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Februar 25, 2010

## Prüfbericht / Test Report

Nr. / No. 50784-01517 (Edition 1)

Applicant: BARTEC GmbH  
Type of equipment: RFID Module  
Type designation: MC9090 RFID HF  
Order No.: EB206639 / 16483  
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)

**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.



## Table of Contents

1	Description of the Equipment Under Test (EUT).....	3
2	Administrative Data .....	4
3	Identification of the Test Laboratory.....	5
4	Summary.....	6
5	Operation Mode and Configuration of EUT .....	7
6	Measurement Procedures .....	8
6.1	Bandwidth Measurements .....	8
6.2	Radiated Emission Measurement 9 kHz to 30 MHz.....	9
6.3	Radiated Emission in Fully or Semi Anechoic Room.....	11
6.4	Carrier Frequency Stability.....	13
7	Photographs Taken During Testing.....	15
8	Test Results .....	19
8.1	Occupied Bandwidth .....	21
8.2	Bandwidth of the Emission.....	25
8.3	Designation of Emissions.....	27
8.4	Spectrum Mask.....	28
8.5	Radiated Emission Measurement 9 kHz to 30 MHz.....	30
8.6	Radiated Emission Measurement 30 MHz to 1 GHz.....	32
8.7	Carrier Frequency Stability.....	33
8.8	Exposure of Humans to RF Fields .....	36
9	Referenced Regulations.....	38
10	Revision History .....	40
11	Charts taken during testing .....	41



## 1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation <sup>1</sup> :	MC9090 RFID HF
Parts <sup>2</sup> :	
Serial number(s):	Test samples
Manufacturer:	BARTEC GmbH
Type of equipment:	RFID Module
Version:	With Würth ferrite No. 742 701 07 on supply line
FCC ID:	
Additional parts/accessories:	

Technical data of EUT	
Application frequency range:	13.56 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 <sup>3</sup> :	
Type of antenna:	Integrated
Size/length of antenna:	
Connection of antenna:	<input type="checkbox"/> detachable <input checked="" type="checkbox"/> not detachable
Type of power supply:	DC supply
Specifications for power supply:	nominal voltage:      7.5 V V

<sup>1</sup> Type designation of the system if EUT consists of more than one part.

<sup>2</sup> Type designations of the parts of the system, if applicable.

<sup>3</sup> Also known as "Class of Emission".

## 2 Administrative Data

### Application details

Applicant (full address):	BARTEC GmbH Max-Eyth-Str. 16 97980 Bad Mergentheim Germany
Contact person:	Mr. Sebastian Kuhn
Order number:	EB206639 / 16483
Receipt of EUT:	January 27, 2010 February 19, 2010 (sample with ferrite core)
Date(s) of test:	January - February 2010
Note(s):	The applicant provided two test samples. One test sample with ferrite core on supply line was used for radiated emissions. The second sample without ferrite core was used for the other tests.

### Report details

Report number:	50784-01517
Edition:	1
Issue date:	February 25, 2010



### 3 Identification of the Test Laboratory

#### Details of the Test Laboratory

Company name:	TÜV SÜD SENTON GmbH
Address:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
Laboratory accreditation:	DAR-Registration No. DAT-PL-171/94-03
FCC test site registration number	90926
Industry Canada test site registration:	3050A-1
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, 15.215 and 15.225**  
of the Federal Communication Commission (FCC) and the  
**Radio Standards Specifications**  
**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. Martin Steindl

Responsible for test report:

Mr. Martin Steindl



## 5 Operation Mode and Configuration of EUT

### Operation Mode(s)

The EUT was configured to transmit continuously with modulation.

### Configuration(s) of EUT

The applicant provided two test samples. The first sample without ferrite core was controlled over the RS-232-interface, the second sample with ferrite core was configured to operate in stand alone mode.

### List of ports and cables

<i>Port</i>	<i>Description</i>	<i>Classification<sup>4</sup></i>	<i>Cable type</i>	<i>Cable length</i>
1	DC supply	dc power	Unshielded	2 m
2	RS-232-interface	signal/control port	Unshielded	2 m <sup>5</sup>

### List of devices connected to EUT

<i>Item</i>	<i>Description</i>	<i>Type Designation</i>	<i>Serial no. or ID</i>	<i>Manufacturer</i>
1	Laptop PC	DELL dimension		DELL

### List of support devices

<i>Item</i>	<i>Description</i>	<i>Type Designation</i>	<i>Serial no. or ID</i>	<i>Manufacturer</i>
	---			

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

<sup>5</sup> 10 cm for the second test sample



## 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:	<input type="checkbox"/> Conducted: See below <input checked="" type="checkbox"/> Radiated: Radiated Emission Measurement 9 kHz to 30 MHz (6.2)
<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>	



## 6.2 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.

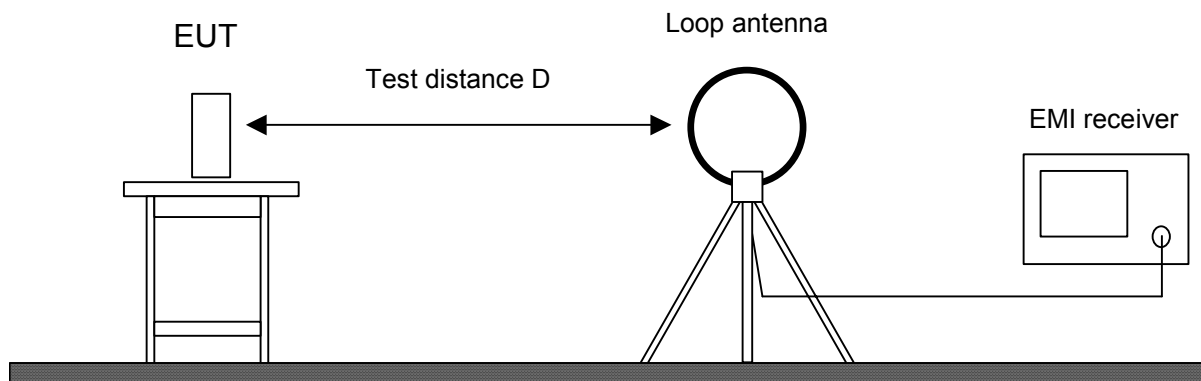
Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

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
<input checked="" type="checkbox"/>	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
<input type="checkbox"/>	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
<input checked="" type="checkbox"/>	Test receiver	ESHS 10	860043/016	Rohde & Schwarz
<input type="checkbox"/>	Preamplifier	CPA9231A	3393	Schaffner
<input checked="" type="checkbox"/>	Loop antenna	HFH2-Z2	882964/1	Rohde & Schwarz
<input checked="" type="checkbox"/>	Fully anechoic room	No. 2	1452	Albatross Projects
<input type="checkbox"/>	Semi-anechoic room	No. 3	1453	Siemens
<input checked="" type="checkbox"/>	Open field test site	EG 1	1450	Senton

## 6.3 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 or semi 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). Final measurements in the frequency range from 30 MHz to 1 GHz are made in both the horizontal and vertical planes of polarization in a semi anechoic room using a EMI receiver with the detector function set to quasi-peak and the measurement bandwidth of the test receiver is set to 120 kHz.

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.

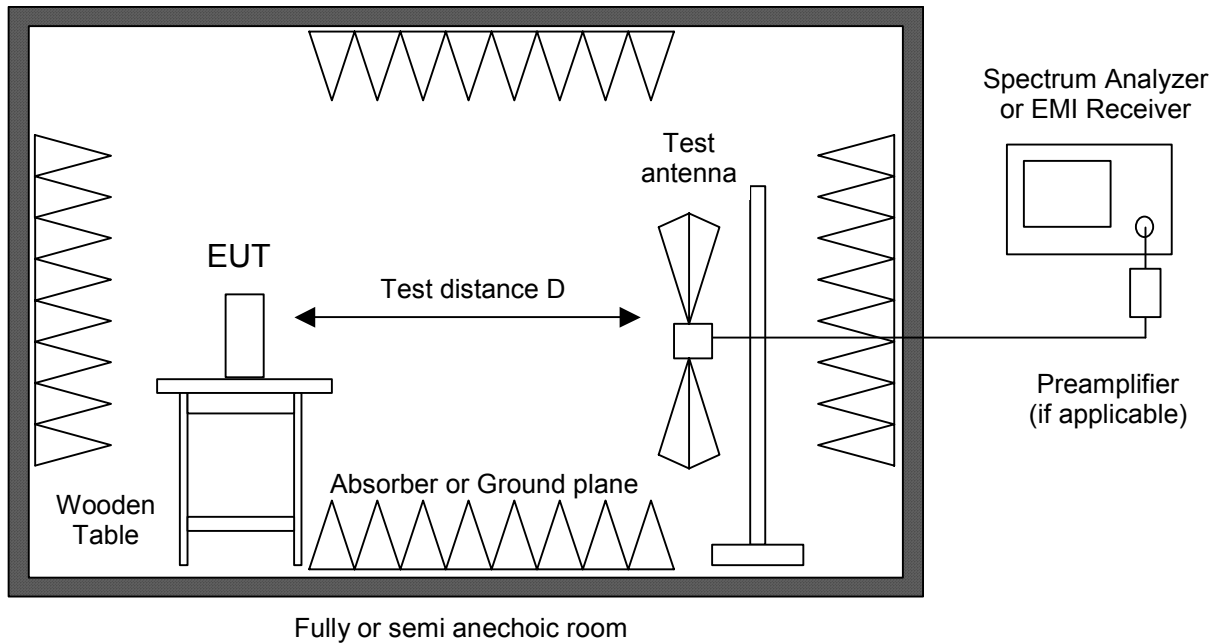
All tests below 18 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance is reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation 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 if applicable.

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 semi anechoic room is used and the plots recorded in the fully or semi anechoic room are indicated as prescans.



Test instruments used:

Used	Type	Model	Serial No. or ID	Manufacturer
<input checked="" type="checkbox"/>	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
<input type="checkbox"/>	EMI test receiver	ESPI7	101018	Rohde & Schwarz
<input type="checkbox"/>	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
<input checked="" type="checkbox"/>	Preamplifier	CPA9231A	3393	Schaffner
<input type="checkbox"/>	Preamplifier	R14601		Advantest
<input type="checkbox"/>	Preamplifier 1-8 GHz	AFS3-00100800-32-LN	847743	Miteq
<input type="checkbox"/>	Preamplifier 0.5-8 GHz	AMF-4D-005080-25-13P	860149	Miteq
<input type="checkbox"/>	Preamplifier 8-18 GHz	ACO/180-3530	32641	CTT
<input type="checkbox"/>	External Mixer	WM782A	845881/005	Tektronix
<input type="checkbox"/>	Harmonic Mixer Accessories	FS-Z30	843389/007	Rohde & Schwarz
<input type="checkbox"/>	Trilog broadband antenna	VULB 9163	9163-188	Schwarzbeck
<input checked="" type="checkbox"/>	Trilog broadband antenna	VULB 9163	9163-214	Schwarzbeck
<input type="checkbox"/>	Horn antenna	3115	9508-4553	EMCO
<input type="checkbox"/>	Horn antenna	3160-03	9112-1003	EMCO
<input type="checkbox"/>	Horn antenna	3160-04	9112-1001	EMCO
<input type="checkbox"/>	Horn antenna	3160-05	9112-1001	EMCO
<input type="checkbox"/>	Horn antenna	3160-06	9112-1001	EMCO
<input type="checkbox"/>	Horn antenna	3160-07	9112-1008	EMCO
<input type="checkbox"/>	Horn antenna	3160-08	9112-1002	EMCO
<input type="checkbox"/>	Horn antenna	3160-09	9403-1025	EMCO
<input type="checkbox"/>	Horn antenna	3160-10	399185	EMCO
<input checked="" type="checkbox"/>	Fully anechoic room	No. 2	1452	Albatross Projects
<input type="checkbox"/>	Semi-anechoic room	No. 3	1453	Siemens
<input checked="" type="checkbox"/>	Semi-anechoic room	No. 8	2057	Albatross Projects

## 6.4 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.

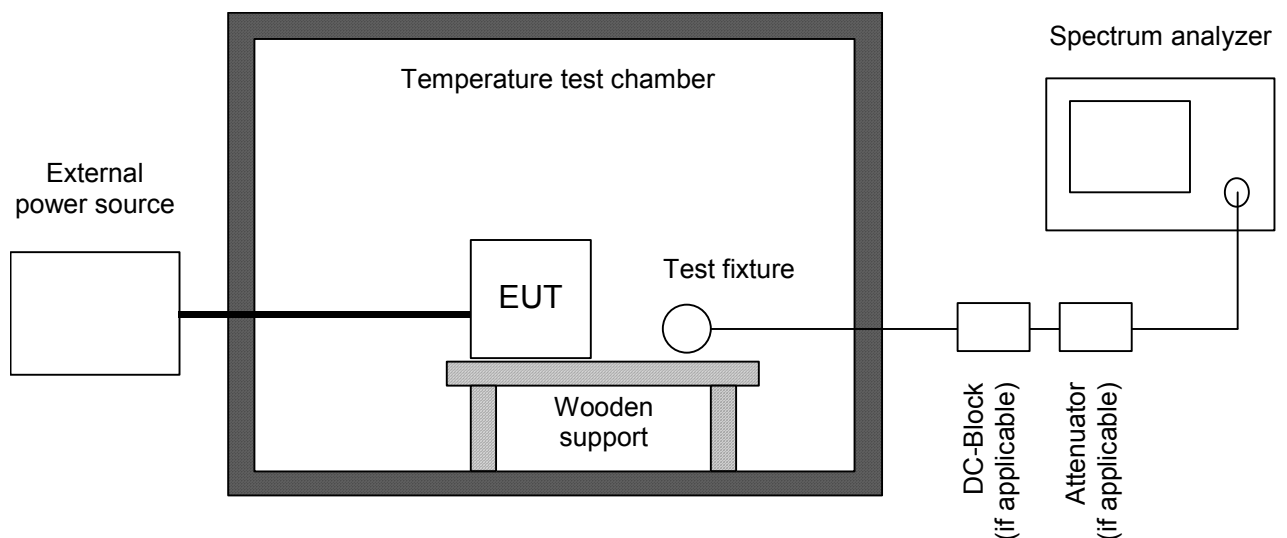
If the EUT provides an antenna connector the spectrum analyzer is connected to this port. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). In cases where the EUT does not provide an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

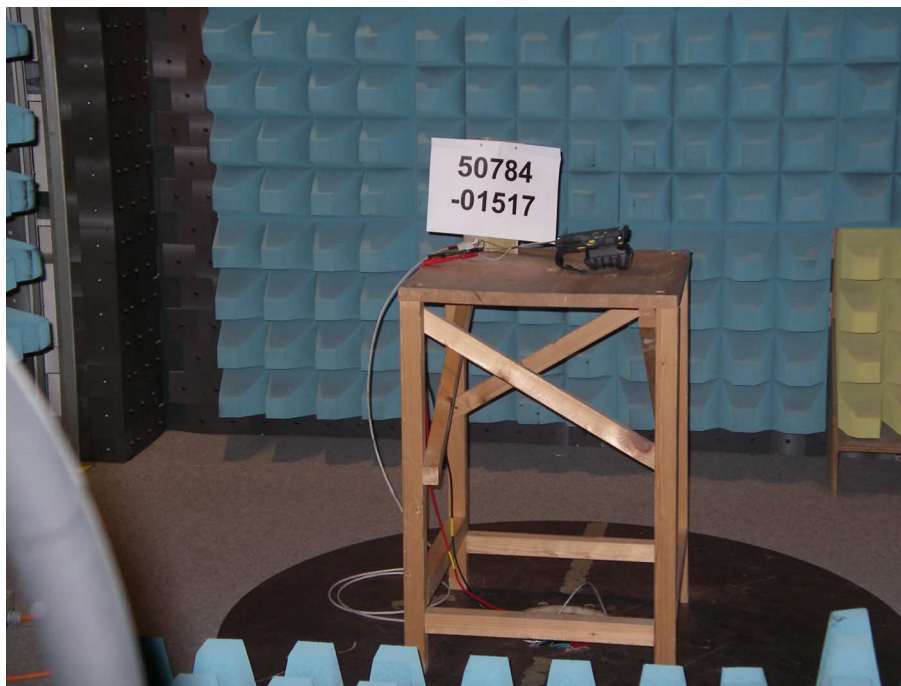
Used	Type	Model	Serial No. or ID	Manufacturer
<input type="checkbox"/>	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
<input checked="" type="checkbox"/>	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz
<input type="checkbox"/>	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
<input type="checkbox"/>	DC-block	7006	A2798	Weinschel
<input type="checkbox"/>	Attenuator	4776-10	9412	Narda
<input type="checkbox"/>	Attenuator	4776-20	9503	Narda
<input checked="" type="checkbox"/>	Test probe	TP01	001	Senton
<input checked="" type="checkbox"/>	Multimeter	21 III	76530546	Fluke
<input type="checkbox"/>	Multimeter	21 III	76381229	Fluke
<input type="checkbox"/>	Multimeter	Fluke 77 III	92370108	Fluke
<input type="checkbox"/>	Multimeter	Fluke 77 IV	93090238	Fluke
<input type="checkbox"/>	Multimeter	Fluke 177	96720024	Fluke
<input type="checkbox"/>	Multimeter	Fluke 177	96720025	Fluke
<input checked="" type="checkbox"/>	DC power supply	NGSM 32/10	203	Rohde & Schwarz
<input type="checkbox"/>	Isolating transformer	RT 5A	10387	Grundig
<input type="checkbox"/>	Isolating transformer	RT 5A	10416	Grundig
<input checked="" type="checkbox"/>	Temperature test chamber	HT4010	07065550	Heraeus



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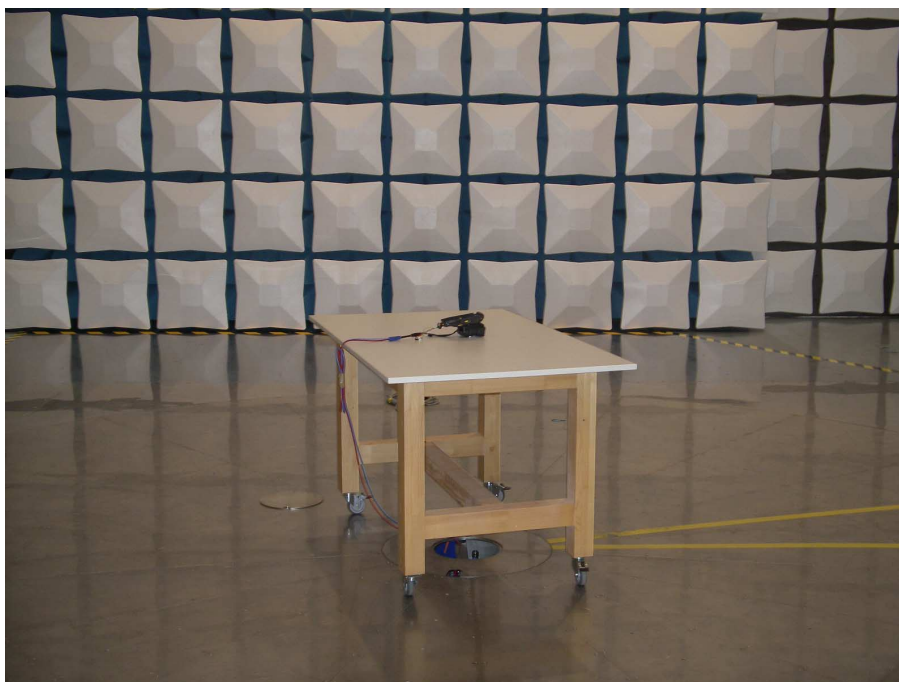
## 7 Photographs Taken During Testing

## Test setup for radiated emission measurement 9 kHz – 30 MHz

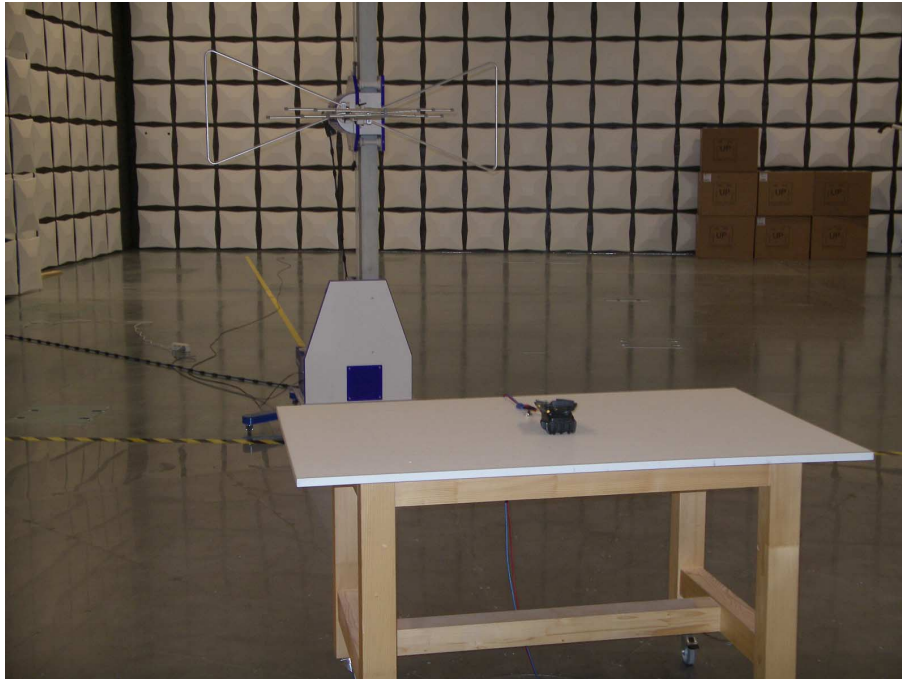




### Test setup for radiated emission measurement (semi anechoic room)



## Test setup for radiated emission measurement (semi anechoic room) - continued -



## 8 Test Results

FCC CFR 47 Parts 2 and 15			
Section(s)	Test	Page	Result
2.1046(a)	Conducted output power	---	Not applicable
2.202(a)	Occupied bandwidth	21	Recorded
15.215(c)	Bandwidth of the emission	25	Test passed
2.201, 2.202	Class of emission	27	Calculated
15.35(c)	Pulse train measurement for pulsed operation	---	Not applicable
15.205(a) 15.205(d)(7)	Restricted bands of operation	--- <sup>6</sup>	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	---	Not applicable
15.225(a)-(d)	Spectrum Mask	28	Test passed
15.205(b) 15.215(b) 15.225(a)(d)	Radiated emission 9 kHz to 30 MHz	30	Test passed
15.205(b) 15.225(d)	Radiated emission 30 MHz to 1 GHz	32	Test passed
15.225(e)	Carrier frequency stability	33	Test passed

<sup>6</sup> See "Spectrum Mask" for the 13.36 to 13.41 MHz band. For all other restricted bands see "Radiated Emission".



<b>IC RSS-Gen Issue 2</b>			
<i>Section(s)</i>	<i>Test</i>	<i>Page</i>	<i>Result</i>
4.8	Transmitter output power (conducted)	---	Not applicable
4.6.1	Occupied Bandwidth	21	Recorded
3.2(h), 8	Designation of emissions	27	Calculated
4.5	Pulsed operation	---	Not applicable
7.2.2	Transmitter AC power lines conducted emissions 150 kHz to 30 MHz	---	Not applicable
5.5	Exposure of Humans to RF Fields	36	Exempted from SAR and RF evaluation

<b>IC RSS-210 Issue 7</b>			
<i>Section(s)</i>	<i>Test</i>	<i>Page</i>	<i>Result</i>
2.2(a)	Restricted bands and unwanted emission frequencies	--- <sup>7</sup>	Test passed
A2.6	Spectrum Mask	28	Test passed
2.2(b)(c), 2.6 A2.6	Unwanted emissions 9 kHz to 30 MHz	30	Test passed
2.2(b)(c), 2.6 A2.6	Unwanted emissions 30 MHz to 1 GHz	32	Test passed
A2.6	Carrier frequency stability	33	Test passed

<sup>7</sup> See "Spectrum Mask" and "Unwanted emissions".

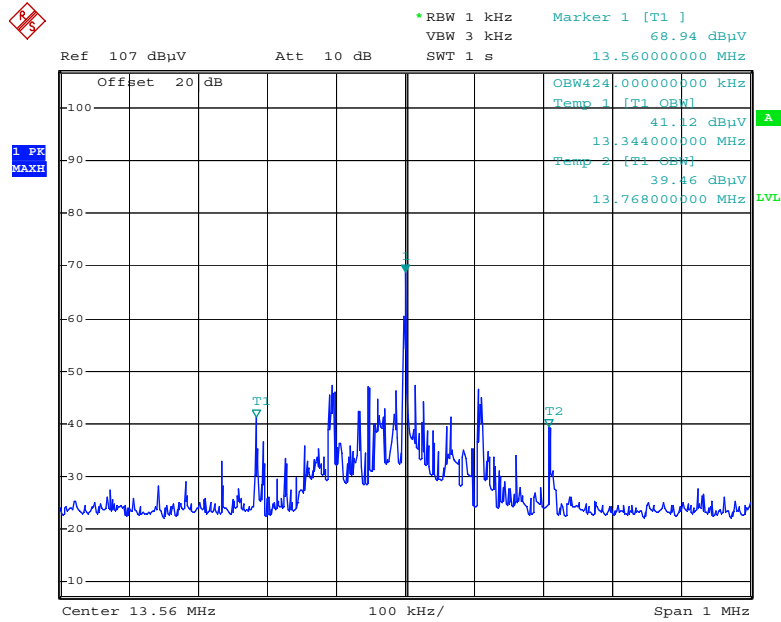


## 8.1 Occupied Bandwidth

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:	Bandwidth Measurements (6.1)	

Comment:	
Date of test:	January 28, 2010
Test site:	Fully anechoic room, cabin no. 2

**Occupied Bandwidth (99 %):**



Date: 28.JAN.2010 09:52:03

Occupied Bandwidth (99 %): **424 kHz**

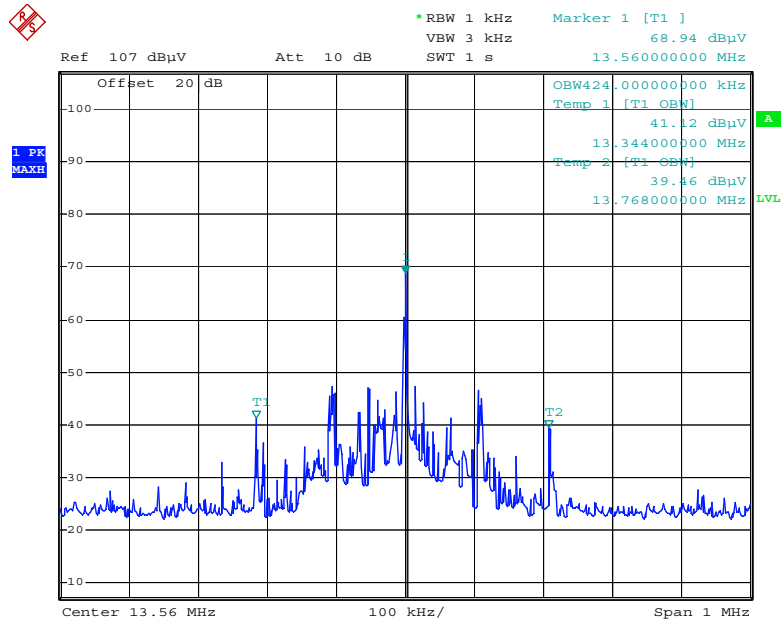


## Occupied Bandwidth (continued)

Rules and specifications:	IC RSS-Gen Issue 2, section 4.6.1
Guide:	IC RSS-Gen Issue 2, section 4.6.1
Description:	<p>If not specified in the applicable RSS the occupied bandwidth is measured as the 99% emission bandwidth.</p> <p>The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.</p> <p>The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is also recorded. The span between the two recorded frequencies is the occupied bandwidth.</p>
Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	January 28, 2010
Test site:	Fully anechoic room, cabin no. 2

**Occupied Bandwidth (99 %):**



Date: 28.JAN.2010 09:52:03

Occupied Bandwidth (99 %): **424 kHz**

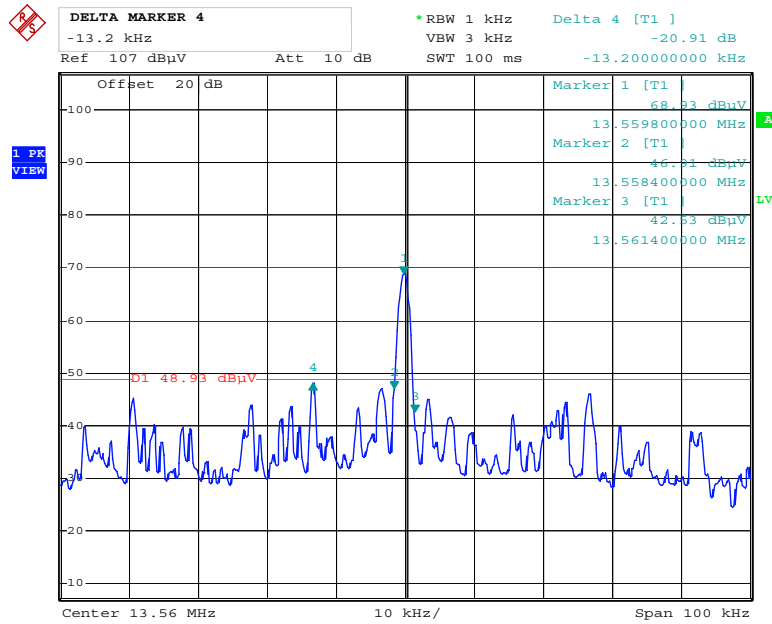




## 8.2 Bandwidth of the Emission

Rules and specifications:	CFR 47 Part 15, section 15.215(c)	
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 (6.1)	

Comment:	
Date of test:	January 28, 2010
Test site:	Fully anechoic room, cabin no. 2



Date: 28.JAN.2010 09:53:43

Permitted frequency band:	<b>13.56 MHz</b>	
20 dB bandwidth:	<b>3 kHz</b>	
Carrier frequency stability:	<input checked="" type="checkbox"/> <b>specified</b>	<input type="checkbox"/> <b>not specified</b>
Maximum frequency tolerances:	<b>+7 Hz -138 Hz</b>	
Bandwidth of the emission:	<b>3.15 kHz</b>	<b>within permitted frequency band<sup>8</sup>:</b> <input checked="" type="checkbox"/> <b>yes</b> <input type="checkbox"/> <b>no</b>

Test Result:	<b>Test passed</b>
--------------	--------------------

<sup>8</sup> If a frequency stability is not specified, it is recommended that the fundamental emission is kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

### 8.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202 IC RSS-Gen Issue 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 = 1.57 kHz
K = Overall numerical factor	K = 1
Calculation:	$B_n = 2 \cdot (1.57 \text{ kHz}) \cdot 1 = 3.14 \text{ kHz}$

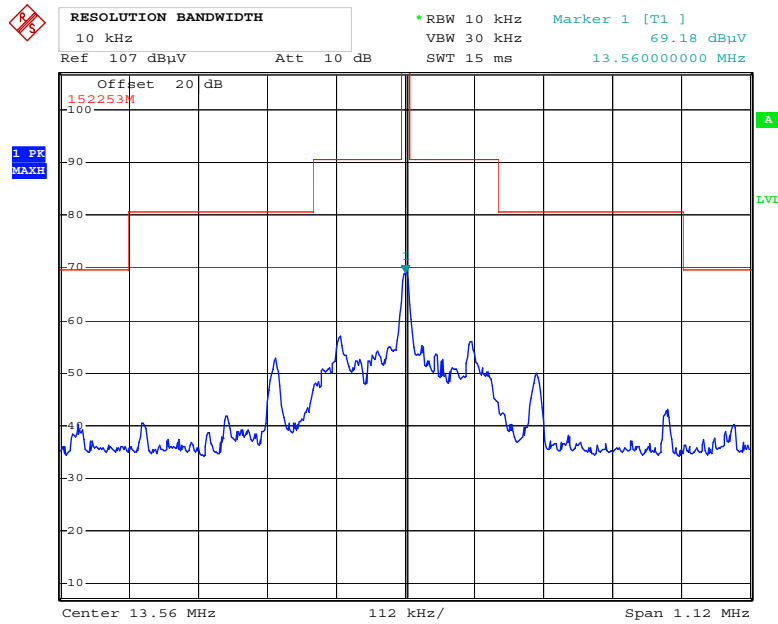
Designation of Emissions:	<b>3K14A1D</b>
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## 8.4 Spectrum Mask

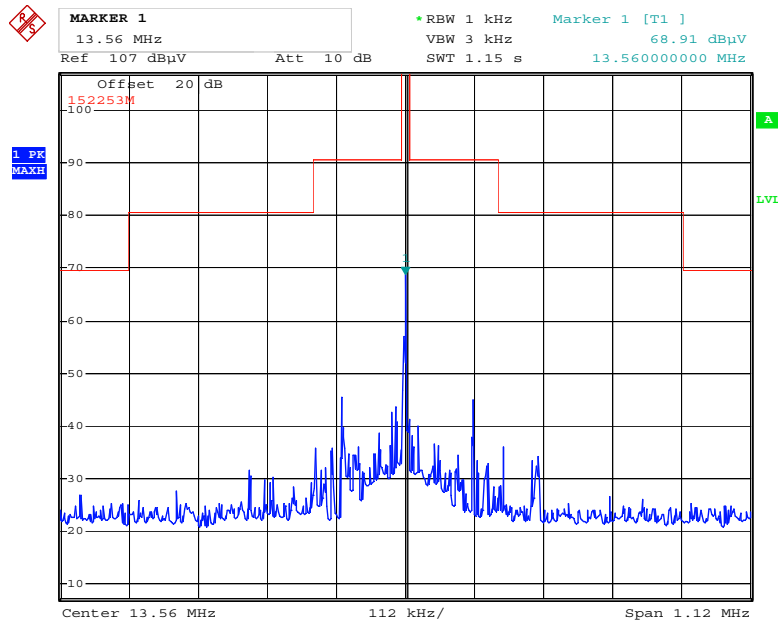
Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d) IC RSS-210 Issue 7, section A2.6			
Guide:	ANSI C63.4			
Description:	Compliance with the spectrum mask is tested using a spectrum analyzer with resolution bandwidth set to a 1 kHz for the band 13.553 to 13.567 MHz and to 10 kHz outside this band. The video bandwidth shall be at least three times greater than the resolution bandwidth.			
Limit:	Frequency of Emission (MHz)	Field Strength ( $\mu\text{V}/\text{m}$ )	Field Strength ( $\text{dB}\mu\text{V}/\text{m}$ )	Measurement Distance d (meters)
	1.705 - 13.110	30	29.5	30
	13.110 - 13.410	106	40.5	30
	13.410 - 13.553	334	50.5	30
	13.553 - 13.567	15848	84.0	30
	13.567 - 13.710	334	50.5	30
	13.710 - 14.010	106	40.5	30
	14.010 - 30.000	30	29.5	30
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.2)			

Comment:	
Date of test:	January 28, 2010
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters
Extrapolation Factor:	40 dB/decade

Test Result:	Test passed
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Date: 28.JAN.2010 09:50:02



Date: 28.JAN.2010 09:48:12



## 8.5 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 ( $\mu\text{V}/\text{m}$ )	Field Strength ( $\text{dB}\mu\text{V}/\text{m}$ )	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 (6.2)			

Comment:	
Date of test:	January 29, 2010
Test site:	Open field test site

Test Result:	Test passed
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Extrapolation factor: -40 dB/decade										
Frequency (MHz)	Detector	Distance		Reading Value (dBµV)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
		d1 (m)	d (m)							
13.56000	Quasi-Peak	10	30	41.5	20.0	-19.1		42.4	84.0	<b>41.6</b>

**Sample calculation of final values:**

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

$$\text{Final Value (dBµV/m)} = \text{Reading Value } d_1 \text{ (dBµV)} + \text{Correction Factor (dB/m)} \\ + \text{Extrapolation Factor (dB)} + \text{Pulse Train Correction (dB)}$$

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

## 8.6 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:	Radiated Emission in Fully or Semi Anechoic Room (6.3)		

Comment:	
Date of test:	February 24, 2010
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)
162.720	horizontal	Quasi-Peak	27.7	10.1		37.8	43.5	5.7
189.840	horizontal	Quasi-Peak	26.3	11.9		38.2	43.5	5.3
298.320	horizontal	Quasi-Peak	28.7	14.8		43.5	46.0	2.5
325.440	horizontal	Quasi-Peak	28.2	15.3		43.5	46.0	2.5
433.920	vertical	Quasi-Peak	23.4	17.7		41.1	46.0	4.9
881.400	horizontal	Quasi-Peak	20.1	24.1		44.2	46.0	<b>1.8</b>
894.960	horizontal	Quasi-Peak	16.8	24.4		41.2	46.0	4.8
908.520	horizontal	Quasi-Peak	19.0	24.5		43.5	46.0	2.5
922.080	horizontal	Quasi-Peak	17.0	24.6		41.6	46.0	4.4
935.640	horizontal	Quasi-Peak	15.9	24.6		40.5	46.0	5.5

### Sample calculation of final values:

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



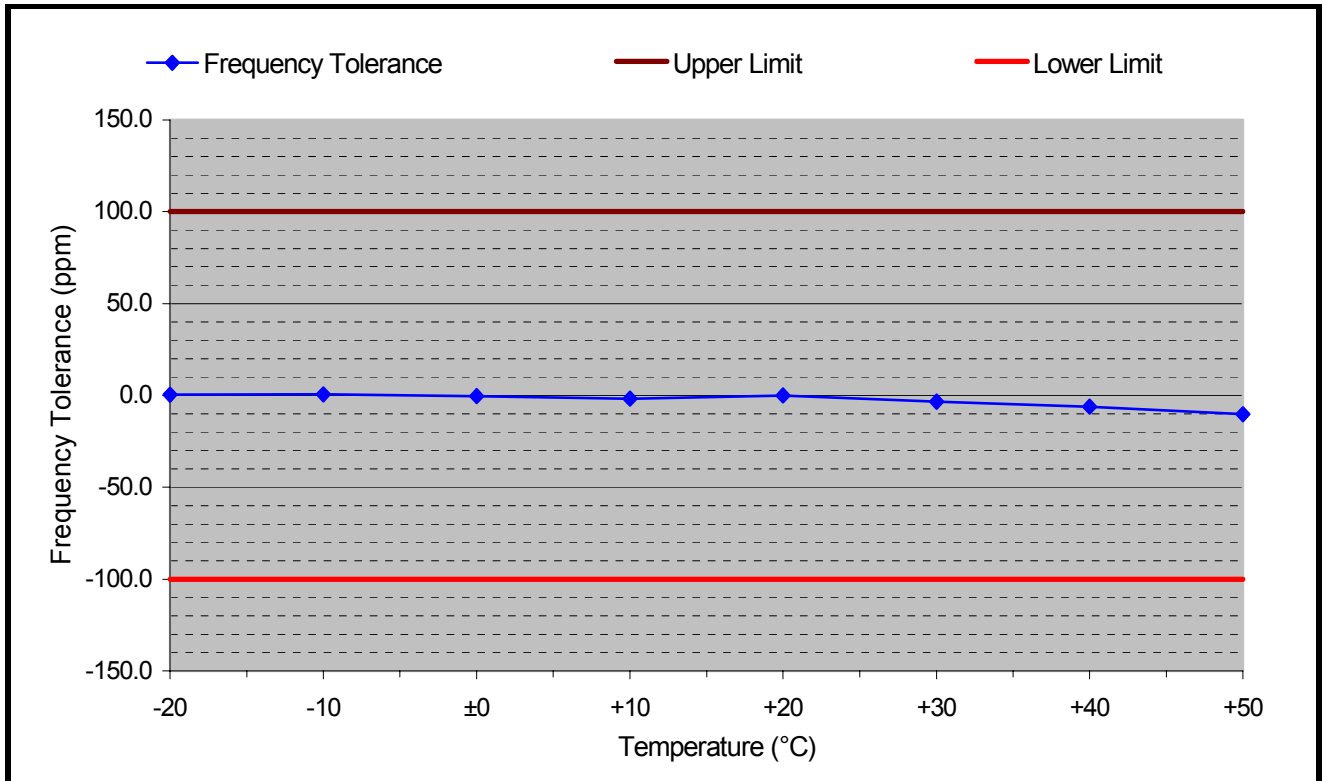


## 8.7 Carrier Frequency Stability

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 $\pm 0.01\%$ ( $\pm 100$ ppm) of the carrier frequency under nominal conditions.
Temperature range:	-20°C to +50°C (at normal supply voltage)
Voltage range:	85% to 115% of the rated supply voltage (at a temperature of +20°C)
Measurement procedure:	Carrier Frequency Stability (6.4)

Comment:	
Date of test:	January 28, 2010

### 8.7.1 Carrier Frequency Stability vs. Temperature

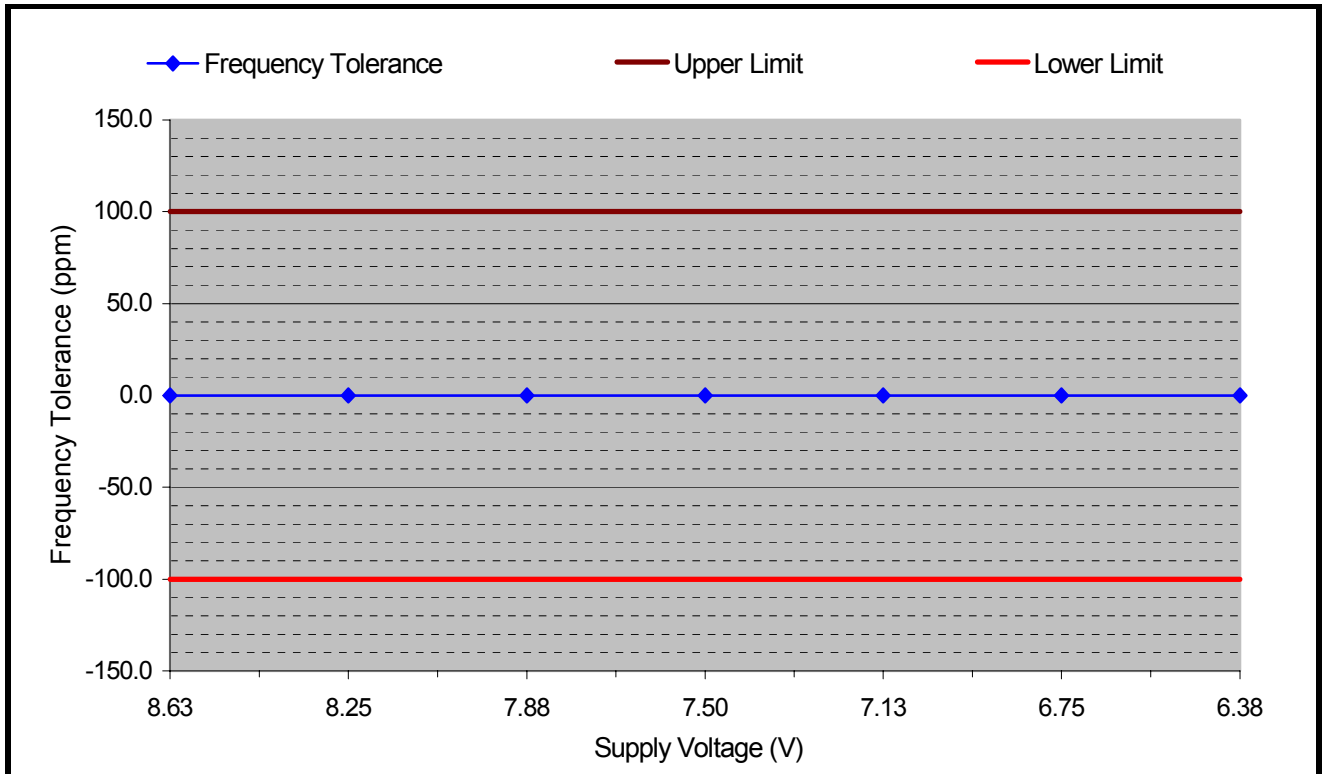


Supply voltage: 7.5 V      Nominal frequency: 13.559862 MHz

Temperature (°C)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
-20	13.559868	6	0.4	+100.0	-100.0	99.6
-10	13.559869	7	0.5	+100.0	-100.0	99.5
±0	13.559858	-4	-0.3	+100.0	-100.0	99.7
+10	13.559838	-24	-1.8	+100.0	-100.0	98.2
+20	13.559862	0	0.0	+100.0	-100.0	100.0
+30	13.559815	-47	-3.5	+100.0	-100.0	96.5
+40	13.559778	-84	-6.2	+100.0	-100.0	93.8
+50	13.559724	-138	-10.2	+100.0	-100.0	<b>89.8</b>

Test Result: Test passed

### 8.7.2 Carrier Frequency Stability vs. Supply Voltage



Temperature: +20 °C      Battery End Point: Not applicable  
 Nominal frequency: 13.559778 MHz

Supply Voltage (V)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
8.63	13.559778	0	0.0	+100.0	-100.0	<b>100.0</b>
8.25	13.559778	0	0.0	+100.0	-100.0	<b>100.0</b>
7.88	13.559778	0	0.0	+100.0	-100.0	<b>100.0</b>
7.50	13.559778	0	0.0	+100.0	-100.0	<b>100.0</b>
7.13	13.559778	0	0.0	+100.0	-100.0	<b>100.0</b>
6.75	13.559778	0	0.0	+100.0	-100.0	<b>100.0</b>
6.38	13.559778	0	0.0	+100.0	-100.0	<b>100.0</b>

Test Result: Test passed



## 8.8 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
<b>The antenna is</b>				
<input type="checkbox"/> detachable				
<p>The conducted output power (CP in watts) is measured at the antenna connector:</p> $CP = \dots\dots\dots \mathbf{W}$ <p>The effective isotropic radiated power (EIRP in watts) is calculated using</p> <p><input type="checkbox"/> the numerical antenna gain: <math>G = \dots\dots\dots</math></p> $EIRP = G \cdot CP \Rightarrow EIRP = \dots\dots\dots \mathbf{W}$ <p><input type="checkbox"/> the field strength<sup>9</sup> in V/m: <math>FS = \dots\dots\dots \mathbf{V/m}</math></p> $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = \dots\dots\dots \mathbf{W}$ <p>with:</p> <p>Distance between the antennas in m: <math>D = \dots\dots\dots \mathbf{m}</math></p>				
<input checked="" type="checkbox"/> not detachable				
<p>A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by<sup>9</sup>:</p> $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = \mathbf{2.484 \cdot 10^{-6} W}$ <p>with:</p> <p>Field strength in V/m: <math>FS = \mathbf{2.877 \cdot 10^{-3} V/m}</math></p> <p>Distance between the two antennas in m: <math>D = \mathbf{3 m}</math></p>				
<b>Selection of output power</b>				
<p>The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.):</p> $TP = \mathbf{2.484 \cdot 10^{-6} W}$				

<sup>9</sup> The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses. If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.



Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
<b>Separation distance between the user and the transmitting device is</b>				
<input type="checkbox"/> less than or equal to 20 cm		<input checked="" type="checkbox"/>		
<input checked="" type="checkbox"/> greater than 20 cm				
<b>Transmitting device is</b>				
<input type="checkbox"/> in the vicinity of the human head		<input checked="" type="checkbox"/>		
<input type="checkbox"/> body-worn				
<b>SAR evaluation</b>				
SAR evaluation is required if the separation distance between the user and the device is less than or equal to 20 cm.				
<input type="checkbox"/> 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.				<input type="checkbox"/>
<input type="checkbox"/> 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.				<input type="checkbox"/>
<input type="checkbox"/> 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.				<input type="checkbox"/>
<input type="checkbox"/> 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.				<input type="checkbox"/>
<input type="checkbox"/> SAR evaluation is documented in test report no. ....				
<b>RF exposure evaluation</b>				
RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm.				
<input checked="" type="checkbox"/> The device operates below 1.5 GHz and its e.i.r.p. is equal to or less than 2.5 W.				<input checked="" type="checkbox"/>
<input type="checkbox"/> 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.				<input type="checkbox"/>
<input type="checkbox"/> RF exposure evaluation is documented in test report no. ....				

## 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, 2008
<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, 2008
<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 checked="" type="checkbox"/>	RSS-Gen	Radio Standards Specification RSS-Gen Issue 2 containing General Requirements and Information for the Certification of Radiocommunication Equipment, published by Industry Canada	June 2007
<input checked="" type="checkbox"/>	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
<input type="checkbox"/>	RSS-310	Radio Standards Specification RSS-310 Issue 2 for Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment, published by Industry Canada	June 2007
<input checked="" type="checkbox"/>	RSS-102	Radio Standards Specification RSS-102 Issue 3: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) , published by Industry Canada	June 2009
<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



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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

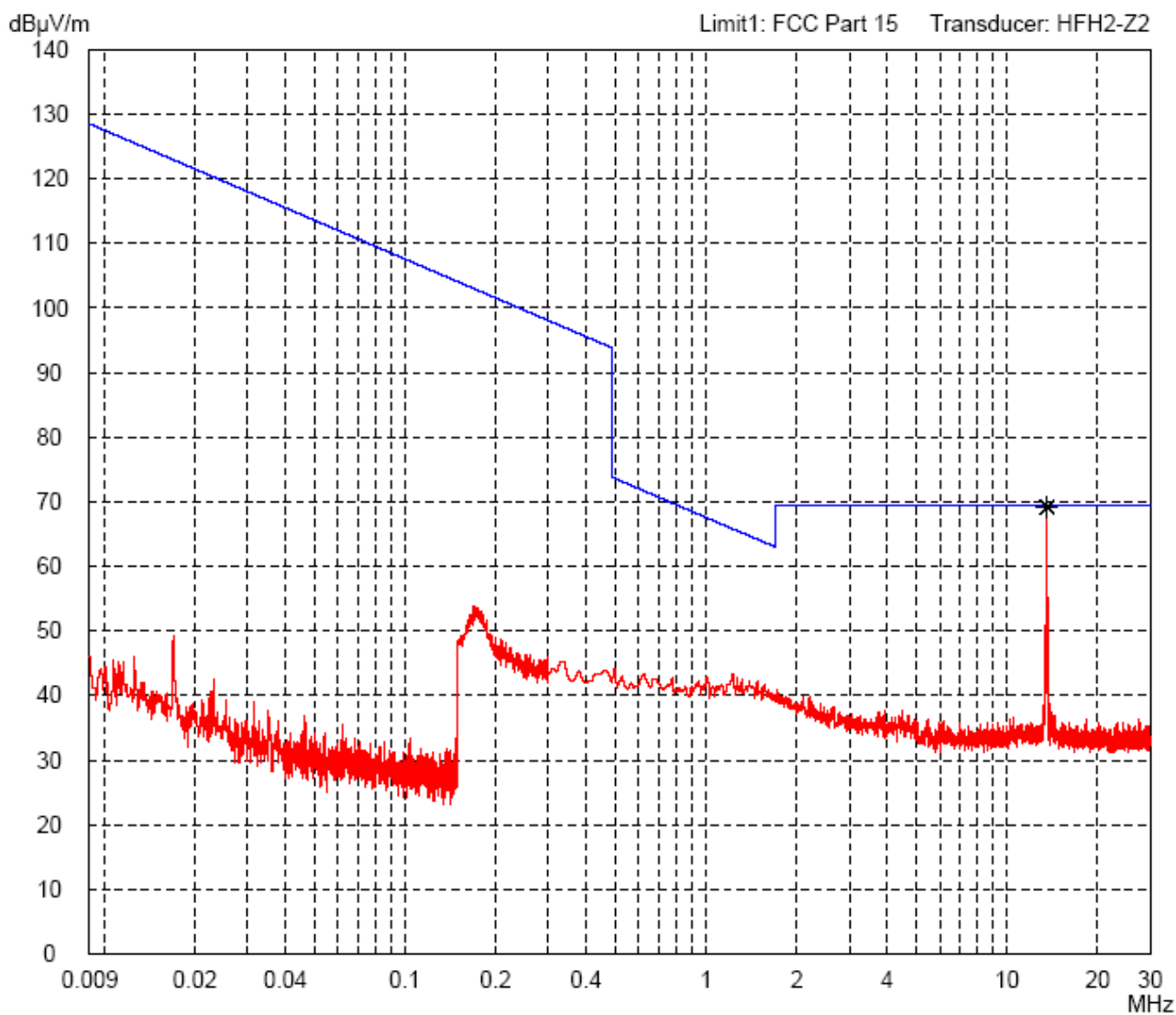


## 10 Revision History

Revision History			
<i>Edition</i>	<i>Date</i>	<i>Issued by</i>	<i>Modifications</i>
1	25.02.10	M. Steindl (cj)	First Edition



## 11 Charts taken during testing



K8 CISPR 16-2-3 Electric Field Strength 30MHz-1GHz (3m)

