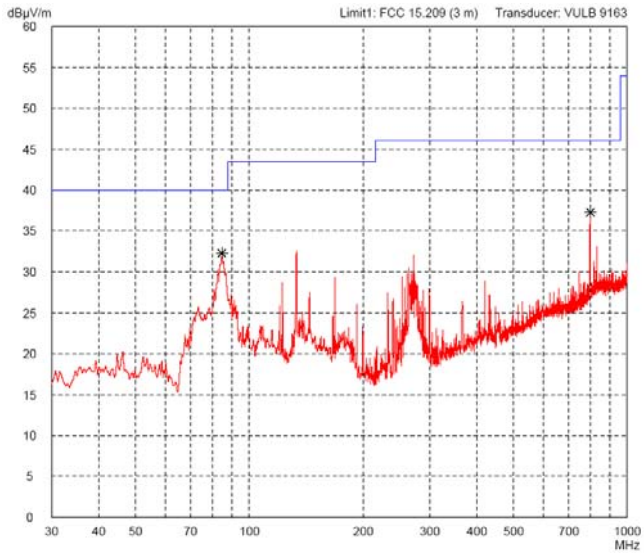
Prescan in fully-anechoic room

Horizontal Polarisation	Vertical Polarisation
	

Final results (Open Area Test Site)

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
74.00	Horizontal	Quasi-Peak	22.0	9.6	31.6	40	8.4
84.00	Horizontal	Quasi-Peak	24.0	11.5	35.5	40	4.5
86.00	Horizontal	Quasi-Peak	22.0	12.5	34.5	40	5.5
800.0	Vertical	Quasi-Peak	15.0	23.0	38.0	46	8.0

Sample calculation of final values:

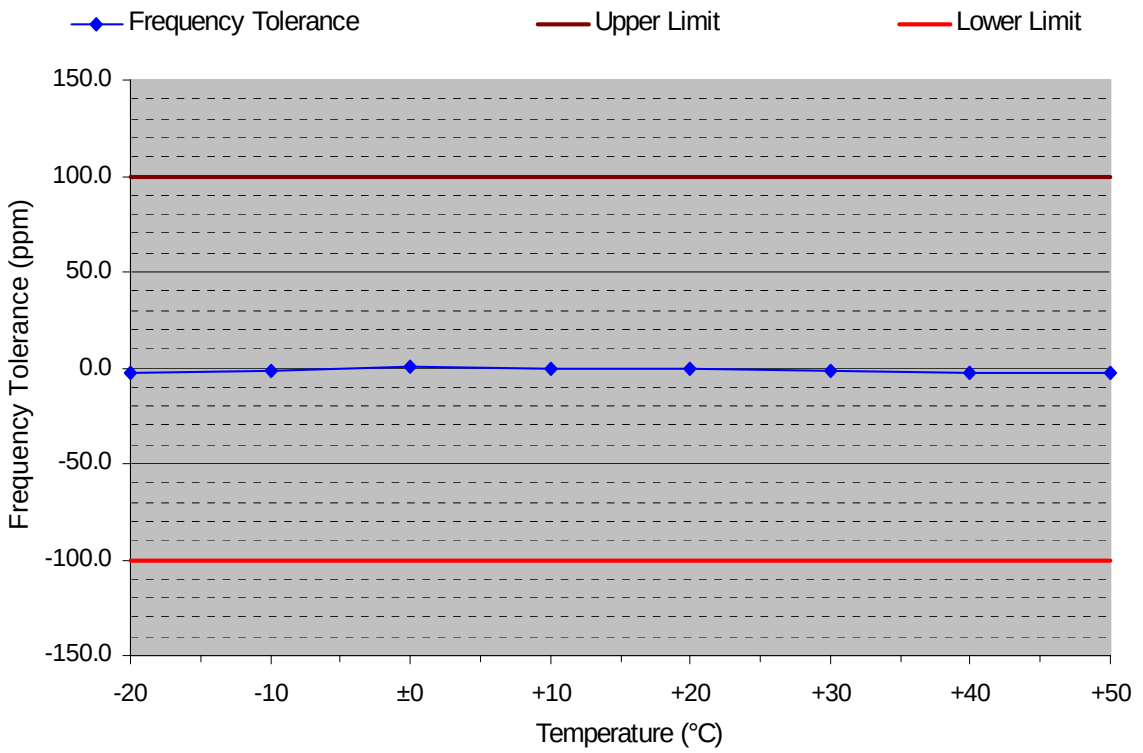
Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

8.1.8 Carrier Frequency Stability

Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-Gen Issue 2, section 4.7 and IC RSS-210 Issue 7, section A2.6
Guide:	ANSI C63.4
Limit:	The frequency tolerance of the carrier signal shall be maintained within ±0.01 % (±100 ppm) of the carrier frequency under nominal conditions.
Temperature range: Voltage range:	-20°C to +50°C (at normal supply voltage) 85% to 115% of the rated supply voltage (at a temperature of +20°C)
Measurement procedure:	Carrier Frequency Stability (6.6)

Comment:	Test performed at first testings of module
Date of test:	July 28, 2006

8.1.8.1 Carrier Frequency Stability vs. Temperature

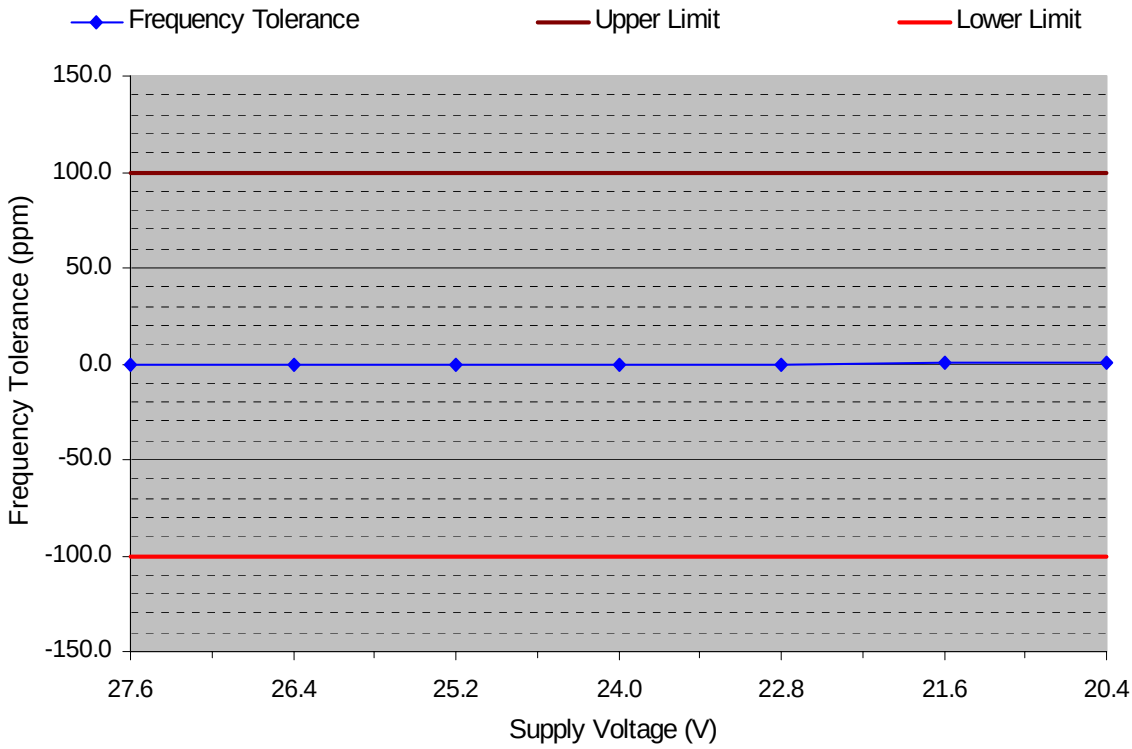


Supply voltage: V Nominal frequency: 13.561998 MHz

Temperature (°C)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
-20	13.561968	-30	-2.2	+100.0	-100.0	97.8
-10	13.561980	-18	-1.3	+100.0	-100.0	98.7
±0	13.562002	4	0.3	+100.0	-100.0	99.7
+10	13.561998	0	0.0	+100.0	-100.0	100.0
+20	13.561998	0	0.0	+100.0	-100.0	100.0
+30	13.561982	-16	-1.2	+100.0	-100.0	98.8
+40	13.561966	-32	-2.4	+100.0	-100.0	97.6
+50	13.561956	-42	-3.1	+100.0	-100.0	**96.9**

Test Result:	Test passed

8.1.8.2 Carrier Frequency Stability vs. Supply Voltage



Temperature: +20 °C
Nominal frequency: 13.561988 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	13.561988	0	0.0	+100.0	-100.0	100.0
26.4	13.561988	0	0.0	+100.0	-100.0	100.0
25.2	13.561988	0	0.0	+100.0	-100.0	100.0
24.0	13.561988	0	0.0	+100.0	-100.0	100.0
22.8	13.561988	0	0.0	+100.0	-100.0	100.0
21.6	13.561990	2	0.1	+100.0	-100.0	**99.9**
20.4	13.561990	2	0.1	+100.0	-100.0	**99.9**

Test Result:	Test passed

8.1.9 Exposure of Humans to RF Fields

Rules and specifications:	IC RSS-Gen Issue 2, section 5.5
Guide:	IC RSS-102 Issue 2, 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**Fehler! Textmarke nicht definiert.**: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **439.5 · 10^{-9} W** with: Field strength in V/m: FS = **363.1 · 10^{-6} V/m** Distance between the two antennas in m: D = **10 m**			☒ ☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.):				

[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.

TP = **439.5 · 10^{-9} W**				

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 the device is less than or equal to 20 cm.				
☐ The device operates from 3 kHz up to 1 GHz inclusively and its source-based time-averaged output power is less than, or equal to 200 mW for General Public Use and 1000 mW for Controlled Use.				☐
☐ The device operates above 1 GHz up to 2.2 GHz inclusively and its source-based time-averaged output power is less than, or equal to 100 mW for General Public Use and 500 mW for Controlled Use.				☐
☐ The device operates above 2.2 GHz up to 3 GHz inclusively and its source-based time-averaged output power is less than, or equal to 20 mW for General Public Use and 100 mW for Controlled Use.				☐
☐ The device operates above 3 GHz up to 6 GHz inclusively and its source-based time-averaged output power) is less than, or equal to 10 mW for General Public Use and 50 mW for Controlled Use.				☐
☐ SAR evaluation is documented in test report no.				
RF exposure evaluation				
RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm.				
☒ The device operates below 1.5 GHz and its e.i.r.p. is equal to or less than 2.5 W.				☒
☐ The device operates at or above 1.5 GHz and the e.i.r.p. of the device is equal to or less than 5 W.				☐
☐ RF exposure evaluation is documented in test report no.				

8.2 Test Results for Antenna WAL

8.2.1 Occupied Bandwidth – Antenna WAL

Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.4, annex H.6
Guide:	ANSI C63.4
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 C63.4, 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. The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

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

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

Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	January 24, 2008
Test site:	Fully anechoic room, cabin no. 2

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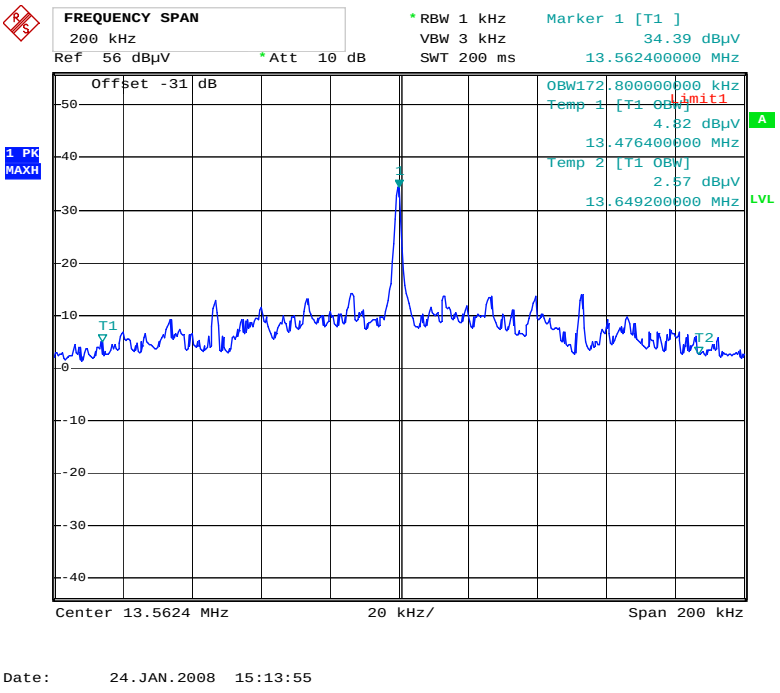
Occupied Bandwidth (99 %):



Occupied Bandwidth (99 %):	**172.8 kHz**

8.2.2 Bandwidth of the Emission – Antenna WAL

Rules and specifications:	CFR 47 Part 15, section 15.215(c)
Guide:	ANSI C63.4
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 resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

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

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

Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	January 24, 2008
Test site:	Fully anechoic room, cabin no. 2

Test Result:	Test passed

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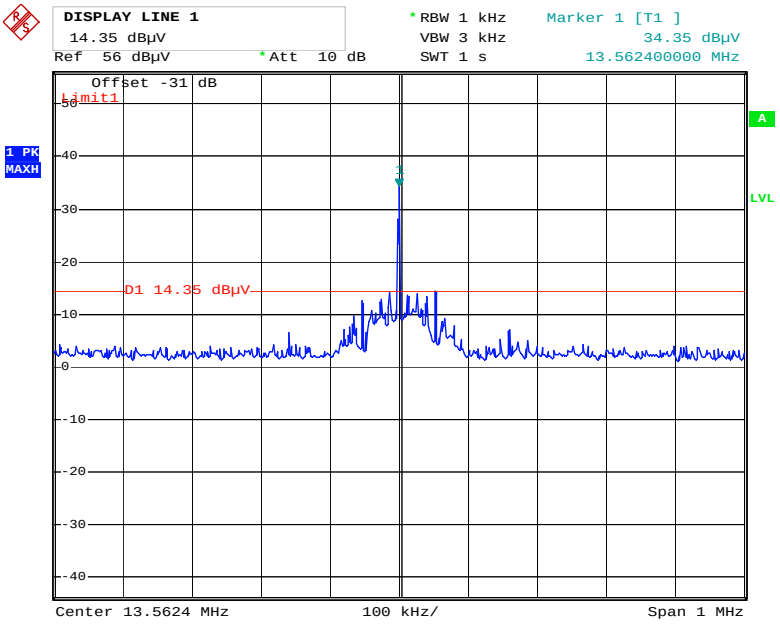
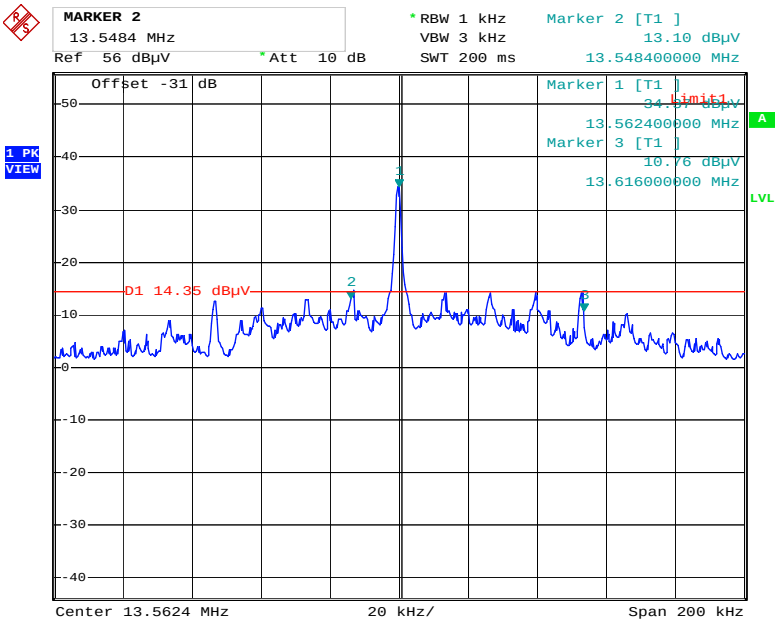


Date: 24.JAN.2008 15:20:40



Date: 24.JAN.2008 15:25:04

Permitted frequency band:	**13.11 - 14.01 MHz**	
20 dB bandwidth:	**32.0 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☒ **specified** **+127 Hz** **-76 Hz**	☐ **not specified**
Bandwidth of the emission:	**32.2 kHz**	**within permitted frequency band[9]:** ☒ **yes** ☐ **no**

Test Result:	Test passed

[9] 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.

8.2.3 Designation of Emissions – Antenna WAL

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202 IC RSS-Gen Issue 2, sections 3.2(h) and 8
Guide:	ANSI C63.4 / TRC-43

Type of modulation:	Amplitude Modulation

B_n = Necessary Bandwidth	B_n = 2BK
B = Modulation rate	B = 5.0 kHz
K = Overall numerical factor	K = 1
Calculation:	$B_n = 2 \cdot (5.0\ kHz) \cdot 1 = 10.0\ kHz$

Designation of Emissions:	**10K0A1D**

8.2.4 Conducted Powerline Emission Measurement 150 kHz to 30 MHz – Antenna WAL

Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-Gen Issue 2, section 7.2.2		
Guide:	ANSI C63.4 / 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)		

Test Result:	Test passed

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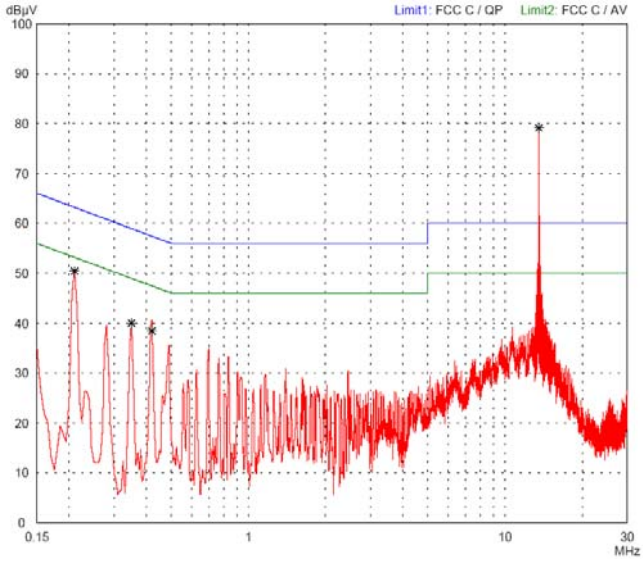
Comment:	Unit retested with antenna connector terminated with 50 Ohms resistive load, see test results for antenna SET for reference
Date of test:	January 25, 2008
Test site:	Shielded room, cabin no. 4

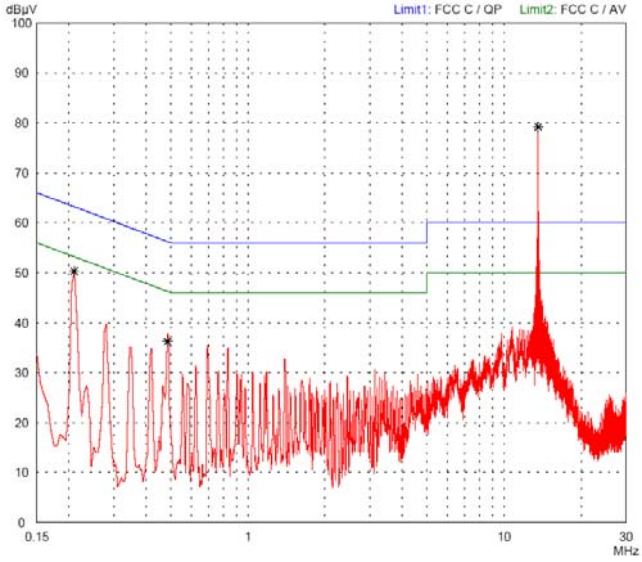
Test Result:	Test passed - with antenna terminated

Live Wire, Qasi-Peak Detector



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.21	50.4		50.4	63.2	12.8
0.35	39.9		39.9	59.0	19.1
0.42	38.4		38.4	57.4	19.0
13.56	79.2		79.2	60.0	-19.2

Neutral Wire, Quasi-Peak Detector



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.210	50.3		50.3	63.2	12.9
0.485	36.2		36.2	56.3	20.1
13.565	79.2		79.2	60.0	-19.2

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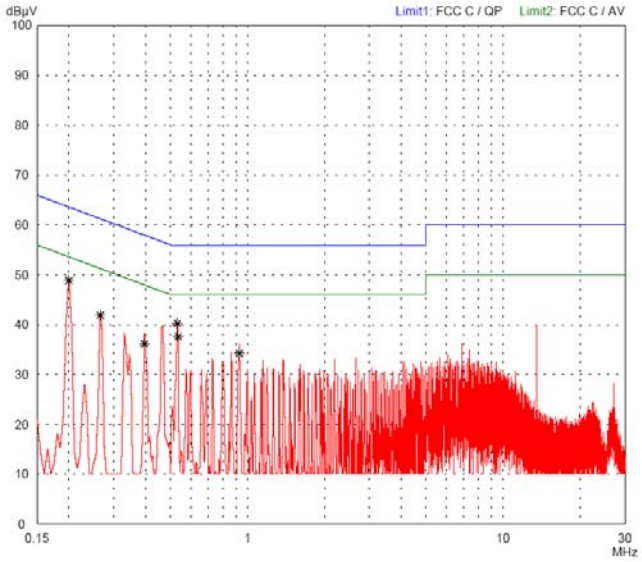
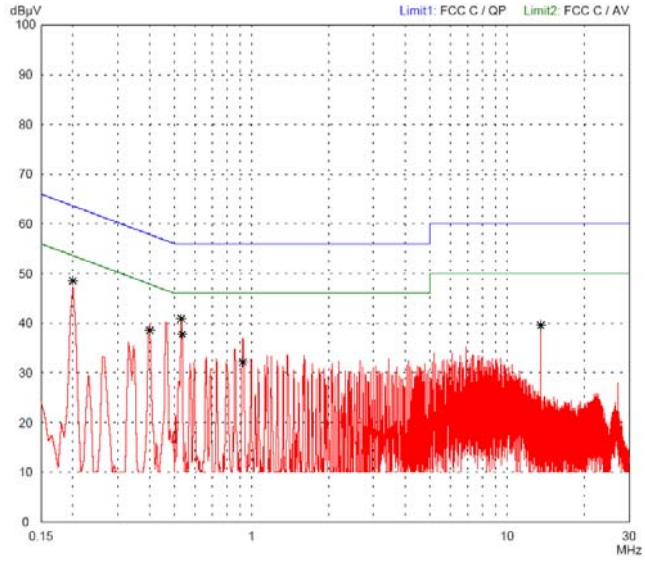
Live Wire, Qasi-Peak Detector Antenna terminated	Neutral Wire, Quasi-Peak Detector Antenna terminated



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.200	48.9		48.9	63.6	14.7
0.265	41.9		41.9	61.3	19.4
0.395	36.2		36.2	58.0	21.8
0.530	40.3		40.3	56.0	15.7
0.535	37.7		37.7	56.0	18.3
0.930	34.3		34.3	56.0	21.7



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.200	48.6		48.6	63.6	15.0
0.400	38.5		38.5	57.9	19.4
0.530	40.9		40.9	56.0	15.1
0.535	37.9		37.9	56.0	18.1
0.925	32.2		32.2	56.0	23.8
13.560	39.6		39.6	60.0	20.4

Sample calculation of final values:

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

8.2.5 Spectrum Mask – Antenna WAL

Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d) IC RSS-210 Issue 7, section A2.6
Guide:	ANSI C63.4
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.

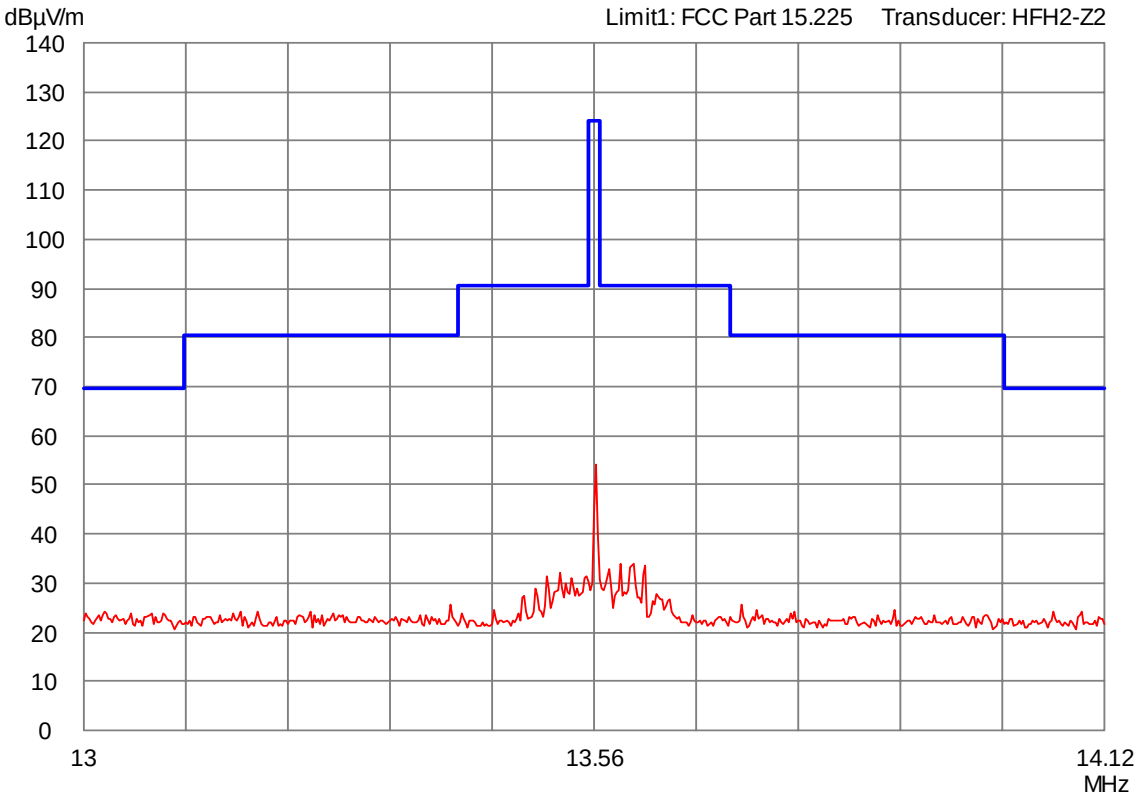
Limit:

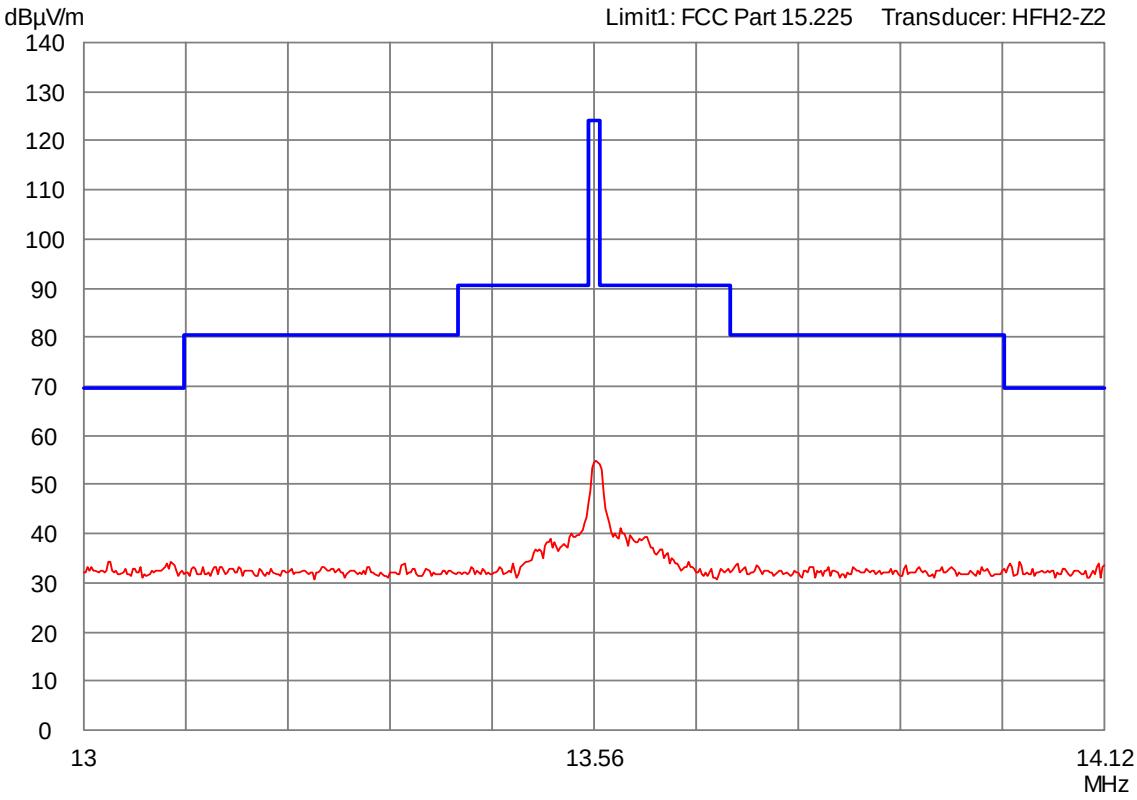
Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
1.705 - 13.110	30	29.5	30
13.110 - 13.410	106	40.5	30
13.410 - 13.553	334	50.5	30
13.553 - 13.567	15848	84.0	30
13.567 - 13.710	334	50.5	30
13.710 - 14.010	106	40.5	30
14.010 - 30.000	30	29.5	30

Measurement procedure:	**Fehler! Verweisquelle konnte nicht gefunden werden.** (**Fehler! Verweisquelle konnte nicht gefunden werden.**)

Comment:	
Date of test:	January 24, 2008
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters
Extrapolation Factor:	40 dB/decade

Test Result:	Test passed


dBµV/m
Limit1: FCC Part 15.225
Transducer: HFH2-Z2
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
13
13.56
14.12
MHz


dBµV/m
Limit1: FCC Part 15.225
Transducer: HFH2-Z2
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
13
13.56
14.12
MHz

8.2.6 Radiated Emission Measurement 9 kHz to 30 MHz – Antenna WAL

Rules and specifications:	CFR 47 Part 15, sections 15.205 and 15.225(a)-(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6			
Guide:	ANSI C63.4			
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:	January 24, 2008
Test site:	Open field test site

Test Result:	Test passed

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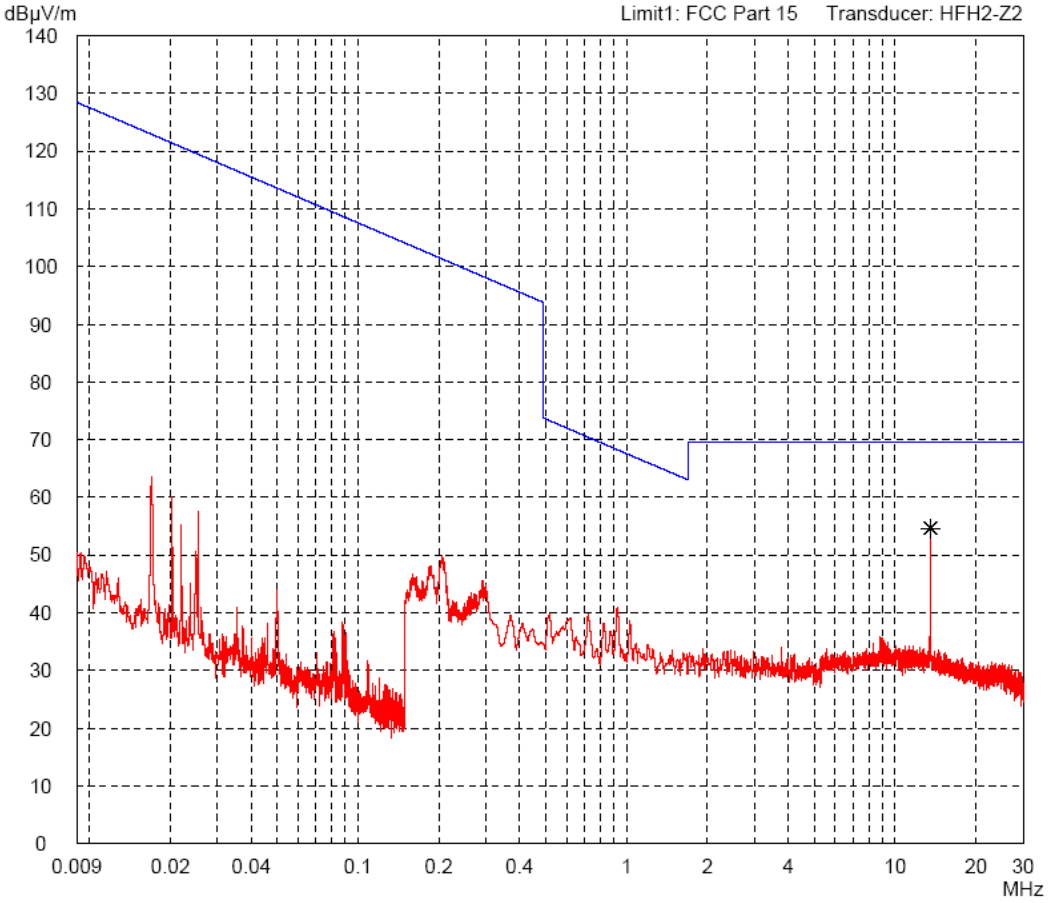
Prescan at 3 distance in a shielded enclosure (FAR)



Final result (Open Area Test Site without Ground Plane

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	30.1	20.0	-19.1		31.0	84.0	**53.0**

Sample calculation of final values:

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

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

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

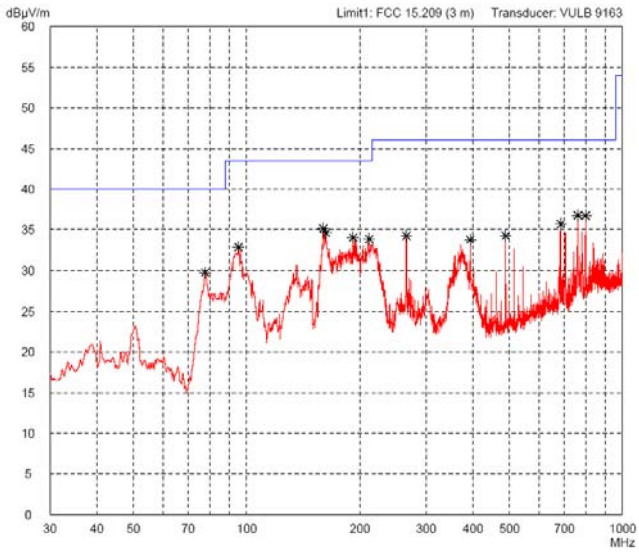
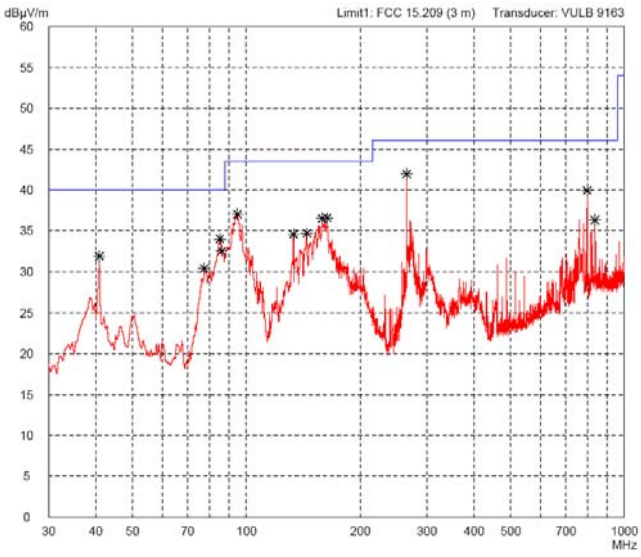
8.2.7 Radiated Emission Measurement 30 MHz to 1 GHz

Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6		
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:	Frequencies < 1 GHz: Open field test siteFrequencies > 1 GHz: Fully anechoic room, cabin no. 2		

Comment:	
Date of test:	January 25, 2008
Test site:	Frequencies ≤ 1 GHz: Open field test site Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Prescan in fully-anechoic room

Horizontal Polarisation	Vertical Polarisation
	

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Final results (Open Area Test Site)

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)
40.677	vertical	Quasi-Peak	25.8	11.8		37.6	40.0	2.4
73.700	vertical	Quasi-Peak	24.5	9.4		33.9	40.0	6.1
77.460	vertical	Quasi-Peak	28.7	9.4		38.1	40.0	1.9
77.700	horizontal	Quasi-Peak	11.4	9.4		20.8	40.0	19.2
83.430	vertical	Quasi-Peak	20.9	9.5		30.4	40.0	9.6
86.790	vertical	Quasi-Peak	27.9	9.7		37.6	40.0	2.4
90.250	vertical	Quasi-Peak	23.6	9.9		33.5	43.5	10.0
94.110	vertical	Quasi-Peak	23.4	10.2		33.6	43.5	9.9
95.300	horizontal	Quasi-Peak	23.0	10.3		33.3	43.5	10.2
95.480	vertical	Quasi-Peak	23.7	10.3		34.0	43.5	9.5
134.660	vertical	Quasi-Peak	11.0	13.5		24.5	43.5	19.0
145.920	vertical	Quasi-Peak	16.0	13.7		29.7	43.5	13.8
150.500	horizontal	Quasi-Peak	22.7	13.9		36.6	43.5	6.9
156.330	vertical	Quasi-Peak	19.9	14.4		34.3	43.5	9.2
156.800	horizontal	Quasi-Peak	28.3	14.4		42.7	43.5	0.8
157.400	horizontal	Quasi-Peak	28.4	14.4		42.8	43.5	**0.7**
157.970	vertical	Quasi-Peak	21.0	14.4		35.4	43.5	8.1
160.000	horizontal	Quasi-Peak	24.8	14.4		39.2	43.5	4.3
161.330	vertical	Quasi-Peak	20.5	14.5		35.0	43.5	8.5
164.460	vertical	Quasi-Peak	19.3	14.7		34.0	43.5	9.5
171.550	vertical	Quasi-Peak	13.5	15.1		28.6	43.5	14.9
187.900	horizontal	Quasi-Peak	13.2	15.9		29.1	43.5	14.4
210.500	horizontal	Quasi-Peak	11.3	16.8		28.1	43.5	15.4
265.500	vertical	Quasi-Peak	6.8	19.0		25.8	46.0	20.2
266.500	horizontal	Quasi-Peak	13.6	19.1		32.7	46.0	13.3
393.300	horizontal	Quasi-Peak	8.1	18.4		26.5	46.0	19.5
488.220	horizontal	Quasi-Peak	7.1	20.1		27.2	46.0	18.8
760.600	horizontal	Quasi-Peak	7.4	24.2		31.6	46.0	14.4
798.040	horizontal	Quasi-Peak	10.2	24.7		34.9	46.0	11.1
798.300	vertical	Quasi-Peak	10.2	24.7		34.9	46.0	11.1
834.400	vertical	Quasi-Peak	2.2	25.3		27.5	46.0	18.5

Sample calculation of final values:

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

8.3 Test Results for Antenna SET

8.3.1 Occupied Bandwidth – Antenna SET

Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.4, annex H.6
Guide:	ANSI C63.4
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 C63.4, 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. The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

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

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

Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	October 7, 2008
Test site:	Fully anechoic room, cabin no. 2

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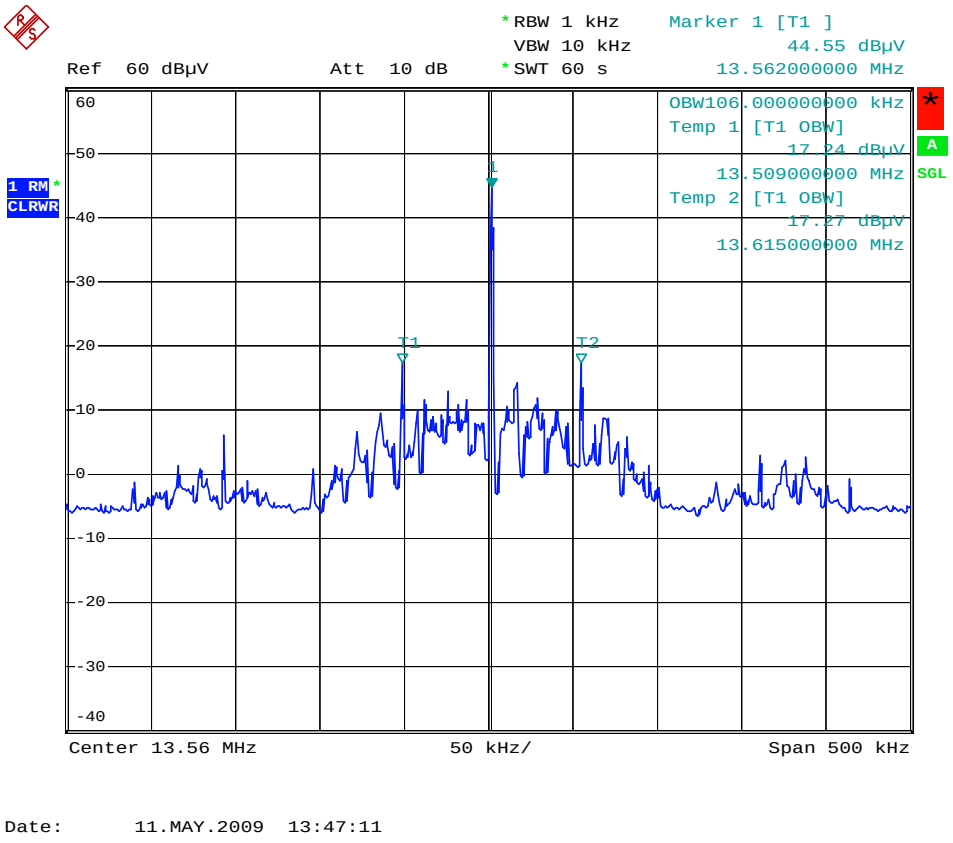
Occupied Bandwidth (99 %):



Occupied Bandwidth (99 %):	**172.8 kHz**

8.3.2 Bandwidth of the Emission – Antenna SET

Rules and specifications:	CFR 47 Part 15, section 15.215(c)
Guide:	ANSI C63.4
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 resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:

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

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

Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	June 02, 2009
Test site:	Fully anechoic room, cabin no. 2

Test Result:	Test passed

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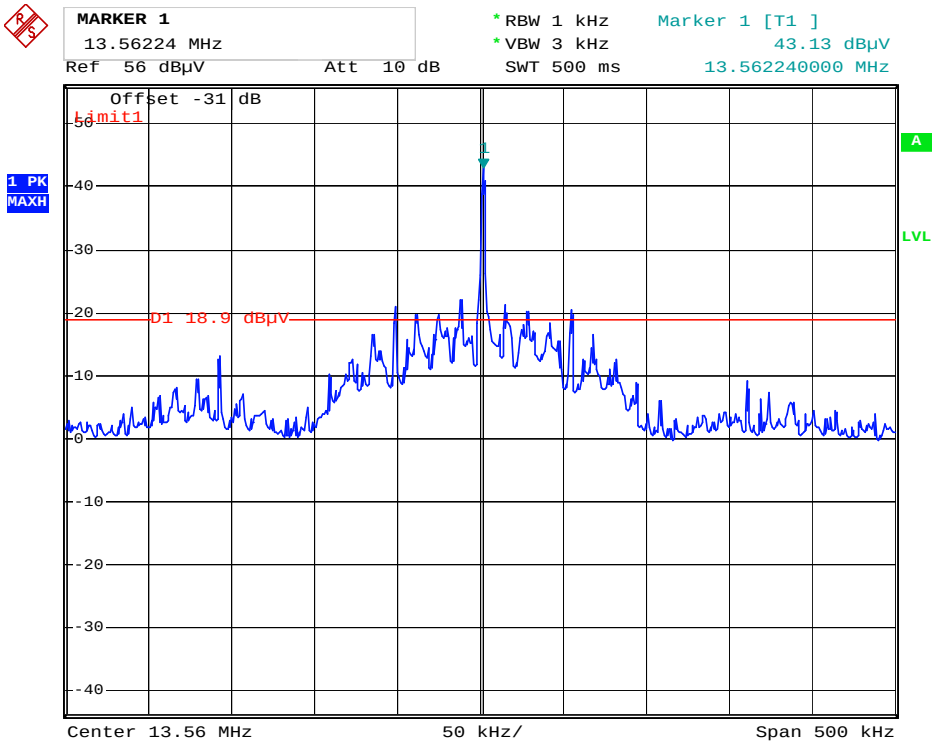
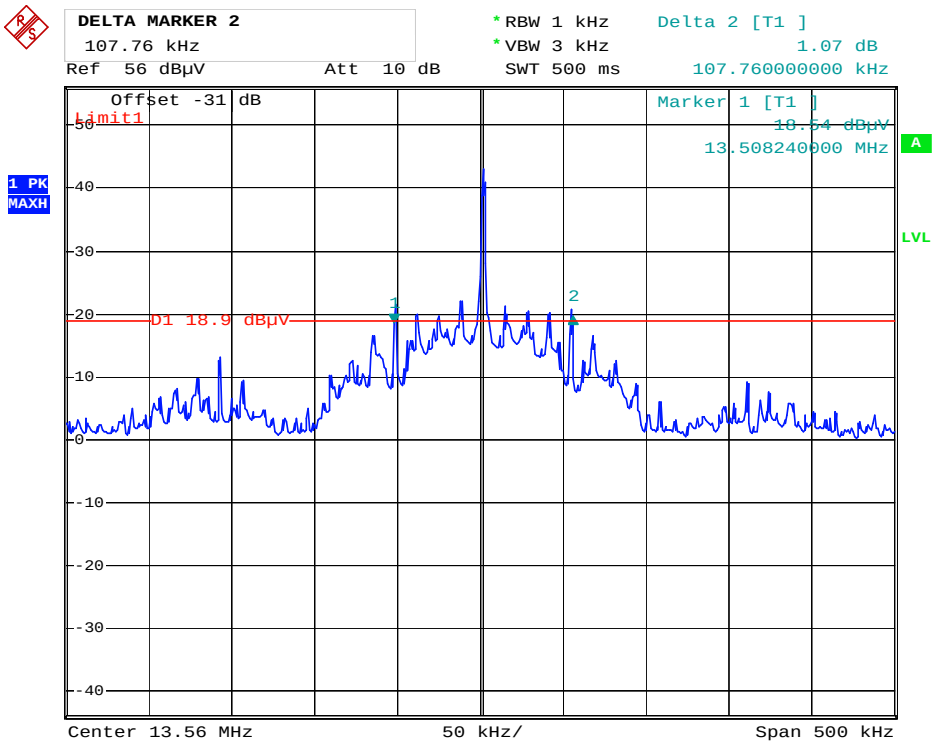




Permitted frequency band:	**13.11 – 14-01 MHz**	
20 dB bandwidth:	**107.76 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☒ **specified** **+127 Hz** **-76 Hz**	☐ **not specified**
Bandwidth of the emission:	**107.76 kHz**	**within permitted frequency band[10]:** ☒ **yes** ☐ **no**

Test Result:	Test passed

[10] 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.

8.3.3 Designation of Emissions – Antenna SET

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202 IC RSS-Gen Issue 2, sections 3.2(h) and 8
Guide:	ANSI C63.4 / TRC-43

Type of modulation:	Amplitude Modulation

B_n = Necessary Bandwidth	B_n = 2BK
B = Modulation rate	B = 5.0 kHz
K = Overall numerical factor	K = 1
Calculation:	$B_n = 2 \cdot (5.0\ kHz) \cdot 1 = 10.0\ kHz$

Designation of Emissions:	**10K0A1D**

8.3.4 Spectrum Mask – Antenna SET

Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d) IC RSS-210 Issue 7, section A2.6
Guide:	ANSI C63.4
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.

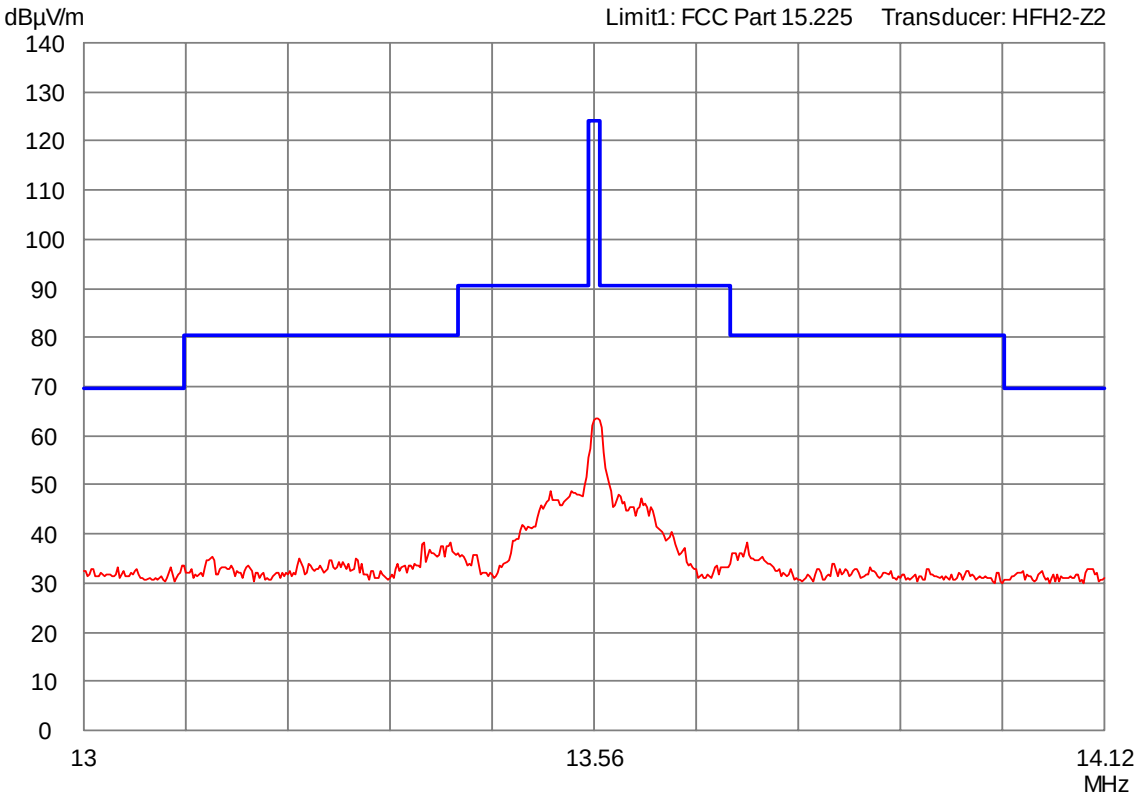
Limit:

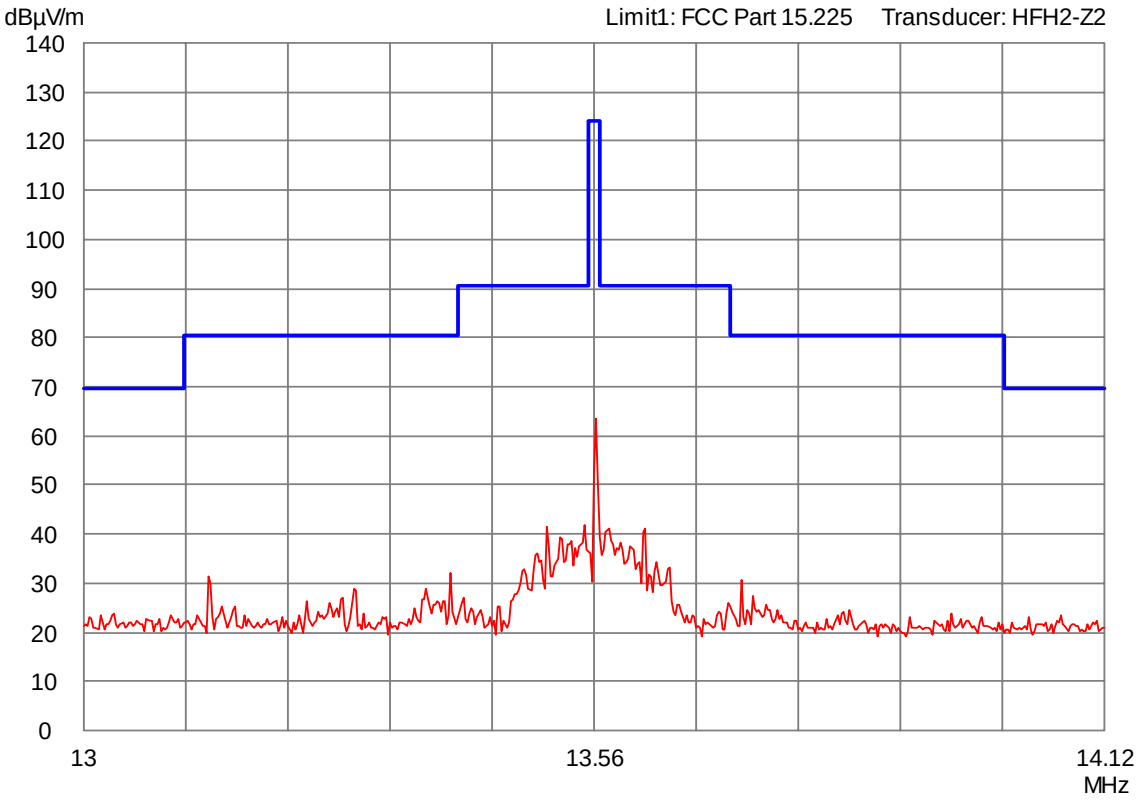
Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
1.705 - 13.110	30	29.5	30
13.110 - 13.410	106	40.5	30
13.410 - 13.553	334	50.5	30
13.553 - 13.567	15848	84.0	30
13.567 - 13.710	334	50.5	30
13.710 - 14.010	106	40.5	30
14.010 - 30.000	30	29.5	30

Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	June 02, 2009
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters
Extrapolation Factor:	40 dB/decade

Test Result:	Test passed


dBµV/m
Limit1: FCC Part 15.225
Transducer: HFH2-Z2
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
13
13.56
14.12
MHz


dBµV/m
Limit1: FCC Part 15.225
Transducer: HFH2-Z2
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
13
13.56
14.12
MHz

8.3.5 Radiated Emission Measurement 9 kHz to 30 MHz – Antenna SET

Rules and specifications:	CFR 47 Part 15, sections 15.205 and 15.225(a)-(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6			
Guide:	ANSI C63.4			
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)			

Test Result:	Test passed

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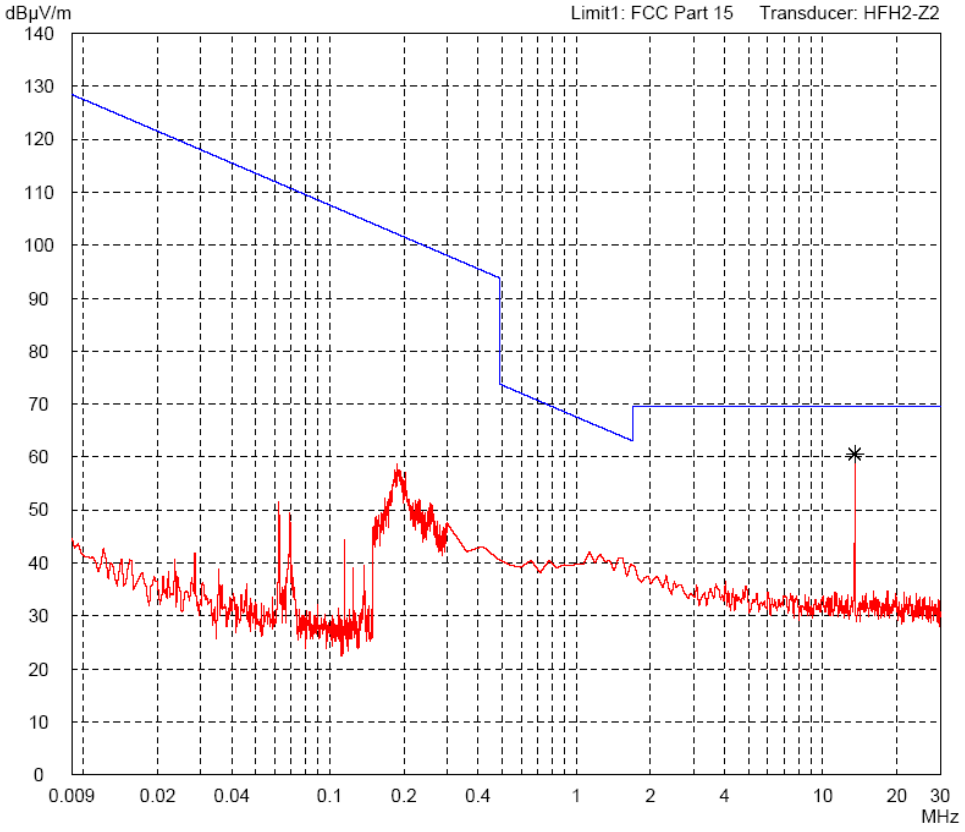
Comment:	
Date of test:	June 02, 2009
Test site:	Open field test site

Test Result:	Test passed

Prescan at 3 distance in a shielded enclosure (FAR)



Final result (Open Area Test Site without Ground Plane

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	3	30	45	20,0	-40	N/A	25.0	84,0	**59.0**

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.

8.3.6 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-Gen Issue 2, section 7.2.2		
Guide:	ANSI C63.4 / 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:	Unit retested with antenna connector terminated with 50 Ohms resistive load, see test results for antenna SET for reference
Date of test:	11 May 2009
Test site:	Shielded room, cabin no. 4

Test Result:	Test passed

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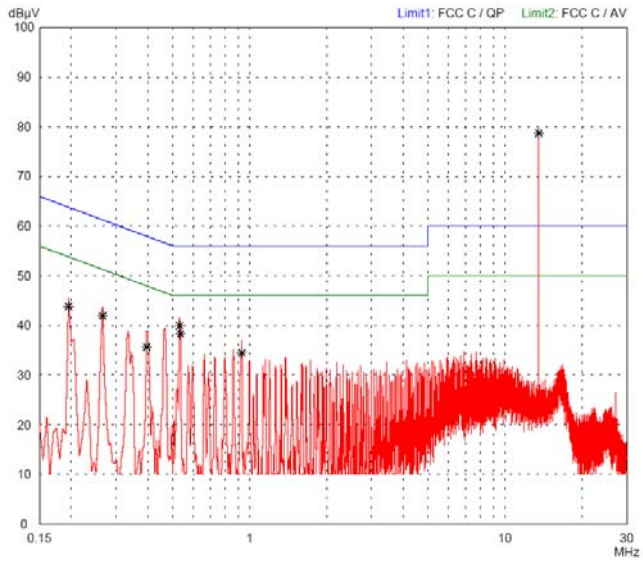
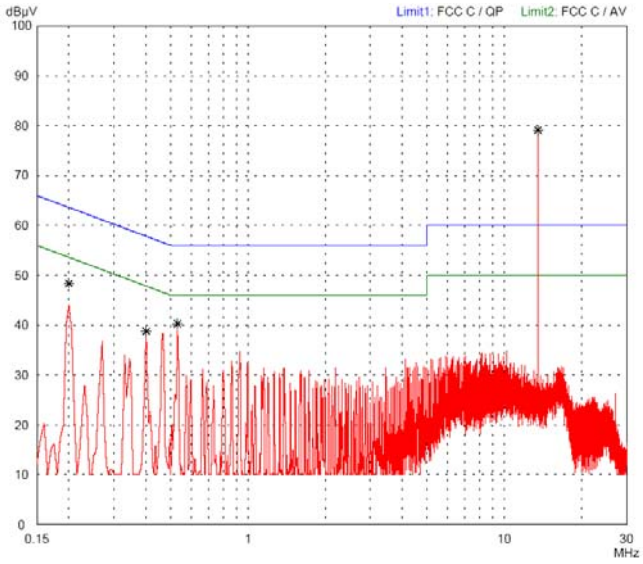
Live Wire, Qasi-Peak Detector	Neutral Wire, Quasi-Peak Detector

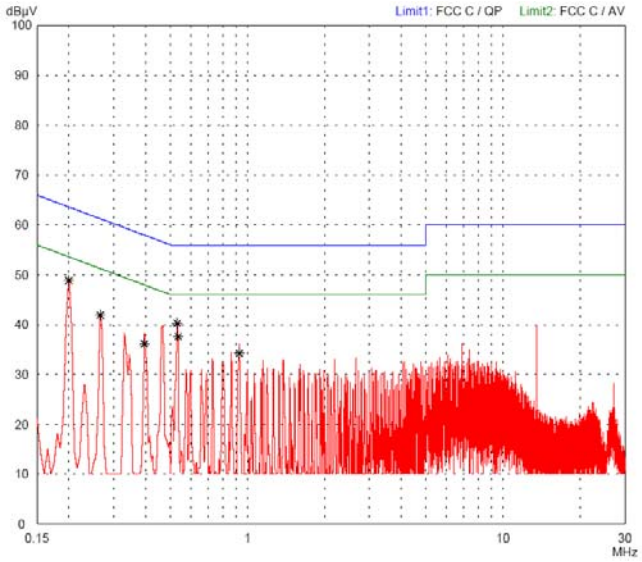




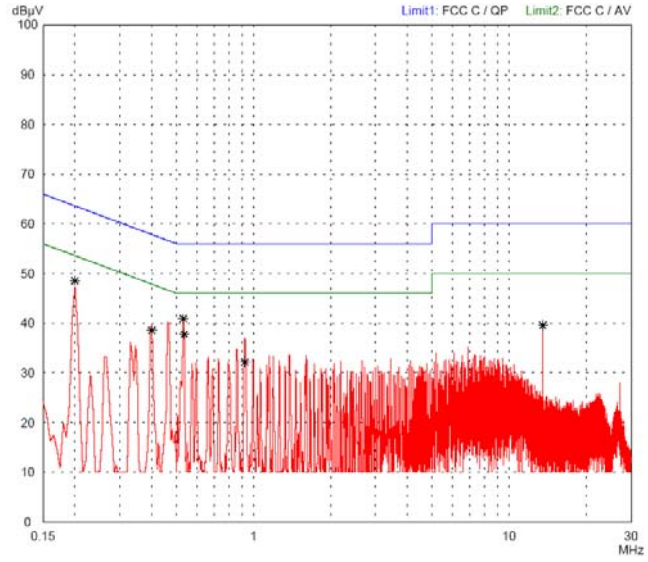
Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.195	43.8		43.8	63.8	20.0
0.265	42.0		42.0	61.3	19.3
0.395	35.7		35.7	58.0	22.3
0.530	40.0		40.0	56.0	16.0
0.535	38.2		38.2	56.0	17.8
0.930	34.5		34.5	56.0	21.5
13.560	78.7		78.7	60.0	-18.7

Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.20	48.4		48.4	63.6	15.2
0.40	38.8		38.8	57.9	19.1
0.53	40.3		40.3	56.0	15.7
13.56	79.1		79.1	60.0	-19.1

Live Wire, Qasi-Peak Detector Antenna terminated	Neutral Wire, Quasi-Peak Detector Antenna terminated



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.200	48.9		48.9	63.6	14.7
0.265	41.9		41.9	61.3	19.4
0.395	36.2		36.2	58.0	21.8
0.530	40.3		40.3	56.0	15.7
0.535	37.7		37.7	56.0	18.3
0.930	34.3		34.3	56.0	21.7



Frequency MHz	Reading dBµV	Correction factor dB	Value dBµV	Limit dBµV	Margin dB
0.200	48.6		48.6	63.6	15.0
0.400	38.5		38.5	57.9	19.4
0.530	40.9		40.9	56.0	15.1
0.535	37.9		37.9	56.0	18.1
0.925	32.2		32.2	56.0	23.8
13.560	39.6		39.6	60.0	20.4

Sample calculation of final values:

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

8.3.7 Radiated Emission Measurement 30 MHz to 1 GHz – Antenna SET

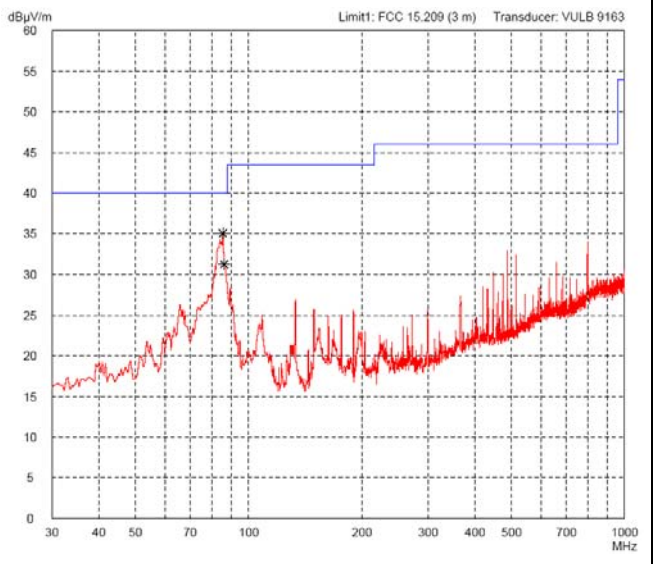
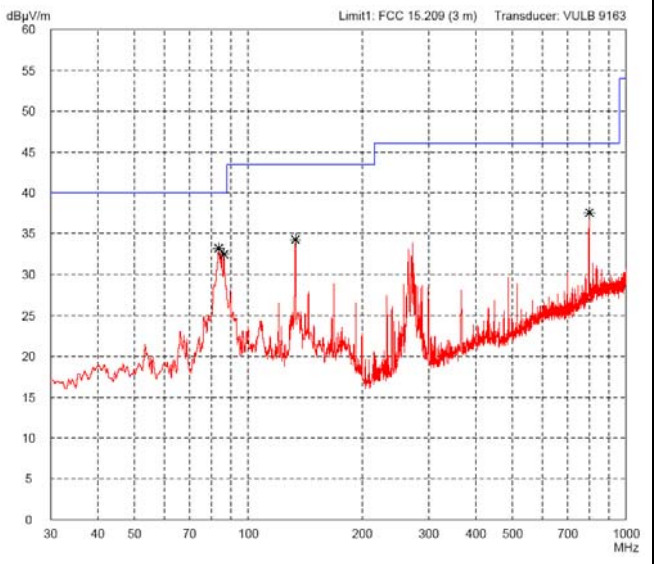
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6		
Guide:	ANSI C63.4		
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
	30 - 88	100	40.0
	88 - 216	150	43.5
	216 - 960	200	46.0
	Above 960	500	54.0
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.		
Measurement procedures:	Radiated Emission in Fully or Semi Anechoic Room (6.4) Radiated Emission at Open Field Test Site (6.5)		

Test Result:	Test passed

Comment:	Test setup 1
Date of test:	October 7, 2008
Test site:	Frequencies ≤ 1 GHz: Open field test site Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

Prescan in fully-anechoic room

Horizontal Polarisation	Vertical Polarisation
	

Final results (Open Area Test Site)

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
84.00	Horizontal	Quasi-Peak	22.0	11.5	33.5	40	6.5
86.00	Horizontal	Quasi-Peak	22.0	12.5	34.5	40	5.5
133.33	Vertical	Quasi-Peak	25.0	12.0	37.0	43.5	6.5
800.0	Vertical	Quasi-Peak	15.0	23.0	38.0	46	8.0

Sample calculation of final values:

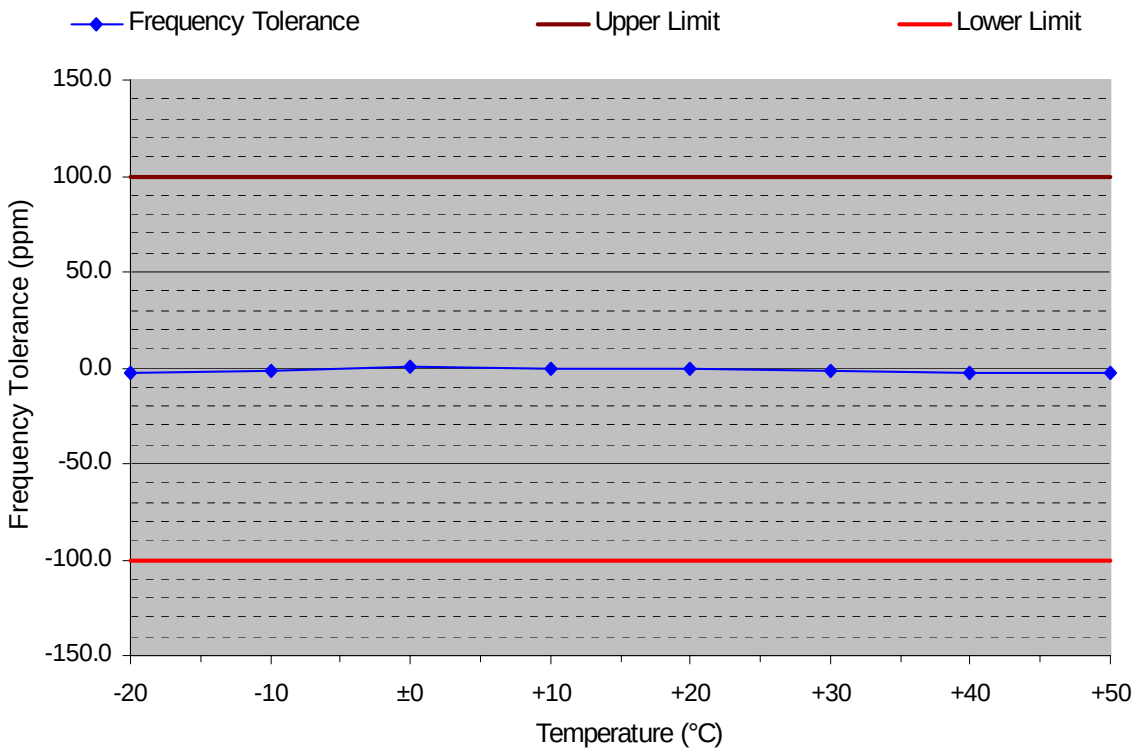
Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

8.3.8 Carrier Frequency Stability – Antenna SET

Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-Gen Issue 2, section 4.7 and IC RSS-210 Issue 7, section A2.6
Guide:	ANSI C63.4
Limit:	The frequency tolerance of the carrier signal shall be maintained within ±0.01 % (±100 ppm) of the carrier frequency under nominal conditions.
Temperature range: Voltage range:	-20°C to +50°C (at normal supply voltage) 85% to 115% of the rated supply voltage (at a temperature of +20°C)
Measurement procedure:	Carrier Frequency Stability (6.6)

Comment:	Test performed at first testings of module
Date of test:	July 28, 2006

8.3.8.1 Carrier Frequency Stability vs. Temperature

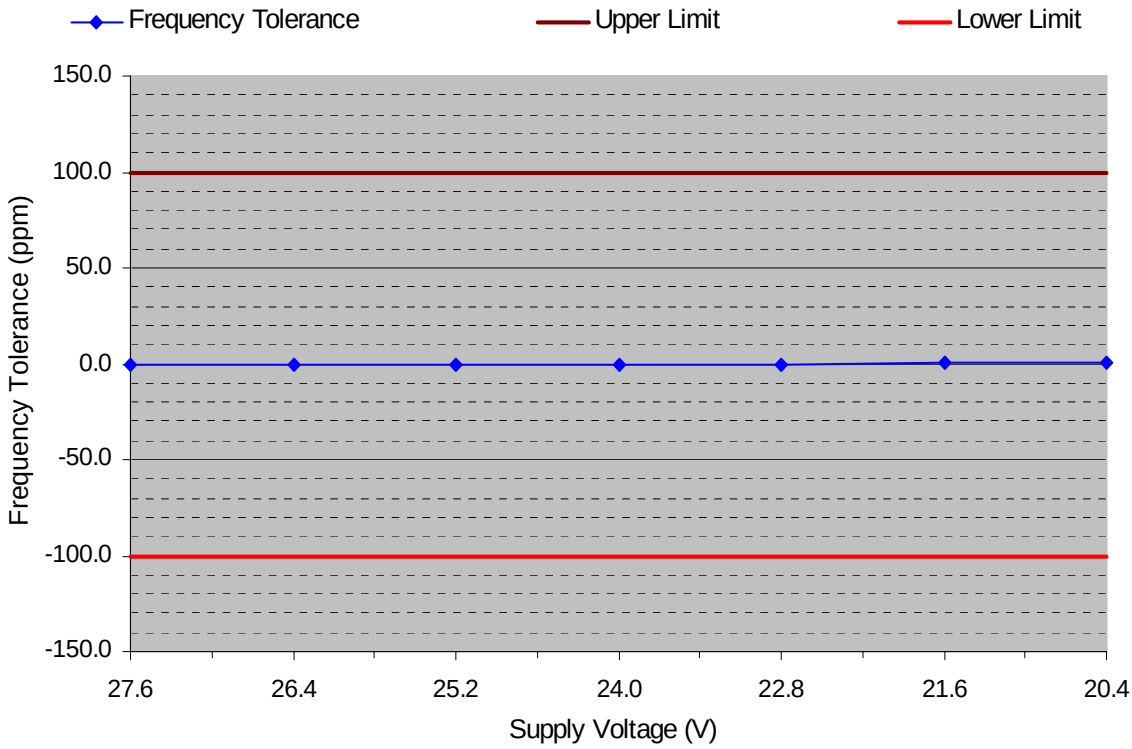


Supply voltage: V Nominal frequency: 13.561998 MHz

Temperature (°C)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
-20	13.561968	-30	-2.2	+100.0	-100.0	97.8
-10	13.561980	-18	-1.3	+100.0	-100.0	98.7
±0	13.562002	4	0.3	+100.0	-100.0	99.7
+10	13.561998	0	0.0	+100.0	-100.0	100.0
+20	13.561998	0	0.0	+100.0	-100.0	100.0
+30	13.561982	-16	-1.2	+100.0	-100.0	98.8
+40	13.561966	-32	-2.4	+100.0	-100.0	97.6
+50	13.561956	-42	-3.1	+100.0	-100.0	**96.9**

Test Result:	Test passed

8.3.8.2 Carrier Frequency Stability vs. Supply Voltage



Temperature: +20 °C
Nominal frequency: 13.561988 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	13.561988	0	0.0	+100.0	-100.0	100.0
26.4	13.561988	0	0.0	+100.0	-100.0	100.0
25.2	13.561988	0	0.0	+100.0	-100.0	100.0
24.0	13.561988	0	0.0	+100.0	-100.0	100.0
22.8	13.561988	0	0.0	+100.0	-100.0	100.0
21.6	13.561990	2	0.1	+100.0	-100.0	**99.9**
20.4	13.561990	2	0.1	+100.0	-100.0	**99.9**

Test Result:	Test passed

8.3.9 Exposure of Humans to RF Fields

Rules and specifications:	IC RSS-Gen Issue 2, section 5.5
Guide:	IC RSS-102 Issue 2, 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[11] 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[13]: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **341.1 · 10^{-9} W** with: Field strength in V/m: FS = **319.9 · 10^{-6} V/m** Distance between the two antennas in m: D = **10 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 = **341.1 · 10^{-9} W**				

[11] 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.

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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 the device is less than or equal to 20 cm.				
☐ The device operates from 3 kHz up to 1 GHz inclusively and its source-based time-averaged output power is less than, or equal to 200 mW for General Public Use and 1000 mW for Controlled Use.				☐
☐ The device operates above 1 GHz up to 2.2 GHz inclusively and its source-based time-averaged output power is less than, or equal to 100 mW for General Public Use and 500 mW for Controlled Use.				☐
☐ The device operates above 2.2 GHz up to 3 GHz inclusively and its source-based time-averaged output power is less than, or equal to 20 mW for General Public Use and 100 mW for Controlled Use.				☐
☐ The device operates above 3 GHz up to 6 GHz inclusively and its source-based time-averaged output power) is less than, or equal to 10 mW for General Public Use and 50 mW for Controlled Use.				☐
☐ SAR evaluation is documented in test report no.				
RF exposure evaluation				
RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm.				
☒ The device operates below 1.5 GHz and its e.i.r.p. is equal to or less than 2.5 W.				☒
☐ The device operates at or above 1.5 GHz and the e.i.r.p. of the device is equal to or less than 5 W.				☐
☐ RF exposure evaluation is documented in test report no.				

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, 2006
☒	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	May 4, 2007
☒	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)
☒	RSS-Gen	Radio Standards Specification RSS-Gen Issue 2 containing General Requirements and Information for the Certification of Radiocommunication Equimpment, published by Industry Canada	June 2007
☒	RSS-210	Radio Standards Specification RSS-210 Issue 7 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada	June 2007
☐	RSS-310	Radio Standards Specification RSS-310 Issue 1 for Low Power Licence-Ecempt Radiocommunicaton Devices (All Frequency Bands): Category II Equipment, published by Industry Canada	September 2005
☒	RSS-102	Radio Standards Specification RSS-102 Issue 2: Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)	November 2005
☐	ICES-003	Interference-Causing Equipment Standard ICES-003 Issue 4 for Digital Apparatus, published by Industry Canada	February 7, 2004
☒	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-CEI/IEC CISPR 22	Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment	2002

☒	TRC-43	Notes Regarding Designation of Emission (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service, published by Industry Canada	October 9, 1982

10 Calibration Status of equipment used during testing

Test Equipment List with Calibration Data

Test report number(s):
50420-081180

Date of test:
10/2008

Type	*Inv.-No.*	*Type Designation*	*Serial Number*	*Manufacturer*	*Calibration Organization*	*Date of Calibration*	
						Last	*Next*
Test receiver	1025	ESVP	881120/024	Rohde & Schwarz	Rohde & Schwarz	03/2008	09/2009
Test receiver	1026	ESHS10	860043/016	Rohde & Schwarz	Rohde & Schwarz	04/2007	10/2008
EMI Test receiver	1569	ESMI	839379/013	Rohde & Schwarz	Rohde & Schwarz	04/2007	10/2009
EMI test receiver	1711	ESPI7	836914/0002	Rohde & Schwarz	Rohde & Schwarz	10/2008	04/2010
Test receiver	2031	ESVP	891846/003	Rohde & Schwarz	Rohde & Schwarz	10/2008	04/2010
Spectrum analyser	1666	FSP30	100063	Rohde & Schwarz	Rohde & Schwarz	10/2007	04/2009
Preamplifier	1142	R14601	13120026	Advantest	Senton	04/2008	04/2010
Preamplifier	1484	ACO/180-3530	32641	CTT	Senton	05/2008	11/2009
Preamplifier	1651	CPA9231A	3393	Schaffner Electrotest	Senton	05/2008	11/2009
Preamplifier	1684	AFS3-00100800-32-LN	847743	MITEQ	Senton	05/2008	11/2009
V-network	1059	ESH3-Z5	894785/005	Rohde & Schwarz	Rohde & Schwarz	12/2005	12/2008
V-network	1060	ESH3-Z5	862770/021	Rohde & Schwarz	Rohde & Schwarz	01/2007	01/2010
V-network	1216	ESH3-Z5	830952/025	Rohde & Schwarz	Rohde & Schwarz	07/2008	07/2011
Loop antenna	1016	HFH2-Z2	882964/0001	Rohde & Schwarz	Rohde & Schwarz	12/2007	06/2009
Double ridged waveguide horn antenna	1516	3115	9508-4553	EMCO Elektronik	ARC	05/2008	05/2011
Biconical Antenna	1518	HK116	842204/01	Rohde & Schwarz	Rohde & Schwarz	06/2008	12/2009
Logarithmic-periodic antenna	1519	HL223	841516/23	Rohde & Schwarz	Rohde & Schwarz	06/2008	12/2009
TRILOG broadband antenna	1722	VULB 9163	9163-188	Schwarzbeck	Schwarzbeck	04/2008	10/2009
TRILOG Broadband Antenna	1802	VULB 9163	9163-214	Schwarzbeck	Schwarzbeck	03/2008	09/2009
Multimeter	1653	21 III	76530546	Fluke	ZMK	05/2008	02/2011
Multimeter	1654	21 III	76361229	Fluke	ZMK	03/2008	12/2010

Note: Date of next calibration contains maximum tolerance if applicable.

11 Revision History

Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	02.06.2009	J. Roidt	Initial edition