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January 11, 2011

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Prüfbericht / Test Report

Nr. / No. 69559-03130-1 (Edition 3)

Applicant: Magneti Marelli
Type of equipment: RFID Reader for Vehicular Environment
Type designation: Car2Go
Order No.: 10/0337
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 3, Sections 7.2.2, 7.2.4, 7.2.5 and
RSS-210 Issue 8, Section A2.6 (Category I Equipment)

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1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation ¹ :	Car2Go
Parts ² :	
Serial number(s):	Test Sample
Manufacturer:	Magneti Marelli
Type of equipment:	RFID Reader for Vehicular Environment
Version:	With modifications according to documentation of applicant of November 15, 2010.
FCC ID:	
Additional parts/accessories:	External antennas

Technical data of EUT	
Application frequency range:	13.110 - 14.010 MHz
Frequency range:	13.56 MHz
Operating frequency:	13.56 MHz
Type of modulation:	ASK
Pulse train:	---
Pulse width:	---
Number of RF-channels ³ :	1
Channel spacing:	---
Designation of emissions ⁴ :	10K0A1D
Type of antenna:	Integrated
Size/length of antenna:	Antenna 1: 13 x 8 cm Antenna 2: 9.7 x 4.2 cm
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: 12.0 V

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 This test report covers the frequency of 13.56 MHz only. For details of the frequency 125 kHz see TÜV SÜD SENTON test report No. 69559-03130-2

⁴ Also known as "Class of Emission".

2 Administrative Data

Application details

Applicant (full address):	Magneti Marelli
Contact person:	Mr. Nicola Scartapacchio of Fakt S.r.l.
Order number:	10/0337
Receipt of EUT:	November 15, 2010
Date(s) of test:	November 15, 2010– December 1, 2010
Note(s):	Mr. Scartapacchio representing the applicant attended testings on November 15, 2010

Report details

Report number:	69559-03130-1
Edition:	3
Issue date:	January 11, 2011

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-2
Contact person:	Mr. Johann Roidt
	Phone: +49 9421 5522-0 Fax: +49 9421 5522-99

4 Summary

Summary of test results

The tested sample complies with the requirements set forth in the
Code of Federal Regulations CFR 47, Part 15, Sections 15.205, 15.215 and 15.225
of the Federal Communication Commission (FCC) and the
Radio Standards Specifications
RSS Gen-Issue 3, Sections 7.2.2 and 7.2.5
RSS-210 Issue 8, Sections 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 operated with continuous carrier at 13.56 MHz operating separately on antenna 1 and antenna 2. The EUT was cooled with compressed air during tests.

Configuration(s) of EUT

The EUT was operated as stand alone device. For configuration purposes the Bluetooth device with the external antennas was operated with a special test software. For tests the Bluetooth device was not operated, but its external antennas were connected.

List of ports and cables

Port	Description	Classification ⁵	Cable type	Cable length
1	Wiring harness with ferrites	dc power signal/control port	Unshielded	2 m
2	RF cable	signal/control port	Shielded	2 m

List of devices connected to EUT

Item	Description	Type Designation	Serial no. or ID	Manufacturer
1	External antennas of "Bluetooth QD"	Car2Go	FYF00C980	Magneti Marelli

List of support devices

Item	Description	Type Designation	Serial no. or ID	Manufacturer
1	Bluetooth QD	Car2Go	FYF00C980	Magneti Marelli

⁵ Ports shall be classified as ac power, dc power or signal/control port

6 Measurement Procedures

6.1 Bandwidth Measurements

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 2, section 2.202(a) CFR 47 Part 15, section 15.215(c) IC RSS-Gen Issue 3, sections 4.6.1 and 4.6.2 ANSI C63.4, annex H.6
Guide:	ANSI C63.4 / IC RSS-Gen Issue 3, sections 4.6.1 and 4.6.2
Measurement setup:	<input type="checkbox"/> Conducted: See below <input checked="" type="checkbox"/> Radiated: Radiated Emission Measurement 9 kHz to 30 MHz (6.2)
<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-Gen Issue 3, sections 7.2.2, 7.2.5
 IC RSS-210 Issue 8, section 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.

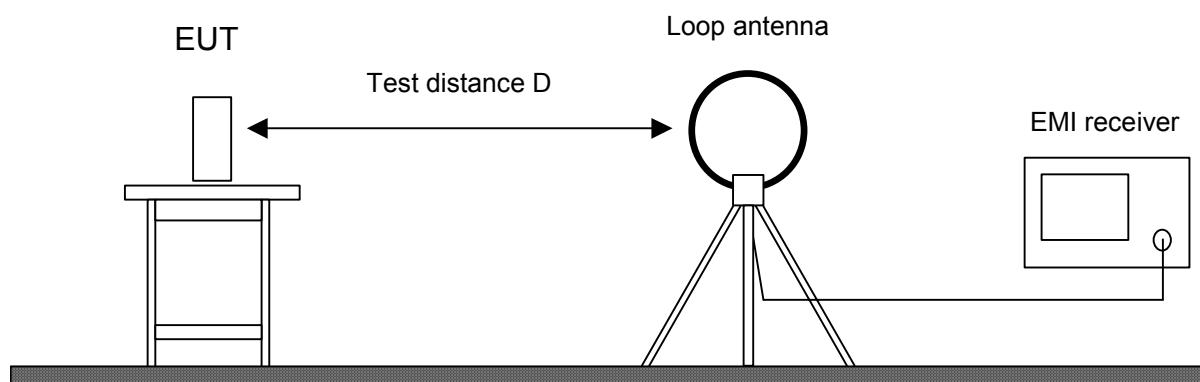
Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

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.

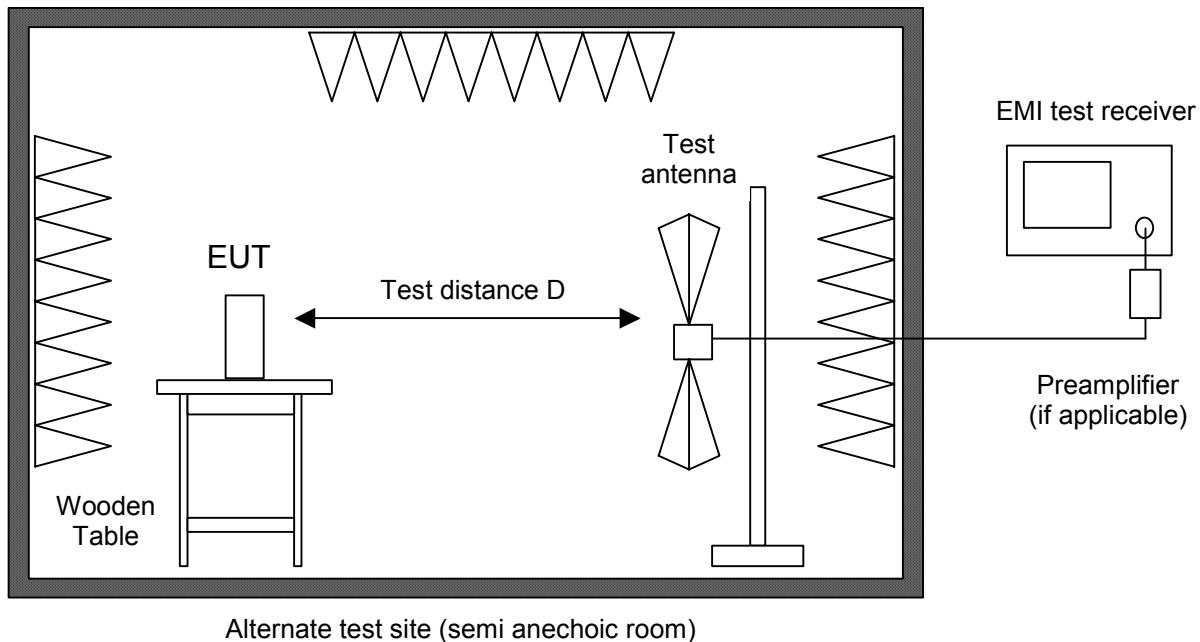


Test instruments used:

Type	Designation	Inv.-no.	Serial No. or ID	Manufacturer
<input type="checkbox"/> Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
<input type="checkbox"/> EMI test receiver	ESMI	1569	839379/013 839587/006	Rohde & Schwarz
<input checked="" type="checkbox"/> EMI test receiver	ESU8	2044	100232	Rohde & Schwarz
<input type="checkbox"/> Test receiver	ESHS 10	1028	860043/016	Rohde & Schwarz
<input type="checkbox"/> Preamplifier	Cabin no. 2	CPA9231A	1651	Schaffner
<input checked="" type="checkbox"/> Loop antenna		HFH2-Z2	1016	Rohde & Schwarz
<input type="checkbox"/> Fully anechoic room	No. 2	1452	---	Albatross
<input type="checkbox"/> Semi anechoic room	No. 3	1453	---	Siemens
<input checked="" type="checkbox"/> Semi anechoic room	No. 8	2057	---	Albatross

6.3 Radiated Emission at Alternative Test Site

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-Gen Issue 3, section 7.2.2, 7.2.5 IC RSS-210 Issue 8, section A2.6
Guide:	ANSI C63.4
<p>Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.</p> <p>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.</p> <p>Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.</p> <p>If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.</p> <p>Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.</p> <p>With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.</p> <p>Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.</p> <p>In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is discharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission.</p> <p>Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.</p> <p>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.</p>	



Test instruments used:

Type	Designation	Inv.-no.	Serial No. or ID	Manufacturer
<input checked="" type="checkbox"/> EMI test receiver	ESU8	2044	100232	Rohde & Schwarz
<input checked="" type="checkbox"/> Trilog antenna Cabin no. 8	VULB 9163	1802	9163-214	Schwarzbeck
<input checked="" type="checkbox"/> Semi anechoic room	No. 8	2057	---	Albatross

6.4 Carrier Frequency Stability

Measurement Procedure:

Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-Gen Issue 3, section 4.7 and IC RSS-210 Issue 8, 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.

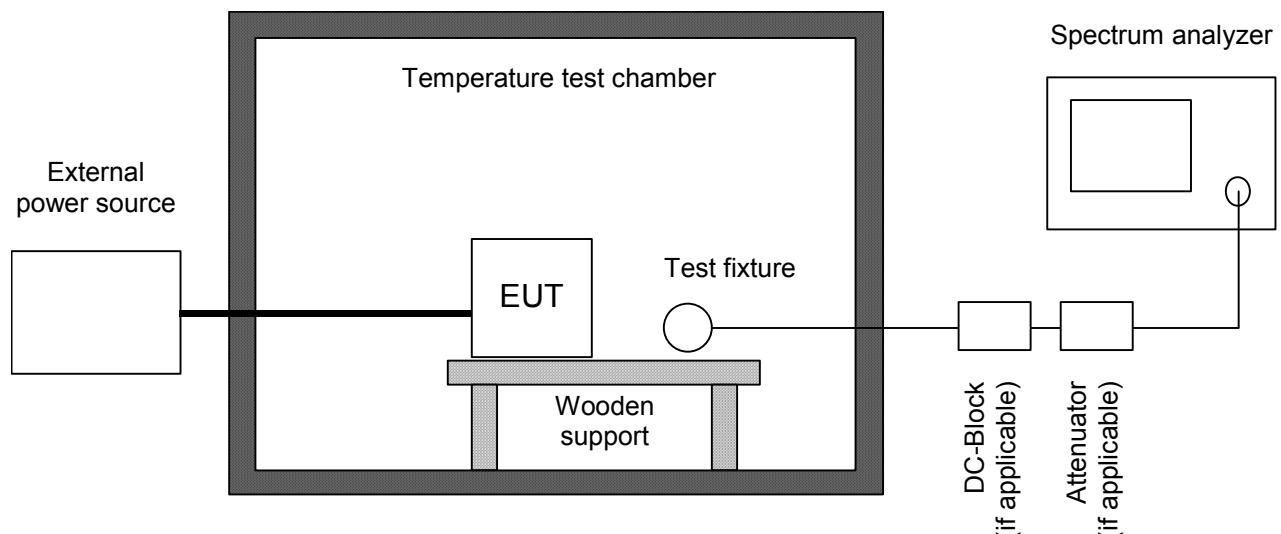
If the EUT provides an antenna connector the spectrum analyzer is connected to this port. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). In cases where the EUT does not provide an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

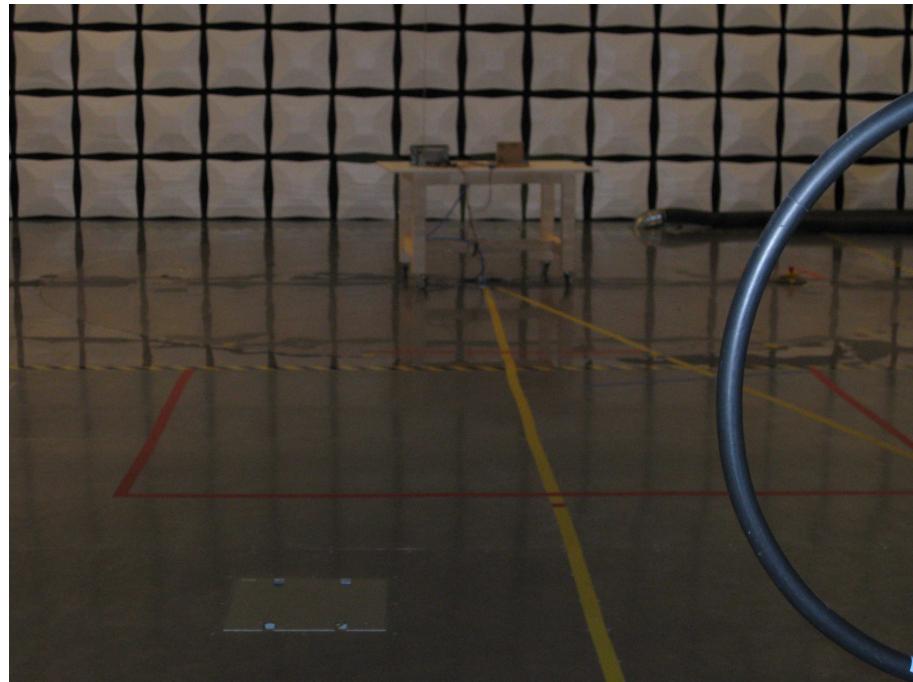


Test instruments used:

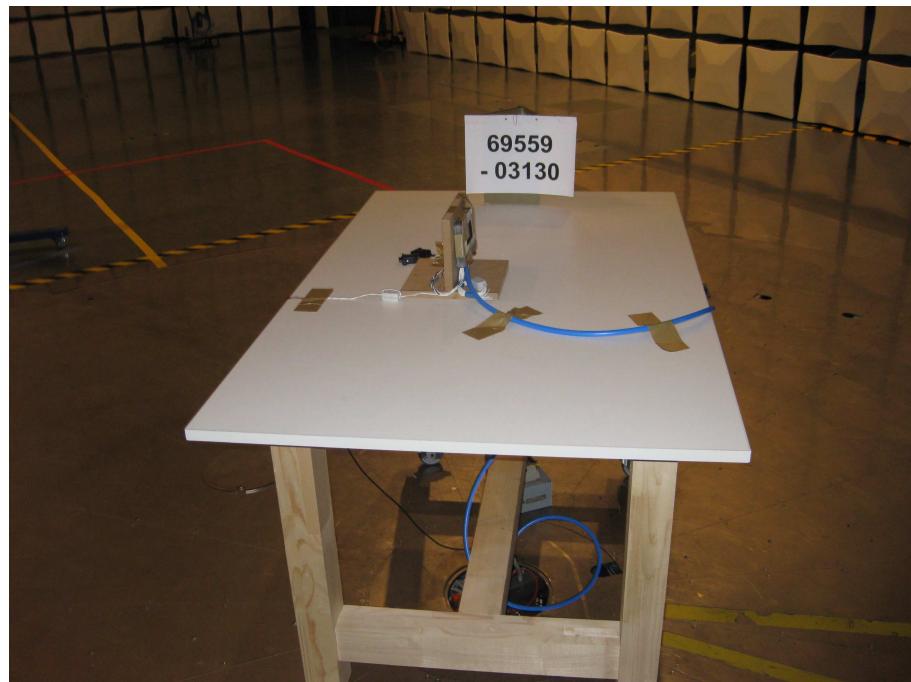
Type	Designation	Inv.-no.	Serial No. or ID	Manufacturer
<input type="checkbox"/> Spectrum analyzer	FSP30	1666	100036	Rohde & Schwarz
<input checked="" type="checkbox"/> EMI test receiver	ESPI7	1711	836914/0002	Rohde & Schwarz
<input type="checkbox"/> EMI test receiver	ESMI	1569	839379/013 839587/006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

7 Photographs Taken During Testing

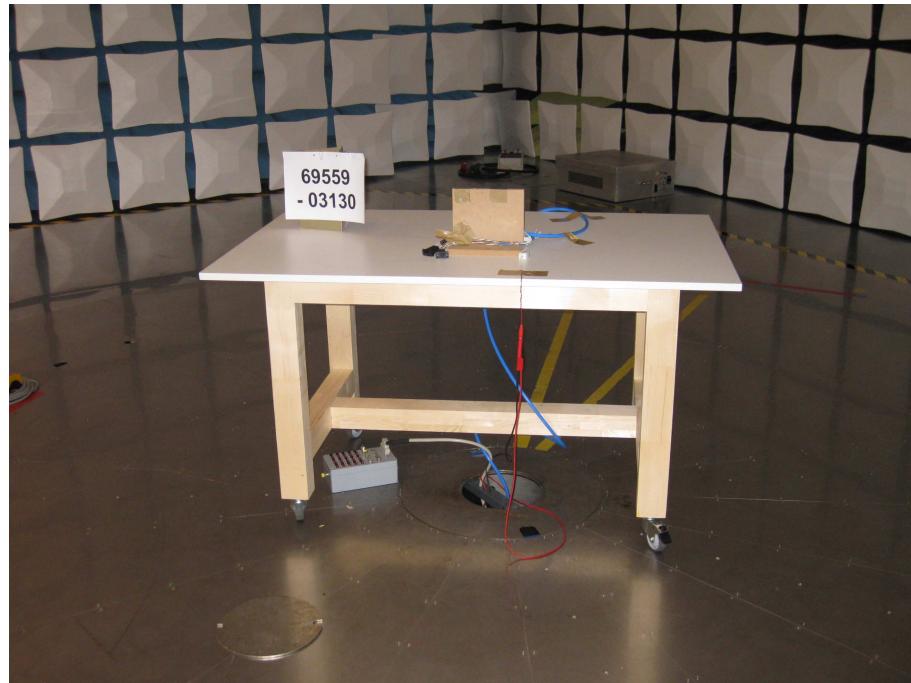
Test setup for radiated emission measurement 9 kHz – 30 MHz



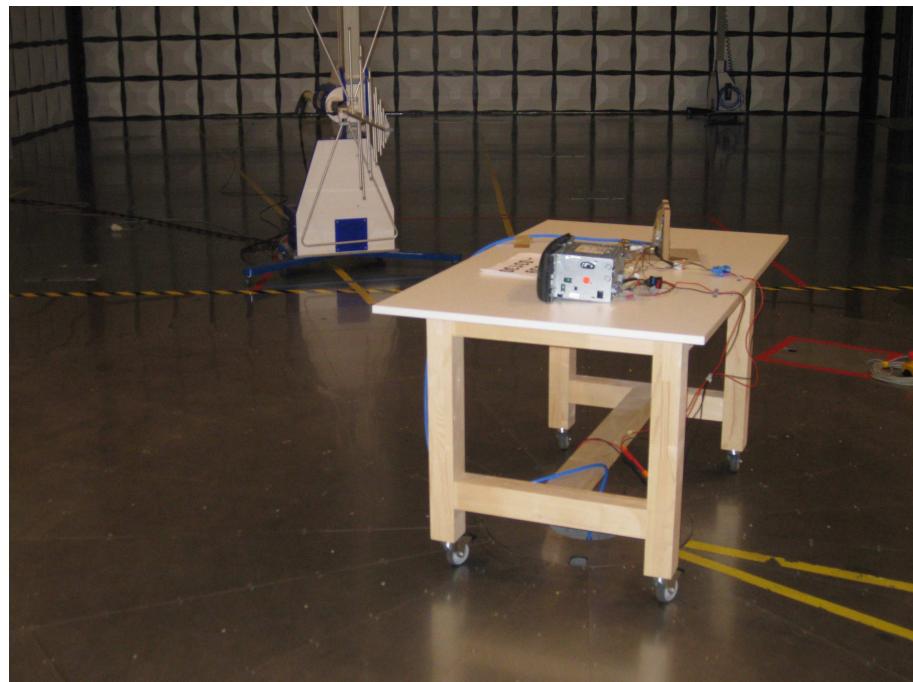
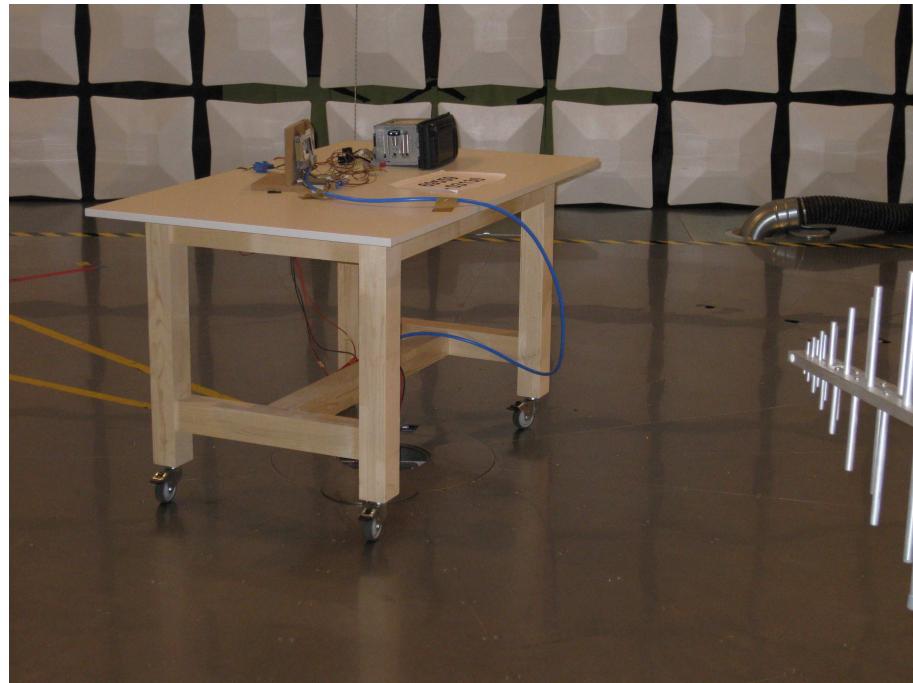
Test setup for radiated emission measurement (alternate test site)



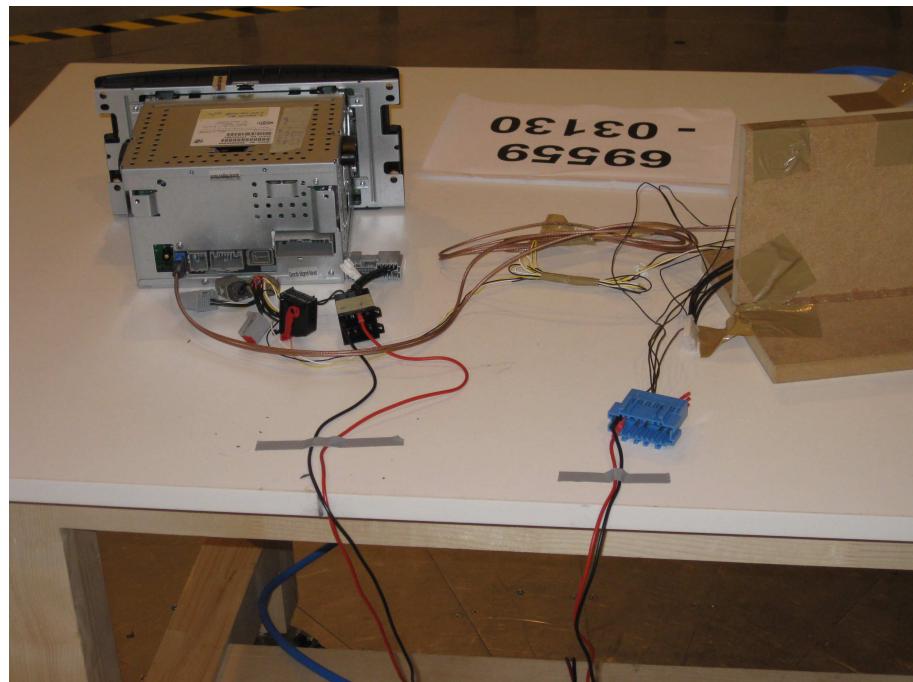
**Test setup for radiated emission measurement
(alternate test site) - continued -**



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



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



8 Test Results

FCC CFR 47 Parts 2 and 15			
<i>Section(s)</i>	<i>Test</i>	<i>Page</i>	<i>Result</i>
2.1046(a)	Conducted output power	---	Not applicable
2.202(a)	Occupied bandwidth	23	Recorded
15.215(c)	Bandwidth of the emission	29	Not applicable
2.201, 2.202	Class of emission	34	Calculated
15.35(c)	Pulse train measurement for pulsed operation	---	Not applicable
15.205(a) 15.205(d)(7)	Restricted bands of operation	--- ⁶	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	---	Not applicable
15.225(a)-(d)	Spectrum Mask	35	Test passed
15.205(b) 15.215(b) 15.225(a)(d)	Radiated emission 9 kHz to 30 MHz	38	Test passed
15.205(b) 15.225(d)	Radiated emission 30 MHz to 1 GHz	41	Test passed
15.225(e)	Carrier frequency stability	44	Test passed

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

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<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	23	Recorded
3.2(h), 8	Designation of emissions	34	Calculated
4.5	Pulsed operation	---	Not applicable
7.2.2	Restricted bands and unwanted emission frequencies	--- ⁷	Test passed
7.2.4	Transmitter AC power lines conducted emissions 150 kHz to 30 MHz	---	Not applicable
7.2.5	Unwanted emissions 9 kHz to 30 MHz	38	Test passed
7.2.5	Unwanted emissions 30 MHz to 1 GHz	41	Test passed
5.5	Exposure of Humans to RF Fields	47	Exempted from SAR and RF evaluation

IC RSS-210 Issue 8

<i>Section(s)</i>	<i>Test</i>	<i>Page</i>	<i>Result</i>
A2.6	Spectrum Mask	35	Test passed
A2.6	Unwanted emissions 9 kHz to 30 MHz	38	Test passed
A2.6	Unwanted emissions 30 MHz to 1 GHz	41	Test passed
A2.6	Carrier frequency stability	44	Test passed

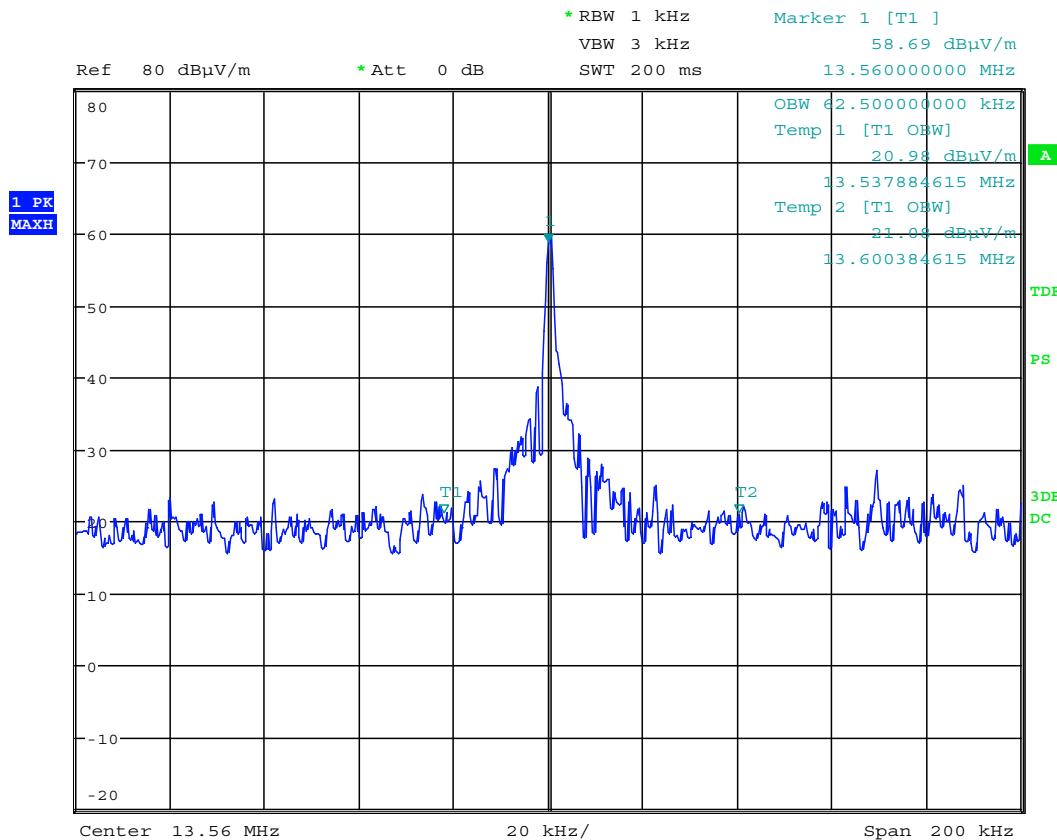
⁷ See "Spectrum Mask" and "Unwanted emissions".

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:	<p>The occupied bandwidth according to CFR 47 Part 2, section 2.202(a), is measured as the 99% emission bandwidth, i.e. below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.</p> <p>The occupied bandwidth according to ANSI C63.4, annex H.6; is measured as the frequency range defined by the points that are 26 dB down relative to the maximum level of the modulated carrier.</p> <p>The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:</p> <table border="1"><thead><tr><th>Fundamental frequency</th><th>Minimum resolution bandwidth</th></tr></thead><tbody><tr><td>9 kHz to 30 MHz</td><td>1 kHz</td></tr><tr><td>30 MHz to 1000 MHz</td><td>10 kHz</td></tr><tr><td>1000 MHz to 40 GHz</td><td>100 kHz</td></tr></tbody></table> <p>The video bandwidth shall be at least three times greater than the resolution bandwidth.</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
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								
Measurement procedure:	Bandwidth Measurements (6.1)								

Comment:	Transmitting on antenna 1
Date of test:	December 1, 2010
Test site:	Fully anechoic room, cabin no. 2

Occupied Bandwidth (99 %):

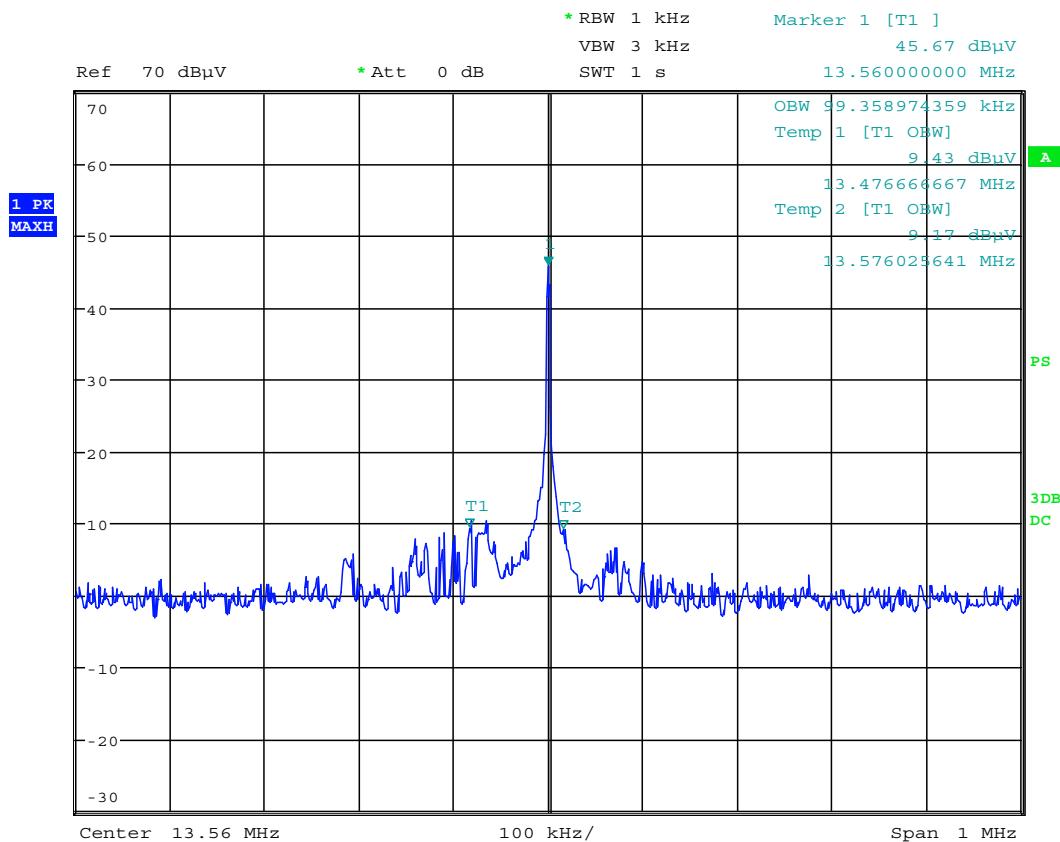


Date: 1.DEC.2010 16:36:33

Occupied Bandwidth (99 %):	62.5 kHz
----------------------------	----------

Comment: Transmitting on antenna 2
Date of test: December 1, 2010
Test site: Fully anechoic room, cabin no. 2

Occupied Bandwidth (99 %):



Date: 1.DEC.2010 16:29:42

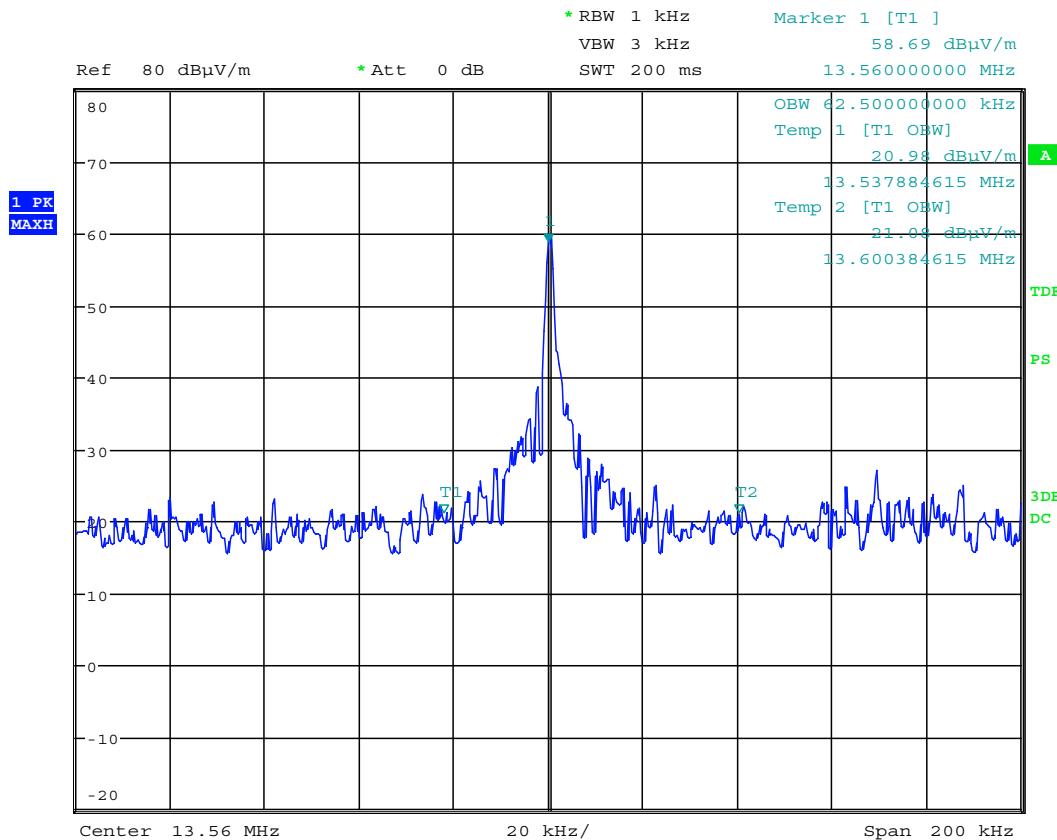
Occupied Bandwidth (99 %): **99.36 kHz**

Occupied Bandwidth (continued)

Rules and specifications:	IC RSS-Gen Issue 3, section 4.6.1
Guide:	IC RSS-Gen Issue 3, 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:	Transmitting on antenna 1
Date of test:	December 1, 2010
Test site:	Fully anechoic room, cabin no. 2

Occupied Bandwidth (99 %):

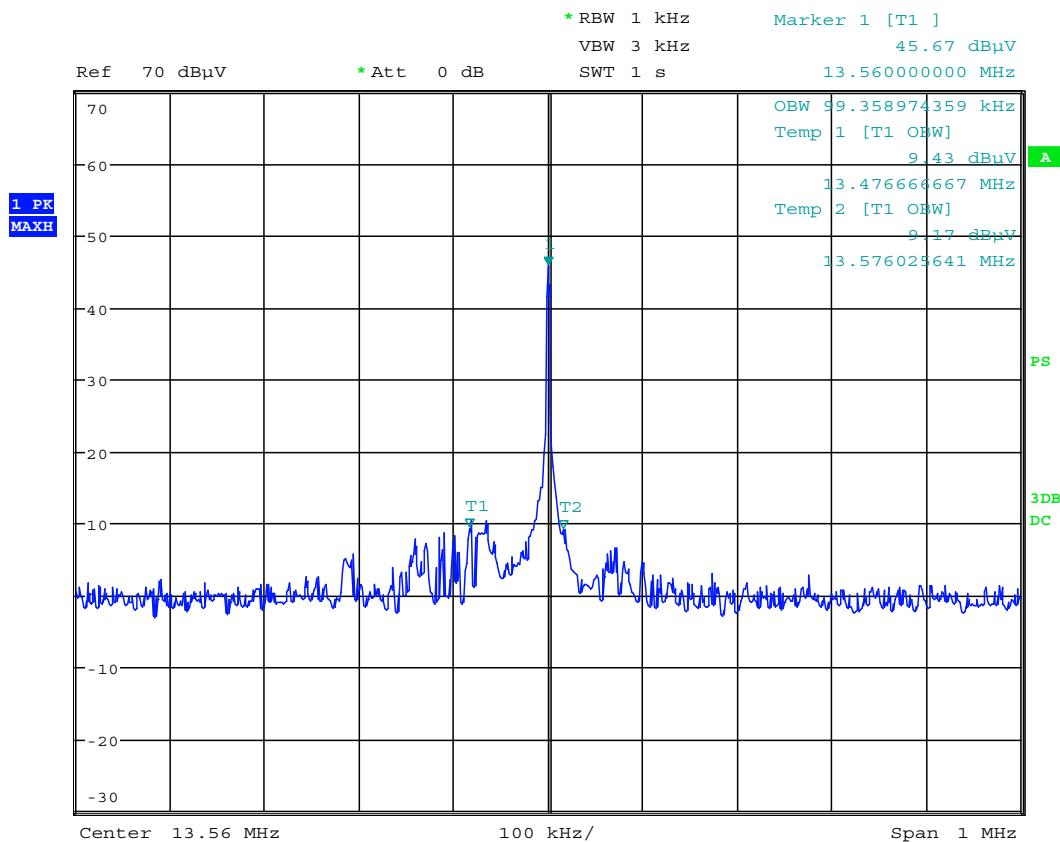


Date: 1.DEC.2010 16:36:33

Occupied Bandwidth (99 %):	62.5 kHz
----------------------------	----------

Comment:	Transmitting on antenna 2
Date of test:	December 1, 2010
Test site:	Fully anechoic room, cabin no. 2

Occupied Bandwidth (99 %):



Date: 1.DEC.2010 16:29:42

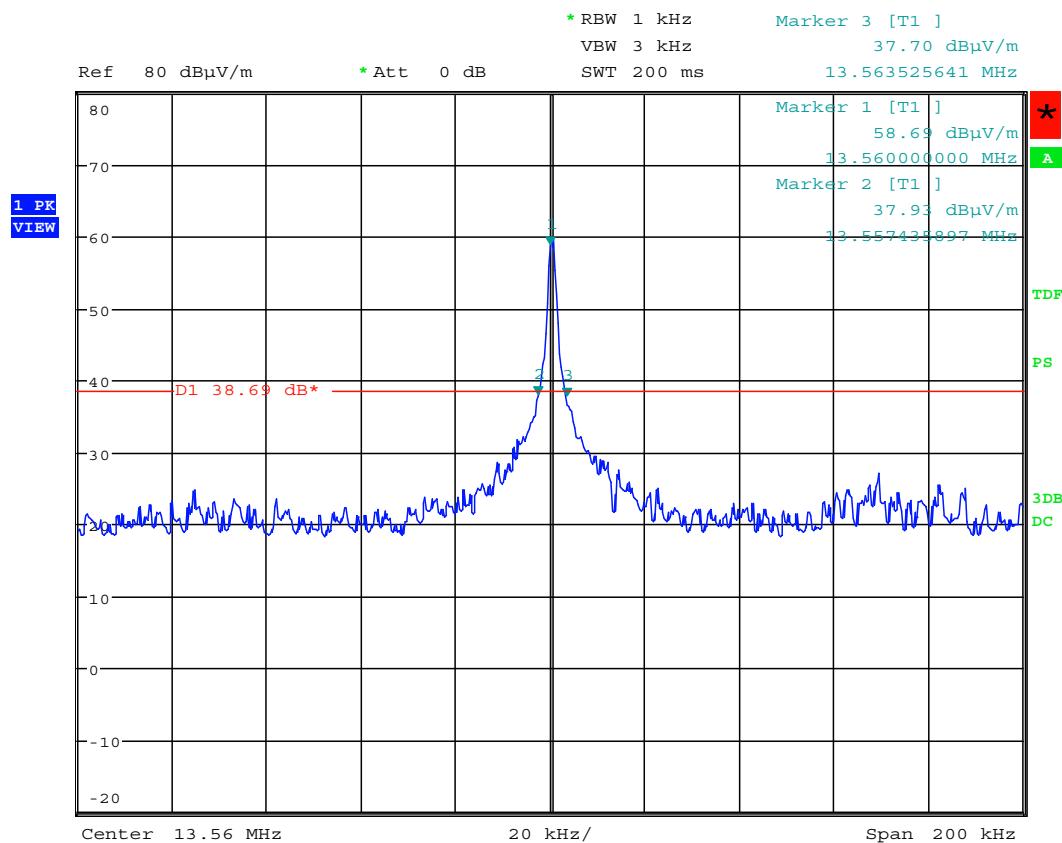
Occupied Bandwidth (99 %):	99.36 kHz
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8.2 Bandwidth of the Emission

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> <table border="1"><thead><tr><th>Fundamental frequency</th><th>Minimum resolution bandwidth</th></tr></thead><tbody><tr><td>9 kHz to 30 MHz</td><td>1 kHz</td></tr><tr><td>30 MHz to 1000 MHz</td><td>10 kHz</td></tr><tr><td>1000 MHz to 40 GHz</td><td>100 kHz</td></tr></tbody></table> <p>The video bandwidth shall be at least three times greater than the resolution bandwidth.</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
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								
Measurement procedure:	Bandwidth Measurements (6.1)								

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

Comment:	Transmitting on antenna 1
Date of test:	December 1, 2010
Test site:	Fully anechoic room, cabin no. 2



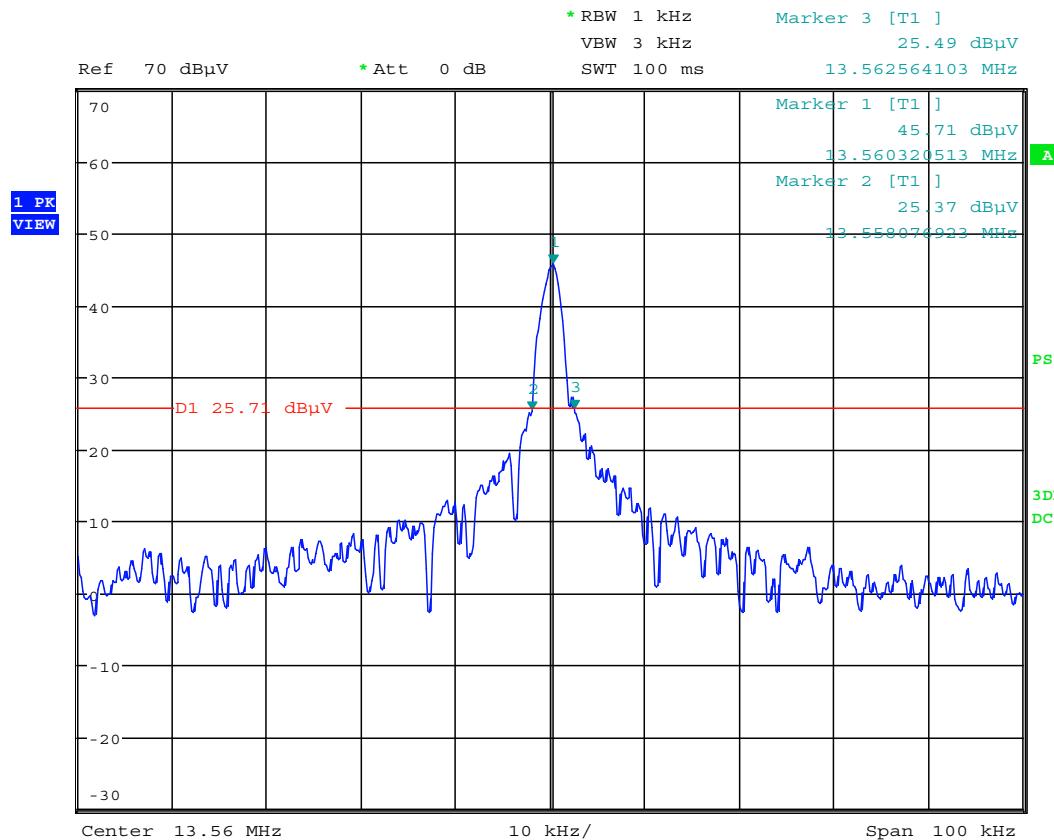
Date: 1.DEC.2010 16:37:13

Permitted frequency band:	13.110 - 14.010 MHz	
20 dB bandwidth:	6.09 kHz	
Carrier frequency stability:	<input checked="" type="checkbox"/> specified	<input type="checkbox"/> not specified
Maximum frequency tolerances:	+0.105 kHz -0.148 kHz	
Bandwidth of the emission:	6.34 kHz	within permitted frequency band⁸: <input checked="" type="checkbox"/> yes <input type="checkbox"/> no

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

⁸ 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.

Comment: Transmitting on antenna 2
Date of test: December 1, 2010
Test site: Fully anechoic room, cabin no. 2



Date: 1.DEC.2010 16:31:23

Permitted frequency band:	13.110 - 14.010 MHz	
20 dB bandwidth:	4.49 kHz	
Carrier frequency stability:	<input checked="" type="checkbox"/> specified	<input type="checkbox"/> not specified
Maximum frequency tolerances:	+.105 kHz - 0.148 kHz	
Bandwidth of the emission:	4.74 kHz	within permitted frequency band⁹: <input checked="" type="checkbox"/> yes <input type="checkbox"/> no

Test Result:	Test passed
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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.

8.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202 IC RSS-Gen Issue 3, sections 3.2(h) and 8
Guide:	ANSI C63.4 / TRC-43

Type of modulation:	Amplitude Modulation
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$B_n = \text{Necessary Bandwidth}$	$B_n = 2BK$
$B = \text{Modulation rate}$	$B = 5 \text{ kHz}$
$K = \text{Overall numerical factor}$	$K = 1$
Calculation:	$B_n = 2 \cdot (5 \text{ kHz}) \cdot 1 = 10 \text{ kHz}$

Designation of Emissions:	10K0A1D
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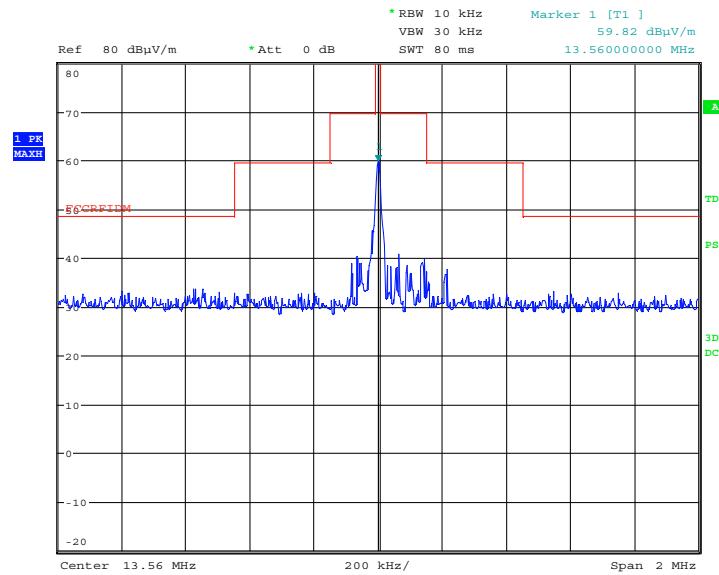
8.4 Spectrum Mask

Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d) IC RSS-210 Issue 8, section A2.6			
Guide:	ANSI C63.4			
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:	Radiated Emission Measurement 9 kHz to 30 MHz (6.2)			

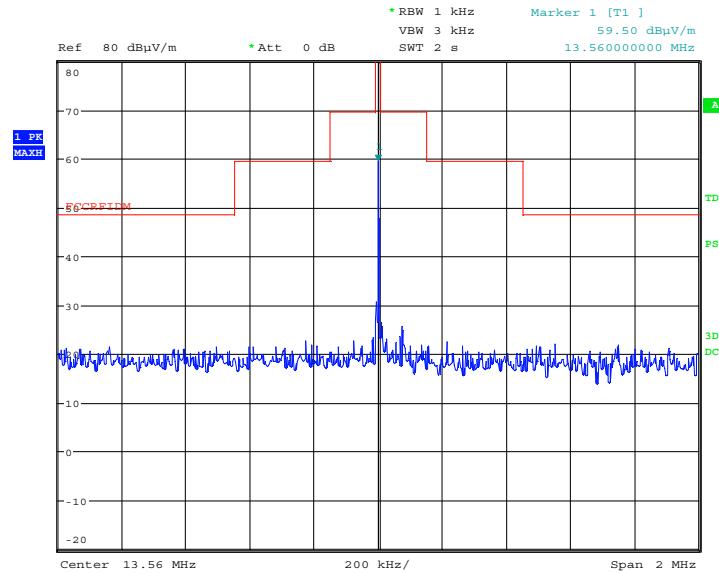
Comment:	
Date of test:	December 1, 2010
Test site:	Fully anechoic room, cabin no. 2
Test distance:	10 meters
Extrapolation Factor:	40 dB/decade

Test Result:	Test passed
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Transmitting with antenna 1

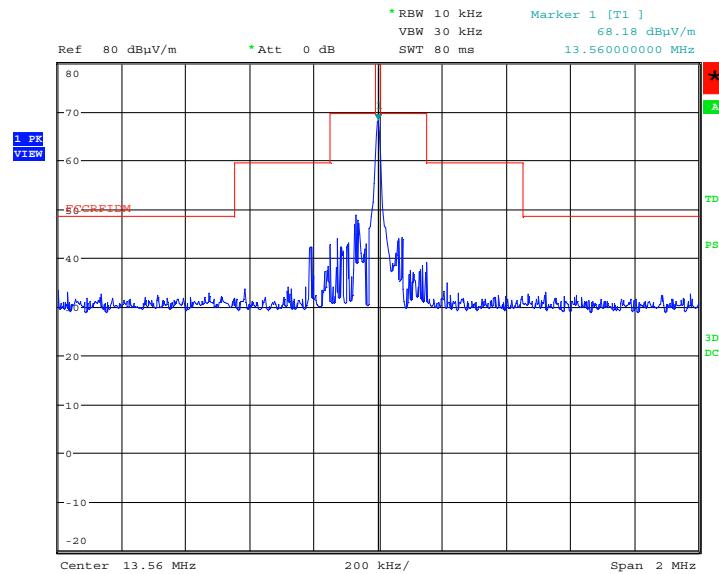


Date: 1.DEC.2010 16:35:57

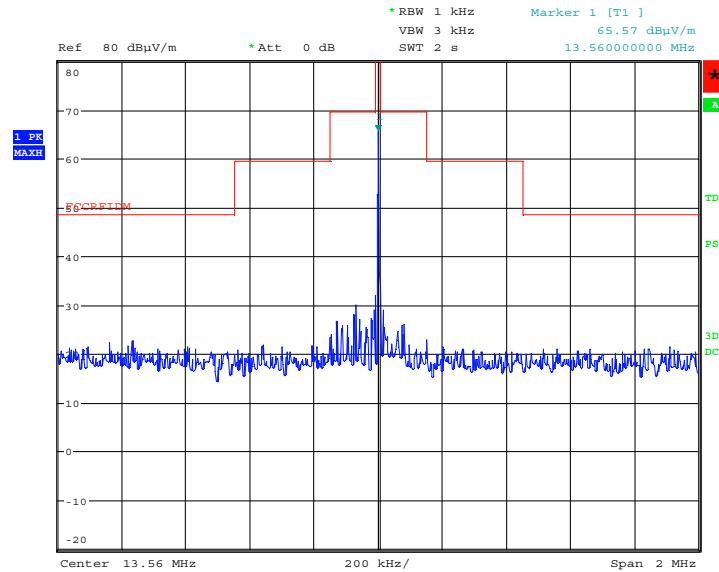


Date: 1.DEC.2010 16:35:43

Transmitting with antenna 2



Date: 1.DEC.2010 16:33:30



Date: 1.DEC.2010 16:33:48

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-Gen Issue 3, sections 7.2.2 and 7.2.5 IC RSS-210 Issue 8, section 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
Measurement procedure:	14.010 - 30.000 Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.			
	Radiated Emission Measurement 9 kHz to 30 MHz (6.2)			

Test Result:	Test passed
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Comment:	Transmitting on antenna 1
Date of test:	November 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 d1 (m)	Distance d (m)	Reading Value (dB μ V)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dB μ V/m)	Limit (dB)
13.56000	Quasi-Peak	10	30	30.9	20.0	-19.1		31.8	84.0
27.12000	Quasi-Peak	10	30	18.7	20.0	-19.1		19.6	29.5

Sample calculation of final values:

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

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

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

Comment:	Transmitting on antenna 2
Date of test:	November 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 d1 (m)	Distance d (m)	Reading Value (dB μ V)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
13.56000	Quasi-Peak	10	30	29.3	20.0	-19.1		30.2	84.0	53.8

Sample calculation of final values:

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

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

Note: Extrapolation factor (dB) and final value (dB μ V/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-Gen Issue 3, section 7.2.2, 7.2.5 IC RSS-210 Issue 8, section 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 at Alternative Test Site (6.3)		

Test Result:	Test passed
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Comment:	Transmitting on antenna 1
Date of test:	November 15, 2010
Test site:	Frequencies \leq 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 (dB μ V)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
109.740	vertical	Quasi-Peak	24.7	9.4		34.1	43.5	9.4
149.160	horizontal	Quasi-Peak	25.7	8.9		34.6	43.5	8.9
154.740	horizontal	Quasi-Peak	24.7	9.4		34.1	43.5	9.4
157.830	horizontal	Quasi-Peak	26.5	8.5		35.0	43.5	8.5
271.200	horizontal	Quasi-Peak	27.0	9.5		36.5	46.0	9.5
298.320	horizontal	Quasi-Peak	33.6	6.2		39.8	46.0	6.2
325.440	horizontal	Quasi-Peak	39.8	3.1		42.9	46.0	3.1
339.000	horizontal	Quasi-Peak	31.4	7.3		38.7	46.0	7.3
352.560	horizontal	Quasi-Peak	35.0	5.5		40.5	46.0	5.5
379.680	horizontal	Quasi-Peak	43.6	1.2		44.8	46.0	1.2
406.800	horizontal	Quasi-Peak	33.4	6.3		39.7	46.0	6.3

Sample calculation of final values:

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

Comment:	Transmitting on antenna 2
Date of test:	November 30, 2010
Test site:	Frequencies \leq 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 (dB μ V)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
162.720	horizontal	Quasi-Peak	28.9	10.1		39.0	43.5	4.5
176.280	horizontal	Quasi-Peak	25.2	10.9		36.1	43.5	7.4
203.400	horizontal	Quasi-Peak	24.7	12.4		37.1	43.5	6.4
325.440	horizontal	Quasi-Peak	26.0	15.3		41.3	46.0	4.7
339.000	horizontal	Quasi-Peak	21.7	15.9		37.6	46.0	8.4
352.560	horizontal	Quasi-Peak	22.9	16.2		39.1	46.0	6.9
366.120	horizontal	Quasi-Peak	20.2	16.4		36.6	46.0	9.4
420.360	vertical	Quasi-Peak	21.6	17.5		39.1	46.0	6.9
501.720	horizontal	Quasi-Peak	22.1	18.7		40.8	46.0	5.2
528.840	horizontal	Quasi-Peak	20.7	19.2		39.9	46.0	6.1

Sample calculation of final values:

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

8.7 Carrier Frequency Stability

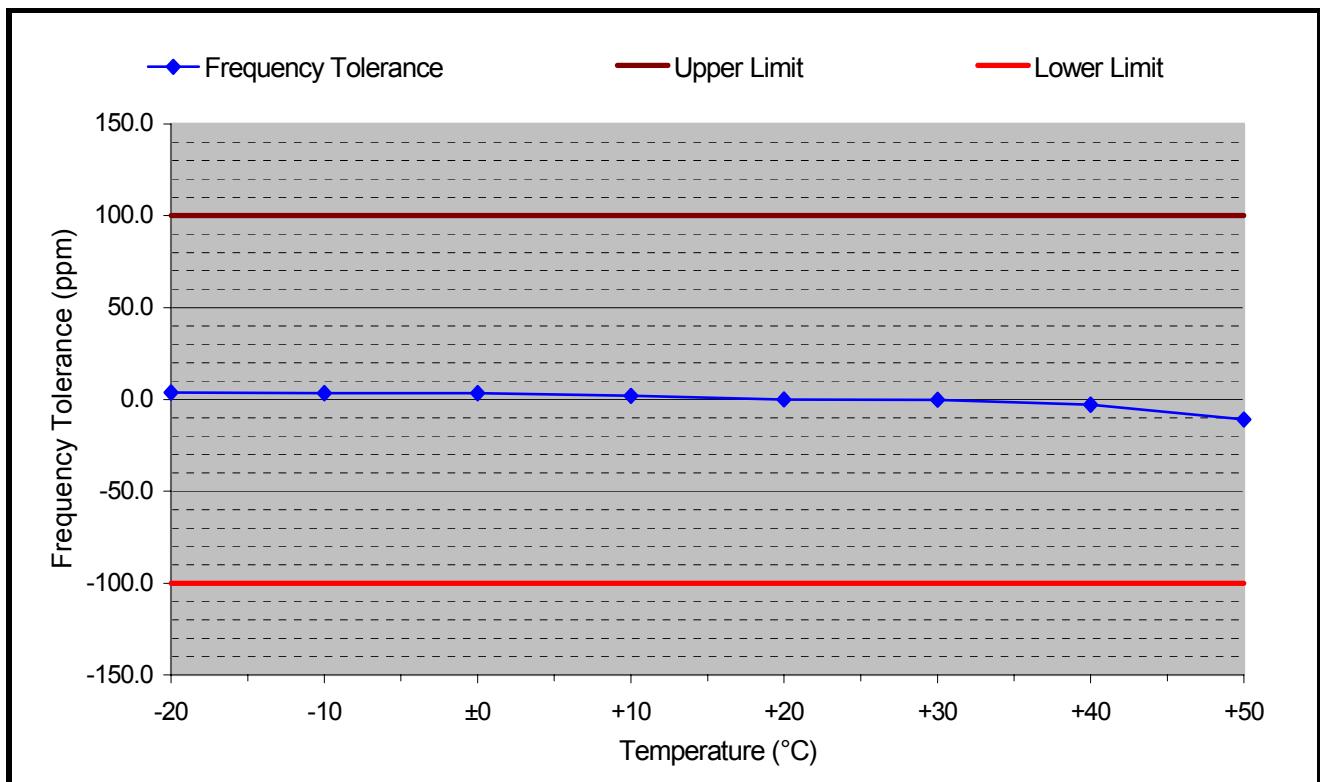
Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-Gen Issue 3, section 4.7 and IC RSS-210 Issue 8, section A2.6
Guide:	ANSI C63.4
Limit:	The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ (± 100 ppm) of the carrier frequency under nominal conditions.
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:

November 29, 2010

8.7.1 Carrier Frequency Stability vs. Temperature



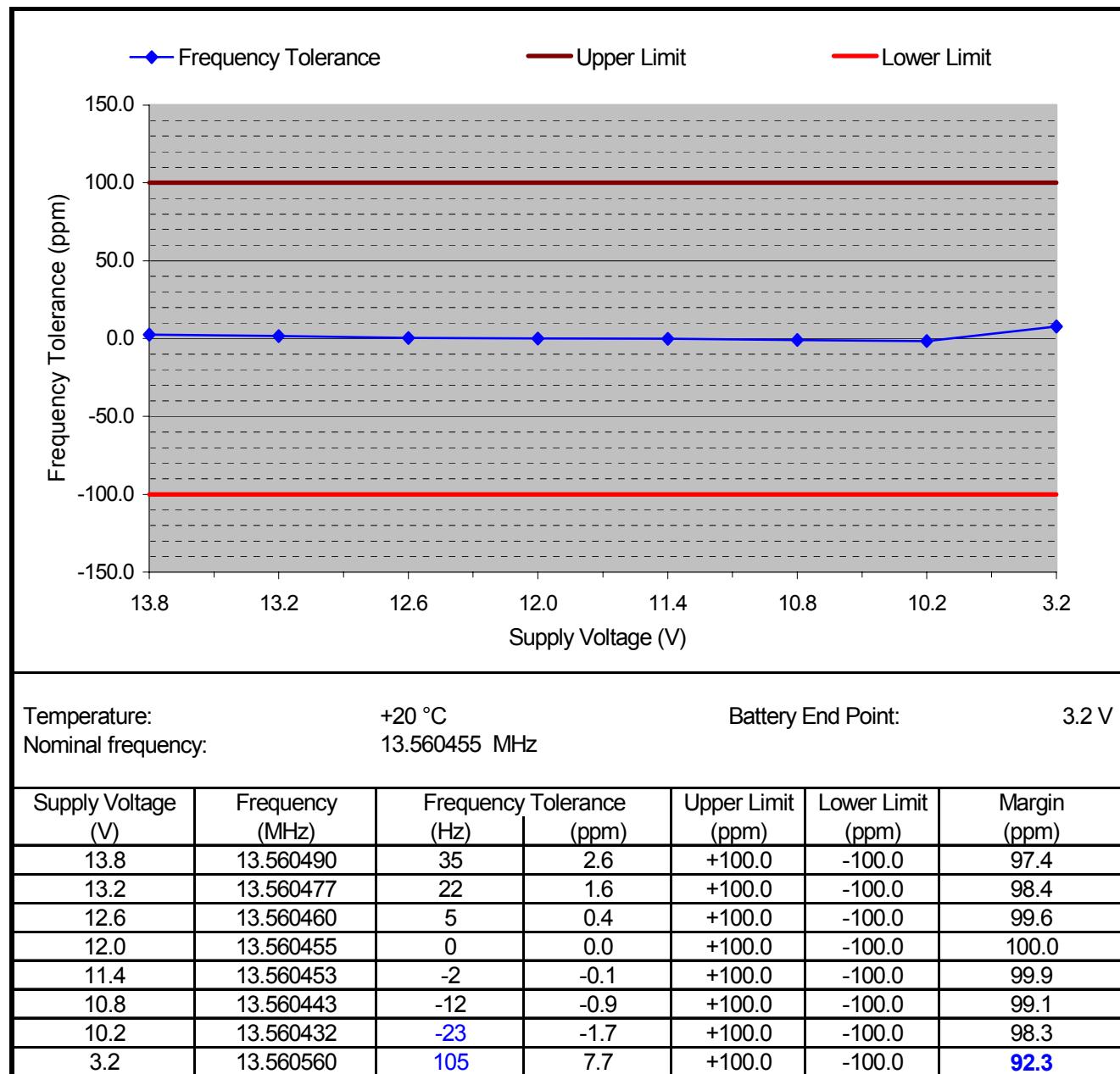
Supply voltage: V Nominal frequency: 13.560455 MHz

Temperature (°C)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
-20	13.560505	50	3.7	+100.0	-100.0	96.3
-10	13.560501	46	3.4	+100.0	-100.0	96.6
±0	13.560501	46	3.4	+100.0	-100.0	96.6
+10	13.560482	27	2.0	+100.0	-100.0	98.0
+20	13.560455	0	0.0	+100.0	-100.0	100.0
+30	13.560452	-3	-0.2	+100.0	-100.0	99.8
+40	13.560415	-40	-2.9	+100.0	-100.0	97.1
+50	13.560307	-148	-10.9	+100.0	-100.0	89.1

Test Result:

Test passed

8.7.2 Carrier Frequency Stability vs. Supply Voltage



Test Result:	Test passed
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8.8 Exposure of Humans to RF Fields

Rules and specifications:	IC RSS-Gen Issue 3, section 5.5
Guide:	IC RSS-102 Issue 4, section 2.5

Exposure of Humans to RF Fields		Applicable	Declared by applicant	Measured	Exemption
The antenna is					
<input type="checkbox"/> detachable					
The conducted output power (CP in watts) is measured at the antenna connector: $CP = \dots \text{ W}$					
The effective isotropic radiated power (EIRP in watts) is calculated using					
<input type="checkbox"/> the numerical antenna gain: $G = \dots$					
$EIRP = G \cdot CP \Rightarrow EIRP = \dots \text{ W}$					
<input type="checkbox"/> the field strength ¹⁰ in V/m: $FS = \dots \text{ V/m}$					
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = \dots \text{ W}$					
with: Distance between the antennas in m: $D = \dots \text{ m}$					
<input checked="" type="checkbox"/> not detachable					
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by ¹⁰ :					
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = 410.1 \text{ nW}$					
with: Field strength in V/m: $FS = 350 \mu\text{V/m}$					
Distance between the two antennas in m: $D = 10 \text{ m}$					
Selection of output power					
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): $TP = 410.1 \text{ nW}$					

¹⁰ The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses. If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

Exposure of Humans to RF Fields (continued)		Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is					
<input type="checkbox"/> less than or equal to 20 cm <input checked="" type="checkbox"/> greater than 20 cm			<input checked="" type="checkbox"/>		
Transmitting device is					
<input type="checkbox"/> in the vicinity of the human head <input type="checkbox"/> body-worn			<input checked="" type="checkbox"/>		
SAR evaluation					
<p>SAR evaluation is required if the separation distance between the user and the device is less than or equal to 20 cm.</p> <ul style="list-style-type: none"> <input type="checkbox"/> The device operates from 3 kHz up to 1 GHz inclusively and with output power (i.e. the higher of the conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 200 mW for general public use and 1000 mW for controlled use. <input type="checkbox"/> The device operates above 1 GHz and up to 2.2 GHz inclusively and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 100 W for general public use and 500 W for controlled use. <input type="checkbox"/> The device operates above 2.2 GHz and up to 3 GHz inclusively and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 20 mW for general public use and 100 mW for controlled use. <input type="checkbox"/> The device operates above 3 GHz and up to 6 GHz inclusively and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 10 mW for general public use and 50 mW for controlled use. <input type="checkbox"/> SAR evaluation is documented in test report no. 					<input type="checkbox"/>
RF exposure evaluation					
<p>RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm.</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> The device operates below 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 2.5 W. <input type="checkbox"/> The device operates at or above 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 5 W. <input type="checkbox"/> RF exposure evaluation is documented in test report no. 			<input checked="" type="checkbox"/>		<input type="checkbox"/>

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, 2010
<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, 2010
<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 3 containing General Requirements and Information for the Certification of Radiocommunication Equipment, published by Industry Canada	December 2010
<input checked="" type="checkbox"/>	RSS-210	Radio Standards Specification RSS-210 Issue 8 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada	December 2010
<input type="checkbox"/>	RSS-310	Radio Standards Specification RSS-310 Issue 3 for Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment, published by Industry Canada	December 2010
<input checked="" type="checkbox"/>	RSS-102	Radio Standards Specification RSS-102 Issue 4: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), published by Industry Canada	March 2010
<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

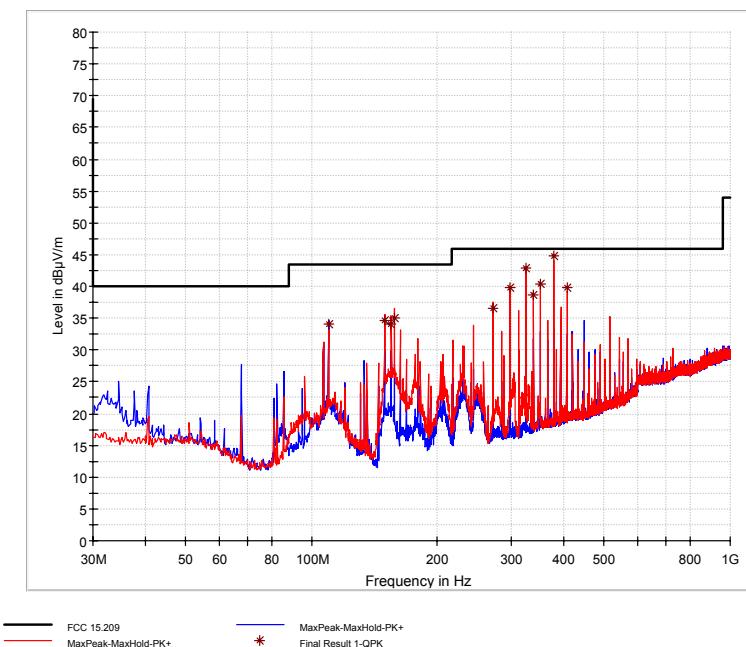
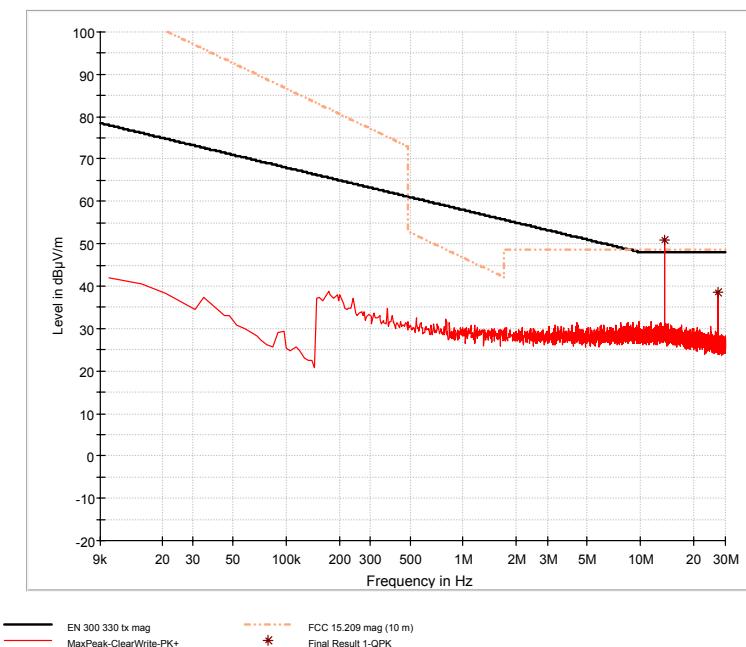
<input type="checkbox"/>	CAN/CSA- CEI/IEC CISPR 22	Limits and Methods of Measurement of Radio Distur- bance Characteristics of Information Technology Equipment	2002
<p>CAN/CSA CISPR 22-10 Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (Adopted IEC CISPR 22:2008, sixth edition, 2008-09)</p>			
<input type="checkbox"/>	CAN/CSA CISPR 22-10	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement (Adopted IEC CISPR 22:2008, sixth edition, 2008-09)	2010
<input checked="" type="checkbox"/>	TRC-43	Notes Regarding Designation of Emissions (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service, published by Industry Canada	October, 2008

10 Revision History

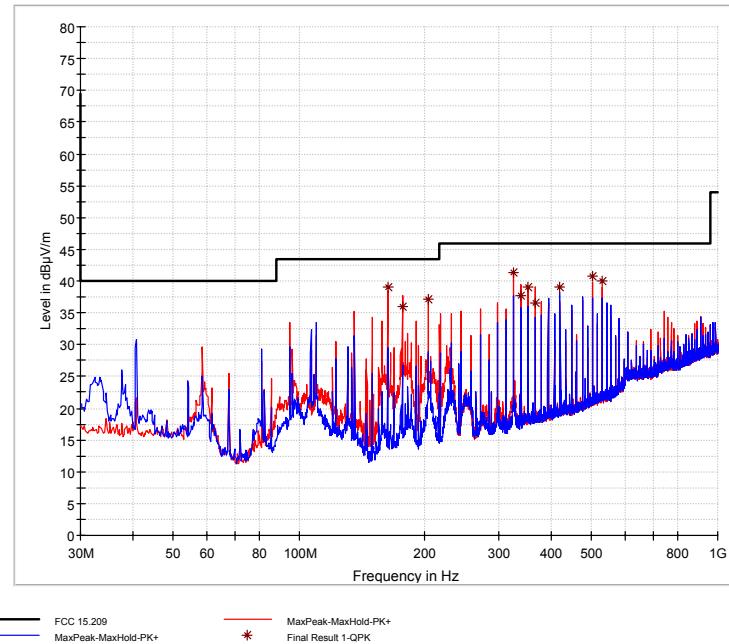
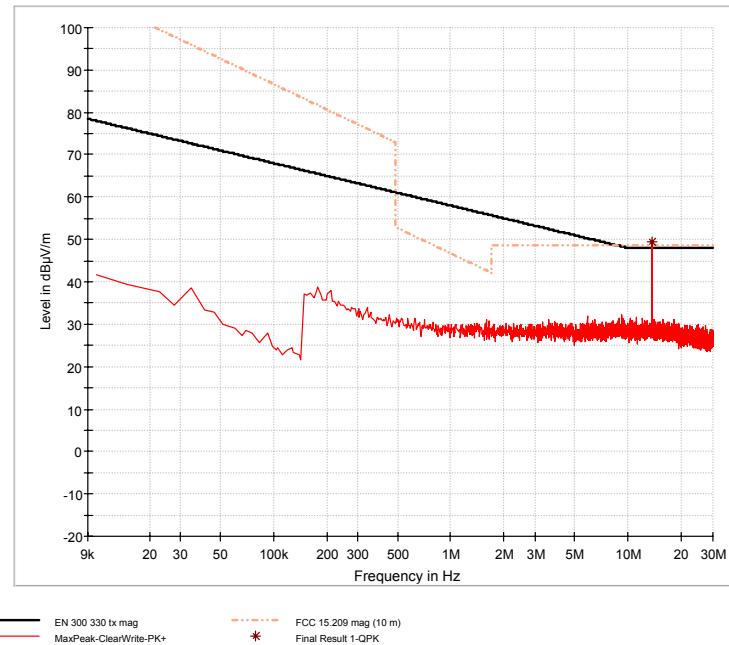
Revision History			
<i>Edition</i>	<i>Date</i>	<i>Issued by</i>	<i>Modifications</i>
1	16.12.10	M. Steindl (cj)	First Edition
2	23.12.10	M. Steindl (cj)	Edition 2 RSS 210 updated to Issue 8
3	10.01.11	M. Steindl (cj)	Correction of indication of measurement distance of spectrum mask measurement. Calibration data attached

11 Charts taken during testing

Transmitting on antenna 1



Transmitting on antenna 2



12 Calibration data

Test Equipment List with Calibration Data

Test report number(s): 69559-03130-1

Type	Inv.-No.	Type Designation	Serial Number	Manufacturer	Calibration Organization	Date of Calibration	Last	Next
EMI test receiver	1711	ESPI7	836914/0002	Rohde & Schwarz	Rohde & Schwarz	09/2009	03/2011	
EMI test receiver	2044	ESU8	100232	Rohde & Schwarz	Rohde & Schwarz	05/2009	11/2010	
Loop antenna	1016	HFH2-Z2	882964/0001	Rohde & Schwarz	Rohde & Schwarz	09/2009	03/2011	
TRILOG Broadband Antenna	1802	VULB 9163	9163-214	Schwarzbeck	Schwarzbeck	11/2009	05/2011	

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